Part 1 General

1.1 RELATED REQUIREMENTS

.1 This Specification shall revise, amend, and supplement the requirements of CW1110.

1.2 REFERENCE STANDARDS

.1 City of Winnipeg General Conditions for Construction, Revision 2019-09-01.

.2 City of Winnipeg Specification CW1110.

1.3 ADMINISTRATIVE

.1 Submit to the Contract Administrator submittals required by individual Specification sections 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 extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Do not proceed with Work affected by submittal until reviewed by the 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. If both Imperial and SI Metric units are shown, SI Metric equivalent shall be the primary unit with the Imperial shown in parentheses.

.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. Submittals not stamped, signed, dated, and identified as to specific project will be returned without being examined and considered rejected.

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

.7 Verify field measurements and affected adjacent Work are co-ordinated.

.8 Contractor's responsibility for errors and omissions in submission is not relieved by the Contract Administrator’s review of submittals.

.9 Contractor's responsibility for deviations in submission from requirements of Contract documents is not relieved by the Contract Administrator’s review.

.10 Keep one reviewed copy of each submission on site.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 The term “Shop Drawing” as defined in the City’s General Conditions for Construction (Revision 2020-01-31) means all drawings, diagrams, illustrations, schedules, performance charts, brochures, and other data which are prepared by the Contractor, Subcontractor, manufacturer, supplier, or distributor and which illustrate some portion of the Work.

.2 Submit Shop Drawings stamped and signed by professional engineer registered or licensed in the Province of Manitoba if requested.

.3 Shop drawings for the following components shall bear the seal of Registered

Professional Engineer in the Province of Manitoba

.1 Shoring/Excavation System as detailed in the Tender document.

.2 Design calculations for the Shoring/Excavation system.

.3 Primary liner design for the trenchless stub and temporary bulkhead installation as detailed in the Tender document.

.4 Carrier pipe blocking details and grouting plan as detailed in the Tender document.

.5 Reinforcing Steel

.6 Metal Fabrications

.7 Pre-cast concrete structures

.8 Anti floatation base design for the dry well

.9 Wet Well Stainless Steel Gate (indicating design loads and gate operator thrust loads)

.10 Lift Station Roof framing (showing joist layout, joist connections to wall, standing seam roof attachments, design load info, etc.)

.11 Structural steel (Monorail Frame)

.12 Aluminum components (wet well hatch, wet well platform, grating etc)

.13 Any other shop drawings in the NMS specifications or the Tender that require the seal of a Registered Professional Engineer in the Province of Manitoba.

.4 Construction of any Work item requiring a shop drawing may not commence until the specific shop drawing submittal has been approved. No shaft construction may proceed without approved shop drawings that include engineered stamped drawings demonstrating that the shoring design(s)

.1 Meet all provincial regulations.

.2 Are able to support soil and active loading

.3 Permits the effective installation of the planed works.

.4 Demonstrates that the shoring also supports the planned hand tunnelling works as well as interacting with the thrust block design (where shafts are used to facilitate tunnelling)

.5 Any other requirements as detailed in the Tender document.

.5 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 co-ordinated, regardless of section under which adjacent items will be supplied and installed. Indicate cross references to design Drawings and Specifications.

.6 Allow seven (7) Business Days for review of each submission by the Contract Administrator.

.7 The review by the Contract Administrator of the Shop Drawings is for the sole purpose of ascertaining conformance with the design concept.

.8 Adjustments made on Shop Drawings by the Contract Administrator are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to the Contract Administrator prior to proceeding with Work.

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

.10 Accompany submissions with transmittal, containing:

- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each Shop Drawing, product data, and sample.
- .5 Other pertinent data.

.11 Submissions include:

- .1 Date and revision dates.
- .2 Project title and number.
- .3 Section name and clause number equipment is specified under.
- .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.
- .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.

.12 After the Contract Administrator’s review, distribute copies as required.

.13 Submit electronic copy of Shop Drawings for each requirement requested in Specification sections and as the Contract Administrator may reasonably request.

.14 Submit electronic copies of product data sheets or brochures for requirements requested in Specification sections and as requested by the Contract Administrator where Shop Drawings will not be prepared due to standardized manufacture of product.

.15 Submit electronic copies of test reports for requirements requested in Specification sections

and as requested by the Contract Administrator.

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

.2 Testing must have been within three (3) years of date of Contract award for project.

.16 Submit electronic copies of certificates for requirements requested in Specification sections and as requested by the Contract Administrator.

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

.2 Certificates must be dated after award of Contract and include the project name.

.17 Submit electronic copies of manufacturer’s instructions for requirements requested in Specification sections and as requested by the Contract Administrator.

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

.18 Submit electronic copies of manufacturer's field reports for requirements requested in Specification sections and as requested by the Contract Administrator.

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

.20 Submit electronic copies of operation and maintenance data for requirements requested in Specification sections and as requested by the Contract Administrator

.21 Delete information not applicable to project.

.22 Supplement standard information to provide details applicable to project.

.23 If upon review by the Contract Administrator, no errors or omissions are discovered or if only minor corrections are made, a copy 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.

1.5 DESCRIPTION OF CONSTRUCTION METHODS

.1 The Contractor shall, if required by the Contract Administrator, submit for the review of the Contract Administrator method statements which describe in detail, supplemented with drawings where necessary, the methods to be adopted for executing any portion of Work.

.2 These method statements shall also include details of constructional plan and labour to be employed. Acceptance by the Contract Administrator shall not relieve the Contractor of any of his responsibilities, nor shall reasonable refusal to approve entitle the Contractor to extra payment or an extension of time.

1.6 REQUESTS FOR INFORMATION

.1 In the event that the Contractor, or any Subcontractor involved in the Work, determines that some portion of the Drawings, Specifications, or other Contract Documents requires clarification or interpretation by the Contract Administrator, the Contractor shall submit a Request for Information (RFI) in writing to the Contract Administrator.

.2 Submission Procedure:

.1 Submit RFI's to the Contract Administrator on the "Request for Information" form appended to this section. The Contract Administrator shall not respond to a RFI except as submitted on this form.

.2 Number RFI's consecutively in one sequence in order submitted, in a numbering system established by the Contract Administrator.

.3 Submit one distinct subject per RFI request. Do not combine unrelated items on one form.

.4 Where RFI form does not have sufficient space, attach additional sheets as required.

.5 Submit with RFI form all necessary supporting documentation.

.3 In the RFI, the Contractor shall clearly and concisely set forth:

.1 the issue for which clarification or interpretation is sought and why a response is needed from the Contract Administrator; and

.2 an interpretation or understanding of the requirement along with reasons why such an understanding was reached.

.4 The Contract Administrator will review all RFIs to determine whether they are valid RFIs. If it is determined that the document is not a valid RFI, it will be returned to the Contractor not having been reviewed with an explanation why it was deemed not valid.

.5 A RFI response shall be issued within 14 Calendar Days of receipt of the request from the Contractor unless the Contract Administrator determines that a longer time is necessary to provide an adequate response. When the RFI submission is received by the Contract Administrator before noon, the review period commences on that Calendar Day. When the RFI submission is received by the Contract Administrator after noon, the review period commences on the subsequent Calendar Day.

.6 If, at any time, the Contractor submits a large number of RFIs or the Contract Administrator considers the RFI to be of such complexity that the Contract Administrator cannot process the RFIs within 14 Calendar Days, the Contract Administrator shall confer with the Contractor within five (5) Calendar Days of receipt of such RFIs and the Contract Administrator and the Contractor will jointly prepare an estimate of the time necessary for processing same as well as an order of priority among the RFIs submitted. The Contractor shall accommodate such necessary time at no impact to the schedule and at no additional cost to the Contract.

.7 If the Contractor submits a RFI on an activity with 14 Calendar Days or less of available time to the impacted activity on the current project schedule, the Contractor shall not be entitled to any time extension due to the time it takes the Contractor Administrator to respond to the request provided that the Contract Administrator responds within the 14 Calendar Days set forth above.

.8 A RFI response from the Contract Administrator will not change any requirement of the Contract. In the event the Contractor believes that the RFI response from the Contract Administrator will cause a change to the requirements of the Contract, the Contractor shall within 14 Calendar Days give written notice to the Contract Administrator stating that the Contractor believes the RFI response will result in a change in requirements to the Contract and the Contractor intends to submit a change request. Failure to give such written notice of 14 Calendar Days shall waive the Contractor's right to seek additional time or cost under the requirements of the Contract.

1.7 CLOSEOUT SUBMITTALS

1. Refer to Section 01 78 00 – Closeout Submittals for closeout submittal requirements.

1.8 MISCELLANEOUS SUBMITTALS

.1 Prepare and submit submittals required by individual Specification sections.

.2 Copies: Submit one electronic copy to Contract Administrator. Method of electronic submission to be coordinated with Contract Administrator after execution of the Contract. Submit hard copies only where specifically required under individual Specification sections.

.3 Contract Administrator will review submittals for general conformance with design concept and intent, and general compliance with Contract.

.4 Contract Administrator's review does not relieve Contractor from compliance with requirements of Contract nor from errors in submittals or Contractor's design.

.5 Contractor is responsible for confirmation of dimensions at jobsite; fabrication processes; means, methods, techniques, sequences. and procedures of construction; coordination of work of all trades; and performance of Work in safe and satisfactory manner.

.6 At Contract Administrator's option, Contract Administrator's review comments and review stamp will be placed either directly on submitted copies of submittals or on separate submittal review comment form.

.7 Where work is to be designed by Contractor, comply with applicable codes and furnish submittals signed and sealed by professional engineer licensed in Province of Manitoba, as required by Specifications. If requested, calculations shall be submitted for review. Calculations shall also be signed and sealed by a professional engineer registered in the Province of Manitoba.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Request for Information (RFI)

RFI No. 0

For details and instructions on how to complete this document, click the [¶] icon under the Home tab to display the hidden text.

RFI Title: | **RFI No.:** 0

Date RFI initiated: | **Date Response Requested by:**

Date Response Issued:

Project Name:

Submitted To:

Contract Administrator (CA): | Consultant Ref. No.

Company/Dept.: | Tender No.

Requested By:		***For CA Use***	
Name:		City File No.:	
Title:		Project ID:	
Company:		Project Record Index No.:	
Email::		Purchase Order No.:	

Request/Question: (to be completed by Contractor)

Answer/Response: (to be completed by Contract Administrator)

Attachment(s):

Distribution (to be completed by Contract Administrator)

- Contract Administrator
- Contractor
- City Project Manager
- Other:

Part 1 General

1.1 INSPECTION

.1 Allow the Contract Administrator access to the Work. If part of the Work is in preparation at locations other than the Site, allow access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection if the Work is designated for special tests, inspections, or approvals by the Contract Administrator or inspection authorities.

.3 If the 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 at no additional cost and have inspections or tests satisfactorily completed and make good such Work.

.4 The Contract Administrator will order part of the Work to be examined if the Work is suspected to be not in accordance with the Contract. If, upon examination, such work is found not in accordance with the Contract, correct such Work and pay cost of examination and correction. If such Work is found in accordance with the Contract, the City shall pay cost of examination and replacement.

1.2 INDEPENDENT INSPECTION AGENCIES

.1 The Contract Administrator is to determine/approve the required inspection/testing. Independent inspection/testing agencies shall be engaged and coordinated by the Contractor for purpose of inspecting and/or testing portions of the Work. The Contract Administrator is to be copied on all inspection and/or testing results and correspondence from the inspection/testing agency. Additional tests required due to defective Work shall be paid by the Contractor at no additional cost to the Contract.

.2 All equipment required for executing inspection and testing will be provided by the respective agencies.

.3 Employment of inspection/testing agencies does not relieve or relax the Contractor's responsibility to perform the Work in accordance with the Contract.

.4 If defects are revealed during inspection and/or testing, the appointed agency will request additional inspection and/or testing to ascertain the full degree of defect. Correct the defect and irregularities as advised by the Contract Administrator at no cost to the City. The Contractor shall be responsible for the costs of the subsequent testing and inspection of the corrected Work. The City shall deduct such costs from the Contract, amount of which will be determined by the Contract Administrator.

1.3 ACCESS TO WORK

.1 The City, the Contract Administrator, and other inspection authorities shall have access to the Work.

1.4 REJECTED WORK

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

.2 Make good other contractor's work damaged by such removals or replacement of defective Work.

.3 If, in opinion of the Contract Administrator, it is not expedient to correct defective Work or Work not performed in accordance with the Contract, the City will deduct from the Contract Price the difference in the value between Work performed and that called for by the Contract, amount of which will be determined by the Contract Administrator.

1.5 REPORTS

.1 Submit draft inspection and test reports to the Contract Administrator, prior to inclusion with the operation and maintenance manuals and in accordance with Section 01 33 00 – Submittal Procedures

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 OPERATION AND MAINTENANCE MANUALS

.1 General

.1 Provide operation and maintenance manuals in accordance with Section 01 33 00 – Submittal Procedures.

.2 An electronic draft copy of the operation and maintenance manuals shall be submitted (word version, if available) two (2) weeks prior to Substantial Performance of the Work for review and comments. Submission of individual data will not be accepted unless directed by the City. Make changes and incorporate the Contract Administrator's review comments as required and re-submit as directed by the Contract Administrator.

.3 After review and acceptance by the City, five (5) hard copies and one electronic (PDF) copy of the final operation and maintenance manuals shall be submitted. The final electronic copy shall be provided on a flash memory drive.

.4 Prepare operation and maintenance manuals using personnel experienced in maintenance and operation of described products.

.5 Operation and maintenance instructions and technical data to be sufficiently detailed with respect to design elements, construction features, component function, correct installation procedure, and maintenance requirements to permit effective start-up, operation, maintenance, repair, modification, extension, and expansion of any portion or feature of installation. Technical data to be in the form of approved Shop Drawings, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists.

.6 For the guidance of the City's operation and maintenance personnel, the Contractor shall prepare operation and maintenance manuals for the Work, describing in detail the construction of each part of the Work and the recommended procedure for operation, servicing, and maintenance.

.7 All instructions in these operation and maintenance manuals shall be in simple language to guide the City in the proper operation and maintenance of this installation.

.2 Format

.1 Organize data as instructional manual.

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf, 8.5" by 11" with spine and face pockets.

.3 When multiple binders are used, correlate data into related consistent groupings.

.1 Identify contents of each binder on spine and face.

.4 Cover: identify each binder with title sheet labelled "Operation and Maintenance Instructions", and containing project name and date, facilities covered in the manual, City's Contract number, the name and address of the Contractor, and the issue date.

.5 Arrange content by Division and 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 type written data.

.8 Drawings: provide with reinforced punched binder tab.

.1 Bind in with text; fold larger drawings to size of text pages.

.3 Contents

.1 For each operation and maintenance manual volume, provide an overall title sheet that includes:

.1 The title "Operation and Maintenance Instructions";

.2 Project name and date;

.3 Facilities covered in the manual;

.4 City's Contract number;

.5 Addresses and telephone numbers of Consultant and Contractor with name of responsible parties; and

.6 Schedule of products and systems, indexed to content of volume;

.2 For each operation and maintenance manual volume, provide an overall list of contents which includes the contents for all the operation and maintenance manual volumes.

.3 In addition to operation and maintenance information required in the individual Specification sections, include:

.1 Brochures/catalogue excerpts of all components of the Work.

.2 Product data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.3 Documentation of all test results.

.4 Complete set of equipment and assembly drawings.

.5 Installation, start-up, individual equipment operation and maintenance manuals.

.6 Shop Drawings and cutsheets of all equipment and materials.

.1 Do not utilize the cutsheet and Shop Drawing submittals that were sent to the Contract Administrator for review as these may contain inaccurate information and markups. Only provide cutsheets and Shop Drawings representing the final materials and equipment supplied, without any markups from the Contract Administrator.

.2 For generic cutsheets and Shop Drawings that list multiple model numbers or configurations, place a rectangle around the specific model that was supplied and cross out other models.

.7 Sections for the record Drawings and as-built Drawings of all installations. Drafted record Drawings and as-built Drawings of size 432x279 mm (11 x 17") will be inserted by the Contract Administrator, based on the as-built Drawings marked up by the Contractor.

.8 Names, addresses, and telephone numbers of all major Subcontractors and suppliers.

.9 Certificate of Inspection from the inspection authority.

.10 Testing and commissioning documentation.

.11 Warranty certificate, signed and dated.

.12 Written process narratives outlining the programming of the PLC systems for individual processes or systems.

.13 Final instrumentation set points including but not limited to:

.1 Units

.2 Scale

.3 Alarm points (low-low, low, high, high-high)

.4 4-20 mA settings

.14 Logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 – Quality Control.

.4 General catalog data for the operations and maintenance manual is unacceptable. If manufacturer’s specification sheets are generalized in any way, they shall be clearly marked to show exactly which item has been supplied, and the project designation for that item (e.g., SF-Y601) is to be noted on manufacturer’s specification sheet which includes all details for this unit, including complete model number, serial number, and construction and performance data.

.4 Equipment and Systems

.1 For each item of equipment and each system include description of unit or system, and component parts.

.1 Give function, normal operation characteristics, and limiting conditions.

.2 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.

.1 Include regulation, control, stopping, shut-down, and emergency instructions.

.2 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 co-ordination 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 Additional requirements: as specified in individual Specification sections.

.5 Materials and Finishes

.1 Building products, applied materials, and finishes: include product data, with catalogue number, size, composition, and colour and texture designations.

.1 Provide information for re-ordering custom manufactured products if applicable.

.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.

1.2 AS-BUILT / RECORD DRAWINGS

.1 Accurately mark-up deviations from the Contract caused by the Site conditions and changes ordered by the Contract Administrator. Update daily.

.2 The Contractor shall keep one complete set of white prints at the Site during the Work, including all addenda, change orders, Site instructions, clarifications, and revisions for the purpose of the as-built and record Drawings. As the Work on-site proceeds, the Contractor shall clearly mark up the white prints in red pencil all the Work which deviated from the original Contract. Identify Drawings as "Project Record Copy". Maintain in good condition and make available for inspection on-site by the Contract Administrator at all times.

1.3 WARRANTIES AND BONDS

.1 Develop warranty management plan to contain information relevant to warranties.

.2 Submit warranty management plan, 30 days before planned pre-warranty meeting, to the Contract Administrator for approval.

.3 Warranty management plan to include required actions and documents to assure that the City 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 Submit warranty information, made available during construction phase, to the Contract Administrator for approval prior to each monthly pay estimate.

.6 Assemble approved information in binder, submit upon acceptance of work, and organize binder as follows:

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

.2 List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by Subcontractors, suppliers, and manufacturers, within ten Business Days after completion of applicable item of Work.

.4 Verify that documents are in proper form and contain full information.

.5 Co-execute submittals when required.

.6 Retain warranties and bonds until time specified for submittal.

.7 Except for items put into use with the City's permission, leave date of beginning of time of warranty until date of Total Performance is determined.

.8 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 warranty items, to include roofs, HVAC balancing, pumps, and commissioned systems. 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 two-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.

.3 Procedure and status of tagging of equipment covered by extended warranties.

.4 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

.9 Respond in timely manner to oral or written notification of required construction warranty repair work.

.10 Written verification to follow oral instructions.

.1 Failure to respond will be cause for the Contract Administrator to proceed with action against the Contractor.

1.4 WARRANTY TAGS

.1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by the Contract Administrator.

.2 Attach tags with copper wire and spray with waterproof silicone coating.

.3 Leave date of acceptance until project is accepted.

.4 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

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.

.2 The Contractor shall provide, commission and turn over to the City a complete operating sewage lift station and associated works as described herein the specifications.

.3 Related Requirements

.1 301-2024 Bid Opportunity.

.4 Acronyms:

.1 Cx - Commissioning.
.2 EMCS - Energy Monitoring and Control Systems.
.3 O&M - Operation and Maintenance.
.4 PI - Product Information.
.5 PV - Performance Verification.
.6 TAB - Testing, Adjusting and Balancing.

1.2 REFERENCES

.1 Sections 01 91 13.13 – Commissioning Plan

.2 Section 01 91 13.16 – Commissioning Forms

.3 Section 01 91 13.18 – Commissioning Training

.4 Section 22 05 00 – Common Work Results for Plumbing

.5 Section 23 05 00 – Common Work Results for HVAC

.6 Section 26 05 00 – Common Work Results for Electrical

.7 Section 40 05 00 – Common Work Results for Automation

1.3 GENERAL

.1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved.

.2 Objectives:

.1 Verify installed equipment, systems and integrated systems operate in accordance with Contract Documents and design criteria and intent.

.2 Ensure appropriate documentation is compiled into the O&M Manual.

.3 Effectively train O&M staff.

.3 Contractor assists Cx Agent in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.

.1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively operated with each other as intended in accordance with Contract Documents and design criteria.

.2 During these checks, adjustments shall be made to enhance performance to meet environmental or user requirements.

.4 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

1.4 COMMISSIONING OVERVIEW

.1 For Cx responsibilities refer to Section 01 91 13.13 - Commissioning Plan.

.2 Cx to be a line item of Contractor's bid price. The Contractor shall inform all sub-Contractors and Suppliers/Manufacturers of the requirements herein and include all costs for the Cx services in the bid price.

.3 Measurement and payment:

.1 Cx shall be measured by the Contract Administrator on a lump sum basis at the contract price for “Commissioning, O&M, Training & As-Builts”. The price shall be payment in full for all labour, equipment and materials – including other items incidental to the Work as described in these specifications. Where a minimum amount of time is stated in the specifications for a Manufacturer’s services, any additional time required to perform the specified services shall be at no additional cost to the City.

.4 Cx activities supplement field quality and testing procedures described in relevant technical sections.

.5 Cx is conducted in concert with activities performed during final stages of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the built pumping station upgrades are constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities includes transfer of critical knowledge to facility operational personnel.

.6 Contract Administrator will issue Commissioning Acceptance Certificate when:

.1 Completed Cx documentation has been received, reviewed for suitability and approved by Contract Administrator.

.2 Equipment, components and systems have been commissioned.

.3 O&M training has been completed.

1.5 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

.1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the unfunctional system, including related systems as deemed required by Contract Administrator, to ensure effective performance.

.2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

1.6 PRE-CX REVIEW

.1 Before Construction:

.1 Review Contract Documents, confirm by writing to Contract Administrator.

.1 Adequacy of provisions for Cx.

.2 Aspects of design and installation pertinent to success of Cx.

.2 The Contractor shall retain the services of a Cx Agent. The agent shall:

.1 Have a demonstrated minimum of five years' experience in the commissioning of similar facilities.

.2 Perform the duties as outlined in this Section, referenced Sections, and additional tasks as necessary to provide a complete and fully operational system to the satisfaction of the City and Construction Administrator.

.2 During Construction:

.1 Co-ordinate provision, location and installation of provisions for Cx.

.3 Before start of Cx:

.1 Have completed Cx Plan up-to-date.

.2 Ensure installation of related components, equipment, sub-systems, systems is complete.

.3 Fully understand Cx requirements and procedures.

.4 Have Cx documentation ready for use during commissioning.

.5 Understand completely design criteria and intent and special features.

.6 Submit complete start-up documentation to Contract Administrator.

.7 Have Cx schedules up-to-date

.8 Ensure systems have been cleaned thoroughly.

.9 Complete TAB procedures on systems, submit TAB reports to Contract Administrator for review and approval.

.10 Ensure "As-Built" system schematics are available.

.4 Inform Contract Administrator in writing of discrepancies and deficiencies on finished works.

1.7 CONFLICTS

.1 Report conflicts between requirements of this section and other sections to Contract Administrator before start-up and obtain clarification.

.2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.8 ACTION AND INFORMATIONAL SUBMITTALS

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

.1 Submit no later than 12 weeks after award of Contract:

.1 Name of Contractor's third party Cx agent.

.2 Draft Cx documentation.

.3 Preliminary Cx schedule.

.2 Request in writing to Contract Administrator for changes to submittals and obtain written approval at least 8 weeks prior to start of Cx.

.3 Submit proposed Cx procedures to Contract Administrator where not specified and obtain written approval at least 8 weeks prior to start of Cx.

.4 Provide additional documentation relating to Cx process required by Contract Administrator.

1.9 COMMISSIONING DOCUMENTATION

.1 Refer to Section 01 91 13.16 - Commissioning Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms for requirements and instructions for use.

.2 Contract Administrator to review and approve Cx documentation.

.3 Provide completed and approved Cx documentation to Contract Administrator.

1.10 COMMISSIONING SCHEDULE

.1 Provide detailed Cx schedule as part of construction schedule in accordance with 301-2024 Bid Opportunity D18, Detailed Work Schedule.

.2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:

.1 Approval of Cx reports.

.2 Verification of reported results.

.3 Repairs, retesting, re-commissioning, re-verification.

.4 Training.

1.11 COMMISSIONING MEETINGS

.1 Convene Cx meetings following project meetings: 301-2024 Bid Opportunity D18, Detailed Work Schedule and as specified herein.

.2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.

.3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.

.4 At 60% construction completion stage, Contractor to call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Discussion items at meeting to include:

.1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.

.2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.

.5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.

.6 Meeting will be chaired by Cx Agent, who will record and distribute minutes.

.7 Ensure City of Winnipeg, Contract Administrator, subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

1.12 STARTING AND TESTING

.1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.13 WITNESSING OF STARTING AND TESTING

.1 Provide 21 days notice prior to commencement.

.2 Contract Administrator and the City to witness of start-up and testing

.3 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

1.14 MANUFACTURER'S INVOLVEMENT

.1 Factory testing: In addition to requirements of Divisoin 40, manufacturer to:

.1 Coordinate time and location of testing.

.2 Provide testing documentation for approval by Contract Administrator.

.3 Arrange for Contract Administrator to witness tests.

.4 Obtain written approval of test results and documentation from Contract Administrator prior to delivery to site.

.2 Obtain manufacturer’s installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Contract Administrator.

.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.

.3 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.

.4 Qualifications of manufacturer's personnel:

.1 Experienced in design, installation and operation of equipment and systems (minimum 5 years of experience).

.2 Ability to interpret test results accurately.

.3 To report results in clear, concise, logical manner.

1.15 PROCEDURES

.1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.

.2 Conduct start-up and testing in following distinct phases:

.1 Included in delivery and installation:

.1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.

.2 Visual inspection of quality of installation.

.2 Start-up: follow accepted start-up procedures and as indicated in related Divisions.

.3 Operational testing: document equipment performance.

.4 System PV: include repetition of tests after correcting deficiencies.

.5 Post-substantial performance verification: to include fine-tuning.

.3 Correct deficiencies and obtain approval from Contract Administrator after distinct phases have been completed and before commencing next phase.

.4 Document required tests on approved PV forms.

.5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment, at the contractor’s expense, by an independent testing agency selected by Contract Administrator. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:

.1 Minor equipment/systems: implement corrective measures approved by Contract Administrator.

.2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Contract Administrator.

.3 If evaluation report concludes that major damage has occurred, Contract Administrator shall reject equipment.

.1 Rejected equipment to be removed from site and replaced with new.

.2 Subject new equipment/systems to specified start-up procedures.

1.16 START-UP DOCUMENTATION

.1 Assemble start-up documentation and submit to Contract Administrator for approval before commencement of commissioning.

.2 Start-up documentation to include:

.1 Factory and on-site test certificates for specified equipment.
.2 Pre-start-up inspection reports.
.3 Signed installation/start-up check lists.
.4 Start-up reports,
.5 Step-by-step description of complete start-up procedures, to permit Contract Administrator to repeat start-up at any time.

1.17 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

.1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.

.2 With assistance of manufacturer develop written maintenance program and submit Contract Administrator for approval before implementation.

.3 Operate and maintain systems for length of time required for commissioning to be completed.

.4 After completion of commissioning, operate and maintain systems until issuance of certificate of commissioning acceptance.

1.18 TEST RESULTS

.1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.

.2 Provide manpower and materials, assume costs for re-commissioning.

1.19 START OF COMMISSIONING

.1 Notify Contract Administrator at least 21 days prior to start of Cx.

.2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.20 INSTRUMENTS / EQUIPMENT

.1 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 the following equipment as required:

.1 2-way radios.
.2 Ladders.
.3 Equipment as required to complete work.

1.21 COMMISSIONING PERFORMANCE VERIFICATION

.1 Carry out Cx:

.1 Under actual operating conditions, over entire operating range, in all modes.

.2 On independent systems and interacting systems.

.2 Cx procedures to be repeatable and reported results are to be verifiable.

.3 Follow equipment manufacturer's operating instructions.

.4 EMCS trending to be available as supporting documentation for performance verification.

1.22 WITNESSING COMMISSIONING

.1 Contract Administrator and the City to have the opportunity to witness activities and verify results.

1.23 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 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.

.3 Provide copies of certificates to Contract Administrator within 5 days of test and with Cx report.

1.24 SUNDRY CHECKS AND ADJUSTMENTS

.1 Make adjustments and changes which become apparent as Cx proceeds.

.2 Perform static and operational checks as applicable and as required.

1.25 DEFICIENCIES, FAULTS, DEFECTS

.1 Correct deficiencies found during start-up and Cx to satisfaction of Contract Administrator.

.2 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.

1.26 COMPLETION OF COMMISSIONING

.1 Upon completion of Cx leave systems in normal operating mode.

.2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.

.3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Contract Administrator.

1.27 ACTIVITIES UPON COMPLETION OF COMMISSIONING

.1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.

1.28 TRAINING

.1 In accordance with Section 01 91 13.83 - Commissioning Training.

1.29 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

.1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.30 OCCUPANCY

.1 Cooperate fully with Contract Administrator during stages of acceptance and occupancy of facility.

1.31 INSTALLED INSTRUMENTATION

.1 Use instruments installed under Contract for TAB and PV if:

.1 Accuracy complies with these specifications.

.2 Calibration certificates have been deposited with Contract Administrator.

.2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

1.32 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 +/- 10% of specified values.

.2 Instrument accuracy tolerances:

.1 To be of higher order of magnitude than equipment or system being tested.

.3 Measurement tolerances during verification:

.1 Unless otherwise specified actual values to be within +/- 2 % of recorded values.

1.33 CITY'S PERFORMANCE TESTING

.1 Performance testing of equipment or system by Contract Administrator will not relieve Contractor from compliance with specified start-up and testing procedures.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Description of overall structure of Plan and roles and responsibilities of commissioning team.

.2 Related Requirements

.1 301-2024 Bid Opportunity.

1.2 REFERENCE STANDARDS

.1 American Water Works Association (AWWA)

.2 Hydraulic Institute (ANSI/HI)

.1 9.6.3, Rotodynamic Pumps – Guideline for Operating Region
.2 9.6.4, Rotodynamic Pumps for Vibration Measurements and Allowable Values
.3 14.6, Rotodynamic Pumps for Hydraulic Performance Acceptance Tests

.3 National Fire Protection Association (NFPA)

.1 NFPA 820, Fire Protection in Wastewater Treatment and Collection Facilities

.4 Public Works and Government Services Canada (PWGSC)

.1 PWGSC - Commissioning Guidelines CP.4 -3rd edition.

1.3 GENERAL

.1 Provide a fully functional pumping station:

.1 Systems, equipment and components meet City's functional requirements before date of acceptance, and operate consistently at peak efficiencies and within specified energy budgets under normal loads.
.2 O&M personnel have been fully trained in aspects of installed systems.
.3 Complete documentation relating to installed equipment and systems.

.2 Acronyms:

.1 Cx - Commissioning.
.2 HMI – Human Machine Interface
.3 O&M - Operation and Maintenance.
.4 PI - Product Information.
.5 PLC – Programmable Logic Controller
.6 PV - Performance Verification.
.7 TAB - Testing, Adjusting and Balancing.
.8 WHMIS - Workplace Hazardous Materials Information System.

.9 WHMIS Safety Data Sheets (SDS).

.3 Commissioning terms used in this Section:

.1 Bumping: short term start-up to prove ability to start and prove correct rotation.

.2 Deferred Cx - Cx activities delayed for reasons beyond Contractor's control due to lack of occupancy, weather conditions, need for heating/cooling loads.

.4 Use this Cx Plan as master planning document for Cx:

.1 Outlines organization, scheduling, allocation of resources, documentation, pertaining to implementation of Cx.

.2 Communicates responsibilities of team members involved in Cx Scheduling, documentation requirements, and verification procedures.

.3 Sets out deliverables relating to O&M, process and administration of Cx.

.4 Describes process of verification of how built works meet design requirements.

.5 Management tool that sets out scope, standards, roles and responsibilities, expectations, deliverables, and provides:

.1 Overview of Cx.

.2 General description of elements that make up Cx Plan.

.3 Process and methodology for successful Cx.

1.4 DEVELOPMENT OF 100% CX PLAN

.1 Cx Plan to be 100% completed minimum 8 weeks prior to commissioning to take into account:

.1 Approved shop drawings and product data.

.2 Approved changes to contract.

.3 Contractor's project schedule.

.4 Cx schedule.

.5 Contractor's, sub-contractor's, suppliers' requirements.

.6 Project construction team's and Cx team's requirements.

.2 Submit completed Cx Plan to Contract Administrator and obtain written approval.

1.5 REFINEMENT OF CX PLAN

.1 During construction phase, revise, refine and update Cx Plan to include:

.1 Changes resulting from Client program modifications.

.2 Approved design and construction changes.

.2 Revise, refine and update during construction phase. At each revision, indicate revision number and date.

.3 Submit each revised Cx Plan to Contract Administrator for review and obtain written approval.

.4 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

1.6 COMPOSITION, ROLES AND RESPONSIBILITIES OF CX TEAM

.1 Contract Administrator to maintain overall responsibility for project and is sole point of contact between members of commissioning team.

.2 The Cx Team shall consist of the following members:

.1 Contract Administrator is responsible for:

.1 During construction, conducting periodic site reviews to observe general progress.

.2 Monitoring operations and Cx activities.

.3 Ensuring Cx activities are carried out to deliver of a fully operational sewage lift station including:

.1 Review of Cx documentation from operational perspective.

.2 Witnessing, certifying accuracy of reported results.

.3 Witnessing and certifying TAB and other tests.

.4 Ensuring implementation of final Cx Plan.

.5 Witnessing verification of performance of installed systems and equipment.

.6 Ensuring implementation of Training Plan.

.7 Training on the HMI, PLC panel selector switches, and standalone level controllers located within the PLC panel.

.8 Commissioning of the HMI, PLC, and standalone level controllers.

.2 Construction Team: contractor, subcontractors, suppliers and support disciplines, are responsible for construction/installation in accordance with Contract Documents, including:

.1 Testing.

.2 TAB.

.3 Organizing Cx

.4 Performance of Cx activities to ensure delivery of a fully operational sewage lift station including:

.1 Review for performance, reliability, durability of operation, accessibility, maintainability, operational efficiency under conditions of operation.

.2 Protection of health, safety and comfort of occupants and O&M personnel.

.5 Delivery of training and Cx documentation.

.6 Assigning one person as point of contact with Contract Administrator and Cx agent for administrative and coordination purposes.

.3 Contractor's Cx agent implements specified Cx activities including:

.1 Demonstrations.

.2 Training, except as noted below.

.1 HMI training, PLC panel selector switches training, and training on the standalone level controllers located within the PLC panel.

.3 Testing.

.4 Development of Cx documentation.

.5 Preparation, submission of test reports.

.6 Developing O&M Manual.

.4 The City: represents lead role in Operation Phase and onwards and is responsible for:

.1 Receiving the completed facility.

.2 Participating in training.

.3 Day-To-Day operation and maintenance of the completed facility.

1.7 CX PARTICIPANTS

.1 Employ the following Cx participants to verify performance of equipment and systems:

.1 Installation contractor/subcontractor:

.1 Equipment and systems except as noted below.

.1 HMI screens, PLC Control panel, PLC panel selector switches, and standalone level controllers commissioning shall be in the scope of the Contract Administrator.

.2 Equipment manufacturer: equipment specified to be installed and started by manufacturer.

.1 To include performance verification.

.1 Process pumps (P-L01, P-L02)

.3 Specialist subcontractor: equipment and systems supplied and installed by specialist subcontractor.

.4 Ensure that Cx participants:

.1 Could complete work within scheduled time frame.

.2 Are available for emergency and troubleshooting service during first year of occupancy by the City for adjustments and modifications outside responsibility of O&M personnel, including but not limited to:

.1 Modify ventilation rates.

.2 Pump operations

.3 Instrumentation and control

.5 Provide names of participants to Contract Administrator and details of instruments and procedures to be followed for Cx 3 months prior to starting date of Cx for review and approval.

1.8 EXTENT OF CX

.1 Commission mechanical systems and associated equipment including but not limited to:

.1 Process pumping systems:

.1 Process Pumps (P-L01, P-L02)

.2 Process Valves

.3 Flow meter

.4 Flow Control Valve (FV-B80, Offtake Structure 3)

.5 Wet well site glass level gauges

.2 Plumbing systems:
  .1 Domestic CWS
    .1 Booster Pump & Pressure tank (P-L52, V-L52)
    .2 Backflow Preventer (BFP-L55)
  .2 Utility Sink & Tankless Water Heater (U-L53, HTR-L54)
  .3 Hose Bibbs
  .4 Floor drains
  .5 Sump Pumps (P-L51, P-V50)
.3 HVAC systems:
  .1 HVAC systems
    .1 Fans (SF-L60, EF-L61, EF-V61, AHU-V60)
    .2 Air conditioning unit (ACU-L62)
    .3 Unit Heaters (UH-L63)
    .4 Duct Heaters (HCE-L64, HCE-L65)
    .5 Dampers (XV-L60-1, XV-L61-1, XV-V-60-1, XV-V61-1)
    .6 HVAC Controls
.4 Conveying Equipment:
  .1 Electric Chain Hoist (HO-L50)
.5 Utilities:
  .1 Propane Tank (TK-L56)
  .2 Propane Vaporizer (U-L57)
.6 Fire and life safety systems:
  .1 Fire extinguishers (FEX-L66, FEX-L67)

.2 Commission electrical systems and equipment:

.1 Low voltage below 750 V:
  .1 Low voltage equipment.
  .2 Low voltage distribution systems.
  .3 Motor control centres.
  .4 Motor control field devices.
.2 Emergency power generation systems:
  .1 Transfer switchgear.
  .2 Uninterruptible power systems.
.3 Lighting systems:
  .1 Lighting equipment.
  .2 Distribution systems.
  .3 Emergency lighting systems, including battery packs.

.3 Commission automation systems and equipment:

.1 Process instrumentation.
.2 Control panels.

.3 Local operation stations.

1.9 DELIVERABLES RELATING TO O&M PERSPECTIVES

.1 General requirements:

.1 Compile English documentation.

.2 Documentation to be computer-compatible format ready for inputting for data management.

.3 Refer to additional specification sections within contract documents for equipment-specific requirements.

.2 Provide deliverables:

.1 Warranties.

.2 Project record documentation.

.3 Inventory of spare parts, special tools and maintenance materials.

.4 Maintenance Management System (MMS) identification system used.

.5 WHMIS information.

.6 WHMIS Safety Data Sheets (SDS).

.7 Electrical Panel inventory containing detailed inventory of electrical circuitry for each panel board. Duplicate of inventory inside each panel.

1.10 DELIVERABLES RELATING TO THE CX PROCESS

.1 General:

.1 Start-up, testing and Cx requirements, conditions for acceptance and specifications form part of relevant technical sections of these specifications.

.2 Refer to additional specification sections within contract documents for equipment-specific requirements.

.2 Definitions:

.1 Cx as used in this section includes:

.1 Cx of components, equipment, systems, subsystems, and integrated systems.

.2 Factory inspections and performance verification tests.

.3 Deliverables: provide:

.1 Cx Specifications.

.2 Startup, pre-Cx activities and documentation for systems, and equipment.

.3 Completed installation checklists (ICL).

.4 Completed product information (PI) report forms.

.5 Completed performance verification (PV) report forms.

.6 Results of Performance Verification Tests and Inspections.

.7 Description of Cx activities and documentation.

.8 Description of Cx of integrated systems and documentation.

.9 Training Plans.

.10 Cx Reports.

.11 Prescribed activities during warranty period.

.4 Contract Administrator to witness and certify tests and reports of results provided to Departmental Representative.

1.11 PRE-CX ACTIVITIES AND RELATED DOCUMENTATION

.1 Items listed in this Cx Plan include the following:

.1 Pre-Start-Up inspections: by Contractor prior to permission to start up and rectification of deficiencies to Contract Administrators satisfaction.

.2 Contractor to use approved check lists.

.3 Contract Administrator may monitor all of these pre-start-up inspections.

.4 Include completed documentation with Cx report.

.5 Conduct pre-start-up tests: conduct pressure, static, flushing, cleaning, and "bumping" during construction as specified in technical sections. To be witnessed and certified by Contract Administrator and does not form part of Cx specifications.

.6 Contract Administrator may monitor some of these inspections and tests.

.7 Include completed documentation in Cx report.

.2 Pre-Cx activities - MECHANICAL:

.1 Process pumping systems:

.1 "Bump" each item of equipment in its "stand-alone" mode.

.2 Complete pre-start-up checks and complete relevant documentation.

.3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.

.2 Plumbing systems:

.1 "Bump" each item of equipment in its "stand-alone" mode.

.2 Complete pre-start-up checks and complete relevant documentation.

.3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.

.3 HVAC equipment and systems:

.1 "Bump" each item of equipment in its "stand-alone" mode.

.2 At this time, complete pre-start-up checks and complete relevant documentation.

.3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.

.4 Perform TAB on systems. TAB reports to be approved by Contract Administrator.

.3 Pre-Cx activities – FIRE AND LIFE SAFETY SYSTEMS

.1 No pre-Cx activities.

.4 Pre-Cx activities - ELECTRICAL:

.1 Low voltage distribution systems under 750 V:

.1 Requires independent testing agency to perform pre- energization and post-energization tests.

.2 Emergency power generation systems

.1 Transfer switch: test of manual operation of switch

.3 Lighting systems:

.1 Emergency lighting systems:

.1 Tests to include verification of lighting levels and coverage, initially by disrupting normal power.

.4 Automation systems: these include:

.1 Instrumentation calibration.

.2 Control panel loop checks and field wiring connections for process and HVAC.

.3 Communications between the pumping station and the City's SCADA system.

1.12 START-UP

.1 Start up components, equipment and systems.

.2 Equipment manufacturer, supplier, installing specialist sub-contractor, as appropriate, to start-up, under Contractor's direction, all equipment and systems except the following:

.1 PLC control panel, HMI screens, and standalone level controllers shall be started up under the supervision of the Contract Administrator. Contract Administrator shall perform commissioning of the PLC control panel and standalone level controllers.

.3 Contract Administrator to monitor some of these start-up activities.

.1 Rectify start-up deficiencies to satisfaction of Contract Administrator.

.4 Performance Verification (PV):

.1 Approved Cx Agent to perform.

.1 Repeat when necessary until results are acceptable to Contract Administrator.

.2 Use modified generic procedures to suit project requirements.

.3 Contract Administrator to witness and certify reported results using approved PI and PV forms.

.4 Contract Administrator to approve completed PV.

.5 Contract Administrator reserves right to verify up to 30% of reported results at random.

.6 Failure of randomly selected item shall result in rejection of PV report or report of system startup and testing.

1.13 CX ACTIVITIES AND RELATED DOCUMENTATION

.1 Perform Cx by specified Cx agency using procedures developed by Cx agency and approved by Contract Administrator.

.2 Contract Administrator to monitor Cx activities.

.3 Upon satisfactory completion, Cx agency performing tests to prepare Cx Report using approved PV forms.

.4 Cx agency to witness and certify reported results of Cx activities and forward to Contract Administrator.

.5 Contract Administrator reserves right to verify a percentage of reported results at no cost to contract.

1.14 CX OF INTEGRATED SYSTEMS AND RELATED DOCUMENTATION

.1 Cx to be performed by specified Cx specialist, using procedures developed by Cx agency and approved by Contract Administrator.

.2 Tests to be witnessed by the City and Contract Administrator and documented on approved report forms.

.3 Upon satisfactory completion, Cx specialist to prepare Cx Report, to be certified by Cx agency and submitted to Contract Administrator for review.

.4 Contract Administrator reserves right to verify percentage of reported results.

.5 Integrated systems to include:

.1 HVAC and associated systems forming part of integrated HVAC systems.

.2 Transfer switch.

.3 Lighting & Emergency lighting systems.

.4 Automation systems.

1.15 INSTALLATION CHECK LISTS (ICL)

.1 Refer to Section 01 91 13.16 - Commissioning Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.16 PRODUCT INFORMATION (PI) REPORT FORMS

.1 Refer to Section 01 91 13.16 - Commissioning Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.17 PERFORMANCE VERIFICATION (PV) REPORT

.1 Refer to Section 01 91 13.16 - Commissioning Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.18 CX SCHEDULES

.1 Prepare detailed Cx Schedule and submit to Contract Administrator for review and approval same time as project Construction Schedule. Include:

.1 Milestones, testing, documentation, training and Cx activities of components, equipment, subsystems, systems and integrated systems, including:

.1 Cx agents' credentials: 60 days before start of Cx.

.2 Cx procedures: 3 months after award of contract.

.3 Submission of list of instrumentation with relevant certificates: 21 days before start of Cx.

.4 Notification of intention to start TAB: 21 days before start of TAB.

.5 TAB: after successful start-up, correction of deficiencies and verification of normal and safe operation.

.6 Notification of intention to start Cx: 14 days before start of Cx.

.7 Notification of intention to start Cx of integrated systems: after Cx of related systems is completed 14 days before start of integrated system Cx.

.8 Identification of deferred Cx.

.9 Implementation of training plans.

.10 Cx reports: immediately upon successful completion of Cx.

.2 Detailed training schedule to demonstrate no conflicts with testing, completion of project and hand-over to the City.

.2 After approval, incorporate Cx Schedule into Construction Schedule.

.3 Contract Administrator, Contractor, and Contractor's Cx agent will monitor progress of Cx against this schedule.

1.19 CX REPORTS

.1 Submit reports of tests, witnessed and certified by Cx agency to Contract Administrator who will verify reported results.

.2 Include completed and certified PV reports in properly formatted Cx Reports.

.3 Before reports are accepted, reported results to be subject to verification by Contract Administrator.

1.20 ACTIVITIES DURING WARRANTY PERIOD

.1 Cx activities must be completed before issuance of Commissioning Certificate, it is anticipated that certain Cx activities may be necessary during Warranty Period, including:

.1 Fine tuning of HVAC systems.

1.21 TESTS TO BE PERFORMED BY THE CITY

.1 None anticipated on this project.

1.22 TRAINING PLANS

.1 Refer to Section 01 91 13.18 – Commissioning Training.

1.23 FINAL SETTINGS

.1 Upon completion of Cx to satisfaction of Contract Administrator, lock control devices in their final positions, indelibly mark settings marked and include in Cx Reports.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Commissioning forms to be completed for equipment, system and integrated system.

.2 Related Requirements

.1 301-2024 Bid Opportunity

.2 Section 40 80 11 – Automation - Commissioning

1.2 INSTALLATION/ START-UP CHECK LISTS

.1 Include the following data:

.1 Product manufacturer's installation instructions and recommended checks.

.2 Special procedures as specified in relevant technical sections.

.3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.

.2 Equipment manufacturer's installation/start-up check lists are acceptable for use. As deemed necessary by Contract Administrator supplemental additional data lists will be required for specific project conditions.

.3 Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.

.4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Contract Administrator. Check lists will be required during Commissioning and will be included in Operation & Maintenance Manual (O&M Manual) at completion of project.

.5 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.3 PRODUCT INFORMATION (PI) REPORT FORMS

.1 Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment. This documentation is included in the O&M Manual at completion of work.

.2 Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain Contract Administrator's approval.

1.4 PERFORMANCE VERIFICATION (PV) FORMS

.1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.

.2 PV report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.

.3 Prior to PV of integrated system, complete PV forms of related systems and obtain Contract Administrator's approval.

1.5 SAMPLES OF COMMISSIONING FORMS

.1 Contractor’s Cx Agent will develop and provide to Contract Administrator samples of required project-specific Commissioning forms in electronic format for review and approval. The following equipment categories are representative of the forms that may be required but not limited to:

- .1 Process Pumping System Commissioning Forms:
  - .1 Process Pumps
  - .2 Process Valves
  - .3 Flow Meter
  - .4 Flow Control Valve & Electric Actuator
  - .5 Level Gauge
- .2 Plumbing System Commissioning Forms:
  - .1 Booster pump
  - .2 Utility sink & water heater
  - .3 Sump Pumps
- .3 HVAC System Commissioning Forms:
  - .1 Fans
  - .2 Air Handling Unit
  - .3 Air Conditioning Unit
  - .4 Unit Heater
  - .5 Duct Heater
  - .6 Dampers
  - .7 Filter
  - .8 HVAC controls
- .4 Conveying Equipment
  - .1 Electric Chain Hoist
- .5 Utilities
  - .1 Propane Tank
  - .2 Propane Vaporizer
- .6 Fire and Life Safety Systems Commissioning Forms:
  - .1 Fire extinguishers

.7 Low Voltage (below 750V) Commissioning Forms
- .1 Low voltage equipment
- .2 Low voltage distribution systems
- .3 Motor control centres
- .4 Motor control field devices

.8 Emergency Power Generation Systems
- .1 Transfer switchgear
- .2 Uninterruptible power systems

.9 Lighting Systems
- .1 Lighting equipment.
- .2 Distribution systems.
- .3 Emergency lighting systems, including battery packs.

.10 Automation systems and equipment:
- .1 Process instrumentation calibration sheets.
- .2 Process instrumentation loop checks
- .3 PLC control panels
  - .1 PLC Control Panel and standalone level controllers shall be commissioned by the Contract Administrator. As part of the loop check procedure, Contractor shall assist/collaborate with Contract Administrator to verify functionality of each PLC input/output to the instrumentation device in the field.

.2 Revise items on Commissioning forms to suit project requirements.

1.6 CHANGES AND DEVELOPMENT OF NEW REPORT FORMS

.1 When additional forms are required, but are not available from Contract Administrator, develop appropriate verification forms and submit to Contract Administrator for approval prior to use.

1.7 COMMISSIONING FORMS

.1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.

.2 Strategy for Use:

- .1 Commissioning agent provides project-specific Commissioning forms.
- .2 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.
- .3 Confirm operation as per design criteria and intent.
- .4 Identify variances between design and operation and reasons for variances.
- .5 Verify operation in specified normal and emergency modes and under specified load conditions.
- .6 Record analytical and substantiating data.
- .7 Verify reported results.

.8 Form to bear signatures of recording technician and reviewed and signed off by Contract Administrator.

.9 Submit immediately after tests are performed.

.10 Reported results in true measured SI unit values.

.11 Provide Contract Administrator with originals of completed forms.

.12 Maintain copy on site during start-up, testing and commissioning period.

.13 Forms to be both hard copy and electronic format with typed written results in Operation & Maintenance Manual in accordance with Section 01 78 00 – Closeout Submittals.

1.8 LANGUAGE

.1 To suit the language profile of the awarded contract.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 This Section specifies roles and responsibilities of Commissioning Training.

.2 Related Requirements

.1 301-2024 Bid Opportunity

.2 Section 40 80 11 – Automation - Commissioning

1.2 TRAINEES

.1 Trainees: personnel selected for operating and maintaining the facility. Includes facility managers, operators, maintenance staff, security staff, and technical specialists as required.

.2 Trainees will be available for training during later stages of construction for purposes of familiarization with systems.

1.3 INSTRUCTORS

.1 Contract Administrator will provide:

.1 Operator training on HMI screens; navigation and general use.

.2 Operator training on PLC panel selector switches

.3 Operator training on standalone level controllers

.2 Contractor and certified factory-trained manufacturers' personnel: to provide instruction on the following:

.1 Start-Up, operation, shut-down of equipment, components and systems.

.2 Control features, 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.

.3 Contractor and equipment manufacturer to provide instruction on:

.1 Start-up, operation, maintenance and shut-down of equipment they have certified installation, started up and carried out PV tests.

1.4 TRAINING OBJECTIVES

.1 Training to be detailed and duration to ensure:

.1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.

.2 Effective on-going inspection, measurements of system performance.

.3 Proper preventive maintenance, diagnosis and trouble-shooting.

.4 Ability to update documentation.

.5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

1.5 TRAINING MATERIALS

.1 Instructors to be responsible for content and quality.

.2 Training materials to include:

.1 "As-Built" Contract Documents.

.2 Operating Manual.

.3 Maintenance Manual.

.4 TAB and PV Reports.

.3 Training materials to be in a format that permits future training procedures to same degree of detail.

1.6 SCHEDULING

.1 Include in Commissioning Schedule time for training.

.2 Deliver training during regular working hours, training sessions to be 3 hours in length.

.3 Training to be completed prior to acceptance of facility.

1.7 RESPONSIBILITIES

.1 Be responsible for:

.1 Implementation of training activities,

.2 Coordination among instructors,

.3 Quality of training, training materials,

.2 City Representative will evaluate training and materials.

.3 Upon completion of training, provide written report, signed by Instructors, witnessed by City Representative.

1.8 TRAINING CONTENT

.1 Training to include demonstrations by Instructors using the installed equipment and systems.

.2 Content includes:

.1 Functional requirements.

.2 System philosophy, limitations of systems and emergency procedures.

.3 Review of system layout, equipment, components and controls.

.4 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.

.5 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.

.6 Maintenance and servicing.

.7 Trouble-shooting diagnosis.

.8 Inter-Action among systems during integrated operation.

.9 Review of O&M documentation.

.3 Provide specialized training as specified in relevant Technical Sections of the construction specifications.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 General

1.1 RELATED REQUIREMENTS

.1 03 20 00 Concrete Reinforcing

.2 03 30 00 Cast-In-Place Concrete

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-A23.1-19/A23.2-19, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA-O86-19 Engineering Design in Wood.

.3 CSA O121-17(R2022), Douglas Fir Plywood.

.4 CSA O151-17, Canadian Softwood Plywood.

.5 CSA O153-19, Poplar Plywood.

.6 CAN/CSA-O325-21, Construction Sheathing.

.7 CSA O437 Series-93(R2011), Standards for OSB and Waferboard.

.8 CSA S269.1-16 (R2021), Falsework and Formwork.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit shop drawings for formwork and falsework.

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.

.2 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1 for formwork and falsework drawings.

.3 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.

.3 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for proprietary materials used in formwork liners and coatings and include product characteristics, performance criteria, physical size, finish, and limitations.

1.4 QUALITY ASSURANCE

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

.2 Retain a professional engineer registered or licensed in Manitoba, Canada, with experience in formwork and falsework design of comparable complexity and scope, to perform following services as part of Work of this Section:

.1 Design of formwork and falsework:

.2 Review, stamp, and sign fabrication and erection Shop Drawings, design calculations and amendments.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.4 Store materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.5 Store and protect formwork from damages.

.6 Replace defective or damaged materials with new.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Formwork materials:

.1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121, CAN/CSA-O86, CSA O437 Series, CSA-O153.

.2 Form ties:

.1 Containment pit walls: Coil type with force fit waterstop disc and setback plastic cone that leaves a 50 mm deep hole in the concrete surface for waterproofing grouting.

.2 Other structures: removable, tapered or snap-off type of fixed or adjustable length with setback plastic cone that leaves a 25 mm minimum deep hole in concrete surface for grouting.

.3 Form liner:

.1 Plywood: medium density overlay Canadian Softwood Plywood to CSA O151.

.4 Form release agent: shall not leave a residue, discolour or stain concrete surface. Form release agent shall be compatible with final coating or waterproofing agent if applicable.

.1 Acceptable products:

RICH-COTE by NCA/ Acrow-Richmond Ltd.,

Sealtight Duogard by W.R. Meadows of Canada Ltd.,

Eucoslip VOX by Euclid Admixture Canada Inc.,

or approved equal in accordance with B8.

.5 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity between 70 and 110s Saybolt Universal at 40 degrees C, flashpoint minimum 150 degrees C, open cup.

.6 Falsework materials: to CSA-S269.1.

.7 Water Stopped Form Ties: For containment pit walls, furnish one of the following:

.1 Orient water stops perpendicular to tie and symmetrical about center of tie.

.2 Design ties to prevent rotation or disturbance of center portion of tie during removal of ends and to prevent water leaking along tie.

.3 Through bolt ties are not permitted for water-holding structures.

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 Fabricate and erect falsework in accordance with CSA S269.1.

.3 Fabricate and erect formwork in accordance with CAN/CSA-S269.1 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.

.4 Align form joints and make watertight.

.1 Keep form joints to minimum.

.5 Locate horizontal form joints for exposed columns and walls at ceiling line unless shown otherwise.

.6 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.

.7 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.1 Continuous pre-formed flashing reglets to forms where built-in flashings occur at concrete surfaces.

.2 PVC waterstops continuous without displacing reinforcement and in accordance with manufacturer’s instructions. Heat seal all joints, intersections and splices.

.3 Where final work will be exposed to view, set form ties in neat regular patterns.

.8 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.

.1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

.9 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

.1 Leave formwork in place for following minimum periods of time after placing concrete.

.1 7 days for walls and sides of beams.

.2 7 days for columns.

.3 14 days for beam soffits, slabs, decks and other structural members, or 7 days when replaced immediately with adequate shoring to standard specified for falsework.

.4 Time periods for walls and beam side forms may be reduced to 3 days if acceptable curing and cold weather protection is provided.

.2 In cold weather, the minimum time interval may be governed by the requirement for protection of concrete as specified elsewhere in these specifications. Generally, the minimum time interval may be governed by the curing requirements of Section 03 30 00 Cast-In-Place Concrete.

.3 Remove formwork when concrete has reached 70% of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.

.4 Provide 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 at not more than 3000 mm apart.

.6 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Concrete Institute (ACI)

.1 SP-66-04, ACI Detailing Manual 2004.

.1 ACI 315-99, Details and Detailing of Concrete Reinforcement.

.2 ACI 315R-04, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.

.2 ASTM International

.1 ASTM A143/A143M-07 (R2020), Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.

.2 ASTM A185/A185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

.3 ASTM A775/A775M-19, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

.3 CSA International

.1 CSA-A23.1-19/A23.2-19 Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CAN/CSA-A23.3-19, Design of Concrete Structures.

.3 CSA-G30.18-21, Carbon Steel Bars for Concrete Reinforcement.

.4 CSA-G40.20/G40.21-13(R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.5 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.6 CSA W186-21, Welding of Reinforcing Bars in Reinforced Concrete Construction.

.4 Reinforcing Steel Institute of Canada (RSIC)

.1 RSIC-2020, Reinforcing Steel Manual of Standard Practice.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Prepare reinforcement shop drawings in accordance with RSIC Manual of Standard Practice and ACI 315

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.

.1 Indicate placing of reinforcement and:

.1 Bar bending details.

.2 Lists.

.3 Quantities of reinforcement.

.4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Contract Administrator, with identifying code marks to permit correct placement without reference to structural drawings.

.5 Indicate sizes, spacings and locations of chairs, spacers and hangers.

.2 Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated.

.3 Indicate position and size of openings in slabs and walls. Coordinate with trades requiring openings.

.3 Quality Assurance Submittals:

.1 Submit in accordance with Section 01 45 00 - Quality Control and as described in PART 2 - SOURCE QUALITY CONTROL.

.2 Mill Test Report: upon request, submit to Contract Administrator certified copy of mill test report of reinforcing steel.

.3 Upon request submit in writing to Contract Administrator proposed source of reinforcement material.

.4 Upon request submit to Contract Administrator epoxy coating applicator certificates identified in Quality Assurance.

1.3 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 Storage and Handling Requirements:

.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.

Part 2 Products

2.1 MATERIALS

.1 Substitute different size bars only if permitted in writing by Contract Administrator.

.2 Reinforcing steel: billet steel, grade 400, deformed bars to CSA-G30.18, unless indicated otherwise.

.3 Reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.18.

.4 Cold-drawn annealed steel wire ties: to ASTM A82/A82M.

.5 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.

.6 Mechanical splices: subject to approval of Contract Administrator.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 ACI 315 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.1 ACI 315R unless indicated otherwise.

.2 Obtain Contract Administrator's written approval for locations of reinforcement splices other than those shown on placing drawings.

.3 Upon approval of Contract Administrator, weld reinforcement in accordance with CSA W186.

2.3 SOURCE QUALITY CONTROL

.1 Upon request, provide Contract Administrator with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.

.2 Upon request inform Contract Administrator 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 Contract Administrator.

.2 When field bending is authorized, bend without heat, applying slow and steady pressure.

.3 Replace bars, which develop cracks or splits.

3.2 PLACING REINFORCEMENT

.1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.

.2 Prior to placing concrete, obtain Contract Administrator's approval of reinforcing material and placement.

.3 Ensure cover to reinforcement is maintained during concrete pour.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 – Cleaning.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 – Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 03 10 00 Concrete Forming and Accessories

.2 03 20 00 Concrete Reinforcing

1.2 REFERENCES

.1 Abbreviations and Acronyms:

.1 Portland Cement: hydraulic cement, blended hydraulic cement (XXb - b denotes blended) and Portland-limestone cement.

.1 Type GU, GUb and GUL - General use cement.

.2 Type MS and MSb - Moderate sulphate-resistant cement.

.3 Type MH, MHb and MHL - Moderate heat of hydration cement.

.4 Type HE, HEb and HEL - High early-strength cement.

.5 Type LH, LHb and LHL - Low heat of hydration cement.

.6 Type HS and HSb - High sulphate-resistant cement.

.2 Fly ash:

.1 Type F - with CaO content less than 15%.Type CI - with CaO content ranging from 15 to 20%.

.2 Type CH - with CaO greater than 20%.

.3 GGBFS - Ground, granulated blast-furnace slag.

.2 Reference Standards:

.1 ASTM International

.1 ASTM C260/C260M-10a(R2016), Standard Specification for Air-Entraining Admixtures for Concrete.

.2 ASTM C309-19, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.3 ASTM C494/C494M-19e1, Standard Specification for Chemical Admixtures for Concrete.

.4 ASTM C1017/C1017M-13, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

.5 ASTM D1752-18, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

.2 CSA International

.1 CSA A23.1/A23.2-19, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA A283-19, Qualification Code for Concrete Testing Laboratories.

.3 CSA A3000-23, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Provide testing results for review by Contract Administrator and do not proceed without written approval when deviations from mix design or parameters are found.

.3 Concrete pours: provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.

.4 Concrete hauling time: provide for review by Contract Administrator deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.

1.4 SUBMITTALS

.1 Submit the mix design and sieve analysis of all aggregate to the Contract Administrator for review a minimum of 10 days prior to delivery of any concrete to site. The Contract Administrator's review of mix design is for general conformance only, and in no way mitigates the contractor's obligation to provide concrete suitable for placing in the locations shown and meeting all the specified requirements.

.2 Do not place any concrete until materials and mix design are reviewed by Contract Administrator.

1.5 QUALIFICATIONS

.1 Concrete work shall be done by an established firm having at least 5 years of proven satisfactory experience in this trade and employing skilled personnel.

1.6 QUALITY ASSURANCE

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

.2 Provide Contract Administrator, minimum 4 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.

.1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.

.3 Minimum 4 weeks prior to starting concrete work, provide proposed quality control procedures for review by Contract Administrator on following items:

.1 Falsework erection.
.2 Hot weather concrete.
.3 Cold weather concrete.
.4 Curing.

.5 Finishes.

.4 Quality Control Plan: provide written report to Contract Administrator verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements:

.1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.

.1 Do not modify maximum time limit without receipt of prior written agreement from Contract Administrator and concrete producer as described in CSA A23.1/A23.2.

.2 Deviations to be submitted for review by Contract Administrator.

.2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

Part 2 Products

2.1 DESIGN CRITERIA

.1 Alternative 1 - Performance : to CSA A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS.

2.2 PERFORMANCE CRITERIA

.1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by Contract Administrator and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

.2 Portland Cement: to CSA A3001, Type GU, Type HS

.3 Blended hydraulic cement: Type GUb, Type HSb to CSA A3001.

.4 Supplementary cementing materials: with minimum 20% Type F fly ash replacement N GGBFS, by mass of total cementitious materials to CSA A3001.

.5 Water: to CSA A23.1.

.6 Aggregates: to CSA A23.1/A23.2.

.7 Admixtures:

.1 Air entraining admixture: to ASTM C260.

.2 Chemical admixture: to ASTM C494 ASTM C1017. Contract Administrator to approve accelerating or set retarding admixtures during cold and hot weather placing.

.8 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2.

.1 Compressive strength: 40 MPa at 28 days.

.2 Net shrinkage at 28 days: maximum 0 %.

.9 Curing compound: to CSA A23.1/A23.2

.10 Waterstops: ribbed extruded PVC type complete with molded corner and intersection pieces.

.1 Cast-in waterstops:

.1 Waterstops for construction joints to have a minimum width of 150 mm unless noted otherwise on the drawings. Acceptable products: PVC Type 5 by Durajoint or approved equal in accordance with B8.

.11 Premoulded joint fillers:

.1 Bituminous impregnated fiber board: to ASTM D1751.

.12 Form tie sealer: non-shrink, non-staining to match adjacent concrete surfaces on exposed work.

.13 Isolation joint sealant: polyurethane sealant. Acceptable products: Sikaflex, Vulkem 45 or approved equivalent.

.14 Bonding adhesive: two component epoxy resin, compatible with potable water. Acceptable products: Sikadur Hi-Mod by Sika or approved equal.

.15 Use compatible additives, admixtures, curing compounds and sealers.

2.3 MIXES

.1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.

.1 Provide concrete mix to meet following hard state requirements:

.1 Base Slabs:

.1 Durability and class of exposure: S-1

.2 Compressive strength at 28 day age: 30 MPa minimum.

.3 Compressive strength at 56 day age: 32 MPa minimum.

.4 Water/Cement Ratio (W/C): 0.45

.5 Aggregate size 20 mm maximum.

.6 Entrained Air: 4%-7%

.2 Grade Beams and Walls:

.1 Durability and class of exposure: S-1

.2 Compressive strength at 28 day age: 30 MPa minimum.

.3 Compressive strength at 56 day age: 32 MPa minimum.

.4 Water/Cement Ratio (W/C): 0.45

.5 Aggregate size 20 mm maximum.
.6 Entrained Air: 4%-7%

.3 Structural Slabs (Lift Station floor, Valve Chamber Roof, Wet Well Roof, Generator and Propane tank pads):
.1 Durability and class of exposure: C-1
.2 Compressive strength at 28 day age: 35 MPa minimum.
.3 Water/Cement Ratio (W/C): 0.45
.4 Aggregate size 20 mm maximum.
.5 Entrained Air: 5%-8%

.4 Exterior Slabs on grade (Non-structural):
.1 Durability and class of exposure: C-2
.2 Compressive strength at 28 day age: 32 MPa minimum.
.3 Water/Cement Ratio (W/C): 0.45
.4 Aggregate size 20 mm maximum.
.5 Entrained Air: 5%-8%

.5 Masonry fill concrete:
.1 Durability and class of exposure: N
.2 Compressive strength at 28 day age: 25 MPa minimum.
.3 Water/Cement Ratio (W/C): 0.45
.4 Aggregate size 20 mm maximum.
.5 Entrained Air: N/A

.2 Provide quality management plan to ensure verification of concrete quality to specified performance.

.3 Concrete supplier's certification: both batch plant and materials meet CSA A23.1 requirements.

.4 Mix proportions shall produce a mixture which will work readily into corners and angles of forms and around reinforcement. Mix proportions shall not permit segregation and shall not cause excessive water to collect on the surface.

.5 The addition of water to concrete on site shall not be permitted.

2.4 CEMENTITIOUS WATERPROOFING

.1 Surfaces to receive cementitious waterproofing:
.1 Valve chamber roof

.2 Application method: mixed into concrete to manufacturer’s recommendations.

.3 Acceptable products: Xypex or approved equivalent.

Part 3 Execution

3.1 PREPARATION

.1 Obtain Contract Administrator's written approval before placing concrete. Provide 48 hours minimum 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 Contract Administrator’s approval of proposed method for protection of concrete during placing and curing.

.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 In locations where new concrete is dowelled to existing work:

.1 Prepare existing concrete surface to CSP 7 profile (scarify to 6-8mm amplitude). Use methods that do not damage the slab. These include milling machines and shotblasting methods.

.2 Ensure prepared concrete surface free of debris, dust, oil prior to application of bonding agent.

.3 Apply bonding agent to prepared concrete surface following manufacturer’s instructions. Approved products:

.1 Sikadur-32 Hi-Mod by Sika Group

.2 Intralok by W.R. Meadows

.3 MasterEmaco A 660 by BASF

.4 Or Approved Equal in Accordance with B8

3.2 INSTALLATION/APPLICATION

.1 Do cast-in-place concrete work to CSA A23.1/A23.2.

.2 Compact concrete thoroughly and uniformly by means of tamping, hand tools, vibrators or finishing machines to secure a dense, homogenous structure, close bond with reinforcement and smooth-formed surfaces.

.3 Use internal vibrator wherever possible. External vibrators may be used where a satisfactory finish cannot be achieved with internal vibrators alone.

.4 Where required, vibration to be supplemented with hand spading adjacent to the forms.

.5 Maintain one spare, workable vibrator at all times while concrete is being placed.

.6 Place concrete continuously between pre-set construction and control joints.

.7 Honeycomb or embedded debris in concrete is not acceptable. Notify Contract Administrator upon discovery.

.8 Remove and replace defective concrete as directed by the Contract Administrator.

.9 Sleeves and inserts:

.1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through slab, except where indicated or approved by Contract Administrator.

.2 Where approved by Contract Administrator, set sleeves and other inserts and openings as indicated or specified elsewhere.

.3 Sleeves and openings greater than 200 x 200 mm not indicated, must be reviewed by Contract Administrator.

.4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from Contract Administrator before placing of concrete.

.5 Confirm locations and sizes of sleeves and openings shown on drawings.

.6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.

.10 Anchor bolts:

.1 Set anchor bolts to templates in co-ordination with appropriate trade prior to placing concrete.

.2 Grout anchor bolts in preformed holes or holes drilled after concrete has set only after receipt of written approval from Contract Administrator.

.1 Formed holes: 100 mm minimum diameter.

.2 Drilled holes: to manufacturers' recommendations.

.3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.

.4 Set bolts and fill holes with epoxy grout.

.11 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.

.12 Curing:

.1 Finish concrete to CSA A23.1/A23.2.

.2 Use procedures as reviewed by Contract Administrator or those noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.

.13 Joint fillers:

.1 Furnish filler for each joint in single piece for depth and width required for joint unless otherwise authorized by the Contract Administrator.

.2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.3 Locate and form isolation, construction and expansion joints as indicated.

.4 Install joint filler.

.5 Use 12 mm thick joint filler to separate slab-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.

.14 Waterstops:

.1 Install continuous waterstops at all construction and expansion joints in the structure to produce a watertight structure.

.2 Be responsible for determining the location of all construction joints not shown on drawings in accordance with accepted practice for the production of a watertight concrete structure. Produce layout drawings detailing the location of all proposed construction joints for review by the Contract Administrator. The Contract Administrator reserves the right to request the use of additional joints to more closely follow the design intent and/or to suit site conditions.

.3 Each piece of waterstop to be of maximum practicable length in order that the number of end joints will be held to a minimum.

.4 Joints at intersections and at ends of pieces to be injection molded. Joints to develop effective water tightness fully equal to that of continuous waterstop material and shall permanently develop not less than 50% of the mechanical strength of the parent section and shall permanently retain its flexibility.

.5 Only straight butt welds will be permitted in the field. All other heat welds must be performed by the manufacturer at the plant.

.6 Handle waterstop carefully to ensure proper placing and freedom from nail punctures.

.7 At horizontal waterstops, place concrete by hand, to ensure that there are no trapped air pockets, proper embedment and no misalignment.

.8 At vertical joints, wire the waterstop properly into position and place concrete carefully to prevent misalignment.

.9 Do not distort or pierce waterstop such as to hamper performance and displace reinforcement when installing waterstops.

.15 Construction Joints:

.1 Locate construction joints not shown on the drawings to least impair the strength of the structure. Locations to be reviewed by the Contract Administrator prior to construction of formwork and placement of reinforcement. The interface between concrete pours is classified as a construction joint if fresh concrete cannot be incorporated integrally by vibration with that previously placed.

.2 Reinforcing steel to be continuous across joints.

.3 Before placing new concrete on hardened concrete, retighten forms, roughen the surface of hardened concrete, remove laitance and saturate the surface with water in advance of concreting.

.4 Apply a bonding agent to concrete surfaces for all construction joints except as noted in this Section.

.16 Finishing.

.1 Finish concrete in accordance with CAN/CSA-A23.1.

.2 Use procedures acceptable to Contract Administrator or those noted in CAN/CSA-A23.1 to remove excess bleed water. Ensure surface is not damaged.

.3 Provide written declaration that compounds used are compatible.

.4 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.

.5 Immediately after the removal of forms, cut all ties back 25 mm from the concrete face. Fins and protrusions shall be rubbed down or ground off. Remove all honeycombed and other defective concrete down to sound concrete.

.6 Patch all honeycombed areas, defective areas, and tie holes. The area to be patched and an area at least 150 mm wide surrounding it to be dampened to prevent absorption of water from the patching mortar. Make a patching mixture of the same material and of approximately the same proportions as used for the concrete, except omit the coarse aggregate. Use a suitable epoxy bonding agent. The mortar to be thoroughly consolidated into place and struck-off so as to leave the patch slightly higher than the surrounding surface. To permit initial shrinkage, leave it undisturbed for at least one hour before being finally finished. The patched area to be kept damp for at least seven days.

.7 Unexposed exterior concrete surfaces are to have a plain, smooth form finish.

.8 Slab and floor surfaces to receive the finish specified below.

.1 Interior formed concrete surfaces.

.1 Refer to Section 099112 - Specialty Chemical-Resistant Paintingor surface preparation for specialty chemical resistant wall coating for secondary containment wall surfaces; application shall be performed only after watertightness testing has been accepted.

.2 Finish exposed surfaces (other than specified for specialty chemical resistant surfaces) to Smooth Rubbed Finish conforming to CAN/CSA-A23.1-19

.2 Exterior formed concrete surfaces.

.1 Surfaces to receive insulation shall be finished to Smooth-Formed Finish conforming to CAN/CSA-A23.1-19

.2 Other surfaces shall be finished to Rough-Formed Finish conforming to CAN/CSA- A23.1-19, Clause 24.3.5.

3.3 SURFACE TOLERANCE

.1 Concrete tolerance to CSA A23.1

3.4 FIELD QUALITY CONTROL

.1 Site tests: conduct tests as follows:

.1 Concrete pours.
.2 Slump.
.3 Air content.
.4 Compressive strength at 7 and 28 days.
.5 Air and concrete temperature.

.2 Three (3) concrete test cylinders and one (1) slump test shall be taken for every 50 cubic meters placement, or each day concrete is placed, whichever is greater.

.3 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Contract Administrator for review to CSA A23.1/A23.2.

.1 Ensure testing laboratory is certified to CSA A283.

.4 Contractor shall pay for cost of Inspection and Testing.

.5 Contractor will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.

.6 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.

.7 Inspection or testing by Contract Administrator will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

.8 The Contractor will pay for costs of tests as specified in Section 01 45 00 – Quality Control.

3.5 CURING

.1 Moist cure in accordance with CAN/CSA A23.1

.2 Moist curing is deemed to be achieved only if one of the following methods are adopted:

.1 Continuous light sprinkling or ponding of clean water such as to saturate every exposed area of concrete subjected to the curing method.
.2 Providing an absorptive cover to the whole concrete surface subjected to the curing method, such as burlap, and keeping the cover continuously wet. Wet shall be defined as the extraction of free water from the absorptive cover by the action of hand-squeezing any quantity of the cover.
.3 Sealing the whole surface of the concrete subjected to the curing method with a continuous waterproof barrier approved by the Contract Administrator.
.4 Covering the whole surface of the concrete subjected to the curing method with polyethylene sheet which is continuously sealed with waterproof tape at every joint and maintained in such condition that will ensure the air trapped between the concrete surface and the polyethylene sheet is continuously maintained at 100% humidity.
.5 Covering the whole surface with Hydradsorb perforated curing cover as supplied by Wallace Construction Specialties Ltd or equal authorized by Contract Administrator.

.3 Submit method of curing to the Contract Administrator for written authorization. Curing method shall state the concrete element to which it is applicable.

.4 Commence moist curing immediately following the final set and continue uninterrupted for the specified moist curing period.

.5 Moist cure normal Portland cement concrete or sulphate-resisting cement concrete for at least seven (7) days.

.6 Moist cure concrete floor slabs, regardless of cement classification, for seven days.

.7 Cure concrete walls as follows:

.1 Continuously soak top of wall.

.2 Loosen forms as soon as possible without damaging concrete.

.3 Maintain continuous supply of water to top of wall to keep inside of forms wet.

.8 Do not use curing compounds except with written authorization by the Contract Administrator. Do not use curing compounds on surfaces which are to receive concrete hardener, floor toppings, or bonded floor coverings such as paint or tile.

3.6 COLD WEATHER REQUIREMENTS

.1 Job preparation:

.1 Preparation for cold weather, including special supplementary equipment, where necessary, shall be done before commencing concrete placing. Ensure that procedures and methods used during cold weather are reviewed and authorized by the Contract Administrator.

.2 Do the work to CAN/CSA-A23.1.

.2 Take cold weather precautions whenever the ambient temperature is, or is expected to be, at or below 10º C.

.3 The Contractor shall have protective measures in place, or adjacent to the work, and these measures shall be reviewed by the Contract Administrator before any concrete is mixed or ordered.

.4 Utilize heated mix water and/or aggregate to achieve concrete temperature between 15º C and 25º C at the time of depositing into the forms.

.5 Maintain concrete temperatures between 10º C and 20º C for a minimum of three (3) days for unloaded areas, and six (6) days for areas receiving partial load.

.6 If enclosures are utilized to maintain concrete temperature, provide suitable access and removable inspection plates so that the temperature of the concrete may be measured and recorded at any time. Locate inspection plates to provide representative areas including corners and more exposed elements, and have their location reviewed by the Contract Administrator.

.7 Where the work is enclosed and heaters are used to provide heat:

.1 Provide an access strip at least 1 m wide between the work and the nearest heater.

.2 Do not discharge heater outlets directly toward the work.

.3 Duct heater exhausts outside enclosure.

.4 Install minimum-maximum thermometers inside the enclosure at the locations reviewed by the Contract Administrator.

.5 Maintain the humidity within the enclosure at or above 40 %.

.8 Removal of forms, shores and protection to conform to Section 03 10 00 – Concrete Forming and Accessories.

.9 At the termination of the protection period, do not allow the concrete temperature to drop more than 10º C in the first 24 hours.

3.7 HOT WEATHER REQUIREMENTS

.1 Job Preparation:

.1 Prepare for hot weather, including protection and curing, where necessary, before commencing concrete placing. Ensure that procedures and methods used during hot weather are reviewed and authorized by the Contract Administrator.

.2 Do the work to CAN/CSA-A23.1.

.3 Take hot weather precautions when concrete temperature at any time exceeds 25º C.

.4 Make available and in working order and adjacent to the work area before any concrete is mixed or ordered the equipment necessary to execute the work under these conditions.

.5 Use ice, low heat cement and pre-cooling of the aggregates as necessary to control concrete temperatures. Do not place concrete whose temperature exceeds 30º C in the mixer.

.6 Concrete whose temperature in the mixer is between 25ºC and 30ºC shall contain a retarder, which reduces mixing water requirements and increases strength.

.7 Protect forms and equipment, including both mixing and placing equipment, from the rays of the sun and cool by wetting as necessary to maintain a temperature of not more than 5º C in excess of ambient temperature nor more than 35ºC.

.8 Prior to placing concrete wet down forms and reinforcement and the area surrounding the work.

.9 Keep mixing time to the minimum, consistent with the production of the quality of concrete specified and place mixed concrete immediately.

.10 Provide windbreaks, sunshades, plastic sheeting or other materials as required by CSA A23.1, Clause 7.4 when the evaporation is expected to exceed the limits shown.

.11 Commence continuous wet curing as soon as the concrete has hardened sufficiently to prevent surface damage.

3.8 DEFECTIVE CONCRETE

.1 Concrete not meeting the requirements of the Specifications and Drawings shall be considered defective concrete.

.2 Concrete not conforming to the lines, details, and grade specified herein or as shown on the Drawings shall be modified or replaced at the Contractor's expense. Finished lines, dimensions, and surfaces shall be correct and true within tolerances specified herein and in the Section 03100.

.3 Concrete not properly placed resulting in honeycombing and other defects shall be repaired or replaced at the Contractor's expense.

.4 To conform to the strength requirements, the average of all tests shall exceed the specified strength. When three (3) or more tests of the same class of concrete are available, the average of any three (3) consecutive tests shall be equal to, or greater than the specified strength, and no strength test shall fall more than 3.5 MPa below the specified strength. If any of the criteria of the above clause are not met, the Contract Administrator shall have the right to require one or more of the following:

.1 Changes in mix proportions for the remainder of the Work

.2 Cores drilled and tested from the areas in question as directed by the Contract Administrator and in accordance with CAN/CSA-A23.2. The test results shall be indicative of the strength of the in-place concrete.

.3 Load testing of the structural elements.

.4 The changes in the mix proportions, cores drilled and tested, and load testing shall be at the Contractor's expense.

.5 Concrete failing to meet the strength requirements of this Specification shall be strengthened or replaced at the Contractor's expense.

3.9 CRACK REPAIRS AND PATCHING

.1 Allow Contract Administrator to review concrete surfaces immediately upon removal of formwork.

.2 Remove all exposed metal form ties, nails and wires, break off fins, and remove all loose concrete.

.3 Thoroughly wet all form tie holes and patch with patching mortar followed by proper curing.

.4 Chip away honeycombed and other defective surfaces to a depth of not less than 25 mm with the edges perpendicular to the surface. The area to be patched and a space at least 150 mm wide entirely surrounding it shall be wetted to prevent absorption of water from the patching mortar. Apply bonding agent to Manufacturer’s instructions and patch with patching mortar followed by proper curing.

.5 The patch shall be made of the same material and of the same proportions as used for the concrete except that the coarse aggregate shall be omitted, and cement added to match the colour of the surrounding concrete. The amount of mixing water shall be as little as is consistent with the requirements.

.6 Utilize the best possible care and construction techniques to minimize cracking of reinforced concrete construction.

.7 Repair all cracks in concrete walls, slabs, footings and other structural components.

.8 Cracks which do appear shall be routed out on each face and repaired with waterproof grout in accordance with manufacturer's recommendation, except those cracks which are in excess of 0.50 mm width or deemed by the Contract Administrator to be structurally detrimental or subject to movement shall be epoxy grouted.

.9 Obtain authorization from Contract Administrator of pressure grouting techniques and epoxy materials to be utilized prior to proceeding with the work.

.10 Depth of epoxy grouting shall be sufficient to restore structural integrity and/or watertightness, as required, but shall not be less than 100 mm.

.11 Cure crack repairs to manufacturer's instructions.

.12 Under certain conditions, the Contract Administrator may consider the use of specialized methods and materials to attain watertight structures if requested by the Contractor. The Contractor shall obtain authorization from the Contract Administrator for repair methods and procedures prior to proceeding with the work.

.13 The repaired structure shall be subjected to water testing until a successful water test is attained.

3.10 PROTECTION

.1 Protect all work, including soil below and adjacent to existing footings, against freezing, overheating, rapid drying, flooding and overloading.

.2 Provide weatherproof coverings, hoardings and heating equipment as required to permit continuous construction throughout any winter or inclement weather and to maintain working and curing conditions and to protect the existing facilities.

3.11 CLEANING

.1 Waste Management and disposal:

.1 Divert unused concrete materials to landfill.

.2 Provide appropriate area on job site where concrete trucks can be safely washed.

.3 Do not dispose of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

.4 Prevent admixtures and additive materials from entering drinking water supplies or streams.

.5 Using appropriate safety precautions, collect liquid or solidify liquid with inert, non-combustible material and remove for disposal.

.6 Dispose of waste in accordance with applicable local, Provincial and National regulations.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 04 05 00 - Common Work Results for Masonry

.2 04 05 13 - Masonry Mortar and Grouting

.3 04 05 19 - Masonry Anchorage and Reinforcing

.4 04 05 23 - Masonry Accessories

.5 04 22 00 - Concrete Unit Masonry

1.2 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CAN/CSA-A165 Series-14(R2019), CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2 and A165.3).

.2 CAN/CSA-A179-14 (R2019), Mortar and Grout for Unit Masonry.

.3 CAN/CSA-A371-14 (R2019), 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 ACTION AND INFORMATIONAL 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 masonry 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 Manitoba, Canada.

.2 Submit shop drawings detailing temporary bracing required, designed to resist wind pressure and lateral forces during installation.

.4 Samples:

.1 Provide samples as follows:

.1 Two (2) of each type of masonry unit specified

.2 One (1) of each type of masonry accessory specified

.3 One (1) of each type of masonry reinforcement and tie proposed for use

.4 As required for testing purposes

.5 Certificates: submit manufacturer's product certificates certifying materials comply with specified requirements.

.6 Test and Evaluation Reports:

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

.2 Test reports to certify compliance of masonry units and mortar ingredients with specified performance characteristics and physical properties.

.3 Submit data for masonry units, in addition to requirements set out in referenced CSA and ASTM Standards, indicating initial rates of absorption.

.7 Installer Instructions: provide manufacturer's installation instructions, including storage, handling, safety and cleaning.

.8 Manufacturer's Reports: provide written reports prepared by manufacturer's on-site personnel to include:

.1 Verification of compliance of work with Contract.

.2 Site visit reports providing detailed review of installation of work, and installed work.

1.4 CLOSEOUT SUBMITTALS

.1 Submit manufacturer's instructions for care, cleaning and maintenance of prefaced masonry units for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 EXTRA MATERIALS

.1 Submit manufacturer's instructions in accordance with Section 01 78 00 - Closeout Submittals covering maintenance requirements and parts catalogue, with cuts and identifying numbers.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect material packages from nicks, scratches, and blemishes.

.4 Protect masonry and other Work from marking and other damage. Protect completed Work from mortar droppings. Use non-staining coverings.

.5 Provide temporary bracing of masonry Work during and after erection until permanent lateral support is in place.

.6 Replace defective or damaged materials with new.

1.7 SITE CONDITIONS

.1 Ambient Conditions: assemble and erect components when temperatures are above 4 degrees C.

.2 Weather Requirements: to CAN/CSA-A371 and to IMIAC – Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

.3 Cold Weather Requirements:

.1 To CAN/CSA-A371 with the following requirements:

.1 Maintain temperature of mortar between 5ºC and 50ºC until batch is used.

.2 Maintain ambient temperature of masonry work and it's constituent materials between 5 degrees C and 50 degrees C and protect site from windchill.

.3 Maintain temperature of masonry above 0 degrees C for minimum 7 days, after mortar is installed.

.4 Hot Weather Requirements:

.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.

.5 Spray mortar surface at intervals and keep moist for maximum of 3 days after installation.

Part 2 Products

2.1 MATERIALS

.1 Masonry materials are specified in other Sections of Division 4.

Part 3 Execution

3.1 INSTALLERS

.1 Experienced and qualifies masons to carry out erection, assembly, and installation of masonry work.

3.2 PREPARATION

.1 Surface preparation: prepare surface in accordance with manufacturer's written recommendations and coordinate with Section 01 71 00 – Examination and Preparation.

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.

.3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

3.4 TOLERANCES

.1 Tolerances in notes to Clause 5.3 of CSA A371 apply.

3.5 CONSTRUCTION

.1 Exposed Masonry:

.1 Remove chipped, cracked, and otherwise damaged units in exposed masonry and replace with undamaged units.

.2 Jointing:

.1 Allow joints to set just enough to remove excess water, and then tool with round joints to provide smooth, compressed, uniformly concave joints where concave joints are indicated.

.2 Strike flush all 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 Cutting:

.1 Cut out neatly 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 Parging:

.1 Use parging mortar specified in Section 04 05 13.

.2 Apply parging mortar where indicated in uniform coating not less than 10 mm thick.

.6 Support of Loads

.1 Use concrete to Section 03 30 00, where concrete fill is used in lieu of solid units, such as vertical cores, bond beams, and lintels.

.2 Install building paper below voids to be filled with concrete or grout; keep paper 25 mm back from faces of units.

.7 Provision for Movement - Roof:

.1 Leave a minimum of 10 mm space or as indicated on the Drawings, between top of non-load bearing walls and partitions and structural elements. Do not use wedges.

.2 Build masonry to tie-in with stabilizers, with provision for vertical movement.

.8 Control Joints:

.1 Construct continuous control joints as indicated on the Drawings.

.9 Expansion Joints:

.1 Build-in continuous expansion joints as indicated on the Drawings.

3.6 FIELD QUALITY CONTROL

.1 Perform site inspection and testing in accordance with Section 01 45 00 – Quality Control.

.2 Inspection and testing will be carried out by a testing laboratory designated by the Contract Administrator.

.3 The Contract Administrator will pay costs for testing.

.4 Costs for additional testing required as a result of defective materials will be the responsibility of the Contractor.

3.7 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

3.8 PROTECTION

.1 Temporary Bracing:

.1 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

.2 Bracing approved by Contract Administrator.

.3 Brace masonry walls as necessary to resist wind pressure and lateral forces during construction.

.2 Moisture Protection:

.1 Keep masonry dry using waterproof, non staining 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 recommended in 1.7, SITE CONDITIONS.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 04 05 00 - Common Work Results for Masonry

.2 04 05 19 - Masonry Anchorage and Reinforcing

.3 04 05 23 - Masonry Accessories

.4 04 22 00 - Concrete Unit Masonry

1.2 WORK INCLUDED

.1 Provide all materials and labour to perform the mortar and grout Work for all masonry walls indicated on the Drawings.

1.3 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA A23.1/A23.2-19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CAN/CSA-A179-14 (R2019), Mortar and Grout for Unit Masonry.

.3 CAN/CSA-A371-14 (R2019), Masonry Construction for Buildings.

.4 CAN/CSA-A3000-23, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.2 International Masonry Industry All-Weather Council (IMIAC)

.1 Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

1.4 ACTION AND INFORMATIONAL 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 masonry mortar and grout and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit copy of WHMIS SDS in accordance with Section 01 35 29.06 - Health and Safety Requirements. Indicate VOCs mortar, grout, parging, colour additives and admixtures. Expressed as grams per litre (g/L).

.3 Samples:

.1 Samples: submit unit samples in accordance with Section 04 05 00 - Common Work Results for Masonry.

.4 Manufacturers' Instructions: submit manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports including sand gradation tests in accordance with CAN/CSA-A179 showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 00 - Common Work Results for Masonry.

.2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Mock-ups:

.1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control and requirements of Section 04 05 00 - Common Work Results for Masonry.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect masonry mortar and grout packages from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.7 SITE CONDITIONS

.1 Ambient Conditions: maintain materials and surrounding air temperature to:

.1 Minimum 10 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.

.2 Weather Requirements: CAN/CSA-A371, International Masonry Industry All-Weather Council (IMIAC) - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

Part 2 Products

2.1 MATERIALS

.1 Mortar and grout: conforming to CSA A179

.2 Aggregate: conforming to CSA A82.56

.3 Water: clean, potable, free of injurious amounts of acids, alkalis, and organic material

.4 Masonry cement: conforming to CSA-A3002 and CAN/CSA-A-179.

.5 Portland cement: conforming to CSA-A3000, normal Type GU

.6 Hydrated lime: conforming to CAN/CSA-A179.

.7 Use aggregate passing 1.18 mm sieve where 6 mm thick joints are indicated.

.8 Dirt resistant additives: aluminum tristearate, calcium stearate, or ammonium stearate.

2.2 MORTAR MIXES

.1 Mortar for exterior masonry above grade:

.1 Load Bearing: type S based on property specifications.

.2 Parging mortar: Type S Cto CSA A179.

2.3 MATERIAL SOURCE

.1 Use same brands of materials and source of aggregate for entire project.

2.4 MORTAR TYPES

.1 Mortar for all masonry:

.1 Type S based on Property Specifications

2.5 GROUT

.1 Grout: to CSA A179, Table 3

2.6 PARGING

Part 3 Execution

3.1 CONSTRUCTION

.1 Do masonry mortar and grout work in accordance with CAN/CSA-A179 except where specified otherwise

3.2 MIXING

.1 Use pre-blended, pre-coloured mortar prepackaged under controlled factory conditions. Ingredients batching limitations to within 1% accuracy.

.2 Mix mortar ingredients in accordance with CAN/CSA-A179 in quantities needed for immediate use.

.3 Maintain sand uniformly damp immediately before mixing process.

.4 Incorporate admixtures into mixes in accordance with Manufacturer's instructions. Provide uniformity of mix and colouration.

.5 Using anti-freeze compounds including calcium chloride or chloride based compounds is prohibited.

.6 Adding air entraining admixture to mortar mix is prohibited.

.7 Use a batch type mixer in accordance with CAN/CSA-A179

.8 Do masonry mortar and grout Work in accordance with CSA A179 except where specified otherwise.

.9 Mix grout to semi-fluid consistency.

.10 Comply with cold weather requirements specified in CSA A371 Masonry Construction for Buildings.

.11 Use mortar within 2 hours of mixing at temperatures of 32 degrees C, or 2-1/2 hours at temperatures under 10 degrees C.

3.3 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.

3.4 GROUT PLACEMENT

.1 Install grout in accordance with manufacturer's instructions.

.2 Install grout in accordance with CAN/CSA-A179

.3 Work grout into masonry cores and cavities to eliminate voids.

.4 Installing grout in lifts greater than 400 mm, without consolidating grout by rodding is prohibited.

.5 Follow high lift grouting procedures in accordance with CAN/CSA A371

.6 Displacing reinforcement while placing grout is prohibited.

3.5 TESTING

.1 Testing of mortar materials will be carried out by an inspection and testing firm designated by the Contract Administrator.

.2 The Contract Administrator will pay costs for tests.

.3 Costs for additional testing required as a result of defective materials will be the responsibility of the Contractor.

.4 Submit samples of all materials proposed for testing.

.5 Testing Mortar Mix:

.1 Test mortar to requirements of Section 01 45 00 - Quality Control, and in accordance with CAN/CSA-A179, for mortar based on property specification. Test prior to construction and during construction for:

.1 Compressive strength.

.2 Consistency.

.3 Mortar aggregate ratio.

.4 Sand/cement ratio.

.5 Water content and water/cement ratio.

.6 Air content.

.7 Splitting tensile strength.

.6 Testing Grout Mix:

.1 Test grout to requirements of Section 01 45 00 - Quality Control, and in accordance with CAN/CSA-A179, for grout based on property specification. Test prior to construction and during construction for:

.1 Compressive strength.

.2 Sand/cement ratio.

.3 Water content and water/cement ratio.

.4 Slump.

3.6 PROTECTION

.1 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position.

3.7 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Remove droppings and splashings using clean sponge and water.

.3 Clean masonry with low pressure clean water and soft natural bristle brush.

.4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 04 05 00 - Common Work Results for Masonry

.2 04 05 13 - Masonry Mortar and Grouting

.3 04 05 23 - Masonry Accessories

.4 04 22 00 - Concrete Unit Masonry

1.2 WORK INCLUDED

.1 Supply all material and labour for the incorporation of the masonry reinforcement and connectors into the Work of this Contract.

1.3 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM)

- .1 ASTM A 36/A 36M-19, Standard Specification for Carbon Structural Steel.
- .2 ASTM A 307-21, Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
- .3 ASTM A 580/A 580M-23, Standard Specification for Stainless Steel Wire.
- .4 ASTM A 641/A 641M-19, Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
- .5 ASTM A 666-23, Standard Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar.
- .6 ASTM A1022/A1022M-22a, Standard Specification for Deformed and Plain Stainless-Steel Wire and Welded Wire for Concrete Reinforcement.

.2 CSA Group (CSA)

- .1 CSA A23.1/A23.2-19 (R2019), Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- .2 CAN/CSA-A179-14 (R2019), Mortar and Grout for Unit Masonry.
- .3 CAN/CSA-A370-14 (R2018), Connectors for Masonry.
- .4 CAN/CSA-A371-14 (R2019), Masonry Construction for Buildings.
- .5 CSA G30.18:21, Carbon Steel Bars for Concrete Reinforcement.
- .6 CSA S304-14(R2019), Design of Masonry Structures.
- .7 CSA W186:21, Welding of Reinforcing Bars in Reinforced Concrete Construction.

.3 Reinforcing Steel Institute of Canada (RSIC)

- .1 Reinforcing Steel Manual of Standard Practice, 2020.

1.4 ACTION AND INFORMATIONAL 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 anchorage and reinforcing materials and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS SDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Shop Drawings:

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

.2 Submit drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada.

.3 Submit drawings detailing bar bending details, anchorage details, lists and placement drawings.

.4 On placement drawings, indicate sizes, spacing, location and quantities of reinforcement and connectors.

.4 Manufacturers' Instructions: submit manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports including sand gradation tests in accordance with CAN/CSA-A179 showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 00 - Common Work Results for Masonry.

.2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Upon request, provide Contract Administrator 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.

1.6 SITE MEASUREMENTS

.1 Make site measurements necessary for proper fit of members.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions and Section 01 61 00 – Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect anchorage and reinforcing materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

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-G30.3, truss type

.3 Connectors: to CSA A370 and CSA S304.1

.4 Corrosion protection: to CSA S304.1, galvanized

.5 Masonry anchors: acceptable products by Hilti, Simpson Strong-Tie, and Ramset/Redhead

.6 Control joint filler: preformed rubber, neoprene, or polyvinyl chloride materials of size and shape indicated.

2.2 FABRICATION

.1 Fabricate reinforcing in accordance with CSA A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by Reinforcing Steel Institute of Canada.

.2 Fabricate connectors in accordance with CAN/CSA A370.

.3 Obtain the Contract Administrator's acceptance for locations of reinforcement splices other than shown on placing drawings.

.4 Upon approval of Contract Administrator, weld reinforcement in accordance with CSA W186.

.5 Ship reinforcement and connectors, clearly identified in accordance with the Drawings.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for anchorage and reinforcing materials installation in accordance with manufacturer's written instructions.

.1 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions remedied [and after receipt of written approval to proceed from Contract Administrator.

3.2 PREPARATION

.1 Direct and coordinate placement of metal anchors for masonry supplied to other Sections.

3.3 INSTALLATION

.1 Supply and install masonry connectors and reinforcement in accordance with CAN/CSA-A370, CAN/CSA-A371, CSA A23.1/A23.2 and CSA S304.1 unless indicated otherwise.

.2 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.3 Prior to placing concrete, mortar, grout, obtain Contract Administrator’s approval of placement of reinforcement and connectors.

.4 Supply and install additional reinforcement to masonry as indicated.

3.4 REINFORCED LINTELS AND BOND BEAMS

.1 Reinforce masonry beams, masonry lintels and bond beams as indicated.

.2 Place and grout reinforcement in accordance with CSA S304.1, CAN/CSA-A371, and CAN/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, CAN/CSA-A371 and CAN/CSA-A179 and as indicated.

3.6 LATERAL SUPPORT AND ANCHORAGE

.1 Supply and install lateral support and anchorage in accordance with CSA S304.1 and as indicated

3.7 FIELD QUALITY CONTROL

.1 Site inspections in accordance with Section 04 05 00 - Common Work Results for Masonry.

.2 Obtain Contract Administrator’s approval of placement of reinforcement and connectors, prior to placing mortar or grout.

3.8 BONDING AND TYING

.1 Bond walls of two (2) or more wythes using metal connectors in accordance with National Building Code, CSA S304.1, CSA A371, and as indicated.

.2 Tie masonry veneer to backing in accordance with National Building Code, CSA S304.1, CSA A371, and as indicated.

3.9 MASONRY ANCHORS

.1 Install metal anchors where indicated.

.2 If masonry anchors are not specified on the Drawings, review proposed anchor and application with the Contract Administrator prior to use.

3.10 CONTROL JOINTS

.1 Terminate reinforcement 25 mm short of each side of control joints unless otherwise indicated.

.2 Install continuous control joint fillers in control joints.

3.11 FIELD BENDING

.1 Do not field bend reinforcement and connectors except where indicated or authorized by Contract Administrator.

.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.

3.12 FIELD TOUCH-UP

.1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcement steel and connectors with compatible finish to provide continuous coating.

3.13 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 04 05 00 - Common Work Results for Masonry

.2 04 05 13 - Masonry Mortar and Grouting

.3 04 05 19 - Masonry Anchorage and Reinforcing

.4 04 22 00 - Concrete Unit Masonry

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM D 2240-15 (2021), Standard Test Method for Rubber Property - Durometer Hardness.

.2 CSA Group (CSA)

.1 CAN/CSA-A371-14 (R2019), Masonry Construction for Buildings.

1.3 ACTION AND INFORMATIONAL 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 masonry accessories 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 Manitoba, Canada.

.2 Indicate on drawings:

.1 Flashing, installation details, sizes, spacing, location and quantities of fasteners.

.4 Samples:

.1 Submit 2 samples of masonry accessories as follows:

.1 Materials: cured, and coloured samples, illustrating colour and colour range. Include:

.1 Movement joint filler.

.2 Lap adhesive.

.3 Mechanical fasteners.

.4 Reglets.

.5 Brick vents.

.2 Moisture control material samples, illustrating colour and colour range, size, and shape. Include:

.1 Weep hole vents.

.2 Mortar diverters.

.3 Grout screens.

.3 Flashing material samples, illustrating colour and colour range, size, shape, and profile. Include as specified:

.1 Sheet metal flashings.

.2 Composite flashings.

.3 Plastic and rubber flashings.

1.4 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports including sand gradation tests in accordance with CAN/CSA-A179 showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 00 - Common Work Results for Masonry.

.2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Manufacturer's Instructions: submit manufacturer's instructions as follows:

.1 Submit installation instructions for fillers, adhesives, reglets, brick vents, weeps, vents, diverters, screens, flashings.

1.5 SITE MEASUREMENTS

.1 Make site measurements necessary to ensure proper fit of members.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect masonry accessories from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Movement joint filler: purpose-made elastomer to ASTM D 2240 of size and shape indicated

.1 Use low VOC products

.2 Material type: expanded polyethylene

.2 Lap adhesive: recommended by masonry flashing manufacturer. Use low VOC products.

.3 Weep hole vents: purpose-made PVC.

.4 Mechanical fasteners: recommended by flashing manufacturer to suit project requirements.

2.2 MOISTURE CONTROL

.1 Weep Hole Vents: PVC

.2 Cell vents: polypropylene plastic, honeycomb design.

.1 Size: 9.5 mm x 63.5 mm x 85.7 mm

.3 Mortar diverters: shaped and sized to suit cavity spaces.

.4 Grout Screens: 6 mm square monofilament screen fabricated form high-strength, non-corrosive polypropylene polymers to isolate flow of grout in designated areas.

2.3 FLASHINGS

.1 Sheet metal: galvanized steel

.1 Thickness: as noted on drawings.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrate previously installed under other Sections are acceptable for masonry accessories installation in accordance with manufacturer's written instructions.

.1 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 INSTALLATION: MATERIALS

.1 Install continuous movement joint fillers in movement joints at locations indicated on drawings.

.2 Lap adhesive: apply adhesive to flashing lap joints.

.3 Mechanical fasteners: install fasteners to suit application and in accordance with manufacturer's written installation instructions.

.4 Reglets: install reglets at locations indicated on drawings.

3.3 INSTALLATION: MOISTURE CONTROL

.1 Install weep hole vents in vertical joints immediately over flashings, in exterior wythes of cavity wall and masonry veneer wall construction, at maximum horizontal spacing of 600 mm on centre.

.2 Mortar diverters: install purpose made diverters in cavities where indicated and as directed, size and shape to suit purpose and function.

.3 Grout screens: install purpose made screens in cavities where indicated and as directed, size and shape to suit purpose and function.

3.4 INSTALLATION: FLASHINGS

.1 Build in flashings in masonry in accordance with CAN/CSA-A371

.1 Install flashings under exterior masonry bearing on foundation walls, slabs, shelf angles, and steel angles over openings, and at base of cavity wall and where cavity interrupted by horizontal members or supports and as shown on drawings. Install flashings under weep hole courses and as indicated.

.2 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 Install vertical flashing where outer veneer returns at window or door jambs, to prevent contact of veneer with inner wall.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 04 05 00 - Common Work Results for Masonry

.2 04 05 13 - Masonry Mortar and Grouting

.3 04 05 19 - Masonry Anchorage and Reinforcing

.4 04 05 23 - Masonry Accessories

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM E 336-23, Standard Test Method for Measurement of Airborne Sound Attenuation Between Rooms in Buildings.

.2 CSA Group (CSA)

.1 CAN/CSA-A165 Series-14(R2019), CSA Standards on Concrete Masonry Units consists: A165.1, A165.2, A165.3.

.2 CAN/CSA-A371-14(R2019), Masonry Construction for Buildings.

.3 CSA S304-14(R2019), Design of Masonry Structures.

.4 CSA A370-14(R2018), Connectors for Masonry

.3 National Research Council Canada (NRC)

.1 National Building Code of Canada 2010 (NBC).

.4 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S101-14(R2014), Standard Methods of Fire Endurance Tests of Building Construction and Materials.

1.3 ACTION AND INFORMATIONAL 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 concrete masonry units and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports including sand gradation tests in accordance with CAN/CSA-A179 showing compliance with specified performance characteristics

and physical properties, and in accordance with Section 04 05 00 - Common Work Results for Masonry.

.2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Mock-ups:

.1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control and requirements of Section 04 05 00 - Common Work Results for Masonry supplemented as follows:

.1 Construct mock-up panel of concrete unit masonry construction 1200 x 1800 mm.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.1 Offload concrete unit masonry packages using equipment that will not damage the surfaces.

.2 Do not use brick tongs to move or handle masonry.

.3 Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Do not double stack cubes of concrete unit masonry.

.3 Protect all materials from damage due to weather conditions.

.4 Cover masonry units with non-staining waterproof membrane covering.

.5 Allow air circulation around units.

.6 Installation of wet or stained masonry units is prohibited.

.7 Keep concrete unit masonry in individual cardboard packaging provided by manufacturer until units are ready to be installed.

.8 Store and protect concrete unit masonry from nicks, scratches, and blemishes.

.9 Replace defective or damaged materials with new.

1.6 COLD WEATHER REQUIREMENTS

.1 Conform to weather protection requirements in CSA A371.

1.7 PROTECTION

.1 Cover tops of completed and partially completed walls with waterproof coverings at end of each working day. Drape covers over walls and extend 600 mm down both sides. Anchor securely in position.

.2 Protect adjacent finished surfaces from marking or damage due to masonry Work.

.3 Provide temporary bracing of masonry Work during erection to prevent damage due to winds or other lateral loads until permanent structure provides adequate bracing.

Part 2 Products

2.1 MATERIALS

.1 Concrete blocks: to CSA A165, normal weight and strength units, type H/15/A/M, modular size.

.2 Special shapes: provide Type H/15/A/M bull-nosed units for exposed corners. Provide purpose made shapes for lintels and bond beams. Provide additional special shapes as indicated or required.

2.2 EXPOSED FACES

.1 Notwithstanding visual inspection requirements of CSA Standards, masonry units shall be free of surface indentations, surface cracks due to manufacture, or chipping. Units so delivered shall not be used where exposed to view, but may be used where concealed.

2.3 REINFORCEMENT

.1 Reinforcement in accordance with Section 04 05 19 - Masonry Anchorage and Reinforcing.

2.4 CONNECTORS

.1 Connectors in accordance with Section 04 05 19 - Masonry Anchorage and Reinforcing.

2.5 FLASHING

.1 Flashing: in accordance with Section 04 05 23 - Masonry Accessories.

2.6 MORTAR MIXES

.1 Mortar and mortar mixes in accordance with Section 04 05 13 - Masonry Mortar and Grouting.

2.7 GROUT MIXES

.1 Grout and grout mixes in accordance with Section 04 05 13 - Masonry Mortar and Grouting.

2.8 CLEANING COMPOUNDS

.1 Use low VOC products in compliance with SCAQMD Rule 1168.

.2 Compatible with substrate and acceptable to masonry manufacturer for use on products.

.3 Cleaning compounds compatible with concrete unit masonry and in accordance with manufacturer's written recommendations and instructions.

2.9 TOLERANCES

.1 Tolerances for standard concrete unit masonry tolerances in accordance with CAN/CSA-A165.1, supplemented as follows:

.1 Maximum variation between units within specific job lot not to exceed 2 mm.

.2 No parallel edge length, width or height dimension for individual unit to differ by more than 2 mm.

.3 Out of square tolerance not to exceed 2 mm.

.2 Tolerances for architectural concrete masonry units in accordance with CAN/CSA-A165.1, supplemented as follows:

.1 Maximum variation in length or height between units within specific job lot for specified dimension not to exceed 2 mm.

.2 No parallel edge length, width or height dimension for individual unit to differ by more than 2 mm.

.3 Out of square tolerance not to exceed 2 mm.

.4 Maximum variation in width between units within specific job lot for specified dimension not to exceed 2 mm.

Part 3 Execution

3.1 PREPARATION

.1 Protect adjacent finished materials from damage due to masonry work.

3.2 REINFORCEMENT

.1 Install reinforcing in accordance with Section 04 05 19 - Masonry Anchorage and Reinforcing.

3.3 CONNECTORS

.1 Install connectors in accordance with Section 04 05 19 - Masonry Anchorage and Reinforcing.

3.4 FLASHING

.1 Install flashings: in accordance with Section 04 05 23 - Masonry Accessories.

3.5 MORTAR PLACEMENT

.1 Place mortar in accordance with Section 04 05 13 - Masonry Mortar and Grouting.

3.6 GROUT PLACEMENT

.1 Place grout in accordance with Section 04 05 13 - Masonry Mortar and Grouting.

3.7 REPAIR/RESTORATION

.1 Upon completion of masonry, fill holes and cracks, remove loose mortar and repair defective work.

3.8 PROTECTION

.1 Brace and protect concrete unit masonry in accordance with Section 04 05 00 - Common Work Results for Masonry.

3.9 WORKMANSHIP

.1 Build masonry Work true-to-line, plumb, square, and level, with vertical joints in proper alignment.

.2 Tolerances for exposed masonry Work shall be:

.1 Variation from mean plane: 3 mm under 2500 mm straight edge

.2 Variation in masonry openings: 6 mm maximum

.3 Variation from plumb: 9 mm in 6 m

.3 Assume complete responsibility for dimensions, plumbs, and levels of this Work and constantly check same with graduated rod.

.4 Masonry courses to be of uniform height, and both vertical and horizontal joints to be of equal and uniform thickness.

.5 Extend non-load bearing partitions to underside of floor or roof construction above and provide 40 mm deflection clearance. Install lateral support angles and insulation filler as detailed.

.6 Construct walls upward in a uniform manner, no one portion being raised more than 1200 mm above another at any time. Build no more than 1500 mm of wall measured vertically in any one day.

.7 Buttering corners of units, throwing mortar into joints, and deep or excessive furrowing of bed joints will not be permitted. Do not shift or tap units after mortar has taken initial set. Where adjustments must be made after mortar has started to set, remove mortar and replace with fresh supply.

3.10 BLOCKWORK

.1 Lay concrete block in running bond, with thicker end of face shell upward. Coursing to be modular 200 mm for one block and one joint.

.2 Use special shaped units where indicated, specified, or required. Use bull-nosed units for exposed external corners at door and window jambs. Exposed open cells not permitted.

.3 Concrete masonry units shall have face shells and their end joints fully filled with mortar, and joints squeezed tight. Also fill webs at cores, to be reinforced and grouted, and strike flush at core taking care to prevent mortar from falling into core.

.4 Tie intersecting non-bearing walls together with masonry reinforcing every second course.

.5 Do not tie intersecting bearing walls together in masonry bond, except at corners.

3.11 MORTAR AND POINTING

.1 Make all joints uniform in thickness, straight, in line, and with mortar compressed to form concave joints.

3.12 BUILDING IN

.1 Build in door and window frames, steel lintels, sleeves, anchor bolts, anchors, nailing strips, and other items to be built into masonry.

.2 Do not distort metal frames. Bed anchors of frames in mortar and fill frame voids with mortar or grout as walls are erected.

3.13 BEARINGS

.1 Fill concrete block solid with 25 MPa concrete for two (2) courses below bearing points of structural members and where indicated on Drawings.

.2 Install building paper and wire mesh reinforcing in the bed below the second block course from top.

3.14 CONTROL JOINTS

.1 Provide continuous vertical control joints in concrete block partitions and walls at locations indicated, or at a maximum 6000 mm on center.

.2 Form control joints as detailed. Stop horizontal masonry reinforcing 25 mm from each side of joints.

3.15 EXPANSION JOINTS

.1 Construct expansion joints where indicated, as detailed.

3.16 CUTTING MASONRY

.1 Cutting of masonry units exposed in finished Work is to be done with accepted type power saw. Where electrical conduit outlets and switch boxes occur, grind and cut units before services are installed.

.2 Obtain Contract Administrator's permission before cutting any part of area which may impair appearance or strength of the Work.

.3 Patching of masonry is not permitted without Contract Administrator's authorization.

3.17 BOND BEAMS

.1 Install concrete block bond beams where indicated and where required for bearing of structural members.

.2 Make bond beams of knockout blocks with two (2) 15M reinforcing bars and fill with 20 MPa concrete.

3.18 REINFORCED BLOCK LINTELS

.1 Install reinforced concrete block lintels over openings as indicated on the Drawings using 25 MPa concrete.

.2 Cast and cure lintels on plank. Set special channel lintel blocks using specified mortar.

.3 Place wood stops at either end of lintel to prevent movement.

.4 Place 25 mm of concrete in voids, place in deformed reinforcing bars and place concrete to level of block sides. Rod and tamp concrete well without disturbing reinforcing. Allow lintels to cure seven (7) days before removing shores.

.5 Minimum bearing shall be 400 mm each side of openings.

3.19 PROVISIONS FOR OTHER TRADES

.1 Provide openings in masonry walls where required or indicated.

.2 Accurately locate chases and openings and neatly finish to required sizes.

.3 Where masonry encloses conduit, ducts, and piping, bring to proper level indicated and as directed. Do not cover any pipe or conduit chases or enclosures until advised that Work has been reviewed and tested.

.4 Build masonry neatly around conduit, ducts, sleeves, and piping passing through.

3.20 CLEANING

.1 Allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block and finally by brushing.

.2 Scrub surfaces to be cleaned using non-acid cleaning solution of type which will not harm constructed masonry. Check masonry unit Manufacturer for acceptable solution. Clean trial test area and obtain permission to proceed.

.3 Use large amounts of water and do cleaning in accordance with solution Manufacturer's instructions.

.4 Point or replace defective mortar to match existing as required or directed.

.5 Repeat cleaning operations as often as necessary until Work is satisfactory.

.6 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.7 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 01 45 00 – Quality Control

.2 4 05 00 – Common Work Results for Masonry

.3 07 92 00 – Joint Sealants

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM C 144-18, Standard Specification for Aggregate for Masonry Mortar.

.2 ASTM C 150/C 150M-22, Standard Specification for Portland Cement.

.3 ASTM C 568/C 568M-22, Standard Specification for Limestone Dimension Stone.

.2 CSA Group (CSA)

.1 CAN/CSA-A370:14 (R2018), Connectors for Masonry.

.2 CAN/CSA-A371-14 (R2019), Masonry Construction for Buildings.

.3 CAN/CSA-A3000:23, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

1.3 ACTION AND INFORMATIONAL 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 quarried stone veneer cladding and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate sizes and sections of stone veneer, arrangements of joints and bonding, anchoring, dowelling and cramping.

.2 No work to be started until final approval of shop drawings.

.4 Samples:

.1 Submit two samples for each finish product specified, indicating range of colour and finish to be supplied.

1.4 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 00 - Common Work Results for Masonry.

.2 Mock-ups:

.1 If required by the contract administrator, construct mock-ups in accordance with Section 01 45 00 - Quality Control:

.1 Construct mock-up panel of exterior limestone stone veneer construction 1200 x 1800 mm, showing colours and textures, use of reinforcement, ties, through wall flashing, weep holes, jointing, coursing, mortar and quality of work.

.2 Mock-up used:

.1 To judge quality of work, substrate preparation, operation of equipment and material application.

1.5 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 Storage and Handling Requirements:

.1 Store materials off ground, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect quarried stone veneer cladding from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.6 SITE CONDITIONS

.1 Ambient Conditions:

.1 Do not install at temperatures below 12 degrees C or above 38 degrees C.

.2 Maintain temperatures at or above 12 degrees C until cementitious materials have fully cured.

.3 Do not apply epoxy mortar and grouts at temperatures below 15 degrees C or above 32 degrees C.

.2 Field Measurements:

.1 Make site measurements necessary to ensure proper fit of members.

Part 2 Products

2.1 MATERIALS

.1 Limestone: to ASTM C119-20 and ASTM C568/C568M-15, category II - Medium Density.

.1 Limestone shall be free from all defects which would affect appearance or durability.

.2 Quarry seams shall be well back from finished face.

.3 Fossils and other natural markings permitted only to the extent that they do not disfigure finished appearance. Loose or large white fossils are not permitted.

.2 Colour to be buff.

.3 Texture to be sawn face and split face, as indicated on design drawings.

.4 Grade shall be standard grade.

2.2 MORTAR AND ADHESIVE MATERIALS

.1 Portland cement: to CAN/CSA-A3000, type GU.

.2 Sand: to ASTM C 144, passing 16 mesh.

.3 Hydrated lime: to ASTM C 207, Type S.

.4 Latex additive: formulated for use in Portland cement mortar and thin set bond coat.

.5 Water: potable and free of minerals and chemicals which are detrimental to mortar and grout mixes.

.6 Dry set Portland cement mortar: to ANSI A108.5.

.7 Latex Portland cement mortar: to ANSI A108.5.

.8 Bond Breaker: preformed, compressible, resilient, non staining, non waxing, closed-cell polyethylene foam pad, non absorbent to liquid and gas, 3.2 mm thick or polyethylene sheet, 6 to 10 mil thick.

2.3 FINISHES

.1 Stone shall be manufactured accurately to sizes, shapes, and details as indicated on drawings. Except when drawings call for slopes, angles or curves, cut all stone square, with exposed faces true, beds and joints dressed straight and at right angles to faces.

.2 Face to be sawn and split faced as indicated on drawings.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for quarried stone veneer cladding installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.
.2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

.1 Protect adjacent finished materials from damage due to masonry work.

.2 Cut stone to shape and dimensions and full to square with joints as indicated. Dress exposed faces true.

.3 Make joints 10 mm thick.

.4 Cut-in reglets for flashings where indicated.

.5 Execute moulded work from full size details. Make exposed arrises in true alignment and ease slightly to prevent snipping.

.6 Back-check stone contacting structural members as indicated. Allow minimum of 25 mm clearance between back of stone and steel and concrete structural members. Shape beds of stone resting on structural work to fit supports.

.7 Cut stones for anchors, clamps, dowels and support systems. Provide Lewis pin and clamp holes in pieces which can not be manually lifted. Do not cut holes in exposed surfaces.

3.3 INSTALLATION

.1 Construction in accordance with CAN/CSA-A371.

.2 Apply asphalt emulsion to concrete surfaces, shelf angles, structural steel supports against which stone is to be applied.

.3 Waterproof exterior slabs on back prior to setting.

.4 Clean stone exposed surfaces by washing with stiff fibre brush and water.

.5 Drench dry stones with clean water just before setting.

.6 Install anchors, dowels and cramps.

.7 Set stones plumb, true, level in full bed of mortar with vertical joints slushed full except where otherwise specified. Completely fill anchor, dowel and lifting holes. Keep edges and faces aligned to respect indicated tolerances.

.8 Embed in mortar ends only of lugged sills and steps. Leave balance of joint open for final pointing.

.9 Place soft-wood wedges under stones to maintain joint thickness. Set heavy stones and projecting courses after mortar in courses below has hardened sufficiently to support weight.

.10 Prop and anchor projecting stones until wall above is set.

.11 Use soaked softwood wedges to support stone in proper alignment until mortar has set. Remove wedges when dry and without breaking them off, fill voids with pointing mortar.

.12 Install 6 to 10 mil polyethylene sheet to prevent bond between back of stone facing and concrete substrate or install 3 mm polyethylene foam bond breaker. Maintain minimum projection requirements of stone anchors into concrete substrate.

.13 Use plastic weep hole vents.

.14 Install air breather vents in joints at top of cavity wall and below shelf angles or structural support.

.15 or modify to suit requirements.

.16 Tool joints after initial set has occurred.

.17 Rake out joints to 25 mm depth and make ready for pointing with pointing mortar. Sponge stone face along joints and remove droppings and splashed mortar immediately.

.18 Pointing: remove dirt and loose mortar from joints by using pressure air stream.

- .1 Wet joints for mortar pointing. Dry joints for sealant pointing.
- .2 Point joints with pointing mortar in 2 stages. Rub smooth with plastic tool to slightly concave joint.

3.4 TOLERANCES

.1 To CAN/CSA-A371.

3.5 FIELD QUALITY CONTROL

.1 Site Tests Inspection: in accordance with Section 04 05 00 - Common Work Results for Masonry supplemented as follows:

.1 After setting, protect projected areas, corner, etc. with boards. Cover walls at night during rains.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 At end of each working day, brush off loose mortar from stone face.

.3 At completion, wash stonework with stiff-fibre brushes and clean water.

3.7 PROTECTION

.1 Brace and protect quarried stone veneer cladding in accordance with Section 04 05 00 - Common Work Results for Masonry.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 05 12 23 – Structural Steel for Buildings

1.2 WORK INCLUDED

.1 Shop fabricated ferrous metal items, galvanized and prime painted. The following is a list of principal items only. Refer to Drawings for items not specifically listed.

.2 Roof framing (cold-formed joist design and supply by others)

.3 Monorail beam and support frame (structural steel, galvanized)

.4 Exterior hatch over wet well (aluminum)

.5 Wet well intermediate platform (aluminum)

.6 Wet well ladder and ladder extension (aluminum)

.7 Valve chamber roof hatches (prefabricated aluminum by others)

.8 Anchors, plates, bolts, nuts, screws, brackets, chains, etc., required for Work of this Section

1.3 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM A 53/A 53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A123-13 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

.3 ASTM F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

.2 CSA Group (CSA)

.1 CSA G40.20-13 /G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CSA S16-14, Design of Steel Structures.

.4 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).

.5 CSA W59-13, Welded Steel Construction (Metal Arc Welding) Metric

.6 CSA S157-17 (R2022) Strength design in aluminum

.7 CSA W59.2-18 (R2023) Welded aluminum construction

.8 CSA W47.2-11 (R2020) Certification of companies for fusion welding of aluminum

.3 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - current edition

.4 Underwriters Laboratories (UL)

.1 UL 2768-11, Architectural Surface Coatings

.5 NACE International

.1 NACE International

.1 ANSI/NACE No. 13/SSPC-ACS-1-2016 -SG, Industrial Coating and Lining Application Specialist Qualification and Certification.

.6 National Building Code of Canada 2020.

1.4 ACTION AND INFORMATIONAL 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 sections, plates, pipe, tubing, bolts 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 Manitoba, Canada.

.2 Indicate profiles, sizes, materials, core thicknesses, finishes, connections, attachments, size and type of fasteners, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

.3 Coordinate with steel joist supplier for any connections to joists.

.4 Include erection drawings, elevations, and details where applicable.

.5 Indicate welded connections using CISC standard welding symbols. Clearly indicate net weld lengths.

.4 Certificates:

.1 Submit certifications for Application Specialists to demonstrate compliance to the requirements of ANSI/NACE No.13.

1.5 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Qualifications:

.1 Welding Work on all load carrying structures and assemblies is to be performed by a firm certified by the Canadian Welding Bureau to the requirements of CSA W47.1 and W47.2 in Division 1 or 2.1.

.2 Ensure that specialists, who perform steel surfaces preparation and coating applications, are certified by a recognized Applicator Certification Agency, in accordance with NACE 13 /SSPC ACS-I, Applicator Certification Standard (ACS).

.3 Maintain a current and valid ACS certification during project period.

.1 Application specialists who perform surface preparation and coating application work on this project must have a current ACS.

.4 Notify Contract Administrator of any change in application specialist certification status.

.1 Any delays to the completion of the Project due to invalid certifications will not be considered, and liquidated damages shall not be waived for any non-performance by Contractor.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Structural steel: conforming to CAN/CSA-G40.21; Type W with minimum yield strength of 350 MPa

.2 Structural Steel welding materials: conforming to CSA W59

.3 Aluminum: conforming to CSA S157 alloy 6061-T651

.4 Aluminum welding materials: conforming to CSA W59.2

.5 Structural steel anchor bolts: conforming to ASTM F1554 Gr. 55

.6 Stainless steel and hardware: 316 Stainless Steel

.7 Bolts, nuts, and washers: conforming to ASTM A325

.8 Accessories: anchors, plates, bolts, nuts, screws, brackets, etc., material to be compatible with items.

2.2 FINISHES

.1 Monorail Beam:

- Surface preparation to SP6 (commercial blast)
- One prime coat Interzinc 52 zinc-rich epoxy (2.5 mil DFT)
- One finish coat Intergard 345 high build epoxy (6.0 mil DFT)
- Monorail capacity indicated in 100mm high block letters (black)

.2 Galvanizing: conforming to CAN/CSA-G164 or ASTM A123; zinc-rich coating for touch-up

2.3 ISOLATION COATING (ALUMINUM)

.1 Isolate aluminum from the following components by means of bituminous paint (Interuf 16 or approved equal in accordance with B8):

.1 Dissimilar metals except stainless steel
.2 Concrete, grout, mortar, masonry,

2.4 ACCESS COVERS AND FRAMES

.1 Fabricate from aluminum. Components as shown in the drawings

2.5 PRE-MANUFACTURED HATCHES (VALVE CHAMBER ROOF)

.1 Pre-manufactured hatches to be Bilco insulated aluminum with spring latch and padlock hasp.

Models, dimensions and quantities:

Model	Part #	Size(mm)	Quantity
ME-50	MRS350001	914X914	2
D-50 (double leaf)	XRDX50001	1830X2745	2
D-50 (double leaf)	XRDX50001	1525X1525	2
D-50 (double leaf)	XRDX50001	1830X1830	1

.2 Hatches to be fitted with Yale #112 lock

2.6 GENERAL FABRICATION

.1 Verify all dimensions on site prior to shop fabrication.

.2 Fabricate items of sizes and profiles detailed on Drawings, with joints neatly fitted and properly secured.

.3 Fit and shop assemble in largest practical sections for delivery to Site.

.4 Supply all components required for proper anchorage of miscellaneous metals. Fabricate anchorage and related components of same material and finish as metal fabrications, unless otherwise specified or shown.

.5 Weld connections where possible, otherwise bolt connections. Cut off bolts flush with nuts.

.6 Accurately form all connections and joints with exposed faces flush, mitres, and joints tight.

.7 Exposed welds and metal sections shall be smooth and flush; grind or file if required.

.8 Provide for flush welded or hairline butt field joints.

.9 Shop fabricate openings in members for other building components. Reinforce openings to restore member to original design strengths.

.10 Provide lugs, clips, brackets, hangers, and struts as required for attaching miscellaneous metal items securely to building structure.

.11 Thoroughly clean all surfaces of rust, scale, grease, and foreign matter prior to prime painting or galvanizing.

.12 Galvanize and prime paint items as shown. Do not shop prime surfaces in contact with or embedded in concrete or requiring field welding.

Part 3 Execution

3.1 EXAMINATION

.1 Before starting erection, examine other Work which may affect this Work.

.2 Notify the Contract Administrator of any conditions which would prejudice proper installation of this Work.

.3 Commencement of erection Work implies acceptance of existing conditions.

3.2 ERECTION

.1 Obtain Contract Administrator’s permission prior to site cutting or making adjustments which are not part of scheduled Work.

.2 Install items plumb, square and level, fit accurately, and maintain free from distortion or defects detrimental to appearance and performance.

.3 Make provision for erection stresses and temporary bracing. Keep Work in alignment at all times.

.4 Replace items damaged in course of installation.

.5 Perform required field welding. All visible field welds shall be smooth; grind or file if required. Field welding to be performed only by welders certified in accordance with CSA W47.1 and W47.2

.6 Perform necessary cutting and altering for the installation of Work of other Sections, and as indicated on Drawings. No additional cutting is to be done without the permission of the Contract Administrator.

.7 Perform all field assembly bolting and welding to match standard of shop bolting and welding.

.8 After installation, touch up field bolts, nuts, welds, and scratched and damaged prime painted surfaces. Field touch-up primer shall be same as shop primer. Touch up galvanized surfaces with galvalume.

.9 Supply, to appropriate Sections, items required to be cast into concrete and built into masonry, complete with necessary setting templates.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by metal fabrications installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 03 30 00 – Cast-in-Place Concrete

.2 04 22 00 – Concrete Unit Masonry

.3 07 13 52 – Modified Bituminous Sheet Waterproofing

1.2 WORK INCLUDED

.1 Roof parapets

.2 Blocking in wall

.3 Wood furring and grounds

.4 Concealed wood blocking for support of items and equipment supported by walls

.5 Wood treatment

1.3 REFERENCE STANDARDS

.1 American National Standards Institute/National Particleboard Association (ANSI/NPA)

.1 ANSI/NPA A208.1-2009 Particleboard.

.2 ASTM International (ASTM)

.1 ASTM A 123/A 123M-15, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A 153/A 153M-09 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.3 ASTM A 307-14 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength.

.4 ASTM A 653/A 653M-15, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.5 ASTM D 5456-14b, Standard Specification for Evaluation of Structural Composite Lumber Products.

.6 ASTM F 1667-13 Standard Specification for Driven Fasteners: Nails, Spikes and Staples.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-11.3-M87, Hardboard.

.2 CAN/CGSB-71.26-M88, Adhesive for Field-Gluing Plywood to Lumber Framing for Floor Systems.

.4 Canadian Wood Council

.1 Wood Design Manual 2010 (R2014) Edition

.2 Engineering Guide for Wood Frame Construction 2014

.5 CSA Group (CSA)

.1 CAN/CSA-A123.2-03(R2013), Asphalt Coated Roofing Sheets.

.2 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.

.3 CSA O86-14 Engineered Design in Wood

.4 CSA O112.9-10, Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).

.5 CSA O121-08(R2013), Douglas Fir Plywood.

.6 CSA O141-05(R2014), Softwood Lumber.

.7 CSA O151-09(R2014), Canadian Softwood Plywood.

.8 CSA O153-13, Poplar Plywood.

.9 CSA O325-07(R2012), Construction Sheathing.

.6 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber 2010.

.7 National Research Council Canada (NRC)

.1 National Building Code of Canada 2010 (NBC).

.8 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S706-09, Standard for Wood Fibre Insulating Boards for Buildings.

1.4 ACTION AND INFORMATIONAL 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 wood products and accessories and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Include manufacturer's pre-engineered floor, ceiling and roof joist span charts, and manufacturer's pre-engineered installation details.

.3 Submit certified test reports for prefabricated structural members from approved independent laboratory indicating compliance with specifications for specified performance characteristics and physical properties.

.4 Submit CCMC Product Evaluation Report for engineered wood products.

.5 Submit manufacturer's installation instructions.

.3 Shop Drawings:

.1 For structural applications or conditions beyond the scope of the manufacturer's pre-engineered design information, submit drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada.

.2 Include on drawings:

.1 Design data in accordance with CAN/CSA-O86 and CWC Engineering Guide for Wood Frame Construction.

.2 Indicate configuration and spacing of joists, hanger and connector types, fasteners, locations and design values; bearing details.

.3 Submit stress diagrams or print out of computer design indicating design loads for members. Indicate allowable load and stress increase.

.4 Indicate arrangement of webs or other members to accommodate ducts and other specialties.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store materials off ground with moisture barrier at both ground level and as a cover forming a well-ventilated enclosure, with drainage to prevent standing water.

.3 Store wood I-beams and I-joists on edge.

.4 Stack, lift, brace, cut and notch engineered lumber products in strict accordance with manufacturer's instructions and recommendations.

.5 Store and protect architecturally exposed lumber from nicks, scratches, and blemishes.

.6 Replace defective or damaged materials with new.

.7 Store separated reusable wood waste convenient to cutting station and work areas.

Part 2 Products

2.1 MATERIALS

.1 Softwood lumber: CSA O141, non-structural light grading 19% maximum moisture content.

.2 Plywood: CSA O121M - Douglas fir CSA O151M - softwood type, with waterproof glue.

.3 Fasteners: Electro Hot dipped galvanized steel for exterior, high humidity, and treated wood locations; plain finish elsewhere; size and type to suit condition.

.4 Anchors: Toggle bolt type for anchorage to hollow masonry expansion shield and lag belt type for anchorage to solid masonry or concrete bolts or ballistic fasteners for anchorages to steel.

2.2 WOOD TREATMENT

.1 Wood preservative pressure treatment: CSA O80M using waterborne preservative with 0.30 percent retainage, manufactured by Wolman.

Part 3 Execution

3.1 SITE APPLIED WOOD TREATMENT

.1 Apply preservative treatment in accordance with CSA O80M Manufacturer's instructions.

.2 Treat Site-sawn ends.

.3 Allow preservative to cure prior to erecting members.

3.2 INSTALLATION

.1 Erect wood framing members level and plumb.

.2 Space framing and furring as noted on the Drawings.

.3 Construct curb members of single pieces.

.4 Curb all roof openings except where prefabricated curbs are provided. Form corners by lapping side members alternately.

.5 Provide blocking, sized to suit, for support of surface mounted accessories and equipment.

.6 Provide wood blocking around each door frame opening.

.7 Place miscellaneous blocking, furring, strapping, canting, nailing strips, framing and sheathing where indicated on Drawings and as required for secure support of anchorage of other specified materials. Place members true to lines and levels. Secure rigidly in place.

.8 Coordinate the installation of bucks, anchors, blocking, which is to be placed in or behind partitions. Allow such items to be installed after partition framing is complete. Ensure that allowance is made for thickness of wall finish to be applied.

.9 Place sheathing with end joints staggered. Secure sheets over firm bearing. Maintain minimum 1.5 mm and maximum 3 mm spacing between joints on walls. Place perpendicular to framing members.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.4 WASTE MANAGEMENT

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

.2 Re-use scrap lumber to the greatest extent possible. Separate scrap lumber for use on site as accessory components, including shims, bracing, and blocking.

.3 Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill. Prevent saw dust and wood shavings from entering the storm drainage system.

.4 Do not burn scrap lumber that has been pressure treated.

.5 Do not send lumber treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by rough carpentry installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 04 22 00 – Concrete Unit Masonry

.2 07 92 00 - Joint Sealants

1.2 REFERENCE STANDARDS

.1 Canadian General Standards Board (CGSB)

.1 CGSB 71-GP-24M-AMEND-77(R1983), Adhesive, Flexible, for Bonding Cellular polystyrene Insulation.

.2 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S604-2012, Standard for Factory-Built Type A Chimneys.

.2 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.

.3 ASTM

.1 ASTM E 96/E 96M-13, Standard Test Methods for Water Vapour Transmission of Materials.

1.3 ACTION AND INFORMATIONAL 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 for board insulation and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS SDS - Safety Data Sheets in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Quality Assurance Submittals: submit following in accordance with Section 01 33 00 – Submittal Procedures.

.1 Submit certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Submit manufacturer's installation instructions.

1.4 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 Storage and Handling Requirements:

.1 Store materials off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect specified materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Place materials defined as hazardous or toxic waste in designated containers.

.2 Ensure emptied containers are sealed and stored safely for disposal away from children.

1.6 AMBIENT CONDITIONS

.1 Install solvent curing sealants and vapour release adhesive materials in open spaces with ventilation.

.2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.

.3 Maintain temperature and humidity recommended by materials manufactures before, during and after installation.

1.7 SEQUENCING

.1 Sequence work to permit installation of materials in conjunction with related materials and seals.

Part 2 Products

2.1 INSULATION

.1 Extruded polystyrene (XPS): to CAN/ULC-S701

.1 Type: 4.

.2 Compressive strength: 25 psi

.3 Thickness: as indicated.

.4 Size: Largest practical size available for application.

.5 Edges: square.

2.2 ACCESSORIES

.1 Insulation clips: impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self-locking type.

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 GENERAL

3.3 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for board insulation application in accordance with manufacturer's written instructions.

.2 Visually inspect substrate.

.3 Inform Contract Administrator 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 the Contract Administrator.

3.4 INSTALLATION

.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 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 CSA B149.2 type B and L vents.

.5 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.

.6 Offset both vertical and horizontal joints in multiple layer applications.

.7 Do not enclose insulation until it has been inspected and approved by the Contract Administrator

3.5 RIGID INSULATION INSTALLATION

.1 Imbed insulation boards into vapour barrier type adhesive, applied as specified, prior to skinning of adhesive.

3.6 PERIMETER INSULATION

.1 Exterior application: extend boards below finish grade as indicated. Install on exterior face of perimeter foundation wall with adhesive.

.2 Exterior application: extend boards 1200 mm from perimeter foundation walls. Slope boards away from foundation on compacted fill.

3.7 CAVITY WALL INSTALLATION

.1 Install extruded polystyrene insulation boards on outer surface of inner wythe of wall cavity over impaling clips.

.2 Leave insulation board joints unbonded over line of expansion and control joints. Bond a continuous 150mm wide modified bituminous membrane over expansion and control joints using compatible adhesive and primer before application of insulation.

3.8 CLEANING

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

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.9 PROTECTION OF WORK

.1 Protect finished work in accordance with manufacturer’s recommendations].

.2 Do not permit adjacent work to damage work of this section.

.3 Ensure finished work is protected from climatic conditions.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 07 62 00 – Sheet Metal Flashing and Trim

.2 07 92 00 - Joint Sealants

1.2 REFERENCE STANDARDS

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-19.13M-[M87], Sealing Compound, One Component, Elastomeric Chemical Curing.

.2 CAN/CGSB-19.24M-[M90], Multi-Component, Chemical Curing Sealing Compound.

.3 CGSB 19-GP-14M-[84], Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing.

.2 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC S741, Standard for Air Barrier Materials - Specification

.3 ASTM

.1 ASTM E2178-21a, Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeability of Building Materials

1.3 ACTION AND INFORMATIONAL 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 WHMIS SDS - Safety Data Sheets in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Quality Assurance Submittals: submit following in accordance with Section 01 33 00 – Submittal Procedures.

.1 Existing Substrate Condition: report deviations, as described in PART 3 -EXAMINATION in writing to Contract Administrator.

.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

.4 Manufacturer's Field Reports: submit manufacturer's written reports within [3] days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Applicator: company specializing in performing work of this section with minimum 5 years documented experience with installation of air/vapour barrier systems.

.1 Completed installation must be approved by the material manufacturer.

.2 Applicator: company:

.1 Currently licensed by National Air Barrier Association.

.2 Must maintain their licence throughout the duration of the project.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer’s requirements.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Avoid spillage: immediately notify Contract Administrator if spillage occurs and start clean up procedures.

.4 Clean spills and leave area as it was prior to spill.

1.6 AMBIENT CONDITIONS

.1 Install solvent curing sealants and vapour release adhesive materials in open spaces with ventilation.

.2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.

.3 Maintain temperature and humidity recommended by materials manufactures before, during and after installation.

1.7 SEQUENCING

.1 Sequence work to permit installation of materials in conjunction with related materials and seals.

Part 2 Products

.1 Air/Vapour Barrier

.1 Description: Thermofusible air/vapour barrier for use in wall composed of SBS modified bitumen and a non-woven polyester reinforcement.

.2 Acceptable Product: Sopraseal 180 HD by Soprema or approved equal in accordance with B8.

2.2 SHEET MATERIALS

.1 Sheet Seal: thermofusable elastomeric bitumen membrane reinforced with a non-woven polyester reinforcement.

2.3 SEALANTS

.1 Sealants in accordance with Section 07 92 00 - Joint Sealants.

.2 Butyl Sealant: CGSB 19-GP-14M, butyl rubber base, single component, solvent release, non-skinning, Shore "A" Hardness Range of 10 to 30; black colour.

.3 Primer: recommended by sealant manufacturer.

.4 Substrate Cleaner: non-corrosive type recommended by sealant manufacturer and compatible with adjacent materials].

2.4 ACCESSORIES

.1 Thinner and cleaner for Butyl Sheet: as recommended by sheet material manufacturer.

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 GENERAL

.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 requirements for materials and installation.

3.3 EXAMINATION

.1 Verify that surfaces and conditions are ready to accept work of this section.

.2 Ensure surfaces are clean, dry, sound, smooth, continuous and comply with air barrier manufacturer's requirements.

.3 Report unsatisfactory conditions to Contract Administrator in writing.

.4 Do not start work until deficiencies have been corrected.

.1 Beginning of Work implies acceptance of conditions.

3.4 PREPARATION

.1 Remove loose or foreign matter, which might impair adhesion of materials.

.2 Ensure substrates are clean of oil or excess dust; masonry joints struck flush, and open joints filled; and concrete surfaces free of large voids, spalled areas or sharp protrusions.

.3 Ensure substrates are free of surface moisture prior to application of [self-adhesive] membrane and primer.

.4 Ensure metal closures are free of sharp edges and burrs.

.5 Prime substrate surfaces in accordance with manufacturer's instructions.

.1 Acceptable Product: Elastocol 500 by Soprema or approved equal in accordance with B8.

3.5 INSTALLATION

.1 Install materials in accordance with manufacturer's instructions.

.2 Secure sheet seal to masonry materials with heat bonding.

.1 Caulk with butyl sealant to ensure complete seal.

.2 Position lap seal over firm bearing.

.3 Lap sheet seal onto roof vapour retarder and seal with heat bonding.

.1 Caulk to ensure complete air seal.

.2 Position lap seal over firm bearing.

.4 Apply sealant within recommended application temperature ranges.

.1 Consult manufacturer when sealant cannot be applied within these temperature ranges.

3.6 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

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

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

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

3.7 CLEANING

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

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.8 PROTECTION OF WORK

.1 Protect finished work in accordance with manufacturer's recommendations].

.2 Do not permit adjacent work to damage work of this section.

.3 Ensure finished work is protected from climatic conditions.

3.9 SCHEDULES

.1 Wall Air/Vapour Barrier Over Outer Surface of Masonry:

.1 Seal masonry anchor penetrations air tight.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 07 62 00 – Metal Flashing and Trim.

.2 07 92 00 - Joint Sealants

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM A 167-99, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.2 ASTM A 653/A 653M-18, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 ASTM A 792/A 792M-10, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot Dip Process.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-37.29-M89, Rubber-Asphalt Sealing Compound.

.2 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.

.3 CAN/CGSB-93.1-M85, Sheet Aluminum Alloy, Prefinished, Residential.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Safety Data Sheets (SDS).

.4 Manitoba Building Code 2024 (MBC).

.1 CCMC- Registry of Product Evaluations.

1.3 ACTION AND INFORMATIONAL 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 sheet metal roofing and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Proof of manufacturer's CCMC listing and listing number.

.3 Submit 2 copies of WHMIS SDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional Engineer registered or licensed in Manitoba, Canada.

.4 Samples:

.1 Submit 300 x 300 mm samples of each sheet metal material.

1.4 GUARANTEE

.1 Provide a written guarantee, signed and issued in the name of the City of Winnipeg stating that the entire roofing system is guaranteed against leading for a period of five (5) years from the date of Substantial Performance.

1.5 WORKMANSHIP

.1 The Roofing Subcontractor must be a member in good standing with the Roofing Contractors Association of Manitoba. Provide written confirmation prior to commencement of work.

.2 The Contractor is responsible for ensuring that the design, supply and total installation of this project are supervised and executed by fully trained and qualified personnel.

.3 Installer shall demonstrate at least five (5) years experience in projects with similar scope.

1.6 ROOF SYSTEM DESIGN

.1 Prefinished roof deck supplier to design connections to substructure for minimum 40 psf uplift, based on connections as required. Contractor to submit to the Contract Administrator sealed shop drawings of anchorage details to the Contract Administrator for review prior to fabrication and installation.

1.7 FIELD QUALITY CONTROL

.1 Inspection of roof application will be carried out by an independent agency selected by the Contract Administrator.

.2 Notify the Contract Administrator a minimum 48 hours prior to commencing roofing operations to arrange inspections. Permit agency full access to all portions of work.

.3 Note that the last inspection is to be a “final inspection” carried out after all roofing is complete, including installation of equipment and openings, and shall be in the presence of the Contract Administrator and the Contractor.

1.8 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 Storage and Handling Requirements:

.1 Store materials off ground, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect sheet metal roofing from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SHEET METAL MATERIALS

.1 Zinc coated steel sheet: to ASTM A 653/A 653M, commercial quality, with Z275 coating, prefinish as specified in 2.2, 22 gauge minimum base metal thickness.

.2 Basis of Design: 22 gauge, Tradition 100, as manufactured by Vicwest Building Products or approved equal in accordance with B8.

2.2 PREFINISHED STEEL SHEET

.1 Prefinished steel with factory applied silicone modified polyester.

.1 Colour selected by Contract Administrator from manufacturer's standard colours.

.2 Coating thickness: 1.0 mil. dry film thickness minimum.

.3 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20 % to ASTM D 822 as follows:

.1 Outdoor exposure period 1000 hours minimum.

.2 Humidity resistance exposure period 1000 hours minimum.

2.3 ACCESSORIES

.1 Isolation coating: alkali resistant bituminous paint.

.2 Plastic cement: to CAN/CGSB-37.5.

.3 Underlay: dry sheathing to CAN/CGSB-51.32.

.4 Slip sheet: reinforced sisal paper or a heavy felt kraft paper.

.5 Sealant: Asbestos-free sealant, compatible with systems materials, recommended by system manufacturer.

.6 Rubber-asphalt sealing compound: to CAN/CGSB-37.29.

.7 Cleats: of same material, and temper as sheet metal: 50 mm minimum wide.

.1 Thickness same as sheet metal being secured.

.8 Fasteners: concealed.

.9 Washers: of same material as sheet metal, 1 mm thick with rubber packings.

.10 Touch-up paint: as recommended by sheet metal roofing manufacturer.

2.4 WATERPROOF MEMBRANE

.1 Ice And Water Shield as manufactured by Grace, Soprema or Bakelite, or approved equal in accordance with B8, approved for use under metal roofing.

.2 Membrane to be self-adhesive installed on gypsum board sheathing over entire roof.

2.5 CONTINUOUS RIDGE VENT

.1 Continuous ridge vent as per VicWest roof system. 0.76 mm (22 gauge) prefinished steel sheet.

.2 Colour to match roofing.

2.6 FABRICATION

.1 Fabricate aluminum sheet metal in accordance with AA ASM-35.

.2 Form individual pieces in 2400 mm maximum lengths. Make allowances for expansion at joints.

.3 Hem exposed edges on underside 12 mm, mitre and seal.

.4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.5 Apply minimum 0.2 mm dry film thickness coat of plastic cement to both faces of dissimilar metals in contact.

.6 Protect metals against oxidization by backpainting with isolation coating where indicated.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for sheet metal roofing installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Use concealed fastenings except where approved in writing by Contract Administrator before installation.

.2 Install metal roofing system in strict accordance with reviewed shop drawings and manufacturer’s instructions.

.3 Inspect underlayment installation and correct any deficiencies prior to proceeding. Install metal roof system and completely patch and seal any damage to the membrane(s) in accordance with the manufacturer’s instructions.

.4 Install factory manufactured panels in longest practical lengths with special panels to suit valleys and penetrations.

.5 Provide notched and formed closures, to shed water, at changes in pitch and at peaks, ridges and eaves.

.6 Provide sloped roof "crickets" to shed water from behind large roof projections.

.7 Screws anchors: ensure anchor into top truss cord under roof sheathing. Use galvanized anchors, with length and size to meet roof system design.

.8 Deck closures: gauge and profile as recommended by manufacturer.

.9 Ensure the complete integrity of the roof system and the continuity of the building envelope at all roof penetrations.

.10 Include underlay, suitable for metal roofing applications, under sheet metal roofing.

.1 Secure in place and lap joints 100 mm minimum.

.11 Apply slip sheet over underlay to prevent bonding between sheet metal and felt.

.1 Secure with anchorage and lap joints 50 mm minimum in direction of waterflow.

.12 Install sheet metal roof panels using cleats spaced as per manufacturer's installation instructions.

.13 Secure cleats with 2 fasteners each and cover with cleat tabs.

.14 Stagger transverse seams in adjacent panels.

.15 Flash roof penetrations with material matching roof panels and make watertight.

.16 Form seams in direction of water-flow and make watertight.

3.3 STANDING SEAM ROOFING

.1 Install standing seam roofing in strict accordance with manufacturer's written installation instructions.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by sheet metal roofing installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 07 13 52 – Modified Bituminous Sheet Waterproofing

1.2 WORK INCLUDED

.1 Base/drip flashings

.2 Pre-finished Brake Metal

1.3 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)

.1 ANSI/SPRI/FM 4435/ES-1, Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems 2011.

.2 ASTM International (ASTM)

.1 ASTM A 792/A 792M-10(2015), Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.2 ASTM D 4587-11 Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings.

.3 ASTM F 1667-15 Standard Specification for Driven Fasteners: Nails, Spikes and Staples.

.3 Canadian Roofing Contractors Association (CRCA)

.1 Roofing Specifications Manual 2012.

.4 Canadian Sheet Steel Building Institute (CSSBI)

.1 CSSBI S8-2008 Quality and Performance Specification for Prefinished Sheet Steel Used for Building Products.

.2 CSSBI B17-2002 Barrier Series Prefinished Steel Sheet: Product Performance & Applications.

.3 CSSBI Sheet Steel Facts #12 2003 Fastener Guide for Sheet Steel Building Products.

.5 CSA Group (CSA)

.1 CSA A123.3-05(2015), Asphalt Saturated Organic Roofing Felt.

.2 CSA A123.22-08(2013) Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

.6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Safety Data Sheets (SDS).

1.4 EXISTING CONDITIONS/PROTECTION

.1 Exercise care when working on or about roof surfaces to avoid damaging or puncturing membrane or flexible flashings.

.2 Place plywood panels on roof surfaces to Work of this Section and on access routes. Keep in place until completion of Work.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's instructions.

.2 Handle and store flashing materials to prevent creasing, buckling, scratching, or other damage.

Part 2 Products

2.1 SHEET METALS

.1 Galvanized steel: minimum 24-gauge core steel; conforming to requirements of ASTM A525 G90 Galvanized Coating.

.2 Prefinished galvanized flashing: ASTM A446; G90 zinc coating; 24-gauge core steel; shop precoated; Colour as per schedule.

2.2 ACCESSORY MATERIALS AND COMPONENTS

.1 Fasteners: concealed clip type, of same materials as flashings; sized to suit application.

.2 Rubber-asphalt sealing compound: conforming to requirements of CGSB 37-GP-5M.

.3 Bituminous paint: acid and alkali resistant type; black colour.

2.3 FABRICATION

.1 Fabricate metal flashings in accordance with recommendations of CRCA and as indicated on Drawings.

.2 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.3 Form sections in 2438 mm (8 ft) lengths. Make allowances for expansion at joints.

.4 All seams are to be flat lock type except corners. Fabricate corners minimum 460 mm, mitred, soldered or welded, and sealed as one (1) piece.

.5 Hem exposed edges of flashings on underside 13 mm.

.6 Backpaint flashing with bituminous paint where expected to be in contact with cementitious materials or dissimilar metals. Fabricate scuppers as detailed.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verify membrane termination and base flashings are in place, sealed, and secure.

.2 Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

.1 Field measure Site conditions prior to fabricating Work.

.2 Install starter and edge strips, and cleats before starting installation.

3.3 INSTALLATION

.1 Install flashings in accordance with CRCA recommendations and as indicated on Drawings.

.2 Secure flashing in place using concealed type fasteners. Use exposed fasteners in locations approved by the Contract Administrator only. When using exposed fasteners, they are to be of the same finish as flashings.

.3 Apply sealing compound at junction of metal flashings and asphalt felt flashings.

.4 Lock seams and end joints. Fit flashing tight in place. Make corners square, surfaces true and straight in all planes and all lines accurate to profiles.

.5 Counter-flash all mechanical and electrical items projecting through.

.6 Install galvanized flashing to all locations indicated on Drawings.

.7 Install pre-finished flashing to all locations indicated on Drawings.

.8 Seal metal joints watertight.

3.4 CLEANING

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

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.3 Leave work areas clean, free from grease, finger marks and stains.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 05 31 00 – Steel Decking

1.2 WORK INCLUDED

.1 Supply and installation of all sealant and backing materials as required.

1.3 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM C 919-18, Standard Practice for Use of Sealants in Acoustical Applications.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 19-GP-5M-1984, Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).

.2 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.

.3 CGSB 19-GP-14M-1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).

.4 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.

.5 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.

.3 General Services Administration (GSA) - Federal Specifications (FS)

.1 FS-SS-S-200-E(2)1993, Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold Applied, for Portland Cement Concrete Pavement.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Safety Data Sheets (SDS).

1.4 ACTION AND INFORMATIONAL 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 joint sealants and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Manufacturer's product to describe:

.1 Caulking compound.

.2 Primers.

.3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.

.3 Submit 2 copies of WHMIS SDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect joint sealants from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.7 ENVIRONMENTAL CONDITIONS

.1 Sealant and substrate materials to be minimum 5˚C.

.2 Should it become necessary to apply sealants below 5˚C, consult sealant Manufacturer and follow their recommendations.

1.8 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 Health Canada.

Part 2 Products

2.1 MATERIALS

.1 Primers: type recommended by sealant Manufacturer.

.2 Joint fillers

.1 General: compatible with primers and sealants, outsized 30 to 50%.

.2 Polyethylene, urethane, neoprene or vinyl: extruded closed cell foam, Shore A hardness 20, tensile strength 140 to 200 kPa.

.3 Neoprene or butyl rubber: round solid rod, Shore A hardness 70.

.4 Polyvinyl chloride or neoprene: extruded tubing with 6mm minimum thick walls.

.5 Impregnated precompressed polyurethane foam sealant tape.

.6 Acceptable Product: Emseal “Grayflex” or approved equal in accordance with B8.

.3 Bond breaker: pressure sensitive plastic tape, which will not bond to sealants.

.4 Sealants

.1 Sealant shall be UV-resistant and ozone resistant, capable of supporting their own weight, conforming to CAN2-19.13.

.2 Sealants for vertical and horizontal non-traffic bearing joints, to Table 1, CGSB19-GP-23.

.3 Colour of sealants shall match adjacent surface. Colours to be selected by the Contract Administrator, from standard colour range.

.4 Joint cleaner: xylol, methylethylketone or non-corrosive type recommended by sealant Manufacturer and compatible with joint forming materials.

2.2 ACCEPTABLE PRODUCTS

.1 For all non-traffic bearing joints unless indicated otherwise Dow Corning No. 790 or approved equal in accordance with B8.

.2 For joints between exterior doors, windows, ductwork, etc., and adjacent materials: Dow Corning No. 795 or approved equal in accordance with B8.

Part 3 Execution

3.1 PREPARATION

.1 Remove dust, paint, loose mortar and other foreign matter. Dry joint surfaces.

.2 Remove rust, mill scale and coatings from ferrous metals by wire brush, grinding or sandblasting.

.3 Remove oil, grease, and other coatings from nonferrous metals with joint cleaner.

.4 Prepare concrete, glazed, and vitreous surfaces to sealant Manufacturer’s instructions.

.5 Examine joint sizes and correct to achieve depth ratio one-half of joint width with minimum width and depth of 6 mm, maximum width 25 mm.

.6 Install joint filler to achieve correct joint depth.

.7 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.8 Apply bond breaker tape where required to Manufacturer’s instructions.

.9 Prime sides of joints in accordance with sealant Manufacturer’s instructions immediately prior to caulking.

3.2 APPLICATION

.1 Apply sealants, primers, joint fillers, bond breakers, to Manufacturer's instructions. Apply sealant using gun with proper size nozzle. Use sufficient pressure to fill voids and joints solid. Superficial pointing with skin bead is not acceptable.

.2 Apply sealant to joints between door frames to adjacent building components, around perimeter of every external opening, to control joints in concrete slabs and where indicated.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

- .1 Leave Work area clean at end of each day.
- .2 Clean adjacent surfaces immediately.
- .3 Remove excess and droppings, using recommended cleaners as work progresses.
- .4 Remove masking tape after initial set of sealant.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by joint sealants installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 08 71 00 - Door Hardware

.2 09 91 23 - Interior Painting

1.2 WORK INCLUDED

.1 Non-rated rolled steel frames

.2 Non-rated hollow steel doors

1.3 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM A 653/A 653M-06a, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM B 29-03, Standard Specification for Refined Lead.

.3 ASTM B 749-03, Standard Specification for Lead and Lead Alloy Strip, Sheet and Plate Products.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.

.3 CSA Group (CSA)

.1 CSA-G40.20-04 /G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA W59-03, Welded Steel Construction (Metal Arc Welding).

.4 Canadian Steel Door Manufacturers' Association (CSDMA)

.1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2000.

.2 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 1990.

1.4 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35 degrees C to 35 degrees C.

.2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.

.3 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104 for ratings specified or indicated.

.4 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN4-S104 and listed by nationally recognized agency having factory inspection services.

1.5 QUALITY ASSURANCE

.1 Conform to requirements of Canadian Steel Door and Frame Manufacturers Association Standards.

.2 Fire rated construction to conform to ULC standards.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Provide product data: in accordance with Section 01 33 00 - Submittal Procedures.

.3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.

.1 Submit drawings stamped and signed by professional Engineer registered or licensed in Manitoba, Canada.

.2 Indicate on Shop Drawings, frame configuration, anchor types and spacings, location of cutouts for hardware, reinforcement and finish.

.3 Indicate on Shop Drawings, door elevations, internal reinforcement, and closure method, and location of cutouts for glazing.

1.7 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 Storage and Handling Requirements:

.1 Store materials off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect door and frames from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Macotta
.2 Allmar
.3 Shanahans

.4 Or approved equal in accordance with B8.

2.2 FRAMES

.1 Type/Size: as shown on Drawings and Schedules.
.2 Frames: 1.52 mm (16 gauge) cold rolled sheet steel with ZF75 Colourbond coating.
.3 Bumpers: Resilient rubber.
.4 Anchors: purpose made to rigidly secure frames, 3 per jamb.
.5 Mortar Guard Boxes: 0.76 mm (22 gauge) welded in place.
.6 Primer: zinc chromate type.
.7 Insulation: Sprayed-in Polyurethane Foam.

2.3 DOORS

.1 Insulated Core Doors: minimum 1.52 mm (16 gauge.) surface sheets, and top and bottom end channels; steel stiffened, cores filled with polyurethane insulation.

.2 Reinforcement for hardware:

.1 Locks: minimum 1.52 mm (16 gauge) steel.
.2 Butts: minimum 3.42 mm (10 gauge) steel.
.3 Flush Bolts: minimum 3.42 mm (10 gauge) steel
.4 Door Closures: minimum 1.9 (14 gauge) mm steel.
.5 Door Holders: minimum 1.9 mm (14 gauge) steel.

2.4 FABRICATION - FRAMES

.1 Fabricate frames as welded unit.

.2 Fabricate frames with hardware reinforcement plates welded in place. Provide mortar guard boxes.

.3 Prepare frame for silencers. Provide three (3) single silencers for single doors and mullions of double doors on strike side, and two single silencers on frame head at double doors without mullions.

.4 Attach channel spreaders at bottom of frames for shipping.

.5 Reinforce exterior frames at lock side, to prevent frame distortion.

2.5 FABRICATION - DOORS

.1 Fabricate hollow metal doors and panels in accordance with requirements of "Canadian Manufacturing Standards for Steel Doors and Frames" produced by the Canadian Steel Door and Frame Manufacturer's Association and as indicated on Drawings.

.2 Fabricate fire rated hollow metal doors in accordance with requirements of ULC. Place ULC labels where visible when in installed position.

.3 All doors in fire rated walls shall be listed and labelled with a maximum temperature rise limitation of 250□C after 30 minutes in accordance with the National Building Code.

.4 Mechanically interlock longitudinal seams of honeycomb core type doors weld seams and sand flush. Top and bottom of doors closed with end channels recessed and spot welded in place.

.5 Reinforce and prepare doors to receive hardware. Refer to Section 08700 for hardware requirements.

.6 Each exterior hollow metal door to be supplied complete with a full length 3.42 mm (10 gauge) anti-intrusion plate welded to latch side of door.

Part 3 Execution

3.1 INSTALLATION

.1 Install doors and frames in accordance with Canadian Steel Door and Frame Manufacturers Association standards.

.2 Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

.3 After installation, touch up all scratched or damaged surface and prime.

.4 Insulate all frames exposed to the exterior.

3.2 TOLERANCES

.1 Maximum diagonal distortion: 2 mm measured with straight edge, corner to corner.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 08 11 00 – Metal Doors and Frames

1.2 WORK INCLUDED

.1 Hardware for hollow metal doors

.2 Thresholds and weatherstripping

1.3 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)

.1 ANSI/BHMA A156.1-2000, American National Standard for Butts and Hinges.
.2 ANSI/BHMA A156.2-2003, Bored and Preassembled Locks and Latches.
.3 ANSI/BHMA A156.3-2001, Exit Devices.
.4 ANSI/BHMA A156.4-2000, Door Controls - Closers.
.5 ANSI/BHMA A156.5-2001, Auxiliary Locks and Associated Products.
.6 ANSI/BHMA A156.8-2005, Door Controls - Overhead Stops and Holders.
.7 ANSI/BHMA A156.10-1999, Power Operated Pedestrian Doors.
.8 ANSI/BHMA A156.12-2005, Interconnected Locks and Latches.
.9 ANSI/BHMA A156.13-2002, Mortise Locks and Latches Series 1000.
.10 ANSI/BHMA A156.15-2006, Release Devices - Closer Holder, Electromagnetic and Electromechanical.
.11 ANSI/BHMA A156.16-2002, Auxiliary Hardware.
.12 ANSI/BHMA A156.18-2006, Materials and Finishes.

.2 Canadian Steel Door and Frame Manufacturers' Association (CSDMA)

.1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 2009.

.3 Underwriters' Laboratories of Canada (ULC)

.1 ULC – List of Equipment and Materials, Volume 2.

1.4 COORDINATION

.1 Coordinate Work of this Section with other directly affected Sections involving Manufacturer of and internal reinforcement for door hardware.

.2 Supply templates to Manufacturers of components affected by hardware.

1.5 REGULATORY REQUIREMENTS

.1 Conform to applicable code for requirements applicable to fire rated doors, frames and hardware.

.2 Conform to ULC requirements for fire rated doors, frames and hardware.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Shop Drawings:

.1 Indicate on Shop Drawings, locations, and mounting heights of each type of hardware.

.3 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.

.4 Hardware List:

.1 Submit Contract hardware list.

.2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.

.3 Hardware list shall list each door individually and shall list hardware for each door as a described item, not by a code as is done in the Specification. Hardware list shall be in terminology understandable by a layman.

.4 Submit one (1) copy of Manufacturers' catalogue cuts of each item, with hardware list.

.5 Put parts lists, Manufacturer’s instructions, and catalogue cuts into maintenance manual as per Section 01 33 00 – Submittal Procedures

.6 Supply templates to door and frame Manufacturer to enable accurate sizes, locations of cut outs, and reinforcement for hardware.

.7 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.8 Manufacturer's Instructions: submit manufacturer's installation instructions.

1.7 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.

1.8 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials:

.1 Supply maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

1.9 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 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.10 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 hardware in locked, dry area in individual packages or like groups.

.2 Store and protect door hardware from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 As per schedule on drawings.

.2 Use Products from a single Manufacturer for all similar items.

2.2 DOOR HARDWARE

.1 Butts: Provide 1-1/2 pair for all doors, except doors over 900 mm wide or over 2,200 mm high are to have two (2) pairs.

.2 Protective plates: supply to both sides of door unless otherwise specified.

2.3 FASTENERS

.1 Supply all fastening devices for installation and operation of hardware.

.2 All exposed fasteners to be finished to match hardware.

.3 Use fasteners compatible with material through which they pass.

2.4 KEYING

.1 Door locks: Use construction cylinders to allow for a grand master key system to match existing system by Medeco to be installed at a later date.

.2 Supply three (3) keys for each lock. Supply three (3) master keys for each group, and three (3) grand master keys.

Part 3 Execution

3.1 INSPECTION

.1 Verify that door and frame components are ready to receive Work and dimensions are as required.

.2 Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

.1 Install hardware in accordance with Manufacturer's instructions.

.2 Install locksets as specified with construction cylinder for later installation of Medeco cylinder keying system by Contract Administrator.

.3 Use the templates provided by hardware item Manufacturer.

.4 Maintain the following mounting heights for doors, from finished floor to centre line of hardware item:

.1 Locksets: 1020 mm

.2 Dead locks: 1525 mm

.3 Exit devices: 1020 mm

3.3 SCHEDULE

.1 Refer to Building Drawings.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 09 91 23 - Interior Painting

.2 07 92 00 - Joint Sealants

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM C 1396/C 1396M-17, Standard Specification for Gypsum Wallboard.

.2 ASTM C 475/C 475M-17(2022), Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.3 ASTM C 645-18, Standard Specification for Nonstructural Steel Framing Members.

.4 ASTM C 754-20, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

.5 ASTM C 840-12(2021), Standard Specification for Application and Finishing of Gypsum Board.

.6 ASTM C 954-22, Standard 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 0.122 in. (2.84 mm) in Thickness.

.7 ASTM C 1002-22, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

.8 ASTM C 1047-19, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

.2 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 ACTION AND INFORMATIONAL 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, framing, sealants, 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.

1.4 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 Storage and Handling Requirements:

.1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store materials inside, level, under cover. Protect from weather, damage from construction operations and other causes, in accordance with manufacturer's printed instructions.

.3 Handle materials to prevent damage to edges or surfaces. Protect metal accessories and trim from being bent or damaged.

.4 Store and protect partition materials from nicks, scratches, and blemishes.

.5 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Performance / Design Criteria:

.1 Roof assembly to be non-combustible construction.

.2 Ceiling assembly to be non-combustible construction.

.2 Gypsum Board:

.1 Gypsum roof sheathing: DensDeck Roof Boards of approved equal in accordance with B8, 16 mm thick, 1200 mm wide x maximum practical length.

.2 Standard board: to ASTM C 1396/C 1396M regular, 16 mm thick, 1200 mm wide x maximum practical length, ends square cut, edges tapered.

.3 Drywall furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.

.4 Steel tapping screws: to ASTM C 1002.

.5 Casing beads, corner beads, control joints and edge trim: to ASTM C 1047, Zinc metal, zinc-coated by electrolytic process, 0.5 mm base thickness, perforated flanges, one piece length per location.

2.2 ACCESSORIES

.1 Sealants: in accordance with Section 07 92 00 - Joint Sealants.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's written instructions prior to partition installation.

.1 Visually inspect.

.2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been.

3.2 ERECTION OF GYPSUM BOARD AND ACCESSORIES

.1 Do application and finishing of gypsum board in accordance with ASTM C 840 except where specified otherwise.

.2 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles.

.3 Install gypsum boards in direction that will minimize number of end-butt joints. Stagger end joints 250 mm minimum.

3.3 APPLICATION

.1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical and mechanical work are approved.

.2 Apply gypsum board to metal furring or framing using screw fasteners. Maximum spacing of screws 300 mm on centre.

3.4 INSTALLATION

.1 Install gypsum roof sheathing to manufacturer’s written instructions with manufacturer’s recommended fasteners to resist uplift requirements of roof system.

.2 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.

.3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.

.4 Install access doors to electrical and mechanical fixtures specified in respective sections.

.1 Rigidly secure frames to furring or framing systems.

.5 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.

.6 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.

.7 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.

.8 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by partition installation.

END OF SECTION

Part 1 General

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

.1 This Section includes one resinous flooring system, one with epoxy body.

.1 Application Method: Metal, power or hand troweled.

1.3 SUBMITTALS

.1 Product Data: For each type of product indicated. Include manufacture's technical data, application instructions, and recommendation for each resinous flooring component required.

.2 Samples of Verification: For each resinous flooring system required, 150 mm square, applied to a rigid backing by Installer for this Project.

.3 Room Finish Schedule: Use resinous flooring indicated on Drawings in room finish schedule.

.4 Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

.5 Maintenance Data: For resinous flooring to include in maintenance manuals.

1.4 QUALITY ASSURANCE

.1 No request for substitution shall be considered that would change the generic type of floor system specified (i.e. epoxy mortar based system). Equivalent materials of other manufactures may be substituted only on approval of the contract administrator. Request for substitution will only be considered only if submitted 10 days prior to bid date. Request will be subject to specification requirements described in this section.

.2 Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.

.1 Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring system indicated.

.2 Contractor shall have completed at least 10 projects of similar size and complexity.

.3 Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, through one source from a single manufacturer, with not less than ten years of successful experience in manufacturing and installing principal materials described in this section. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

.4 Manufacturer Field Technical Service Representatives: Resinous flooring manufacture shall retain the services of Field Technical Service Representatives who are trained specifically on installing the system to be used on the project.

.1 Field Technical Services Representatives shall be employed by the system manufacture to assist in the quality assurance and quality control process of the installation and shall be available to perform field problem solving issues with the installer.

.5 Pre-installation Conference:

.1 Contractor shall arrange a meeting not less than thirty days prior to starting work.

.2 Attendance:

.1 Contractor

.2 Manufacturer/Installer's Representative

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials in original packages and containers, with seals unbroken, bearing manufacture's labels indicating brand name and directions for storage and mixing with other components.

.2 Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

.3 All materials used shall be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors. No on site weighing of volumetric measurements allowed.

1.6 PROJECT CONDITIONS

.1 Environmental Limitation: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

.1 Maintain material and substrate temperature between 65 and 85 deg F (18 and 30 deg C) during resinous flooring application and for not less than 24 hours after application.

.2 Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

.3 Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

.4 Concrete substrate shall be properly cured for a minimum of 30 days. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring.

1.7 WARRANTY

.1 Manufacturer shall furnish a single, written warranty covering both material and workmanship for a period of (1) full year from date of installation, or provide a joint and several warranty signed on a single document by material manufacturer and applicator jointly and severally warranting the materials and workmanship for a period of (1) full year

from date of installation. A sample warranty letter must be included with bid package or bid may be disqualified.

Part 2 Products

2.1 RESINOUS FLOORING

.1 Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include:

.1 Build of Broadcast or liquid rich type system will not be accepted and will result in a disqualification from bid.

.2 Acceptable Manufactures

.1 Stonhard Basis of design

.3 Products: Subject to compliance with requirements:

.1 Stonhard; Stonclad GS®. With top coat Stonkote GS4.

.4 System Characteristics:

.1 Color and Pattern: Pewter
.2 Wearing Surface: Standard smooth with broadcast slip resistant texture.
.3 Integral Cove Base: not required
.4 Overall System Thickness: nominal 6 mm

.5 System Components: Manufacturer's standard components that are compatible with each other and as follows:

.1 Primer:
.1 Material Basis: Stonhard Standard Primer
.2 Resin: Epoxy
.3 Formulation Description: (2) two component, 100 percent solids.
.4 Application Method: Squeegee and roller.
.5 Number of Coats: (1) one.

.2 Mortar Base:
.1 Material design basis: Stonclad GS
.2 Resin: Epoxy.
.3 Formulation Description: (3) three component, 100 percent solids.
.1 Application Method: Metal Trowel.
.2 Thickness of Coats: nominal 6mm.
.4 Number of Coats: One.
.5 Aggregates: Pigmented Blended aggregate.

.3 Top Coat:
.1 Material design basis: Stonkote GS4
.2 Resin: Epoxy.
.3 Formulation Description: (2) two component, 100 percent solids.
.4 Type: pigmented.
.5 Finish: standard.

.6 Number of Coats: one.

.6 System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:

.1 Compressive Strength: 10,000 psi after 7 days per ASTM C 579.
.2 Tensile Strength: 1,750 psi per ASTM C 307.
.3 Flexural Strength: 4,000 psi per ASTM C 580.
.4 Water Absorption: < 1% per ASTM C 413.
.5 Impact Resistance: > 160 in. lbs. per ASTM D 2794.
.6 Flammability: Class 1 per ASTM E-648.
.7 Hardness: 85 to 90, Shore D per ASTM D 2240.

2.2 ACCESSORY MATERIALS

.1 Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

.2 Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service and joint condition indicated. Allowances should be included for Stonflex MP7 joint fill material, and CT5 concrete crack treatment. Unit prices should be included if the extent of control joints and non-moving cracks are not quantifiable at time of bid.

Part 3 Execution

3.1 PREPARATION

.1 General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.

.2 Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

.1 Mechanically prepare substrates as follows:
.1 Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
.2 Comply with ASTM C 811 requirements unless manufacturer's written instructions are more stringent.
.2 Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
.3 Verify that concrete substrates are dry.
.1 Perform in situ probe test, ASTM F 2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity of 75 percent.

.2 Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of 5 lb of water/1000 sq. ft. of slab in 24 hours.

.3 Perform additional moisture tests recommended by manufacturer. Proceed with application only after substrates pass testing.

.4 Verify that concrete substrates have neutral Ph and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

.3 Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

.4 Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

.5 Treat control joints and other non-moving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations. Allowances should be included for Stonflex MP7 joint fill material, and CT5 concrete crack treatment.

3.2 APPLICATION

.1 General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

.1 Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.

.2 Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.

.3 At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.

.1 Apply joint sealant to comply with manufacturer's written recommendations.

.2 Apply primer where required by resinous system, over prepared substrate at manufacturer's recommended spreading rate.

.3 Apply metal trowel single mortar coat in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When cured, sand to remove trowel marks and roughness.

.4 Apply topcoat(s) in number of coats indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.3 TERMINATION

.1 Chase edges to “lock” the flooring system into the concrete substrate along lines of termination.

.2 Penetration Treatment: Lap and seal resinous system onto the perimeter of the penetrating item by bridging over compatible elastomer at the interface to compensate for possible movement.

.3 Trenches: Continue flooring system into trenches to maintain monolithic protection. Treat cold joints to assure bridging of potential cracks.

.4 Treat floor drains by chasing the flooring system to lock in place at point of termination.

3.4 JOINTS AND CRACKS

.1 Treat control joints to bridge potential cracks and to maintain monolithic protection.

.2 Treat cold joints and construction joints to bridge potential cracks and to maintain monolithic protection on horizontal and vertical surfaces as well as horizontal and vertical interfaces.

.3 Discontinue floor coating system at vertical and horizontal contraction and expansion joints by installing backer rod and compatible sealant after coating installation is completed. Provide sealant type recommended by manufacturer for traffic conditions and chemical exposures to be encountered.

3.5 FIELD QUALITY CONTROL

.1 Material Sampling: Contract Administrator may at any time and any numbers of times during resinous flooring application require material samples for testing for compliance with requirements.

.1 Contract Administrator will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.

.2 Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.

.3 If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

3.6 CLEANING, PROTECTING, AND CURING

.1 Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 18 hours.

.2 Protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. Contractor is responsible for protection and cleaning of surfaces after final coats.

.3 Cleaning: Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 03 30 00 - Cast-In-Place Concrete

.2 04 22 00 - Concrete Unit Masonry

.3 05 21 00 - Steel Joist Framing

.4 05 31 00 - Steel Decking

.5 05 50 00 - Metal Fabrications

1.2 WORK INCLUDED

.1 Prepare surfaces which are to receive finish. Surfaces include underside steel deck, steel joists and concrete unit masonry.

.2 Finish surfaces as indicated in the schedule at the end of this Section.

1.3 REFERENCE STANDARDS

.1 Environmental Protection Agency (EPA)

.1 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, EPA Method 24 - Surface Coatings.

.2 SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Safety Data Sheets (SDS).

.3 Master Painters Institute (MPI)

.1 The Master Painters Institute (MPI)/Architectural Painting Specification Manual (ASM) - [current edition].

.2 Standard GPS-1-12, MPI Green Performance Standard.

.3 Standard GPS-2-12, MPI Green Performance Standard.

.4 National Research Council Canada (NRC)

.1 National Fire Code of Canada 2015 (NFC).

.5 Society for Protective Coatings (SSPC)

.1 SSPC Painting Manual, Volume Two, 8th Edition, Systems and Specifications Manual.

1.4 QUALITY ASSURANCE

.1 Acceptable Manufacturers, materials, workmanship and all items affecting the Work of this Section are to be in accordance with CPCA Architectural Painting Specification Manual.

.2 Prior to ordering paints, submit to the Contract Administrator for review a complete schedule of paint materials proposed for use. This schedule shall include Manufacturer's name, brand name or code number, type and recommended application.

1.5 COLOUR SCHEDULE

.1 Paint colours shall be as per room finish schedule and as selected by the Contract Administrator.

.2 Prior to commencement of Work, the Contract Administrator will furnish three (3) copies of colour schedule.

1.6 DELIVERY

.1 Deliver paint materials in sealed original labelled containers, bearing Manufacturer's name, type of paint, brand name, colour designation and instructions for mixing or reducing.

1.7 STORAGE

.1 Provide adequate storage facilities. Store paint materials at a minimum ambient temperature of 8°C and in a well-ventilated area.

.2 Take all precautionary measures to prevent fire hazards and spontaneous combustion.

1.8 ENVIRONMENTAL CONDITIONS

.1 Ensure surface temperatures or the surrounding air temperature is above 5°C before applying finishes. Minimum application temperatures for latex paints for interior Work is 7°C and for exterior Work 10°C.

.2 Provide adequate continuous ventilation and sufficient heating facilities to maintain temperatures above 7°C for twenty-four (24) hours before, during and forty-eight (48) hours after application of finishes.

.3 Provide minimum 300 Lux of lighting on surfaces to be finished.

1.9 PROTECTION

.1 Adequately protect other surfaces from paint and damage. Make good any damage as a result of inadequate or unsuitable protection.

.2 Furnish sufficient drop cloths, shields and protective equipment to prevent spray or droppings from fouling surfaces not being painted and in particular, surfaces within storage and preparation area.

.3 Place cotton waste, cloths and material which may constitute a fire hazard in closed metal containers and remove daily from Site.

.4 Remove all electrical plates, surface hardware, fittings and fastenings, prior to painting operations. These items are to be carefully stored, cleaned and replaced on completion of Work in each area. Do not use solvents that may remove the permanent lacquer finish to clean hardware.

1.10 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's instructions, printed product literature and data sheets for paint and paint products and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS SDS in accordance with Section 01 35 29.06 - Health and Safety Requirements and 01 35 43 - Environmental Procedure.

.3 Confirm products to be used are in MPI's approved product list.

.3 Upon completion, provide 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 number[s].

.4 MPI Environmentally Friendly classification system rating.

.5 Manufacturer's Safety Data Sheets (SDS).

.6 MPI #

.4 Samples:

.1 Submit full range colour sample chips to indicate where colour availability is restricted.

.2 Prepare 300 mm x 200 mm samples of paint type finishes when requested by Contract Administrator. Apply finishes on identical type materials to which they will be applied on job.

.3 Identify each sample as to finish, colour name and number and sheen name and gloss units.

.5 Test reports: Provide certified test reports for paint from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

.1 Lead, cadmium and chromium: presence of and amounts.

.2 Mercury: presence of and amounts.

.3 Organochlorines and PCBs: presence of and amounts.

.6 Certificates: Provide certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties. MPI Gateway #.

.7 Manufacturer's Instructions:

.1 Provide manufacturer's installation and application instructions.

1.11 CLOSEOUT SUBMITTALS

.1 Provide in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: Provide operation and maintenance data for painting materials for incorporation into manual.

.3 Include:

.1 Product name, type and use.
.2 Manufacturer's product number.
.3 Colour number[s].
.4 MPI Environmentally Friendly classification system rating.

1.12 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 MATERIALS

.1 Paint materials to be Products of a single Manufacturer.

.2 All painting materials shall be the best quality and shall be accepted by the Contract Administrator.

.3 Paint shall not be settled, caked or thickened in the container, shall be readily dispersed with a paddle to a smooth consistency, and shall have excellent application properties.

.4 Paint shall arrive on the job colour-mixed except for tinting of undercoats and possible thinning.

.5 All thinning and tinting materials shall be as recommended by the Manufacturer for the particular material thinned or tinted.

.6 Mixed colours shall match colour selection made by the Contract Administrator prior to application of the coating.

.7 Paint shall be ready mixed except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating.

.8 Paint shall have good flow and brushing properties, and be capable of drying or curing free of streaks or sags.

.9 Paint accessory materials: Linseed oil, shellac, turpentine, and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

.10 Paint Acceptable Manufacturers: Dulux, Benjamin Moore, C.I.L., or approved equal in accordance with B8.

Part 3 Execution

3.1 CONDITIONS OF SURFACES

.1 Thoroughly examine all surfaces schedule to be painted prior to commencement of Work. Report in writing to the Contract Administrator any condition that may potentially affect proper application. Do not commence until all such defects have been corrected.

.2 Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below maximums established by the paint Manufacturer.

.3 Beginning of installation means acceptance of existing surfaces.

3.2 PREPARATION OF SURFACES

.1 Impervious Surfaces: remove mildew by scrubbing with a solution of TSP and bleach. Rinse with clean water and allow surface to dry completely.

.2 Insulated Surfaces: remove dirt, grease and oil from canvas and cotton insulated coverings.

.3 Galvanized surfaces: remove surface contamination and oils from surfaces and wash with solvent. Apply a coat of etching type primer.

.4 Zinc coated surfaces: remove surface contamination and oils from surfaces and prepare for priming in accordance with metal Manufacturer’s recommendations.

.5 Remove stains caused by weathering of corroding metals from concrete with a solution of sodium metasilicate after being thoroughly wetted with water. Allow to thoroughly dry.

.6 Steel and iron surfaces: remove grease, rust, scale, dirt and dust from surfaces. Where heavy coatings of scale are evident, remove by wire brushing, sandblasting or any other necessary method. Ensure all steel surfaces are satisfactory before paint finishing.

.7 Unprimed steel surfaces: clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts and nuts are similarly cleaned. Prime surfaces to identify defects. Prime paint after defects have been remedied.

.8 Concrete and unit masonry surfaces scheduled to receive paint finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate, rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

.9 Specialty Coating for UV shall be prepared for according to any additional instructions by Manufacturer.

3.3 APPLICATIONS

.1 Apply paint and other finishes in accordance with good trade practice.

.2 Finishes specified are intended to cover surfaces satisfactorily when applied in accordance with Manufacturer's recommendations.

.3 Apply each coat at the proper consistency.

.4 Each coat of paint is to be slightly darker than the preceding coat unless otherwise acceptable to the Contract Administrator.

.5 Sand lightly between coats to achieve required finish.

.6 Do not apply finishes on surfaces that are not sufficiently dry.

.7 Allow each coat of finish to dry before a following coat is applied, unless directed otherwise by Manufacturer.

3.4 PROCESS, MECHANICAL, AND ELECTRICAL EQUIPMENT

.1 Refer to Process, Mechanical, and Electrical Sections with respect to painting and finishing requirements.

.2 Remove grilles, covers and access panels for mechanical and electrical systems from location and paint separately.

.3 Finish paint primed equipment.

.4 Prime and paint insulated and exposed pipes, conduits, boxes, hangers, brackets, collars and supports to match adjacent Work, except where items are plated or pre-finished unless otherwise noted as being painted as separate colour than surrounding Work - refer to Section 15010.

.5 Replace identification markings on mechanical or electrical equipment when painted over or spattered.

.6 Paint interior surfaces of air ducts, convector and baseboard heating cabinets that are visible through grilles and louvres with one (1) coat of flat black paint to limit of sight line. Paint dampers exposed behind louvres, grilles, convector and baseboard cabinets to match face panels.

.7 Paint exposed conduit and electrical equipment occurring in finished areas including baseboard heaters and force flow heaters. Colour and texture are to be selected by Contract Administrator.

.8 Paint both sides and edges of plywood backboards for electrical equipment before installing backboards and before mounting equipment on them.

.9 Colour coding equipment, piping, conduit and exposed ductwork and all colour banding and identification (flow arrows, naming, numbering, etc.) shall be performed to the requirements of Divisions 11 and 15. Piping and ductwork not required to be coded shall be painted in accordance with Mechanical and Process colour schedules.

.10 Paint all exposed exterior mechanical and electrical equipment that has not been factory finished.

.11 Ductwork and piping in truck bay to be finished with epoxy paint.

3.5 PROTECTION

.1 Protect other surfaces from paint or damage. Repair damage.

.2 Furnish drop cloths, shields, and protective methods to prevent spray or droppings from disfiguring other surfaces.

.3 Collect cotton waste, cloths and material which may constitute a fire hazard, place in closed metal containers and remove daily from Site.

3.6 CLEANING

.1 As Work proceeds and upon completion, promptly remove all paint where spilled, splashed or spattered.

.2 During the progress of Work keep the premises free from any unnecessary accumulation of tools, equipment, surplus materials and debris.

.3 Upon completion of Work leave premises neat and clean, to the satisfaction of the Contract Administrator.

3.7 PAINTING AND FINISHING SCHEDULE

.1 Interior Painting:

- .1 Primed Metal Surfaces:
  - .1 One (1) coat enamel undercoat
  - .2 Two (2) coats alkyd semi-gloss enamel
- .2 Galvanized Metal Surfaces:
  - .1 One (1) coat galvanized iron primer
  - .2 Two (2) coats alkyd semi-gloss
- .3 Concrete Block and Concrete
  - .1 One (1) coat latex block filler
  - .2 Two (2) coats alkyd enamel semi-gloss finish
- .4 Gypsum Board
  - .1 One (1) coat primer sealer
  - .2 Two (2) coats acrylic latex semi-gloss finish

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

.1 Submit manufacturer's printed product literature, specifications, and application instructions to Contract Administrator before commencing application.09 91 23 - Interior Painting

1.2 ENVIRONMENTAL CONDITIONS

.1 Maintain ambient and structural base temperature at installation area within limits specified by coating manufacturer. Apply coating during dry weather. Do not apply coating to wet or damp surfaces.Non-rated hollow steel doors

1.3 PROTECTION

.1 Protect plants and vegetation that might be damaged by coating. Protect surfaces not intended to have application of 1coatings. Provide adequate ventilation or isolation measures to protect against toxic fumes.

Part 2 Products

2.1 MATERIALS

.1 Graffiti-resistant coating: one component, water based, non-sacrificial, clear penetrating sealer and liquid repellent.
.2 Acceptable products: Fabrikem Fabrishield Paint Repellent PR-60 for stone.
.3 Or approved equal in accordance with B8.

Part 3 Execution

3.1 PREPARATION

.1 Prepare and clean substrate surfaces in accordance with coating manufacturer's instructions.

.2 Mix and prepare coatings to manufacturer’s instructions.

.3 Take moisture tests on substrates to receive coating to ensure moisture levels are within limits specified by coating manufacturer.

3.2 APPLICATION

.1 Apply coating using low pressure spraying apparatus, at recommended coverage rate for product and substrate.

.2 Apply in uniform, even coat to fully wet substrate, without flooding or rundowns.

.3 Allow area to dry completely before applying additional coats.

3.3 SCHEDULE

.1 Apply graffiti-resistant coating to limestone cladding.

Part 4 Measurement and Payment

4.1 METHOD OF MEASUREMENT AND PAYMENT

.1 Graffiti-Resistant Coatings

The supply and installation of graffiti-resistant coatings shall be considered incidental to the Contract Lump Sum Price for “Building”.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 None

1.2 REFERENCE STANDARDS

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Safety Data Sheets (SDS).

.2 National Fire Protection Association (NFPA)

.1 NFPA 10-2018, Standard for Portable Fire Extinguishers.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies WHMIS SDS - Safety Data Sheets.

.3 Provide shop drawings.

.4 Quality control submittals: submit following in accordance with Section 01 45 00 - Quality Control.

.1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.

.5 Closeout Submittals:

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle materials in accordance with manufacturer’s written instructions.

Part 2 Products

2.1 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS

.1 Stored pressure rechargeable type with hose and shut-off nozzle, ULC labelled for A, B and C class protection

.1 Size 4.5 kg or as indicated on the drawings.

.2 Acceptable Products: Strike First, Sylprotec, Larson, or Badger or approved equal in accordance with B8.

2.2 EXTINGUISHER BRACKETS

.1 Type recommended by extinguisher manufacturer.

2.3 IDENTIFICATION

.1 Identify extinguishers in accordance with recommendations of ANSI/NFPA 10.

.2 Attach bilingual tag or label to extinguishers, indicating month and year of installation. Provide space for service dates.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install or mount extinguishers in cabinets or on brackets in accordance with NFPA 10.

.2 Top of the fire extinguisher should be mounted at 900 mm above finished floor level.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 05 12 23 – Structural Steel for Buildings

.2 05 50 00 – Metal Fabrications

1.2 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI), American Society of Mechanical Engineers (ASME)

- .1 B30.10 – Hooks
- .2 B30.11 – Monorails and Underhung Cranes
- .3 HST-1M – Performance Standard for Electric Chain Hoists
- .4 MH17.1 – Underhung Cranes and Monorail Systems

.2 Canadian Standards Association (CSA)

- .1 CSA C22.1 – Canadian Electrical Code, Part I
- .2 CSA C22.2 No. 33-M1984 (R2004) – Construction and Test of Electric Cranes and Hoists

.3 National Electrical Manufacturer’s Association (NEMA)

- .1 MG 1 – Motors and Generators
- .2 250 – Enclosures for Electrical Equipment (1,000 volts maximum)

.4 Electrical Equipment Manufacturer’s Advisory Council (EEMAC)

- .1 M1-7 – Motors and Generators

.5 National Fire Protection Agency (NFPA)

- .1 NFPA 70 – National Electrical Code: Article 610 – Cranes and Hoists

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

- .1 Submit manufacturer's printed product literature and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Provide shop drawings.

.4 Quality control submittals: submit following in accordance with Section 01 45 00 - Quality Control.

.1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.

.5 Closeout Submittals:

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

Part 2 Products

2.1 GENERAL DESIGN CONDITIONS

.1 The equipment will be operated indoors with ambient temperatures ranging from 5°C to 40°C.

.2 All bearings in trolley and hoist shall be lifetime lubricated.

.3 Each hoist and chain shall be load tested to 125% capacity and test certificates shall be submitted to the Contract Administrator.

.4 Size of monorail beams and support columns shall be as per the Contract Structural drawings.

2.2 HOIST (HO-L50)

.1	Type:	Underhung electric chain hoist
.2	Capacity Rating:	2 metric tons (4,409 lbs)
.3	Type of Trolley:	Push trolley
.4	Monorail Length:	as shown on Contract drawings
.5	Beam Size:	S380x74
.6	Beam Flange:	143 mm
.7	Total Lift:	22 m (72 ft)
.8	Chain:	Corrosion resistant nickel plated
.9	Basis of Design:	Kito ER2SP020LD – dual speed, plain trolley mount
.10	Acceptable Products:	Kito, Columbus McKinnon Co., Harrington or approved equal in accordance with B8.

2.3 ELECTRICAL REQUIREMENTS

.1 Power supply shall be 575 V, 3-phase, 60 Hz.

.2 Supply and install all necessary wiring to connect all parts to the equipment to the junction boxes installed by the Electrical Sub-Contractor. All wiring shall be installed in accordance with the Canadian Electrical Code.

.3 All controls from hoists, trolleys, etc., where electrified shall be of the pendent push-button type and shall operate on 110 VAC.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Hoist shall be factory tested.

.2 Install the equipment described above in accordance with the Contract drawings and with strict adherence to the manufacturer's instructions.

.3 Ensure that the monorail beam is perfectly horizontal, correctly aligned, and properly fastened to the supporting structures. Install travel limit stops on each end of the beam.

.4 Lubricate all necessary points of the hoist as per manufacturer’s instructions and recommended lubricants.

3.3 PAINTING AND FINISHING

.1 The monorail assembly shall receive one shop coat of high visibility yellow epoxy paint.

.2 All exposed surfaces of the monorail and supporting structures shall be painted after installation.

.3 The capacity of the monorail shall be clearly painted on the sides of the beam.

3.4 INSPECTION AND TESTS

.1 Do performance test on each hoist and monorail system.

.2 Load tests in compliances with ANSI B30.11, and ANSI MH27.1.

.3 Final acceptance will be made after the entire installation and testing has been completed. All tests required to prove the ability of the monorail hoist shall be made by the Contractor. A Vendor’s representative is invited to attend.

3.5 WARRANTY

.1 Vendor shall warranty all materials and workmanship of equipment installed under these specifications for a period of three (3) years after installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 09 91 23 - Interior Painting

.2 23 05 93 - Testing, Adjusting and Balancing for HVAC

1.2 REFERENCE STANDARDS

1.3 ACTION AND INFORMATIONAL 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 and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate on drawings:

.1 Mounting arrangements.

.2 Operating and maintenance clearances.

.2 Shop drawings and product data accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Acoustical sound power data, where applicable.

.3 Points of operation on performance curves.

.4 Manufacturer to certify current model production.

.5 Certification of compliance to applicable codes.

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

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

.1 Operation and maintenance manual approved by, and final copies deposited with, Contract Administrator before final inspection.

.2 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

.3 Operation instruction for systems and component.

.4 Description of actions to be taken in event of equipment failure.

.3 Maintenance data to include:

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

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

.4 Performance data to include:

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

.2 Equipment performance verification test results.

.3 Special performance data as specified.

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

.5 Approvals:

.1 Submit electronic copy of draft Operation and Maintenance Manual to Contract Administrator for approval. Submission of individual data will not be accepted unless directed by Contract Administrator.

.2 Make changes as required and re-submit as directed by Contract Administrator.

.6 Additional data:

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

.7 As-built drawings:

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

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

.3 Submit to Contract Administrator for approval and make corrections as directed.

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

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

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

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Furnish spare parts as follows:

.1

.3 Provide one set of special tools required to service equipment as recommended by manufacturers.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 PAINTING REPAIRS AND RESTORATION

.1 Do painting in accordance with Section 09 91 23 - Interior Painting.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

3.3 SYSTEM CLEANING

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

3.4 DEMONSTRATION

.1 Contract Administrator will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

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

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

3.5 PROTECTION

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 None

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)

- .1 ASTM A 126-04(2009), Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
- .2 ASTM B 62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.

.2 American Water Works Association (AWWA)

- .1 ANSI/AWWA C700-09, Standard for Cold Water Meters-Displacement Type, Bronze Main Case.
- .2 ANSI/AWWA C701-12, Standard for Cold Water Meters-Turbine Type for Customer Service.
- .3 ANSI/AWWA C702-10, Standard for Cold Water Meters-Compound Type.

.3 CSA Group (CSA)

- .1 CSA-B64 Series-11, Backflow Preventers and Vacuum Breakers.
- .2 CSA B79-08, Commercial and Residential Drains and Cleanouts.
- .3 CAN/CSA-B356-10, Water Pressure Reducing Valves for Domestic Water Supply Systems.

.4 National Research Council Canada (NRC)

- .1 National Plumbing Code of Canada 2015 (NPC).

.5 Plumbing and Drainage Institute (PDI)

- .1 PDI-G101-R2010, Testing and Rating Procedure for Grease Interceptors with Appendix of Installation and Maintenance.
- .2 PDI-WH201-R2010, Water Hammer Arresters Standard.

1.3 ACTION AND INFORMATIONAL 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 plumbing products and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.4 Instructions: submit manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for plumbing specialties and accessories for incorporation into manual.

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect plumbing materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 FLOOR DRAINS

.1 Floor Drains and Trench Drains: to CSA B79

.2 Type 1: heavy duty; cast iron body, heavy duty non-tilting or hinged lacquered cast iron grate, integral seepage pan and clamping collar.

.3 Type 2: combination funnel floor drain; cast iron body with anchor flange, weepholes, standard 102 x 235 (4”x9”) open throat funnel with vandal resistant, stainless steel allen key screws.

.4 Acceptable Products: Ancon, Mifab, Watts, Zurn or approved equal in accordance with B8.

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.

.2 Access Covers:

.1 Wall Access: face or wall type, polished nickel bronze or stainless steel round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.

.2 Floor Access: round cast iron body and frame with adjustable secured nickel bronze top or cast box with anchor lugs and:

.1 Plugs: bolted bronze with neoprene gasket.

.2 Cover for Unfinished Concrete Floors: cast iron or nickel bronze round, gasket, vandal-proof screws.

.3 Acceptable Products: Ancon, Mifab, Watts, Zurn or approved equal in accordance with B8.

2.3 BACK FLOW PREVENTERS

.1 Preventers: to CSA-B64 Series, double check valve assembly back flow preventer.

.2 Valve body: bronze.

.3 End connections: threaded, NPT.

.4 Maximum working pressure: 1207 kPa (2413 kPa test)

.5 Temperature range: 0.5°C to +60°C

.6 Shutoff valve: Full port, resilient seated, bronze ball valve with bronze ball valve test cock.

.7 Accessories: Drain line air gap fitting.

.8 Acceptable Product: Watts, Ames, Apollo or approved equal in accordance with B8.

2.4 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Bronze construction complete with integral back flow preventer, hose thread spout, replaceable composition disc, and chrome plated in finished areas.

.2 Acceptable Products: Crane, Emco, Mifab, Watts or approved equal in accordance with B8.

2.5 STRAINERS

.1 860 kPa, Y type with 20 mesh, monel, bronze or stainless steel removable screen.

.2 NPS 2 and under, bronze body, screwed ends, with brass cap.

.3 Acceptable Products: Ancon, Mifab, Watts, Zurn or approved equal in accordance with B8.

2.6 DIAPHRAGM EXPANSION TANK

.1 Expansion tank shall be suitable and approved for use on potable water systems. Expansion tank shall use a heavy-duty butyl diaphragm and polypropylene liner or replaceable full acceptance butyl bladder.

.2 Specific Requirements: V-L50

.1 Capacity: 57 L (15 usgal)

.2 Acceptable Product:

.1 Series “PTA” (ASME) rated pre-charged diaphragm-type tank as manufactured by Bell & Gossett, or

.2 series “Well-X-Trol” as manufactured by Amtrol, or

.3 approved equal in accordance with B8.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for plumbing specialities and accessories installation in accordance with manufacturer's written instructions.

.1 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.3 INSTALLATION

.1 Install in accordance with National Plumbing Code of Canada (NPC), provincial codes, and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.4 CLEANOUTS

.1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required code, and as indicated.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 4.

3.5 BACK FLOW PREVENTERS

.1 Install in accordance with CSA-B64 Series, where indicated and elsewhere as required by code

.1 Install backflow preventer as indicated on the drawings.

.2 Pipe discharge to terminate over nearest drain.

3.6 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Install at bottom of risers, at low points to drain systems, and as indicated.

3.7 STRAINERS

.1 Install with sufficient room to remove basket for maintenance.

3.8 START-UP

.1 General:

.1 In accordance with Section 01 91 13 - General Commissioning Requirements: General Requirements, supplemented as specified herein.

.2 Timing: start-up only after:

.1 Pressure tests have been completed.
.2 Disinfection procedures have been completed.
.3 Certificate of static completion has been issued.

.3 Provide continuous supervision during start-up.

3.9 TESTING AND ADJUSTING

.1 General:

.1 Test and adjust plumbing specialties and accessories in accordance with Section 01 91 13 - General Commissioning Requirements: General Requirements, supplemented as specified.

.2 Timing:

.1 After start-up deficiencies rectified.
.2 After certificate of completion has been issued by authority having jurisdiction.

.3 Application tolerances:

.1 Pressure at fixtures: +/- 70 kPa.
.2 Flow rate at fixtures: +/- 20%.

.4 Adjustments:

.1 Verify that flow rate and pressure meet design criteria.
.2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.

.5 Floor drains:

.1 Check operations of flushing features.
.2 Check security, accessibility, removability of strainer.
.3 Clean out baskets.

.6 Vacuum breakers, backflow preventers, backwater valves:

.1 Test tightness, accessibility for O&M of cover and of valve.
.2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.
.3 Verify visibility of discharge from open ports.

.7 Cleanouts:

.1 Verify covers are gas-tight, secure, yet readily removable.

.8 Hose bibbs, sediment faucets:

.1 Verify that flow and pressure meet design criteria.

.2 Check for leaks, replace compression washer if required.

3.10 CLOSEOUT ACTIVITIES

.1 Commissioning Reports: in accordance with Section 01 91 13 - General Commissioning Requirements: reports, supplemented as specified.

.2 Training: provide training in accordance with Section 01 91 13 - General Commissioning Requirements: Training of O&M Personnel, supplemented as specified.

3.11 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.12 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by plumbing specialties and accessories installation.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for plumbing pumps.

.2 Related Requirements

.1 22 05 15 - Plumbing Specialties And Accessories
.2 22 11 16 - Domestic Water Piping

1.2 REFERENCE STANDARDS

.1 Not used

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.

.3 Shop Drawings.

.1 Submit shop drawings to indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.
.2 Wiring and schematic diagrams.
.3 Dimensions and recommended installation.
.4 Pump performance and efficiency curves.

.4 Instructions: submit manufacturer's installation instructions.

.5 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals, include:

.1 Manufacturers name, type, model year, capacity and serial number.
.2 Details of operation, servicing and maintenance.
.3 Recommended spare parts list with names and addresses.

Part 2 Products

2.1 MATERIALS

2.2 DOMESTIC WATER BOOSTER SYSTEM (P-L52)

.1 Packaged simplex system, factory assembled, tested and adjusted, ready for site piping and electrical connections.

.2 Specific Requirements: P-L52

.1 Total Capacity:

.1 Flow rate: 0.69 L/s (11 usgpm) @ 61.2 m (200.7 ft) TDH.

.2 System pressure: 379 kPa (55 psi).

.2 Construction: horizontal, end suction, closed coupled centrifugal, 316 stainless steel body and impeller, stainless steel shaft sleeve, mechanical shaft seal, NPT threaded suction and discharge connections.

.3 Valves: to Section 22 11 16 - Domestic Water Piping. Suction and discharge ball valves.

.4 Motor: Premium efficiency, TEFC, 1-1/2 hp, 3,600 rpm, 575 V/ 3Ø / 60 Hz.

.5 Anchor Bolts and Templates:

.1 Supply for installation by other Divisions.

.6 Control Panel: CSA 1 enclosure complete with:

.1 Externally operated disconnect switch.

.2 Magnetic across-the-line fused starters.

.3 Overload protection for each phase.

.4 Adjustable pressure switch.

.5 Control circuit transformer with fused secondary.

.6 Pressure gauges, 100 mm nominal dia., range 0 to 690 kPa (0 to 100 psi).

.7 Pilot lights; power on.

.7 Operation:

.1 Pump to operate on signal from pressure switch.

.2 Pump start (cut-in pressure) when system pressure drops below 276 kPa (40 psi).

.3 Pump stop (cut-out pressure) when system pressure above 379 kPa (55 psi).

.3 Acceptable Product: Goulds/Xylem e-HM series model 3HM or approved equal in accordance with B8.

2.3 SUMP PUMP SUBMERSIBLE

.1 Specific Requirements: P-L51

.1 Construction: CSA approved, housing epoxy coated cast iron, stainless steel shaft, non-clog cast iron impeller, mechanical shaft seal, stainless steel fasteners, capable of running dry without damage.

.2 Capacity: 5.0 L/s @ 13.1 m TDH

.3 Motor:

.1 Hermetically sealed, oil filled, automatic overload protection
.2 1 hp, 3,450 rpm
.3 208V / 1Ø / 60 Hz

.4 Seals: Carbon / ceramic, Buna-N O-ring
.5 Control: piggy-back style wide angle automatic float switch
.6 Solids handling capability: 19 mm (3/4")
.7 Discharge size: 38 mm (1 ½ ") NPT
.8 Power Cord: 25 ft
.9 Acceptable Product: Liberty FL100 or approved equal in accordance with B8.

.2 Specific Requirements: P-V50

.1 Construction: CSA approved, housing epoxy coated cast iron, stainless steel shaft, non-clog bronze impeller, mechanical shaft seal, stainless steel fasteners, heavy duty ball bearings.
.2 Hazardous area rating: Suitable for Class 1, Division 2, Group D area.
.3 Capacity: 5.5 L/s @ 4.4 m TDH
.4 Motor:
.1 Hermetically sealed, oil filled, automatic overload protection.
.2 1/2hp, 1,725 rpm
.3 115V / 1Ø / 60 Hz.
.5 Seals: Silicon carbide, Buna-N O-rings
.6 Control:
.1 Simplex control panel designed for use with pumps in hazardous environments. Control panel shall be installed outside of the hazardous environment.
.2 NEMA 1 enclosure.
.3 3 control float switches
.4 Pre-wired run capacitor for single phase motors.
.5 Acceptable Product: Liberty ISS-Series or approved equal in accordance with B8.
.7 Solids handling capability: 50 mm (2").
.8 Discharge size: 50 mm (2") NPT.
.9 Power Cord: 25 ft
.10 Acceptable Product: Liberty XLE50 series or approved equal in accordance with B8.

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 data sheet.

3.2 INSTALLATION

.1 Make piping and electrical connections to pump and motor assembly and controls as indicated, and as per manufacturer's instructions.

.2 Ensure pump and motor assembly do not support piping.

3.3 START-UP

.1 General:

.1 In accordance with Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS: General Requirements, supplemented as specified herein.

.2 Procedures:

.1 Check power supply.

.2 Start pumps, check impeller rotation.

.3 Check for safe and proper operation.

.4 Check settings, operation of operating, limit, safety controls, over-temperature, audible/visual alarms, other protective devices.

.5 Test operation of hand-on-auto switch.

.6 Adjust shaft stuffing boxes.

.7 Adjust alignment of piping and conduit to ensure full flexibility.

.8 Eliminate causes of cavitation, flashing, air entrainment.

.9 Measure pressure drop across strainer when clean and with flow rates as finally set.

3.4 PERFORMANCE VERIFICATION (PV) BOOSTER PUMPS

.1 General:

.1 In accordance with Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS General Requirements, supplemented as specified.

.2 Application tolerances:

.1 Flow: +/- 10%.

.2 Pressure: Plus 20%, minus 5%.

.3 PV procedures:

.1 Open all valves in booster pump system.

.2 Operate plumbing fixture (hose bibb or utility sink) to create water demand.

.3 Observe and record booster pump system cut-in and cut-out pressures.

.4 Adjust pressure switch as required to achieve cut-in and cut-out pressure as indicated above.

3.5 PV - SUMP PUMPS

.1 Application tolerances:

.1 Flow: plus 10%; minus 0%.

.2 Pressure: plus 10%; Minus 5%.

.2 PV Procedures:

.1 Fill sump at rate slower than capacity of pump.

.2 Record levels at which pump starts and stops. Determine flow rate by observing time taken to down water level.

.3 Adjust water level controls as necessary.

.4 Check level at which high water level alarm starts and stops. Adjust as necessary.

.3 Check removability of pump for servicing without interfering with installation or operation of other equipment.

3.6 REPORTS

.1 In accordance with Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS: reports, supplemented as specified.

.2 Include:

.1 PV results on approved PV Report Forms.

.2 Product Information report forms.

.3 Pump performance curves (family of curves) with final point of actual performance.

3.7 TRAINING

.1 In accordance with Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS: Training of O&M Personnel, supplemented as specified.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 23 05 15 - Common Installation Requirements for HVAC Pipework

1.2 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers International (ASME)

.1 ANSI/ASME B16.15-[13], Cast Cooper Alloy Threaded Fittings, Classes 125 and 250.

.2 ANSI/ASME B16.18-[12], Cast Copper Alloy Solder Joint Pressure Fittings.

.3 ANSI/ASME B16.22-[13], Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

.4 ANSI/ASME B16.24-[11], Cast Copper Alloy Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500.

.5 ASME B16.26-[13], Cast Copper Alloy Fittings for Flared Copper Tubes.

.6 ASME B31.9-[14], Building Services Piping.

.7 ASME B36.19M-[04], Stainless Steel Pipe.

.2 ASTM International (ASTM)

.1 ASTM A 182/A 182M-[16], Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.

.2 ASTM A 269-[15a], Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

.3 ASTM A 307-[14], Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.4 ASTM A 312/A 312M-[16], Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

.5 ASTM A 351/A 351M-[16], Castings, Austenitic, for Pressure Containing Parts.

.6 ASTM A 403/A 403M-[16], Wrought Austenitic Stainless Steel Piping Fittings.

.7 ASTM A 536-[84(2014)], Standard Specification for Ductile Iron Castings.

.8 ASTM B 32-[08(2014)], Standard Specification for Solder Metal.

.9 ASTM B 42-[15a], Seamless Copper Tube, Standard Sizes.

.10 ASTM B 88M-[14], Standard Specification for Seamless Copper Water Tube (Metric).

.11 ASTM F 876-[15], Standard Specification for Crosslinked Polyethylene (PEX) Tubing.

.12 ASTM F 877-[11], Standard Specification for Crosslinked Polyethylene (PEX) Hot and Cold Water Distribution System.

.3 American National Standards Institute/American Water Works Association (ANSI)/(AWWA)

.1 ANSI/AWWA C111/A21.11-[12], Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.2 ANSI/AWWA C151/A21.51-[09], Ductile Iron Pipe, Centrifugally Cast, for Water.

.3 AWWA C904-[06], Crosslinked Polyethylene (PEX) Pressure Pipe, ½ In. (12 mm) through 3 In. (76mm), for Water Service.

.4 CSA Group (CSA)

.1 CSA B137.5-[13], Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications.

.2 CSA B242-[05], Groove and Shoulder Type Mechanical Pipe Couplings.

.5 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC S101-[07], Fire Endurance Tests of Buildings Construction and Materials.

.2 CAN/ULC S102.2-[10], Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.

.3 CAN/ULC S115-[11], Standard Method of Fire Tests of Firestop.

.6 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).

.7 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Safety Data Sheets (SDS).

.8 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).

.1 MSS-SP-67-[02a], Butterfly Valves.

.2 MSS-SP-70-[06], Grey Iron Gate Valves, Flanged and Threaded Ends.

.3 MSS-SP-71-[05], Grey Iron Swing Check Valves, Flanged and Threaded Ends.

.4 MSS-SP-80-[03], Bronze Gate, Globe, Angle and Check Valves.

.9 National Research Council (NRC)

.1 National Plumbing Code of Canada (NPC) 2020.

.10 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data

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

.3 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 PIPING

.1 Domestic cold water systems, within building.

.1 Above ground:

.1 Copper tube, hard drawn, type L: to ASTM B 88M

.2 PEX Piping to CSA B137.5

.2 Buried or embedded:

.1 Copper tube, soft annealed, type K: to ASTM B 88M, in long lengths and with no buried joints

.2 PEX Piping to CSA B137.5

2.2 FITTINGS

.1 Bronze pipe flanges and flanged fittings, Class 150: to ANSI/ASME B16.24

.2 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15

.3 Cast copper, solder type: to ANSI/ASME B16.18

.4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22

.5 NPS 2 and larger:

.1 ANSI/ASME B16.18 or ANSI/ASME B16.22 roll grooved to CSA B242

.2 PEX fittings to CSA B137.5 and F1960

.6 NPS 1 ½ and smaller:

.1 Wrought copper to ANSI/ASME B16.22 or cast copper to ANSI/ASME B16.18; with stainless steel internal components and EPDM seals. Suitable for operating pressure to 1380 kPa.

.2 PEX fittings to CSA B137.5

2.3 JOINTS

.1 Rubber gaskets, 1.6 mm thick: to AWWA C111

.2 Bolts, nuts, hex head and washers: to ASTM A 307, heavy series

.3 Solder: 95/5 tin copper alloy.

.4 Teflon tape: for threaded joints.

.5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM gasket.

.6 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

.7 NPS 1 ½ and smaller: PEX fittings to CSA B137.5

.8 NPS 2 and larger: PEX fittings to CSA B137.5 and ASTM F 1960. Elbows, adapters, couplings, plugs, tees, multi-port tees and valves

2.4 GATE VALVES

.1 NPS 2 and under, soldered:

.1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc.

.2 NPS 2 and under, screwed:

.1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc.

2.5 GLOBE VALVES

.1 NPS2 and under, soldered:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet.

.2 NPS 2 and under, screwed:

.1 To MSS-SP-80, Class 150, 1 MPa, bronze body, screwed over bonnet, renewable composition disc.

2.6 SWING CHECK VALVES

.1 NPS 2 and under, soldered:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat.

.2 NPS 2 and under, screwed:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat.

2.7 BALL VALVES

.1 NPS 2 and under, screwed:

.1 Class 150.

.2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and BunaN seat, steel lever handle.

.2 NPS 2 and under, soldered:

.1 To ANSI/ASME B16.18, Class 150

.2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland BunaN seat, steel lever handle, with NPT to copper adaptors.

Part 3 Execution

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install in accordance with , Manitoba Plumbing Code and local authority having jurisdiction.

.2 Install pipe work in accordance with Section 23 05 15 - Common Installation Requirements for HVAC Pipework, supplemented as specified herein.

.3 Assemble piping using fittings manufactured to ANSI and Standard Council of Canada (SCC) standards

.4 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.

.5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

.6 Buried tubing:

.1 Lay in well compacted washed sand in accordance with AWWA Class B bedding

.2 Bend tubing without crimping or constriction. Minimize use of fittings.

.7 Valves

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

3.3 PRESSURE TESTS

.1 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa (125 psi).

3.4 FLUSHING AND CLEANING

.1 Flush entire system for 8 h. Ensure outlets flushed for 2 hours.

3.5 PRE-START-UP INSPECTIONS

.1 Systems to be complete, prior to flushing, testing and start-up.

.2 Verify that system can be completely drained.

.3 Ensure that pressure booster systems are operating properly.

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

3.6 DISINFECTION

.1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction.

3.7 START-UP

.1 Timing: start up after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.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 Check control, limit, safety devices for normal and safe operation.

.4 Rectify start-up deficiencies.

3.8 PERFORMANCE VERIFICATION

.1 Scheduling:

.1 Verify system performance after pressure and leakage tests and disinfection are completed, and Certificate of Completion has been issued by authority having jurisdiction.

.2 Procedures:

.1 Verify that flow rate and pressure meet Design Criteria.

.2 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.

.3 Verify compliance with safety and health requirements.

.4 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.

.3 Reports:

.1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Reports, using report forms as specified in Section 01 91 13 - General Commissioning (Cx) Requirements]: Report Forms and Schematics.

3.9 CLEANING

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 07 92 00 - Joint Sealants

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM D 2235-[04], Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

.2 ASTM D 2564-[04e1], Standard Specification for Solvent Cements for Poly (Vinyl-Chloride) (PVC) Plastic Piping Systems.

.2 CSA Group (CSA)

.1 CAN/CSA-Series B1800- [06], Thermoplastic Nonpressure Pipe Compendium - B1800 Series.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Safety Data Sheets (SDS).

.4 National Research Council Canada (NRC)

.1 National Plumbing Code of Canada [2015] (NPC).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

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

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section Manufacturer’s written instructions.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Store at temperatures and conditions recommended by manufacturer.

Part 2 Products

2.1 MATERIAL

.1 Adhesives and Sealants: in accordance with Section 07 92 00 - Joint Sealants.

2.2 PIPING AND FITTINGS

.1 For above ground DWV piping to:

.1 CAN/CSA B1800

2.3 JOINTS

.1 Solvent weld for PVC: to ASTM D 2564

.2 Solvent weld for ABS: to ASTM D 2235

Part 3 Execution

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install in accordance with Manitoba Plumbing Code and local authority having jurisdiction.

3.3 TESTING

.1 Pressure test buried systems before backfilling.

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

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

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

3.5 CLEANING

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

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 09 91 23 - Interior Painting

.2 23 05 93 - Testing, Adjusting and Balancing for HVAC

1.2 REFERENCE STANDARDS

1.3 ACTION AND INFORMATIONAL 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 and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate on drawings:

.1 Mounting arrangements.

.2 Operating and maintenance clearances.

.2 Shop drawings and product data accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Points of operation on performance curves.

.3 Manufacturer to certify current model production.

.4 Certification of compliance to applicable codes.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

.1 Operation and maintenance manual approved by, and final copies deposited with, Contract Administrator before final inspection.

.2 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

.3 Operation instruction for systems and component.

.4 Description of actions to be taken in event of equipment failure.

.3 Maintenance data to include:

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

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

.4 Performance data to include:

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

.2 Equipment performance verification test results.

.3 Special performance data as specified.

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

.5 Approvals:

.1 Submit electronic copies of draft Operation and Maintenance Manual to Contract Administrator for approval. Submission of individual data will not be accepted unless directed by Contract Administrator.

.2 Make changes as required and re-submit as directed by Contract Administrator.

.6 Additional data:

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

.7 As-built drawings:

.1 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).

.2 Submit to Contract Administrator for approval and make corrections as directed.

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

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

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

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Furnish spare parts as follows:

.1 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.3 Provide one set of special tools required to service equipment as recommended by manufacturers.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Not used.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 PAINTING REPAIRS AND RESTORATION

.1 Do painting in accordance with Section ~~[~~09 91 23 - Interior Painting~~]~~.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

3.3 SYSTEM CLEANING

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

3.4 DEMONSTRATION

.1 Contract Administrator will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

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

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

3.5 PROTECTION

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Electrical motors, drives and guards for mechanical equipment and systems.

.2 Supplier and installer responsibility indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

.3 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 22 and 23. Refer to Division 26 for quality of materials and workmanship.

.2 Related Requirements

.1 None.

1.2 REFERENCE STANDARDS

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 90.1-01, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).

.2 Electrical Equipment Manufacturers' Association Council (EEMAC)

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Safety Data Sheets (SDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.3 Closeout Submittals

.1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements: work to be performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

Part 2 Products

2.1 GENERAL

.1 Motors: high efficiency, in accordance with City of Winnipeg standards and to ASHRAE 90.1

2.2 MOTORS

.1 Provide motors for mechanical equipment as specified on drawings and equipment schedules.

.2 Motors under 373 W (1/2 HP): speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.

.3 Motors 373 W (1/2 HP) and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40 degrees C, 3 phase, 575 V, unless otherwise indicated.

2.3 TEMPORARY MOTORS

.1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Contract Administrator for temporary use. Work will only be accepted when specified motor is installed.

2.4 BELT DRIVES

.1 Direct drive arrangement is preferred.

.2 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.3 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise indicated.

.4 For motors under 7.5 kW (10 HP): standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.

.5 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.

.6 Correct size of sheave determined during commissioning.

.7 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.8 Motor slide rail adjustment plates to allow for centre line adjustment.

.9 Supply one set of spare belts for each set installed in accordance with Section 01 78 00 - Closeout Submittals.

2.5 DRIVE GUARDS

.1 Provide guards for unprotected drives.

.2 Guards for belt drives;

.1 Expanded metal screen welded to steel frame.
.2 Minimum 1.2 mm thick sheet metal tops and bottoms.
.3 38 mm dia holes on both shaft centres for insertion of tachometer.
.4 Removable for servicing.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Install belt guards to allow movement of motors for adjusting belt tension.

.5 Guard for flexible coupling:

.1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
.2 Securely fasten in place.
.3 Removable for servicing.

.6 Unprotected fan inlets or outlets:

.1 Wire or expanded metal screen, galvanized, 19 mm mesh.
.2 Net free area of guard: not less than 80% of fan openings.
.3 Securely fasten in place.
.4 Removable for servicing.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Fasten securely in place.

.2 Make removable for servicing, easily returned into, and positively in position.

3.3 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 23 05 53 - Identification For HVAC Piping and Equipment

1.2 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B40.100-2005, Pressure Gauges and Gauge Attachments.

.2 ASME B40.200-2008, Thermometers, Direct Reading and Remote Reading.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-14.4-[M88], Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.

.2 CAN/CGSB-14.5-[M88], Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

.3 Efficiency Valuation Organization (EVO)

.1 International Performance Measurement and Verification Protocol (IPMVP)

.1 IPMVP [2007] Version.

1.3 ACTION AND INFORMATIONAL 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 [thermometers and pressure gauges] and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.4 Test and Evaluation Reports:

.1 Submit certified test reports for thermometers and pressure gauges from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

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, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store thermometers and pressure gauges in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect thermometers and pressure gauges from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 GENERAL

.1 Design point to be at mid-point of scale or range.

.2 Ranges: as indicated.

2.2 DIRECT READING THERMOMETERS

.1 Industrial, variable angle type, mercury-free, liquid filled, 125 mm scale length: to ASME B40.200.

.1 Resistance to shock and vibration.

2.3 REMOTE READING THERMOMETERS

.1 100 mm diameter mercury-free liquid filled activated dial type: to ASME B40.200, accuracy within one scale division, brass movement, stainless steel capillary, stainless steel spiral armour, stainless steel bulb and polished stainless steel case for wall mounting.

2.4 THERMOMETER WELLS

.1 Copper pipe: copper or bronze.

.2 Steel pipe: brass or stainless steel.

2.5 PRESSURE GAUGES

.1 100 mm, dial type: to ASME B40.100, Grade 2A, stainless steel bourdon tube having 0.5% accuracy full scale unless otherwise specified.

.2 Provide:

.1 Lower mount (radial).

.2 Case Material: 304 stainless steel.

.3 Movement: Stainless steel.

.4 Bronze stop cock.

.5 Oil filled for high vibration applications.

.3 Acceptable Products: Wika, Ashcroft, or approved equal in accordance with B8.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 GENERAL

.1 Install thermometers and gauges so they can be easily read from floor or platform.

.1 If this cannot be accomplished, install remote reading units.

.2 Install between equipment and first fitting or valve.

3.3 THERMOMETERS

.1 Install in wells on piping. Include heat conductive material inside well.

.2 Install in locations as indicated:

.3 Install wells as indicated only for balancing purposes.

.4 Use extensions where thermometers are installed through insulation.

3.4 PRESSURE GAUGES

.1 Install in locations as follows:

.1 Suction and discharge of pumps.

.2 Upstream and downstream of control valves.

.3 Upstream and downstream of Backflow Preventers.

.4 In other locations as indicated on the Contract drawings.

.2 Install gauge cocks for balancing purposes, elsewhere as indicated.

.3 Use extensions where pressure gauges are installed through insulation.

3.5 NAMEPLATES

.1 Install engraved lamacoid nameplates in accordance with Section 23 05 53 - Identification For HVAC Piping and Equipment, identifying medium.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.7 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by thermometer and gauge installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 03 30 00 - Cast-in-Place Concrete

.2 05 12 23 - Structural Steel for Buildings

.3 05 50 00 - Metal Fabrications

1.2 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B31.1-07, Power Piping.

.2 ASTM International (ASTM)

.1 ASTM A 125-1996(2007), Standard Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A 307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A 563-07a, Standard Specification for Carbon and Alloy Steel Nuts.

.3 Factory Mutual (FM)

.4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP 58-2002, Pipe Hangers and Supports - Materials, Design and Manufacture.

.2 MSS SP 69-2003, Pipe Hangers and Supports - Selection and Application.

.3 MSS SP 89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.

.5 National Research Council Canada (NRC)

.1 National Plumbing Code of Canada [2015] (NPC).

.6 Underwriter's Laboratories of Canada (ULC)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit shop drawings for:

.1 Bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Manufacturers' Instructions:

.1 Provide manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

.2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP 58

.3 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.4 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP 58

2.2 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with MSS SP 58. ANSI B31.1 and

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.3 PIPE HANGERS

.1 Finishes:

.1 Pipe hangers and supports: galvanized after manufacture.

.2 Use hot dipped galvanizing process.

.3 Ensure steel hangers in contact with copper piping are epoxy coated.

.2 Upper attachment structural: suspension from lower flange of I-Beam:

.1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.

.1 Rod: 9 mm UL listed.

.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed to MSS-SP 58 and MSS-SP 69.

.3 Upper attachment structural: suspension from upper flange of I-Beam:

.1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed to MSS SP 69.

.2 Cold piping NPS 2 1/2 or greater, 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 eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.

.2 Concrete inserts: wedge shaped body with knockout protector plate UL listed to MSS SP 69

.5 Shop and field-fabricated assemblies:

.1 Trapeze hanger assemblies: .

.2 Steel brackets: .

.3 Sway braces for seismic restraint systems: to Section .

.6 Hanger rods: threaded rod material to MSS SP 58

.1 Ensure that hanger rods are subject to tensile loading only.

.2 Provide linkages where lateral or axial movement of pipework is anticipated.

.3 Do not use 22 mm or 28 mm rod.

.7 Pipe attachments: material to MSS SP 58:

.1 Attachments for steel piping: carbon steel galvanized.

.2 Attachments for copper piping: copper plated black steel.

.3 Use insulation shields for hot pipework.

.4 Oversize pipe hangers and supports.

.8 Adjustable clevis: material to MSS SP 69 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.1 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 69

.10 U-bolts: carbon steel to MSS SP 69 with 2 nuts at each end to ASTM A 563

.1 Finishes for steel pipework: galvanized.

.2 Finishes for copper, glass, brass or aluminum pipework: galvanized, with formed portion plastic coated.

.11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP 69

2.4 RISER CLAMPS

.1 Steel or cast iron pipe: galvanized carbon steel to MSS SP 58, type 42, UL listed.

.2 Copper pipe: carbon steel copper plated to MSS SP 58, type 42

.3 Bolts: to ASTM A 307

.4 Nuts: to ASTM A 563

2.5 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:

.1 64 kg/m³ density insulation plus insulation protection shield to: MSS SP 69, galvanized sheet carbon steel. Length designed for maximum 3 m span

2.6 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings. Submit calculations with shop drawings.

2.7 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.8 PLATFORMS AND CATWALKS

.1 To Section 05 50 00 - Metal Fabrications.

2.9 HOUSE-KEEPING PADS

.1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 50 mm larger than equipment; chamfer pad edges.

.2 Concrete: to Section 03 30 00 - Cast-in-Place Concrete.

2.10 OTHER EQUIPMENT SUPPORTS

.1 Fabricate equipment supports from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings.

.2 Submit structural calculations with shop drawings.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with:

.1 Manufacturer's instructions and recommendations.

.2 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 industry standards.

.3 Steel pipes: install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: install below joint.

.3 Clevis plates:

.1 Attach to concrete with 4 minimum concrete inserts, one at each corner.

.4 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

3.3 HANGER SPACING

.1 Plumbing piping: to Provincial Code and authority having jurisdiction.

.2 Fire protection: to applicable fire code.

.3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.

.4 Copper piping: up to NPS 1/2: every 1.5 m.

.5 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.

.6 Within 300 mm of each elbow.

Maximum Pipe Size: NPS	Maximum Spacing Steel	Maximum Spacing Copper
up to 1-1/4	2.4 m	1.8 m
1-1/2	3.0 m	2.4 m
2	3.0 m	2.4 m
2-1/2	3.7 m	3.0 m
3	3.7 m	3.0 m
3-1/2	3.7 m	3.3 m
4	3.7 m	3.6 m
5	4.3 m	

Maximum Pipe Size: NPS	Maximum Spacing Steel	Maximum Spacing Copper
6	4.3 m	
8	4.3 m	
10	4.9 m	
12	4.9 m	

.7 Pipework greater than NPS 12: to MSS SP 69

3.4 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

3.7 CLEANING

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

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.

.2 Sustainable requirements for construction and verification.

.2 Related Requirements

.1 Not used

1.2 REFERENCE STANDARDS

.1 Canadian Gas Association (CGA)

.1 CSA/CGA B149.1-05, Natural Gas and Propane Installation Code.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.

.2 CAN/CGSB-24.3-92, Identification of Piping Systems.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

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

.3 Product data to include paint colour chips, other products specified in this section.

.4 Samples:

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

.2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.4 QUALITY ASSURANCE

.1 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

Part 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers raised or recessed.

.3 Information to include, as appropriate:

.1 Equipment: manufacturer's name, model, size, serial number, capacity.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

.1 Colours:

.1 Hazardous: red letters, white background.

.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

.1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:

.1 Terminal cabinets, control panels: use size # 5.

.2 Equipment in Mechanical Rooms: use size # 9.

2.3 EXISTING IDENTIFICATION SYSTEMS

.1 Apply existing identification system to new work.

.2 Where existing identification system does not cover for new work, use identification system specified this section.

.3 Before starting work, obtain written approval of identification system from Contract Administrator.

2.4 PIPING SYSTEMS GOVERNED BY CODES

.1 Identification:

.1 Propane gas: to CSA/CGA B149.1 and authority having jurisdiction.

2.5 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise

.2 Pictograms:

.1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.

.3 Legend:

.1 Block capitals to sizes and colours listed in CAN/CGSB 24.3

.4 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.

.2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.

.3 Use double-headed arrows where flow is reversible.

.5 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

.2 Length to accommodate pictogram, full length of legend and arrows.

.6 Materials for background colour marking, legend, arrows:

.1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.

.2 Other pipes: pressure sensitive [plastic-coated cloth][vinyl] with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees 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 Colour
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	Background Colour Marking	Legend
Raw Water	Green	RAW WATER
River Water	Green	RIVER WATER
Sea Water	Green	SEA WATER
City Water	Green	CITY WATER
Treated Water	Green	TREATED WATER
Brine	Green	BRINE
Condenser water supply	Green	COND. WTR. SUPPLY
Condenser water return	Green	COND. WTR. RETURN
Chilled water supply	Green	CH. WTR. SUPPLY
Chilled water return	Green	CH. WTR. RETURN
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
High temp HW Htg supply	Yellow	HTHW HTG. SUPPLY++
High temp HW Htg return	Yellow	HTHW HTG. RETURN++
Make-up water	Yellow	MAKE-UP WTR.
Boiler feed water	Yellow	BLR. FEED WTR.
Steam [ ] kPa	Yellow	[ ] kPa STEAM
Steam condensate (gravity)	Yellow	ST. COND. RET. (GRAVITY)
Steam condensate (pumped)	Yellow	ST. COND. RET. (PUMPED)
Safety valve vent	Yellow	STEAM VENT
Intermittent blow-off	Yellow	INT. BLOW-OFF
Continuous blow-off	Yellow	CONT. BLOW-OFF
Chilled drinking water	Green	CH. DRINK WTR.
Drinking water return	Green	CH. DRINK WTR. CIRC.
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HWS recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Waste water	Green	WASTE WATER
Contaminated lab waste	Yellow	CONT. LAB WASTE
Acid waste	Yellow	ACID WASTE (add source)
Storm water	Green	STORM
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Refrigeration suction	Yellow	REF. SUCTION
Refrigeration liquid	Yellow	REF. LIQUID
Refrigeration hot gas	Yellow	REF. HOT GAS
No. [ ] fuel oil suction	Yellow	# [ ] FUEL OIL
No. [ ] fuel oil return	Yellow	# [ ] FUEL OIL
Engine exhaust	Yellow	ENGINE EXHAUST
Lubricating oil	Yellow	LUB OIL
Hydraulic oil	Yellow	HYDRAULIC OIL
Gasoline	Yellow	GASOLINE
Natural gas	to Codes	
Propane	to Codes	
Gas regulator vents	to Codes	
Distilled water	Green	DISTILL. WTR.

Contents	Background Colour Marking	Legend
Demineralized water	Green	DEMIN. WATER
Chlorine	Yellow	CHLORINE
Nitrogen	Yellow	NITROGEN
Oxygen	Yellow	OXYGEN
Compressed air (<700 kPa)	Green	COMP. AIR [ ] kPa
Compressed air (>700 kPa)	Yellow	COMP. AIR [ ] kPa
Vacuum	Green	VACUUM
Fire protection water	Red	FIRE PROT. WTR.
Sprinklers	Red	SPRINKLERS
Carbon dioxide	Red	CO2
Instrument air	Green	INSTRUMENT AIR

2.6 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

.2 Colours: back, or co-ordinated with base colour to ensure strong contrast.

2.7 VALVES, CONTROLLERS

.1 Brass tags with 12 mm stamped identification data filled with black paint.

.2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.8 CONTROLS COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

2.9 LANGUAGE

.1 Identification in English.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 TIMING

.1 Provide identification only after painting specified Section 09 91 23 - Interior Painting has been completed.

3.3 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise

.2 Provide ULC or CSA registration plates as required by respective agency

3.4 NAMEPLATES

.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection:

.1 Do not paint, insulate or cover.

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification easily and accurately readable from usual operating areas and from access points.

.1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 VALVES, CONTROLLERS

.1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.

.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Contract Administrator. Provide one copy (reduced in size if required) in each operating and maintenance manual.

3.7 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

.1 Submit names of personnel to perform TAB to Contract Administrator within 90 days of award of contract.

.2 Provide documentation confirming qualifications, successful experience.

.3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:

.1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.

.2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing -2002.

.4 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.

.6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

.8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.

.1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.

.2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads

.2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.5 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 PRE-TAB REVIEW

.1 Review Contract Documents before project construction is started and confirm in writing to Contract Administrator adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Contract Administrator in writing proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.7 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

1.8 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Contract Administrator for verification of TAB reports.

1.9 START OF TAB

.1 Notify Contract Administrator 3 days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.1 Installation of doors, other construction affecting TAB.

.2 Application of weatherstripping, sealing, and caulking.

.3 Pressure, leakage, other tests specified elsewhere Division 23.

.3 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

.1 Filters in place, clean.

.2 Duct systems clean.

.3 Ducts are airtight to within specified tolerances.

.4 Correct fan rotation.

.5 Volume control dampers installed and open.

.6 Access doors, installed, closed.

.7 Outlets installed, volume control dampers open.

.3 Liquid systems:

.1 Flushed, filled, vented.

.2 Correct pump rotation.

.3 Strainers in place, baskets clean.

.4 Isolating and balancing valves installed, open.

1.10 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 HVAC systems: plus 5 %, minus 5 %.

1.11 ACCURACY TOLERANCES

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

1.12 INSTRUMENTS

.1 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.2 Calibrate within 3 months of TAB. Provide certificate of calibration to Contract Administrator.

1.13 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit, prior to commencement of TAB:

.2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of [Contract Administrator, prior to submission of formal TAB report, sample of rough TAB sheets. Include:

.1 Details of instruments used.

.2 Details of TAB procedures employed.

.3 Calculations procedures.

.4 Summaries.

1.15 TAB REPORT

.1 Format in accordance with referenced standard.

.2 TAB report to show results in SI units and to include:

.1 Project record drawings.

.2 System schematics.

.3 Submit 6 copies of TAB Report to Contract Administrator for verification and approval, in English in D-ring binders, complete with index tabs.

1.16 VERIFICATION

.1 Reported results subject to verification by Contract Administrator.

.2 Provide personnel and instrumentation to verify up to 30 % of reported results.

.3 Number and location of verified results as directed by Contract Administrator.

.4 Pay costs to repeat TAB as required to satisfaction of Contract Administrator.

1.17 SETTINGS

.1 After TAB is completed to satisfaction of Contract Administrator, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

1.18 COMPLETION OF TAB

.1 TAB considered complete when final TAB Report received and approved by Contract Administrator.

1.19 AIR SYSTEMS

.1 Standard: TAB to most stringent of this section or TAB standards of AABC SMACNA.

.2 Do TAB of following systems, equipment, components, controls:

.1 Fans.

.2 Dampers.

.3 Grilles, Registers, and Diffusers.

.3 Qualifications: personnel performing TAB current member in good standing of AABC.

.4 Quality assurance: perform TAB under direction of supervisor qualified to standards of AABC.

.5 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.6 Locations of equipment measurements: to include as appropriate:

.1 Inlet and outlet of dampers, filter, coil, fan, other equipment causing changes in conditions.

.7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.20 OTHER TAB REQUIREMENTS

.1 General requirements applicable to work specified this paragraph:

.1 Qualifications of TAB personnel: as for air systems specified this section.

.2 Quality assurance: as for air systems specified this section.

.2 Zone pressure differences:

.1 Adjust HVAC systems, equipment, controls to establish specified air pressure differentials, with systems in every possible combinations of normal operating modes.

.2 TAB procedures:

.1 Dry well (lower levels): -25 Pa.

.2 Main Floor (Electrical Room): Neutral.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

1.2 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" - means "not concealed" as previously defined.

.3 Insulation systems - insulation material, fasteners, jackets, and other accessories.

.2 TIAC Codes:

.1 CRD: Code Round Ductwork,

.2 CRF: Code Rectangular Finish.

1.3 REFERENCE STANDARDS

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ANSI/ASHRAE/IESNA 90.1-04, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 ASTM International (ASTM)

.1 ASTM B 209M-07, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

.2 ASTM C 335-05ae1, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.

.3 ASTM C 411-05, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.4 ASTM C 449/C 449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.5 ASTM C 547-07e1, Standard Specification for Mineral Fiber Pipe Insulation.

.6 ASTM C 553-02e1, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.7 ASTM C 612-04e1, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.8 ASTM C 795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.9 ASTM C 921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma-[89], Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.4 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).

.5 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-[03], Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S701-[05], Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

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

.3 Manufacturers' Instructions:

.1 Provide manufacture's written duct insulation jointing recommendations. and special handling criteria, installation sequence, and cleaning procedures.

1.5 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, member of TIAC.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Manufacturer’s written instructions.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address and ULC markings.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 To CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C 335

.3 TIAC Code C-1: Rigid mineral fibre board to ASTM C 612, [with][without] factory applied vapour retarder jacket to CGSB 51-GP-52 Ma (as scheduled in PART 3 of this Section)

.4 TIAC Code C-2: Mineral fibre blanket to ASTM C 553 faced [with][without] factory applied vapour retarder jacket to CGSB 51-GP-52 Ma (as scheduled in PART 3 of this section)

.1 Mineral fibre: to ASTM C 553

.2 Jacket: to CGSB 51-GP-52 Ma

.3 Maximum "k" factor: to ASTM C 553

2.3 JACKETS

.1 Canvas:

.1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921

.2 Lagging adhesive: compatible with insulation.

2.4 ACCESSORIES

.1 Vapour retarder lap adhesive:

.1 Water based, fire retardant type, compatible with insulation.

.2 Indoor Vapour Retarder Finish:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C 449

.4 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.

.5 Contact adhesive: quick-setting

.6 Canvas adhesive: washable.

.7 Tie wire: 1.5 mm stainless steel.

.8 Banding: 19 mm wide, 0.5 mm thick stainless steel.

.9 Fasteners: 24 mm diameter pins with 35 mm diameter clips, length to suit thickness of insulation.

Part 3 Execution

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 PRE-INSTALLATION REQUIREMENTS

.1 Pressure test ductwork systems complete, witness and certify.

.2 Ensure surfaces are clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards

.2 Apply materials in accordance with manufacturers instructions and as indicated.

.3 Use 2 layers with staggered joints when required nominal thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Ensure hangers, and supports are outside vapour retarder jacket.

.5 Hangers and supports in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.6 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum 2 rows each side.

3.4 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses: conform to following table:

	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular cold and dual temperature supply air ducts	C-1	Yes	50
Round cold and dual temperature supply air ducts	C-2	Yes	50
Rectangular warm air ducts	C-1	No	25
Round warm air ducts	C-1	No	25
Supply, return and exhaust ducts exposed in space being served	None		
Outside air ducts to mixing plenum	C-1	Yes	25
Mixing plenums	C-1	Yes	25
Exhaust duct between dampers and louvres	C-1	No	25
Rectangular ducts outside	C-1	Special	50
Round ducts outside	C-1	Special	50
Acoustically lined ducts	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

.1 Finishes: conform to following table:

	TIAC Code

	Rectangular	Round
Indoor, concealed	None	None
Indoor, exposed within mechanical room	CRF/1	CRD/2
Indoor, exposed elsewhere	CRF/2	CRD/3
Outdoor, exposed to precipitation	CRF/3	CRD/4
Outdoor, elsewhere	CRF/4	CRD/5

3.5 CLEANING

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

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Not used

1.2 REFERENCE STANDARDS

1.3 ACTION AND INFORMATIONAL 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 electric and electronic control system for HVAC 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, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect electric and electronic control systems from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 THERMOSTAT (LOW VOLTAGE)

.1 Low voltage wall thermostat:

.1 For use on 24 V circuit at 1.5 A capacity.

.2 Temperature setting range: 10 degrees C to 25 degrees C.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for electric and electronic control systems installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 INSTALLATION

.1 Install control devices.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Steel materials, components and installation for the outdoor distribution systems for petroleum products.

.2 Related Requirements

.1 33 56 13 – Aboveground Fuel – Storage Tanks

1.2 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)

.1 ANSI/ASME B16.11-2001, Forged Fittings, Socket-Welding and Threaded.

.2 American Petroleum Institute (API)

.1 API 5L-04, Specification for Line Pipe [43rd Edition].

.2 API 6D-R2002, Specification for Pipeline Valves (Gate, Ball, and Check Valves) 22nd Edition.

.3 API 1102-02, Steel Pipelines Crossing Railroads and Highways [6th Edition].

.4 ANSI/API 1104-01, Standard for Welding Pipeline and Related Facilities 19th Edition.

.3 ASTM International (ASTM)

.1 ASTM A 48/A 48M-03, Standard Specification for Grey Iron Castings.

.2 ASTM A 181/A 181M-01, Specification for Carbon Steel Forgings, for General Purpose Piping.

.3 ASTM A 193/A 193M-05, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.

.4 ASTM A 194/A 194M-04a, Standard Specification for Carbon and Alloy-Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.

.5 ASTM A 216/A 216M-2004, Standard Specification for Steel Castings, Carbon, Suitable For Fusion Welding, for High-Temperature Service.

.4 CSA Group (CSA)

.1 CSA C22.1 SB-02, Canadian Electrical Code, Part 1 (19th Edition), Safety Standard for Electrical Installations (Spiral-bound).

.2 CSA W47.1-03, Certification of Companies for Fusion Welding of Steel Structures.

.3 CAN/CSA W48-01, Filler Metals and Allied Materials for Metal Arc Welding.

.4 CSA W178.2-01, Certification of Welding Inspectors (Developed in co-operation with the Canadian Welding Bureau).

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Safety Data Sheets (SDS).

.6 National Research Council Canada (NRC)

.1 National Fire Code of Canada 2020 (NFC).

.7 Transport Canada / Canadian Transport Commission

.1 General Order No. 0-32, Regulations Respecting the Design, Location, Construction, Operation and Maintenance of Stationary Bulk Storage for Flammable Liquids SOR /85-472.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Shop Drawings:

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

.1 Shop drawings: Submit drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada.

.2 Indicate following:

.1 Pipe network plan.

.2 Pump house and equipment layout.

.3 Connections at distribution points.

.4 Type and location of valves, strainers, disconnect and pipe couplings.

.3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Welders certified in accordance with API 1104 and CSA W47.1.

.1 Assign identification number to welder[s].

.2 Submit records of welder's certification and test results to Contract Administrator.

.2 Inspectors:

.1 Weld inspectors certified in accordance with CSA W178.2.

.2 Inspectors to submit records of inspections and test results to Contract Administrator.

.2 Regulatory Requirements: work to be performed in compliance with applicable Provincial regulations.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with manufacturer's written instructions.

1.6 SITE CONDITIONS

.1 Environmental Requirements:

.1 Safeguard natural streams, waterways and storm drainage systems from possible contamination in accordance with authority having jurisdiction.

Part 2 Products

2.1 STEEL PIPING

.1 Pipe: to API 5L, schedule 80.

.2 Fittings: unless otherwise indicated, welding type, carbon steel, seamless or resistance weld. Wall thickness same as corresponding pipe size.

.3 Flanges: forged carbon steel, raised face, weld neck, to ASTM A 181/A 181M, Grade II Class 150, 1 MPa.

.4 Bolting materials:

.1 Bolts: carbon steel to ASTM A 193/A 193M

.2 Nuts: carbon steel to ASTM A 194/A 194M

.3 Gasket: capable of chemically withstanding fluids and temperatures of 650 degrees C.

.5 Joints:

.1 Buried: welded, except at connections to tanks and equipment where unions are used.

.2 Aboveground: threaded joints using compound approved by Contract Administrator for product being handled.

.3 Welded joints: conform to requirements of CSA W47.1 and CSA W47.1S1.

.6 Flexibility: pipelines connected to buried tanks, except straight fall lines and test valves:

.1 Arrange to permit tank settlement.

.2 Provide double swing joints.

.7 Corrosion and product protection:

.1 Protect piping against external corrosion by painting

2.2 VALVES

.1 Steel without copper bearing alloy: to API 6D. Class 150, 1 MPa

.2 NPS 1 1/2 and smaller: [_____].

.3 Gate valves NPS2 and larger: to ASTM A 216/A 216M, Grade WCB, stainless steel OS&Y, flanged ends.

.4 Plug valves flanged ends: Class 300, 2 MPa, bolted bonnet, tapered plug and seat, carbon steel body and trim with plug, Teflon lining.

.5 Glands and valve seats: materials resistant to conveyed fluid.

.6 Rising stem or other indicating valves: where necessary, to establish visually whether valves are open or shut.

2.3 IDENTIFICATION

.1 Valves: identify with tags, octagonal anodized aluminum, red, with green circle for combustible liquid, flammable liquids resistant, fireproof, permanently inscribed with clear legible characters.

.2 Flammable and combustible liquids pipe: label in accordance with Section 23 05 53 - Identification for HVAC Piping and Equipment.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 HANDLING

.1 Protect and shield pre-coated equipment and piping.

3.3 COATINGS

.1 Clean surfaces to base metal. Store clean pipe for short time period in sheltered dry location.

.2 Shop application; prefabricated piping sections are limited to 15 m maximum length.

.3 Reprime mill primed pipe before coating.

.4 Coating: to manufacturer's recommendations.

3.4 SUPPORTS

.1 Above-ground piping: prevent excessive vibration and stress on adjacent equipment.

3.5 PROTECTION

.1 Protect piping system from damage by vehicular traffic using guard devices, painted with warning colours.

3.6 LOCATION OF PIPEWORK

.1 General: locate not to constitute hazard to personnel, buildings or equipment.

.2 Above-ground outdoor piping:

.1 Do not locate on exterior walls constructed of combustible material.

.2 Do not locate above roofs, windows, or door openings.

.3 Locate above roofs only if roofs are of non-combustible, non-soluble and impermeable materials, and if provision is made to collect spilled fuel from surface of flat roof.

.3 Underground pipework: locate at least 305 mm away from foundations of building structure, except where piping enters building.

.4 Piping passing under railway tracks and roadways: install in conformance with Canadian Transport Commission, General Order No.0-32, Part 5, and API 1102

.5 Flammable or combustible liquids pipework:

.1 Do not install in service tunnels or pedestrian traffic areas.

.2 Locate above-ground where it enters building. Provide with outside control valves at point of entry.

3.7 VALVES

.1 Install valves to control flow and to isolate equipment at following locations:

.1 Loading and unloading connections;

.2 Fill and withdrawal connections of above-ground tanks;

.3 Upstream of liquid level control valves or fill lines to underground tanks;

.4 Branch lines at points of connection to main line;

.5 At equipment requiring periodic servicing such as filters, metres and automatic equipment.

.2 Install globe valves with packing on low-pressure side.

.3 Use steel valves to isolate cast iron metres.

3.8 WELDING

.1 Do work in accordance with API 1104, and Section 23 05 17 - Pipe Welding.

.2 Make joints in accordance with manufacturer's recommendations.

.3 Use bevelling machine to produce bevel cuts.

.4 Electrodes: to CAN/CSA W48

.5 Welds: full penetration. Use welding sockets for joints NPS2 or smaller, conforming to ANSI/ASME B16.11

.6 Make branch connections with welding tees or forged branch outlet fittings.

.7 Weld buried piping, regardless of size.

.8 Leave welds uncovered until inspected and approved by Contract Administrator.

.9 Replace welds which fail to meet API 1104 requirements

3.9 FIELD QUALITY CONTROL

.1 Testing:

.1 Prior to testing, remove foreign matter, flush piping and equipment using same petroleum product as one being transported.

.2 Dispose of testing and flushing liquid to approval of authority having jurisdiction.

.3 Pressure test with air or nitrogen to at least 1.5 times maximum operating pressure. Submit certificate of tests and test results to Contract Administrator.

.4 Isolate tanks from piping system pressure tests.

.5 Test piping systems to 700 kPa. Hold pressure for 24 hours.

.6 Should there be loss of pressure, soap test each weld or use tracer gas with compressed air as directed by Contract Administrator.

3.10 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 07 92 00 - Joint Sealants

.2 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

1.2 REFERENCE STANDARDS

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

.2 ASTM International (ASTM)

.1 ASTM A 480/A 480M-[12], Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 ASTM A 635/A 635M-[09b], Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.

.3 ASTM A 653/A 653M-[11], Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, [2005].

.2 SMACNA HVAC Air Duct Leakage Test Manual, [2012].

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit product data and shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

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, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure (Pa)	SMACNA Seal Class
500 to 750	B
250 to 500	C
125 to 250	C

.2 Seal classification:

.1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.

.2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant, tape or combination thereof.

.3 Class C: transverse joints and connections made air tight with gaskets, sealant, tape, or combination thereof. Longitudinal seams unsealed.

.4 Unsealed seams and joints.

2.2 SEALANT

.1 Sustainability Characteristics:

.1 Adhesives and sealants: in accordance with Section 07 92 00 - Joint Sealants.

.2 Sealant: oil resistant, [water borne], polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus[93 degrees C.

2.3 TAPE

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

2.4 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows:

.1 Rectangular: centreline radius: 1.5 times width of duct.

.2 Round: centreline radius: 1.5 times diameter.

.3 Mitred elbows, rectangular:

.1 To 400 mm: with single thickness turning vanes.

.2 Over 400 mm: with double thickness turning vanes.

.4 Branches:

.1 Rectangular main and branch: with 45 degrees entry on branch.

.2 Round main and branch: enter main duct at 45 degrees with conical connection.

.3 Provide volume control damper in branch duct near connection to main duct.

.4 Main duct branches: with splitter damper.

.5 Transitions:

.1 Diverging: 20 degrees maximum included angle.

.2 Converging: 30 degrees maximum included angle.

.6 Offsets:

.1 Short radiused elbows as indicated.

2.5 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A 653/A 653M, Z90 zinc coating.

.2 Thickness, fabrication and reinforcement: to SMACNA.

.3 Joints: to SMACNA.

2.6 ALUMINUM

.1 To SMACNA. Aluminum type: 3003-H-14.

.2 Thickness, fabrication and reinforcement: to SMACNA.

.3 Joints: to SMACNA.

2.7 HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.

.1 Maximum size duct supported by strap hanger: 500.

.2 Hanger configuration: to SMACNA.

.3 Hangers: galvanized steel angle with galvanized steel rods to following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
Up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.2 For steel joist: manufactured joist clamp.

.3 For steel beams: manufactured beam clamps:

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for metal duct installation in accordance with manufacturer's written instructions.

.1 Visually inspect.

.2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 GENERAL

.1 Do work in accordance with SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.3 Support risers in accordance with SMACNA.

.4 Install breakaway joints in ductwork on sides of fire separation.

3.3 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with as follows:

Duct Size (mm)	Spacing (mm)
To 1500	3000
1501 and over	2500

3.4 WATERTIGHT DUCT

.1 Provide watertight duct for:

.1 Fresh air intake.

.2 As indicated.

.2 Form bottom of horizontal duct without longitudinal seams.

.1 Weld joints of bottom and side sheets.

.2 Seal other joints with duct sealer.

3.5 SEALING AND TAPING

.1 Apply sealant in accordance with SMACNA and to manufacturer's recommendations.

.2 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturers recommendations.

3.6 LEAKAGE TESTS

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

.2 Do leakage tests in sections.

.3 Make trial leakage tests as instructed to demonstrate workmanship.

.4 Do not install additional ductwork until trial test has been passed.

.5 Complete test before performance insulation or concealment Work.

3.7 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Not used

1.2 REFERENCE STANDARDS

.1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, [2005].

1.3 ACTION AND INFORMATIONAL 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 air duct accessories and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Indicate:

.1 Flexible connections.

.2 Duct access doors.

.3 Turning vanes.

.4 Instrument test ports.

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, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect air duct accessories from damage.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 GENERAL

.1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame 75 mm thick with fabric clenched by means of double locked seams.

.2 Material:

.1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90]degrees 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: two sash locks.
.2 301 to 450 mm: four sash locks.
.3 451 to 1000 mm: piano hinge and minimum two sash locks.
.4 Doors over 1000 mm: piano hinge and two handles operable from both sides.

2.4 TURNING VANES

.1 Factory or shop fabricated to recommendations of SMACNA and as indicated

2.5 INSTRUMENT TEST

.1 1.6 mm thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

2.6 SPIN-IN COLLARS

.1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.

.2 Sheet metal thickness to co-responding round duct standards.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for air duct accessories installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 INSTALLATION

.1 Flexible Connections:

.1 Install in following locations:

.1 Inlets and outlets to supply air units and fans.

.2 Inlets and outlets of exhaust and return air fans.

.3 As indicated.

.2 Length of connection: 100 mm.

.3 Minimum distance between metal parts when system in operation: 75 mm.

.4 Install in accordance with recommendations of SMACNA

.5 When fan is running:

.1 Ducting on sides of flexible connection to be in alignment.

.2 Ensure slack material in flexible connection.

.2 Access Doors and Viewing Panels:

.1 Size:

.1 450 x 450 mm for servicing entry.

.2 200 x 200 mm for viewing.

.3 As indicated.

.2 Locations:

.1 Devices requiring maintenance.

.2 Required by code.

.3 Elsewhere as indicated.

.3 Instrument Test Ports:

.1 General:

.1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions

.2 Locate to permit easy manipulation of instruments.

.3 Install insulation port extensions as required.

.4 Locations:

.1 For traverse readings:

.1 Ducted inlets to roof and wall exhausters.
.2 Inlets and outlets of other fan systems.
.3 Main and sub-main ducts.
.4 And as indicated.

.2 For temperature readings:
.1 At outside air intakes.
.2 In mixed air applications in locations as indicated.
.3 At inlet and outlet of coils.
.4 Downstream of junctions of two converging air streams of different temperatures.
.5 And as indicated.

.4 Turning Vanes:

.1 Install in accordance with recommendations of SMACNA and as indicated

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Not used

1.2 REFERENCE STANDARDS

.1 Sheet Metal and Air Conditioning National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-[2013].

1.3 ACTION AND INFORMATIONAL 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 dampers and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for dampers for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect dampers from damage.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 GENERAL

.1 Manufacture to SMACNA standards

2.2 BALANCE DAMPERS

.1 Rectangular Duct:

.1 Material: 304 stainless steel.
.2 Blade: Opposed blade, 1.6 mm thick, symmetrical about pivot point.
.3 Maximum blade height: 100 mm.
.4 Bearing: Stainless steel sleeve pressed into cast housing bolted to the damper frame.
.5 Linkage: Located in jamb out of airstream and constructed of minimum 3.5 mm stainless steel double clevis arms with 4.8 x 19 mm stainless steel tie bars pivoting on 9.5 mm diameter stainless steel pivot pins with lock type retainers.
.6 Blade seals: TPE, mechanically attached to blade.
.7 Channel frame: 16 ga hat channel.
.8 Acceptable product: Ruskin, Greenheck, Price or approved equal in accordance with B8.

.2 Round Duct:

.1 Material: 304 stainless steel.
.2 Blade: Circular, butterfly style damper.
.3 Bearing: Relubricable ball bearing bolted to frame.
.4 Shaft: 304 stainless steel.
.5 Linkage: Locking hand quadrant.
.6 Frame: 304 stainless steel channel.
.7 Acceptable Product: Ruskin CDR92, Greenheck, Price or approved equal in accordance with B8.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for damper installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.
.2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions

.3 Locate balancing dampers in each branch duct, for supply, return and exhaust systems.

.4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.

.5 Dampers: vibration free.

.6 Ensure damper operators are observable and accessible.

.7 Corrections and adjustments conducted by Contract Administrator.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 40 92 00 – Automation -Primary Control Devices

.2 23 33 00 - Air Duct Accessories

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM A 653/A 653M-[11], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

1.3 ACTION AND INFORMATIONAL 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 [dampers] and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for dampers for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect dampers from damage.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 OUTDOOR AIR AND EXHAUST DAMPERS

.1 Opposed or parallel blade type as indicated on equipment schedule.

.2 Frame:

.1 Extruded aluminum (6063-T5) not less than 2.03 mm (0.080") in thickness.

.2 101.6 mm (4.00") deep x 25.4 mm (1.00"), with duct mounting flanges on both sides of frame.

.3 50.8 mm (2.00") mounting flange on rear of damper.

.4 Assembled using zinc-plated steel mounting fasteners. Welded frames shall not be acceptable.

.3 Blades:

.1 Maximum 152.6 mm (6.00") deep extruded aluminum (6063-T5) air-foil profiles with a minimum wall thickness of 1.52 mm (0.060").

.2 Internally insulated with expanded polyurethane foam, thermally broken.

.3 Insulating factor of RSI 0.4 (R 2.29) and a temperature index of 55 (tested to AAMA 1502.7 test method).

.4 Blade seals:

.1 Extruded silicone, secured in an integral slot within the aluminum blade extrusions.

.2 Mechanically fastened to prevent shrinkage and movement over the lift of the damper. Adhesive of clip-on type blade seals shall not be acceptable.

.5 Frame seals:

.1 Extruded silicone, secured in an integral slot within the aluminum frame extrusions and shall be mechanically fastened to prevent shrinkage and movement over the life of the damper. Metallic compression type jamb seals shall not be acceptable.

.6 Bearings:

.1 Dual bearing system composed of a Celcon inner bearing (fixed around a 11.1 mm (7/16") aluminum hexagon blade pivot pin), rotating within a polycarbonate outer bearing inserted in the frame.

.2 Single axle bearing, rotating in an extruded or punched hole shall not be acceptable.

.7 Hexagonal control shaft:

.1 Size: 11.1 mm (7/16").

.2 Adjustable length; integral part of the blade axle. A field-applied control shaft shall not be acceptable.

.3 All parts zinc-plated steel.

.8 Linkage hardware:

.1 Aluminum and corrosion-resistant zinc-plated steel, installed in the frame side, out of the airstream, and accessible after installation.

.2 Complete with cup-point trunnion screws to prevent linkage slippage. Linkage that consists of metal rubbing shall not be acceptable.

.9 Performance:

.1 Designed for operation in temperatures ranging from minus 40°C to plus 100°C.

.2 AMCA rated for leakage Class 1A at 0.25 kPa (1.0 in. w.g.) static pressure differential. Standard air leakage data to be certified under the AMCA certified ratings program.

.10 Dampers shall be custom made to required size, with blade stops not exceeding 31.7 mm (1.25") in height.

.11 Operator:

.1 Refer to Section 40 92 00 - Automation -Primary Control Devices.

.12 Acceptable Product: TAMCO 9000SC or approved equal in accordance with B8.

2.2 RELIEF DAMPERS

.1 Automatic, counterbalanced round, butterfly type, aluminum dampers with ball bearing centre pivoted and counter-weights set to open at static pressure as indicated on equipment schedule.

.2 Frame: Aluminum channel.

.3 Axle: 304 stainless steel.

.4 Bearings: Relubricable ball bearing bolted to frame.

.5 Blade seal: Neoprene.

.6 Acceptable product: Ruskin CBDR82, or approved equal in accordance with B8.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for damper installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions

.3 Seal multiple damper modules with silicon sealant.

.4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.

.5 Ensure dampers are observable and accessible.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 23 05 13 - Common Motor Requirements for HVAC Equipment

.2 23 05 13 - Common Motors Requirements for HVAC Equipment

.3 23 33 00 - Air Duct Accessories

.4 23 40 00 - HVAC Air Cleaning Devices

.5 26 29 23 - Variable Frequency Drives

1.2 REFERENCE STANDARDS

.1 American National Standards Institute/Air Movement and Control Association (ANSI/AMCA)

- .1 ANSI/AMCA Standard 99-2010, Standards Handbook.
- .2 ANSI/ASHRAE 51-07 (ANSI/AMCA 210-07), Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
- .3 ANSI/AMCA Standard 300-2008, Reverberant Room Method for Sound Testing of Fans.
- .4 ANSI/AMCA Standard 301-1990, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.2 The Master Painters Institute (MPI)

- .1 Architectural Painting Specification Manual - current edition.
  - .1 MPI #18, Primer, Zinc Rich, Organic.

1.3 ACTION AND INFORMATIONAL 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 HVAC fans and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

- .1 Provide:
  - .1 Fan performance curves showing point of operation, bhp or kW and efficiency.
- .2 Indicate:
  - .1 Motors, sheaves, bearings, shaft details.
  - .2 Minimum performance achievable with variable speed controllers.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials:

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.1 Provide:

.1 Matched sets of belts (if applicable).

.2 Furnish list of individual manufacturer's recommended spare parts for equipment, include:

.1 Bearings and seals.

.2 Addresses of suppliers.

.3 List of specialized tools necessary for adjusting, repairing or replacing.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect HVAC fans from damage.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.

.2 Capacity: flow rate, total pressure, bhp or W, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.

.3 Fans: statically and dynamically balanced, constructed in conformity with ANSI/AMCA Standard 99

.4 Sound ratings: comply with ANSI/AMCA Standard 301, tested to ANSI/AMCA Standard 300.

.5 Performance ratings: based on tests performed in accordance with ANSI/AMCA Standard 210.

2.2 FANS GENERAL

.1 Fans servicing hazardous locations shall be fabricated in accordance with AMCA Type A or Type B spark-resistant construction.

.2 Motors:

.1 In accordance with Section 23 05 13 - Common Motors Requirements for HVAC Equipment supplemented as specified herein.

.2 Sizes as indicated.

.3 Electronically Commutated Motor (ECM).

.1 Motor enclosure: Open type.

.2 DC electronically commutated type motor (ECM) specifically design for fan applications. AC induction type motor shall not be acceptable. Examples of unacceptable motors are: Shaded pole, permanent split capacitor (PSC), split phase, capacitor start, and 3 phase induction type motors.

.3 Permanently lubricated, heavy duty ball bearing type to match with the fan load.

.4 Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor.

.5 Motor speed controllable down to 20% of full speed (80% turndown).

.6 Speed controlled by a factory supplied, two-speed controller. Each discreet speed adjusted by potentiometer.

.7 Acceptable product: Greenheck “Vari-Green” or approved equal in accordance with B8.

.4 AC Induction

.1 Motor enclosure: TEFC.

.2 Permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the scheduled voltage and phase.

.3 Rated for use with variable speed drives.

.1 Variable speed drives: Refer to Section 26 29 23 - Variable Frequency Drives.

.3 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail motor bases, belt guards, coupling guards fan inlet or outlet safety screens as indicated and as specified in Section 23 05 13 - Common Motor Requirements for HVAC Equipment, inlet or outlet dampers and vanes and as indicated.

.4 Factory primed before assembly in colour standard to manufacturer.

.5 Scroll casing drains: as indicated.

.6 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.

.7 Flexible connections: to Section 23 33 00 - Air Duct Accessories.

.8 Filter Section:

.9 Provide inline filter section for all supply fans with filter in accordance with Section 23 40 00 - HVAC Air Cleaning Devices

2.3 CENTRIFUGAL FANS

.1 Fan wheels:

.1 Welded aluminum or composite construction.

.2 Maximum operating speed of centrifugal fans not more than 50% of first critical speed.

.3 Air foil, or backward inclined blades, as indicated on schedules.

.2 Bearings: heavy duty flange mounted grease lubricated ball or roller self aligning type with oil retaining, dust excluding seals and a certified minimum rated life of 100,000 hours.

.3 Housings:

.1 Volute with inlet cones: fabricated steel for wheels 300 mm or greater, steel, or aluminum, for smaller wheels, braced, and with welded supports.

.2 For horizontally and vertically split housings provide flanges on each section for bolting together, with gaskets of non-oxidizing non-flammable material.

.3 Provide bolted airtight access doors with handles.

.4 Motor: As indicated in schedule:

.5 Acceptable Product: Greenheck SQ-VG or approved equal in accordance with B8.

2.4 IN-LINE CENTRIFUGAL FANS

.1 Characteristics and construction: as for centrifugal fan wheels, with axial flow construction and direct or belt drive as indicated on schedule.

.2 Provide AMCA arrangements 4 or 9 as indicated with stiffened flanges, smooth rounded inlets, and stationary guide vanes.

.3 Acceptable Product: Greenheck QEI, QEID-FJ or approved equal in accordance with B8.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for HVAC fans installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 FAN INSTALLATION

.1 Install fans as indicated, complete with resilient mountings or spring isolators, flexible electrical leads and flexible connections in accordance with Section 23 33 00 - Air Duct Accessories.

.2 Provide sheaves and belts required for final air balance (if required).

.3 Bearings and extension tubes to be easily accessible.

.4 Access doors and access panels to be easily accessible.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Not used

1.2 REFERENCE STANDARDS

1.3 ACTION AND INFORMATIONAL 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 diffusers, registers and grilles and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Indicate following:

.1 Capacity.

.2 Throw and terminal velocity.

.3 Pressure drop.

.4 Neck velocity.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Include:

.1 Keys for volume control adjustment.

.2 Keys for air flow pattern adjustment.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect [diffuser, registers and grilles] from damage.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

2.2 GENERAL

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated on schedule.

2.3 MANUFACTURED UNITS

.1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

2.4 SUPPLY GRILLES AND REGISTERS

.1 General: Furnish and install supply grilles and registers of the sizes and mounting types indicated on the drawings and schedule.

.2 Blades: Blades shall be single deflection type with one set of fully adjustable deflection blades spaced 19 mm (3/4”) on centre. Blades shall run parallel to the long dimension of the grille/register as indicated on the schedule.

.3 Damper: Integral volume control dampers shall be of the opposed blade type and shall be constructed of cold rolled steel. The damper shall be operable from the register face. The damper shall be coated steel.

.4 Finish: B15 Aluminum powder coat.

.5 Acceptable product: Price 610 or approved equal in accordance with B8.

2.5 RETURN AND EXHAUST GRILLES AND REGISTERS

.1 General: Furnish and install exhaust grilles and registers of the sizes and mounting types indicated on the plans and schedule.

.2 Blades: Shall be 0 degree deflection fixed louver type with blades spaced 19 mm (3/4”) on centre. The blades shall run parallel to the long dimension of the grille/register.

.3 Damper: Integral volume damper control damper shall be of the opposed blade type and shall be constructed of cold rolled steel. The damper shall be operable from the diffuser face.

.4 Finish: B15 Aluminum powder coat.

.5 Acceptable product: Price 610Z of approved equal in accordance with B8.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for diffuser, register and grille installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 INSTALLATION

.1 Install in accordance with manufacturers instructions.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 09 91 13 - Exterior Painting

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM E 90-[09], Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.2 National Research Council Canada (NRC)

.1 National Building Code of Canada [2015] (NBC).

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.4 Society of Automotive Engineers (SAE)

1.3 ACTION AND INFORMATIONAL 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 louvers, intakes and vents and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Indicate following:

.1 Pressure drop.

.2 Face area.

.3 Free area.

.3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.4 Test Reports: submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E 90.

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, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect louvers, intakes and vents from damage.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

2.2 GRAVITY ROOF OUTSIDE AIR INTAKES AND RELIEF VENTS

.1 Factory manufactured aluminum or ss.

.1 Complete with integral birdscreen of 2.7 mm diameter aluminum or ss wire.

.2 Maximum throat velocity: 2.5 m/s (500 fpm).

.3 Maximum loss through unit: 15 Pa static pressure.

.4 Maximum velocity through damper area: 1.5 m/s.

.5 Shape: as indicated.

.2 Birdscreens:

.1 Complete with integral birdscreen of 2.7 mm diameter aluminum or ss wire. Use 12 mm mesh on exhaust, 19 mm mesh on intake.

2.3 GOOSENECK HOODS

.1 Thickness: to SMACNA.

.2 Fabrication: to SMACNA.

.3 Joints: to SMACNA.

.4 Supports: as indicated.

.5 Complete with integral birdscreen of 2.7 mm diameter aluminum or ss wire. Use 12 mm mesh on exhaust, 19 mm mesh on intake.

2.4 FIXED LOUVRES - ALUMINUM

.1 Construction: welded with exposed joints ground flush and smooth.

.2 Material: extruded aluminum.

.3 Blade: thermally broken

.4 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

.5 Screen: 12 mm exhaust, 19 mm intake mesh, 2 mm diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.

.6 Finish: anodized. Colour: prefinished to match colour 56072 Charcoal.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for louvres, intakes and vents installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from Contract Administrator.

3.2 INSTALLATION

.1 In accordance with manufacturer's and SMACNA recommendations

.2 Reinforce and brace as indicated.

.3 Anchor securely into opening. Seal with caulking to ensure weather tightness.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Not used

1.2 REFERENCE STANDARDS

.1 American National Standard Institute (ANSI)/American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

.1 ANSI/ASHRAE 52.2-[12], Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particulate Size (ANSI approved).

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-115.10-[M90], Disposable Air Filters for the Removal of Particulate Matter from Ventilating Systems.

.2 CAN/CGSB-115.11-[M85], Filters, Air, High Efficiency, Disposable, Bag Type.

.3 CAN/CGSB-115.12-[M85], Filters, Air, Medium Efficiency, Disposable, Bag Type.

.4 CAN/CGSB-115.13-[85], Filter Media, Automatic Roll.

.5 CAN/CGSB-115.14-[M91], High Efficiency Cartridge Type Supported Air Filters for the Removal of Particulate Matter from Ventilating Systems.

.6 CAN/CGSB-115.15-[M91], High Efficiency Rigid Type Air Filters for Removal of Particulate Matter from Ventilating Systems.

.7 CAN/CGSB-115.16-[M82], Activated Carbon for Odor Removal from Ventilating Systems.

.8 CAN/CGSB-115.18-[M85], Filter, Air, Extended Area Panel Type, Medium Efficiency.

.9 CAN/CGSB-115.20-[95], Polarized Media Air Filter.

.3 International Organization of Standardization (ISO)

.1 ISO 14644-1-[99], Clean Rooms and Associated Controlled Environments - Part 1: Classification of Air Cleanliness.

.4 Underwriters' Laboratories of Canada (ULC)

.1 ULC -S111-[07], Standard Method of Fire Tests for Air Filter Units.

.5 US Department of Defense - Test Method Standard

.1 MIL-STS-282-[95], Filter Units, Protective Clothing, Gas-Mask Components and Related Products; Performance Test Methods.

1.3 ACTION AND INFORMATIONAL 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 HVAC filters and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Furnish list of individual manufacturer's recommended spare parts for equipment such as frames and filters, addresses of suppliers, list of specialized tools necessary for adjusting, repairing or replacing for inclusion in operating manual.

.3 Spare filters: in addition to filters installed immediately prior to acceptance by Contract Administrator, supply 1 complete set of filters for each.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect HVAC filters from damage.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 GENERAL

.1 Media: suitable for air at 100% RH and air temperatures between -40 and 50 degrees C.

.2 Number of units, size and thickness of panels, overall dimensions of filter bank, configuration and capacities: as indicated.

.3 Pressure drop when clean and dirty, sizes and thickness: as indicated on schedule.

2.2 ACCESSORIES

.1 Holding frames: permanent channel section construction of same material as casing/hood, 1.6 mm thick, except where specified.

.2 Seals: to ensure leakproof operation.

.3 Blank-off plates: as required, to fit all openings and of same material as holding frames.

.4 Access and servicing: through doors/panels on each side.

2.3 COTTON PANEL FILTERS

.1 Disposable pleated reinforced cotton dry media: to CAN/CGSB 115.18

.2 Holding frame: galvanized steel, or slide in channel for side access.

.3 Performance:

.1 MERV 8 to ANSI/ASHRAE 52.2.

.4 Fire Rated: to ULC -S111

.5 Nominal thickness: 50 mm.

2.4 FILTER GAUGES - DIAL TYPE

.1 Diaphragm actuated, direct reading.

.2 Range: 0 to 2 times initial pressure.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for filter installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 INSTALLATION GENERAL

.1 Install in accordance with manufacturer's recommendations and with adequate space for access, maintenance and replacement.

3.3 REPLACEMENT MEDIA

.1 Replace media with new upon acceptance.

.2 Filter media new and clean, as indicated by pressure gauge, at time of acceptance.

3.4 FILTER GAUGES

.1 Install type as indicated across each filter bank (pre-filter and final filter) in approved and easy readable location.

.2 Mark each filter gauge with value of pressure drop for clean condition and manufacturer's recommended replacement (dirty) value.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 23 33 00 - Air Duct Accessories

.2 23 33 15 - Dampers - Operating

.3 23 40 00 - HVAC Air Cleaning Devices

1.2 REFERENCE STANDARDS

.1 American National Standards Institute/American Society of Heating, Refrigeration and Air Condition Engineers/Illuminating Engineering Society (ANSI/ASHRAE/IES)

.1 ANSI/ASHRAE 52.2-[2012], Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

.2 ANSI/ASHRAE/IES 90.1-[2010], Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 Canadian Standards Association (CSA)

.3 Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - [current edition].

.1 MPI #18.

1.3 ACTION AND INFORMATIONAL 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 air handling equipment and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate on drawings: fan, fan curves showing point of operation, motor drive, filters, heating coil; include performance data.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for air handling equipment for incorporation into manual.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide 1 spare set of filters.

.3 Provide 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.

.4 Spare filters: in addition to filters installed immediately prior to acceptance by Contract Administrator, supply 1 complete set of filters for each filter unit or filter bank.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect air handling equipment from damage.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 GENERAL

.1 Factory assembled components to form unit supplying air at designed conditions, as indicated.

.2 Approvals: CSA certified for Class 1, Division 2, Groups C & D locations.

.3 Vertical type, as indicated, having air-tight modular components, consisting of casing, fan section with motor and drive, filter section, and heating coil.

.4 Acceptable product: Dexon Canada Air Systems Inc model IRVDH or approved equal in accordance with B8.

2.2 HOUSING

.1 5052 Aluminum 12 ga thickness reinforced and braced for rigidity.

.1 Removable panels: provide access for maintenance of internal parts.

2.3 BLOWERS / FANS

.1 Cabinet hung centrifugal fans with backward inclined aluminum wheels, selected to operate in stable part of performance curve at all times and heavy dutyball bearings.

.1 Provide internally mounted motor as indicated.

.2 Motor: 192 W, 1160 r/min.

2.4 FILTER BOX

.1 Material to match casing. For flat type filter arrangement: as indicated.

.2 Filters: in accordance with Section 23 40 00 - HVAC Air Cleaning Devices.

2.5 COILS

.1 Capacity: as indicated.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for air handling equipment installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 INSTALLATION

.1 Install units in accordance with manufacturer's instructions and as indicated.

.2 Ensure adequate clearance for servicing and maintenance.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 23 40 00 HVAC Air Cleaning Devices.

1.2 REFERENCE STANDARDS

.1 American National Standards Institute/American Society of Heating, Refrigeration and Air-Conditioning Engineers (ANSI/ASHRAE)

.1 ANSI/ASHRAE 52.2-[2007], Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particulate Size.

.2 ANSI/ASHRAE 127-[2007], Method of Testing for Rating Computer and Data Processing Room Unitary Air-Conditioners.

.2 Air Condition Heating and Refrigeration Institute (AHRI)

.1 AHRI 390-2003, Performance Rating of Single Package Vertical Air-Conditioners and Heat Pumps.

.3 ASTM International (ASTM)

.1 ASTM C 547-[11], Specification for Mineral Fiber Pipe Insulation.

.4 CSA Group (CSA)

.1 CSA B52-[05(R2009)], Mechanical Refrigeration Code.

.2 CAN/CSA-C656-[05(R2010)], Performance Standard for Single Package Central Air-Conditioners and Heat Pumps.

1.3 ACTION AND INFORMATIONAL 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 air conditioning components and accessories and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate on drawings:

.1 Major components and accessories including sound power levels of units.

.2 Type of refrigerant used.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for air conditioning components for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect air conditioning components from damage.

.3 Replace defective or damaged materials with new.

1.6 WARRANTY

.1 For electrical room air conditioning 12 months warranty period is extended to 60 months.

Part 2 Products

2.1 DESCRIPTION

.1 Integrated package: to CAN/CSA-C656

.2 System type:

.1 Air flow arrangement: through the wall.

.2 Cooling: direct expansion.

.3 Factory assembled, pre-charged, pre-wired, tested, and ready to operate. Unit performance shall be certified in accordance with AHRI 390-2003.

.4 Efficiency shall be as specified by energy efficiency ration (EER).

.3 Cooling and dehumidifying capacity, with fan heat extracted: based on electrical room environment of 25 degrees C dry bulb and 50 % R.H. (plus or minus 1 degree C and 5% R.H.), with minimum supply air temperature of 14 degrees C and minimum control dead-band of 3 % R.H. separating humidification and dehumidification.

.4 Unit controls not to permit dehumidification and humidification to occur simultaneously.

.5 Unit capacity: as indicated.

.6 Acceptable product: BARD W72A series wall-mount air conditioner or approved equal in accordance with B8.

2.2 CABINET

.1 Wall mounted, 20 guage galvanized steel, stainless steel or aluminum enclosure construction. Base constructed uing 16 guage galvanized steel. Cabinet insulated with non-fiberglass, formaldehyde free insulation.

.2 Factory baked on external finish designed to withstand 1000 hours of salt spray tests per ASTM B117-03. . Colour beige as selected from manufacturer's standard range by Contract Administrator.

.3 Cabinet to house: compressors, condensers, liquid receiver, cooling coil, reheat coil, fans, filters, unit environmental control system, motor starters or contactors.

.4 Include adequate access to components for servicing.

2.3 DISCHARGE PLENUM

.1 Non-ducted discharge plenum.

.2 Supply grille: as indicated.

2.4 RETURN PLENUM AND FILTER HOUSING

.1 Non-ducted return plenum.

.2 Return grille: as indicated.

2.5 FANS

.1 DWDI centrifugal, statically and dynamically balanced, Direct drive, with self-aligning, permanently lubricated, ball or roller bearings.

2.6 FAN MOTORS

.1 Indoor fan: Constant torque, 5-speed electronically commutated motor (ECM).

.2 Outdoor Fan and Condenser: Enclosed casing, ball bearing type.

2.7 COMPRESSORS

.1 Scroll type with:

.1 Vibration isolators.
.2 Adjustable high and low pressure switches.
.3 Anti-slug device.
.4 Motor overload and over temperature protection pump down controls.
.5 Crank case heater.
.6 Refrigerant service valves.
.7 Capacity controls.

2.8 COOLING COIL

.1 Aluminum fins, mechanically bonded to copper tubes, tested to 1.7 MPa, maximum face velocity 2.8 m/s, with stainless steel condensate tray and drain connections.

.2 Direct expansion: with separate refrigerant circuit for each compressor.

.3 Cooling coil condensate drain pans: designed to avoid standing water, easily cleaned or removable for cleaning.

2.9 HEATING COIL

.1 Electric: CSA or ULC approved, 208 volts 3 phase 60 Hz, stainless steel or copper fin-tubular construction.Two stages minimum.

.1 Capacity: as indicated.

.2 2 stages minimum.

.2 Coils: located down-stream of cooling coil.

2.10 FILTERS

.1 Filters: 50 mm flat, disposable type: MERV 8 per Section 23 40 00 HVAC Air Cleaning Devices.

.2 Mounting: in corrosion resistant racks with service access.

2.11 CONDENSER

.1 Air cooled: Integral.

.1 Circuited to provide separate refrigerant circuit for each compressor/evaporator combination.

.2 Aluminum fins, mechanically bonded to copper tubes, tested to 3.1 MPa.

.3 Propeller or centrifugal type fans. Direct drive.

.4 Electrical and control components housed in weather-tight access panels with electrical disconnect switch and control cable for control interconnection and designed for year round operation.

2.12 ECONOMIZER

.1 Provide economizer with enthalpy control to utilize up to 100% outdoor air intake based on outdoor temperature and humidity and provide room pressure relief and ventilation.

.2 Linkage operated outdoor air damper with spring return to close upon loss of power to the damper actuator.

.3 Pre-set and user selectable enthalpy curves.

.4 Economizer shall be capable of providing cooling down to -40°C outdoor temperature without using the compressor.

2.13 ENVIRONMENTAL CONTROLS

.1 Solid state electronic control system.

.2 Front mounted operating panel with visual display.

.3 Panel to include following:

.1 Manual operation and adjustment:
  .1 On-Off air conditioning system control.
  .2 Room temperature set point, indicator and sensitivity adjustment controller.
  .3 Room humidity set point, indicator and sensitivity adjustment controller.
  .4 Alarm silencing switch for each alarm point.
  .5 Alarm circuits test switch.
.2 Operational: Visual and Audible Alarm:
  .1 Loss of air flow.
  .2 High room temperature.
  .3 Low room temperature.
  .4 High humidity.
  .5 Low humidity.
.3 Operational: Visual display:
  .1 Cooling each stage.
  .2 Reheat stage 1 and 2.
  .3 Dehumidification.
  .4 Change filter.

2.14 REMOTE CONTROL PANEL

.1 24VAC programmable thermostat.

2.15 REFRIGERANT CHARGE

.1 Charge refrigerant system at factory, seal and test.

.2 Holding charge of refrigerant applied at factory.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for air conditioning components installation in accordance with manufacturer's written instructions.

  .1 Visually inspect substrate.
  .2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
  .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 GENERAL

.1 Install as indicated, to manufacturer's recommendations, and to EPS 1/RA/2

.2 Manufacturer to certify installation.

.3 Run drain line from cooling coil condensate drain pan to terminate over nearest floor drain.

3.3 EQUIPMENT PREPARATION

.1 Provide services of manufacturer's field engineer to set and adjust equipment for operation as specified.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by electrical room air conditioning installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

.2 23 05 93 - Testing, Adjusting and Balancing for HVAC

.3 26 05 00 - Common Work Results for Electrical

1.2 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No.155-[M1986(R2017)], Electric Duct Heaters

1.3 ACTION AND INFORMATIONAL 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 [duct heaters and controls] and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings showing:

.1 Element support details.

.2 Unit support.

.3 Internal components wiring diagrams.

.2 Submit duct heater schedule indicating quantities, sizes, mounting arrangement and the following performance data:

.1 Electrical: total kW rating, voltage, phase.

.2 Heater element watt/density.

.3 Controller type.

.4 Number of stages and kW rating.

.5 Minimum operating airflow.

.6 Maximum discharge temperature.

.7 Pressure drop at operating airflow.

.8 Accessories included.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 23 05 00 - Common Work Results for HVAC and 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 OPEN COIL DUCT HEATERS

.1 Duct heater approved to CSA C22.2 No.155 and listed for zero clearance to combustible material

.2 Design/Performance Criteria:

.1 Refer to duct heater schedule for size, electrical requirements (volts, phases), capacity (kW), operating airflow, controller type, number of stages and special accessories.

.2 Heater Element Watt/Density: maximum 242 W/mm².

.1 Provide derated coils with low-watt density and low airflow controls when faced velocities are lower than 2.0 m/s or duct heaters are used in variable-air-volume applications.

.3 Heater Rated Load: provide built-in load fuses for duct heaters with rated load exceeding 48 Amps.

.4 Modular Construction: when duct heater modules are assembled on site for large applications, design and construct assembly to operate as a single heater.

.5 Disconnect Switch: provide main disconnect for each duct heater assembly.

.3 Construction:

.1 Frame: corrosion-resistant galvanized steel.

.2 Heating elements: helical coils of high grade nickel-chrome alloy resistance wire supported and insulated by floating ceramic bushings fastened to the frame and supporting brackets.

.3 Coil terminal pins: mechanically secured and insulated from the frame with high temperature ceramic bushings.

.4 Mounting: as indicated on duct heater schedule.

.5 Protective Screens: installed on both sides of heater.

.4 Safety Controls:

.1 High Temperature Cutouts: include fail-safe thermal protection devices which automatically de-energize the heater on overheating condition.

.1 Primary High Limit Switch: automatic reset disc type thermal cutout.

.2 Secondary High-Limit Switch: additional manual reset disc type thermal cutout[for duct heaters of 30 kW and less].

.2 Airflow Proving Switch: diaphragm type air pressure switch with automatic reset, screw type setpoint adjustment and static pressure probe; switch to de-energize duct heater circuits in case of insufficient air flow.

.5 Panel:

.1 Factory mounted [NEMA 1] enclosure with terminal blocks for single point power connections and connection of wiring to thermostat, airflow proving switch and/or external controls.

.2 Remote mounted [NEMA 1] panel as indicated with terminal strips in heater terminal box for power and control wiring.

.3 All built-in controls and electrical components to be factory mounted and wired inside the panel; wiring to be terminated on clearly identified terminal blocks.

.4 Provide unit specific wiring diagram permanently attached inside the panel.

.6 Controls:

.1 Duct heater to include the following built-in controls: magnetic contactors, control transformer, safety controls and controllers.

.2 Controller Type: as indicated on duct heater schedule.

.1 Proportional Control: single-stage proportional control providing full modulation of the heater's capacity.

.1 Silicon Controlled Rectifier (SCR) or Solid State Relay (SSR) controller with integrated heatsink.

.2 Control Input: 0-10 VDC, 4-20 mA.

2.2 ACCESSORIES

.1 Provide accessories where indicated on duct heater schedule.

.2 Pilot Lights: factory mounted and wired on heater panel showing staging, power supply status, overheating condition, no airflow, heating status.

.3 Thermostats: low voltage electronic thermostat compatible with duct heater controller.

.1 Room Thermostats: ventilated casing with adjustable setpoint.

.2 Duct Thermostats: insertion type with casing and adjustable setpoint.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify site conditions are acceptable for duct heater installation in accordance with manufacturer's written instructions.

.1 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 INSTALLATION

.1 Perform installation in accordance with manufacturer's instructions.

.2 Locate duct heater in accordance with manufacturer's minimum recommended distances for operation, service access and unit removal.

.3 Provide additional hangers and supports in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment where duct heater weight cannot be supported solely by existing duct.

.4 Make power and control connections to CSA C22.2 No.155

.5 Verify that ductwork and casings are free of debris before operating and testing duct heaters.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 01 91 13 - General Commissioning Requirements and Section 26 05 00 - Common Work Results for Electrical.

.2 Duct Heater Controls: test operation of safety controls and duct heater staging/modulation by simulating a demand from the local thermostat or external control signal.

.3 Field Adjustments: test and adjust airflow controls during system testing, adjusting and balancing in coordination with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.4 Perform tests in presence of Contract Administrator.

.1 Provide test report and include copy with Operations and Maintenance Manuals.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each working day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 23 09 33 - Electric and Electronic Control System for HVAC

.2 26 05 00 - Common Work Results for Electrical

1.2 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No.46-[M1988(R2006)], Electric Air-Heaters.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA 250-[08], Enclosures for Electrical Equipment (1000 V Maximum).

1.3 ACTION AND INFORMATIONAL 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 unit heaters and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, and cleaning procedures.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for unit heaters for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect unit heaters from damage.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 UNIT HEATERS

.1 Unit heater: to CSA C22.2 No.46, horizontal discharge complete with adjustable louvers finished to match cabinet.

.2 Fan type unit heaters with built-in high-heat limit protection.

.3 Fan motor: totally enclosed, sleeve bearing type with resilient mount.

.1 Built-in fan motor automatic resetting thermal overload protection.

.4 Hangers: as indicated.

.5 Elements: mineral insulated steel sheath with continuous helical brazed fins.

.6 Cabinet: steel, fitted with brackets for rod or wall mounting.

.1 Phosphatized and finished with baked polyester powdercoat paint.

.7 Capacity: as indicated.

.8 Voltage: as indicated.

.9 Options:

.1 Low-voltage control kit to permit the use of low-voltage thermostat control.

.10 Acceptable product: Modine model HER or approved equal in accordance with B8.

2.2 CONTROLS

.1 Wall mounted thermostats: type low voltage electronic, to Section 23 09 33 - Electric and Electronic Control System for HVAC.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for unit heaters installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 INSTALLATION

.1 Suspend unit heaters from ceiling or mount on wall as indicated.

.2 Install thermostats in locations indicated.

.3 Make power and control connections.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Test cut-out protection when air movement is obstructed.

.3 Test fan delay switch to assure dissipation of heat after element shut down.

.4 Test unit cut-off when fan motor overload protection has operated.

.5 Ensure heaters and controls operate correctly.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by unit heaters installation.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 This Section covers items common to Sections Division 26, Electrical. This Section Supplements the requirements of Division 1.

1.2 RELATED SECTIONS

.1 Section 01 78 00 – Closeout Submittals

.2 Section 01 33 00 – Submittal Procedures

.3 Section 01 74 11 – Cleaning

.4 Section 01 91 13 – General Commissioning Requirements

.5 Section 01 91 13.13 – Commissioning Plan

.6 Section 01 91 13.16 – Commissioning Forms

.7 Section 01 91 13.18 – Commissioning Training

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)

.1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.

.3 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

.4 City of Winnipeg

.1 Electrical Design Guide (510276-0000-47ER-0001), Revision 05

.2 City of Winnipeg Automation Design Guide (612620-0013-40ER-0001), Revision 03

.3 CAD Drafting Manual

.4 Identification Standard

.5 WWD CAD/GIS Standards

.6 Winnipeg Electrical By-law including Technical Interpretations, latest edition

1.4 DEFINITIONS

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.5 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates and labels for control items in English.

1.6 DRAWINGS AND SPECIFICATIONS

.1 The intent of the Drawings and Specifications is to include all labour, products, and services necessary for complete work, tested, and ready for operation.

.2 These Specifications and the Drawings and Specifications of all other divisions shall be considered as an integral part of the accompanying Drawings. Any item or subject omitted from either the Specifications or the Drawings, but which is mentioned or reasonably specified in and by the others, shall be considered as properly and sufficiently specified and shall be provided.

.3 Provide all minor items and work not shown or specified but which are reasonably necessary to complete the work.

.4 If discrepancies or omissions in the Drawings or Specifications are found, or if the intent or meaning is not clear, advise the Contract Administrator for clarification before submitting Bid, in accordance with B5.

1.7 CARE, OPERATION AND START-UP

.1 Instruct City maintenance and operating personnel in the operation, care and maintenance of systems, system equipment and components.

.2 Where services of a manufacturer’s factory service engineer are required, arrange and pay for services to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 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.

1.8 PERMITS, FEES AND INSPECTION

.1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Notify Contract Administrator of changes required by Electrical Inspection Department prior to making changes.

.4 Furnish a Certificate of Final Inspection and approvals from inspection authority to the Contract Administrator.

1.9 SUBMITTALS

.1 Prior to delivery of any Products to job Site and sufficiently in advance of requirements to allow ample time for checking, submit Shop Drawings for review as specified in Division 01 33 00 – Submittal Procedures.

.2 Shop drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.

.2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.

.3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.5 Submit copies of 600 x 600 mm minimum size drawings and product data to inspection authorities.

.6 If changes are required, notify Contract Administrator of these changes before they are made.

.3 Quality Control:

.1 Provide CSA certified equipment and material. Where CSA certified equipment and material is not available, submit such equipment and material to inspection authorities for special approval before delivery to site.

.2 Submit test results of installed electrical systems and instrumentation.

.3 Permits and fees: in accordance with General Conditions of contract.

.4 Submit, upon completion of Work, load balance report as described in PART 3.9.1 – LOAD BALANCE

.5 Submit certificate of acceptance from inspection authority upon completion of Work to Contract Administrator.

.4 Manufacturer's Field Reports: submit to Contract Administrator manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3.9 – FIELD QUALITY CONTROL.

1.10 AS-BUILT DRAWINGS

.1 The Contractor shall keep one (1) complete set of white prints at the Site during work, including all addenda, change orders, site instructions, clarifications, and revisions for the purpose of As-Built Drawings. As the Work on-site proceeds, the Contractor shall clearly record in Red Pencil all as-built conditions, which deviate from the original Contract Documents. As-Built Drawings to include circuiting of all devices, conduit and feeder runs (complete with conductor size and number) and locations of all electrical equipment.

1.11 QUALITY ASSURANCE

.1 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices as per the conditions of Provincial Act respecting manpower vocational training and qualification.

.1 Employees registered in a provincial apprentice program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.

1.12 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Contract Administrator with schedule within 2 weeks after award of Contract.

.2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling.

1.13 SYSTEM STARTUP

.1 Instruct Contract Administrator and operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 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.

.3 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 aspects of its care and operation.

1.14 OPERATING INSTRUCTIONS

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.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 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

.4 Post instructions where directed.

.5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

.6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with manufacturer's written instructions.

.2 Material and equipment to be CSA certified. Where CSA certified material and equipment is not available, obtain special approval from inspection authorities before delivery to site and submit such approval as described in PART 1.9 - SUBMITTALS

.3 Minimum enclosure type to be used is NEMA 12 unless otherwise specified.

.4 Factory assemble control panels and component assemblies.

.5 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

.6 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.

.7 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.

2.2 ELECTRICAL EQUIPMENT MODIFICATION

.1 Where electrical equipment is field modified, arrange for special inspection and pay all associated fees.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

.2 Control wiring and conduit: in accordance with Section 26 29 03 - Control Devices except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical sections and as shown on mechanical drawings.

2.4 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of inspection authorities and Contract Administrator.

.2 Decal signs, minimum size 175 x 250 mm.

2.5 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.6 EQUIPMENT IDENTIFICATION

.1 Identify electrical and controls equipment and instrumentation with nameplates and labels as follows:

.1 Lamacoid Requirements as per the City of Winnipeg Electrical Design Guide, Revision 05, Section 2.3 – Identification.

.2 Nameplates: lamacoid 3 mm melamine, white face, black lettering, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.

.3 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
Size 8	50 x 100 mm	2 lines	12 mm high letters

.1 Lamacoid equipment identification structure shall be as per the City of Winnipeg Electrical Design Guide, Revision 05, Section 2.3 – Identification, Table 2-1: Lamacoid requirements.

.2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

.3 Wording on nameplates and labels to be approved by Contract Administrator prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per nameplate and label.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Identify equipment with Size 3 labels engraved as directed by Contract Administrator. Eg. “P-L01”

2.7 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, 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 coding: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

.5 Identify each wire at termination points with unique wire tag, generally as shown on the drawings. Markers shall consist of machine printed sleeves.

2.8 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes, and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

.4 Colour coding as per the City of Winnipeg Electrical Design Guide, Revision 05, Section 4.8 – Conduit Colour Coding, Table 4-5: Conduit Colour Bands.

2.9 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 indoor MCC and distribution enclosures light gray to EEMAC 2Y-1.

.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.

Part 3 Execution

3.1 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

.2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: plastic, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.4 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

.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.

3.5 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. Install electrical equipment 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: 1500 mm.
- .6 Fire alarm stations: 1200 mm.
- .7 Fire alarm bells: 2100 mm.

3.6 CUTTING AND PATCHING

.1 Provide all cutting a patching required.

.2 Return exposed surfaces to an as-found condition.

.3 Exercise care where cutting holes existing concrete elements so as not to damage existing reinforcing.

- .1 Locate existing reinforcing utilizing a reinforcing bar locator and mark out on the surface of the concrete.
- .2 For all holes larger than 50mm passing through reinforced concrete, mark the location of the desired hole and all adjacent rebar. Obtain approval from the Contract Administrator prior to cutting.
- .3 Firestop and seal all penetrations, regardless of whether the penetration requires a fire rating.

3.7 ANCHOR INSTALLATION

.1 The Contractor shall exercise care when installing anchors into existing concrete elements so as not to damage existing reinforcing. All anchors shall be installed utilizing carbide tip drill bits. The existing reinforcing shall be located utilizing a reinforcing bar locator and marked out on the surface of the concrete. The drill holes shall be advanced to the required depth for installation of the anchors. Should reinforcement be encountered while drilling, the hole shall be terminated and repositioned to clear the reinforcement. Do not use core bits that can easily intercept and damage/cut the reinforcing during drilling.

3.8 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.9 FIELD QUALITY CONTROL

.1 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 Provide upon completion of work, load balance report as directed in PART 1.9 - SUBMITTALS: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.2 Conduct following tests:

.1 Power distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.5 Systems: fire alarm system and communications.

.6 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.3 Carry out tests in presence of Contract Administrator.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.5 All test instruments utilized are to have been calibrated within one year of the date utilized.

.6 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1.9 - SUBMITTALS.

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

.3 Schedule site visits, to review Work, as directed in PART 1.11 - QUALITY ASSURANCE.

3.10 CLEANING

.1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.18.1.13 (R2022), Metallic outlet boxes (Tri-national standard, with UL 514A and ANCE NMX-J-023/1)

.2 CSA C22.2 No.65-18 (R2022), Wire Connectors.

.3 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused wiring materials from landfill to metal recycling facility as approved by Contract Administrator.

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Clamps or connectors for armoured 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 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.

.2 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.

.3 Install fixture type connectors and tighten. Replace insulating cap.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

.2 Section 26 05 20 – Wire and Box Connectors - 0 - 1000 V.

.3 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 CSA C22.2 No .0.3:09 (R2023), Test Methods for Electrical Wires and Cables.

.3 CAN/CSA-C22.2 No. 131:17 (R2022), Type TECK 90 Cable.

.4 CAN/CSA-C22.2 No. 38-18 (R2022), Thermoset-insulated Wires and Cables

.5 CAN/CSA-C22.2 No. 239:21, Control and Instrumentation Cables

.2 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

.2 Identification Standard

.3 Electrical Design Guide (510276-0000-47ER-0001), Revision 05

1.3 SHOP DRAWING

.1 Include detail construction, dimension, capacities, weights of equipment or material.

Part 2 Products

2.1 BUILDING WIRES

.1 Wire: to CAN/CSA-C22.2 No. 38, Thermoset-insulated wires and cables.

.2 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.3 Copper conductors: size as indicated, with 1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

.4 Voltage rating:

.1 Circuits 480 V and less: 600 V

.2 Circuits > 480 V: 1000 V

.3 1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90 or RWU90.

.4 Colour coding to Section 26 05 00 – Common Work Results, wires sized 2 AWG and smaller to be factory-coded, taping will not be accepted.

2.2 1 KV TECK90 POWER CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated. (12 AWG minimum where not indicated)

.3 Insulation:

.1 Type: ethylene propylene rubber.

.2 Chemically cross-linked thermosetting polyethylene rated type RW90, 1000 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two-hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 300 mm centers.

.3 Threaded rods: 6 mm dia. to support suspended channels unless indicated otherwise on drawings.

.8 Cable Fittings:

.1 Minimum requirement: Watertight, approved for TECK cable.

.2 Hazardous Locations:

.1 CSA approved.

.2 Watertight type with:

.1 an elastomeric bevelled bushing

.2 a funnel entry, splined gland nut

.3 a non-magnetic, stainless steel grounding device with dual grounding action

.4 a taper threaded hub

.5 a hexagonal body and gland nut

.3 Integral seal type with metal-to-metal contact construction.

.4 Sealing of multi-conductor cable shall be accomplished with a liquid type polyurethane compound.

.5 The fitting must:

.1 Provide an environmental seal around the outer jacket of the cable and electrically bond the fitting to the cable armour prior to potting the explosion-proof seal.

.2 Allow the possibility of disconnection without disturbing the environmental seal, the electrical bonding or the explosionproof seal.

.6 All metal-clad cable fittings, for jacketed and non-jacketed interlocked armour cable, shall incorporate an easily removable armour stop (not requiring fitting disassembly) ensuring proper positioning of the cable armour during cable termination.

.7 Approved products:

.1 T&B Star Teck XP series or approved equal in accordance with B8.

2.3 600 V TECK90 CONTROL CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated. (14 AWG minimum where not indicated)

.3 Insulation:

.1 Type: ethylene propylene rubber.

.2 Chemically cross-linked thermosetting polyethylene rated type RW90, 600 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two-hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 300 mm centers.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.8 Connectors:

.1 Watertight, explosion-proof approved for TECK cable.

2.4 VARIABLE FREQUENCY CONTROL CABLE

.1 Cable: Variable frequency drive cable to CAN/CSA C22.2 No. 131.

.2 Conductors:

.1 Copper power and ground.

.3 Ground Conductors:

.1 Three bare ground conductors spaced evenly around circumference of cable (sectored ground).

.4 Insulation:

.1 Cross linked polyethylene, 2000V.

.5 Armour:

.1 Continuous aluminum sheath formed into corrugates seamless heath.

.6 Outer Jacket:

.1 PVC, UV resistant.

.7 Fire rating: FT4, HL and AG14.

.8 Connectors:

.1 Same as for TECK90 cables.

.9 Standard of Acceptance: Nexans DriveRX cable or approved equal.

2.5 300 V INSTRUMENT ACIC/CIC CONTROL CABLE

.1 Cable: to CAN/CSA-C22.2 No. 239, Control and Instrumentation Cables.

.2 Conductors: 16 AWG where not indicated on drawings, 7 strand concentric lay, Class B tinned copper, twisted pairs/triads.

.3 Insulation: PVC TW75, 75 °C Wet, 105 °C Dry (-40 °C), 300 Volt.

.1 Cables shall have 600V rating when entering 600V equipment such as MCCs and VFDs.

.4 Twisted pairs/triads cabled with staggered lays.

.5 Shielding: Individual twisted pair(s)/triads Aluminum/mylar shield with ST drain wire, 100 % shield. Overall aluminum/mylar shield with ST drain wire. Individual drain wires one size smaller than conductor AWG. Overall drain wire the same AWG as conductors.

.6 Armour: interlocking aluminum.

.7 Overall covering: thermoplastic polyvinyl chloride material (90 °C, -40 °C).

.8 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 300 mm centers.

.9 Connectors:

.1 Watertight, explosion proof approved for armoured cable.

2.6 TYPE RW90 CONDCUTOR

.1 In accordance with CSA C22.2 No.38.

.2 Circuit conductors shall be concentric stranded soft copper, size as indicated (12 AWG minimum where not indicated).

.3 Insulation to be chemically cross-linked thermosetting polyethylene rated type RW90 XLPE, 600V.

.4 Suitable for installation in temperatures down to -40 °C.

.5 90 °C conductor operating temperature.

2.7 WIRING IDENTIFICATION

.1 Provide wiring identification in accordance with Section 26 05 00 – Common Work Results – For Electrical

Part 3 Execution

3.1 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.2 In conduit systems in accordance with Section 26 05 34 – Conduits, Conduit and Conduit Fittings.

3.2 INSTALLATION OF TECK CABLE 0 -1000 V

.1 Group cables wherever possible on channels.

.2 Terminate cables in accordance with Section 26 05 20 – Wire and Box Connectors - 0 -1000 V.

3.3 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible.

.2 Terminate cables in accordance with Section 26 05 20 – Wire and Box Connectors - 0 -1000 V.

3.4 INSTALLATION OF CONTROL CABLES

.1 Ground shields at one end only. Where possible, ground shields at the end where power is supplied to the cable. Utilize shield grounding bar in panels, where present, to ground overall shields. Individual pair shields to be grounded on appropriate terminals.

.2 Shield drain wires, at the ungrounded end, are to be taped back to the cable. Fully insulate the shield. Do not cut the shield drain wire off.

.3 ACIC cable may be installed in cable tray, provided that:

.1 The cable tray does not contain power cables, unless specifically authorized by the Contract Administrator in writing.

.2 The ACIC cable voltage rating is equal or greater than the highest voltage contained in the cable tray.

3.5 TERMINATIONS AND SPLICES

.1 Wire nuts are permitted only in the following circuits:

.1 Lighting circuits.

.2 Receptacle circuits.

.2 Exercise care in stripping insulation from wire. Do not nick conductors.

.3 Strictly follow manufacturer's instructions with regards to tool size and application methods of terminations and compounds.

.4 Where screw-type terminals are provided on equipment and instrumentation, terminate field wiring with insulated fork tongue terminals.

.1 Manufacturer: Thomas and Betts, Sta-Kon, or approved equal in accordance with B8.

3.6 INSTALLATION IN CONDUIT

.1 Utilize cable grips, appropriately selected to accommodate the type and geometry of the cable.

.2 Utilize cable pulling lubricant, compatible with the cable and conduit.

3.7 CABLE INDENTIFICATION

.1 Install cable tags on all cables.

3.8 TESTING

.1 Test all power conductors 10 AWG and larger in accordance with 26 05 00 – Common Work Results.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)

.1 ANSI/IEEE 837-2014, Qualifying Permanent Connections Used in Substation Grounding.

.2 Canadian Standards Association (CSA International)

.1 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.3 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Contract Administrator.

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

Part 2 Products

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as required.

.2 Grounding conductors: stranded copper, tinned, soft annealed, size as indicated.

.3 Insulated grounding conductors: green, type RW90.

.4 Ground bus: copper, size 2/0 AWG, complete with insulated supports, fastenings, connectors.

□

.5 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.
.2 Protective type clamps.
.3 Bolted type conductor connectors.
.4 Thermit welded type conductor connectors.
.5 Bonding jumpers, straps.
.6 Pressure wire connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Use mechanical connectors for grounding connections to equipment provided with lugs.

.5 Soldered joints not permitted.

.6 Install bonding wire for flexible conduit, connected at one end to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.7 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.8 Connect building structural steel and metal siding to ground by welding copper to steel.

.9 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.10 Bond single conductor, metallic armoured cables to cabinet at supply end, and load end.

.11 Ground secondary service pedestals.

3.2 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of 600 V system

.2 Install system and circuit ground connections at secondary of 600V:120/208V transformers.

3.3 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to the following list: service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.

3.4 GROUNDING BUS

.1 Install copper grounding bus mounted on insulated supports on wall of electrical room.

.2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections size 2/0 AWG.

3.5 COMMUNICATION SYSTEMS

.1 Install grounding connections for telecommunication, sound, fire alarm, intercommunication systems as follows:

.1 Telecommunication systems: make telephone grounding system in accordance with telephone company's requirements.

.2 Sound, fire alarm, intercommunication systems as indicated.

3.6 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of 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

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Contract Administrator.

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

Part 2 Products

2.1 FRAMING AND SUPPORT SYSTEM

.1 Materials:

.1 Conduit support structures shall employ an aluminum strut framing system together with the manufacturer's connecting components and fasteners for a complete system.

.2 Finishes:

.1 Wet locations: Aluminum.

.2 Indoors, dry locations: Aluminum.

.3 Nuts, bolts, machine screws: Stainless steel.

2.2 CONCRETE AND MASONRY ANCHORS

.1 Materials: hardened steel inserts, zinc plated for corrosion resistance.

.2 Components: non-drilling anchors for use in predrilled holes, sized to safely support the applied load with a minimum safety factor of four.

.3 Manufacturer: Hilti (Canada) Limited or approved equal in accordance with B8.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors or nylon shields.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.5 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.6 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.

.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 as 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.

.10 Do not use wire lashing 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 Touch up abraded surfaces and cut ends of galvanized members with an approved galvanizing repair compound.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Include detail construction, dimension, capacities, weights of equipment or material.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling.

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

Part 2 Products

2.1 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

.3 Type and size as indicated on the drawings, or sized as per code requirements

.4 Utilize stainless steel or PVC construction for NEMA 4X junction and pull boxes.

2.2 CABINETS

.1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

.2 Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing sheet steel backboard for surface mounting.

Part 3 Execution

3.1 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor.

.3 Install terminal blocks as indicated in Type T cabinets.

.4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.2 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results.

.2 Install size 2 identification labels indicating system name, voltage and phase.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 NO. 18.1:13 (R2022), Metallic Outlet Boxes

.2 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

.6 Material Requirements:

.1 Main Floor & Drywell: PVC

.2 Wet well: Aluminium

.3 Valve Chamber: Aluminium

2.2 SURFACE MOUNTED OUTLET BOXES, METAL

.1 General Requirements:

.1 Acceptable materials:

.1 Cast Aluminum

.2 Cast ferrous alloy with corrosion resistant epoxy coating.

.2 Finish

.1 Epoxy Enamel

.3 Mounting lugs as required.

.4 Wet location covers for all locations unless otherwise approved by the Contract Administrator.

.5 To CSA C22.2 NO. 18.1:13 (R2022)

.2 Round Boxes:

.1 100mm (4") round.

.2 Tapped conduit openings and plugs.

.3 Manufacturer / Model:

.1 Crouse Hinds VXF series

.2 Or approved equal in accordance with B8.

.3 Device Boxes

.1 FS or FD cast aluminum boxes with factory threaded hubs and mounting feet for surface wiring of receptacles.

.2 Single gang unless specified otherwise.

.3 Manufacturer / Model:

.1 Crouse Hinds FS/FD series

.2 Or approved equal in accordance with B8.

2.3 SURFACE MOUNTED OUTLET BOXES, PVC

.1 General Requirements:

.1 To CSA C22.2 No. 18.

.2 Acceptable materials: PVC

.3 Grounding stud.

.4 Mounting lugs as required.

.5 NEMA 4X, unless otherwise indicated.

.2 Specific Requirements:

.1 Ceiling Outlets: IPEX OB series or approved equal in accordance with B8.

.2 Device Boxes: IPEX FS/FD series or approved equal in accordance with B8.

2.4 CONDUIT BOXES FOR PVC CONDUIT

.1 Non-metallic PVC boxes with mounting feet for surface wiring of devices.

.2 Acceptable products: Ipex or approved equal in accordance with B8.

2.5 MASONRY BOXES

.1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

2.6 CONCRETE BOXES

.1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.7 CONDUIT BOXES

.1 Cast FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

2.8 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

2.9 SERVICE FITTINGS

.1 'High tension' receptacle fitting made of 2-piece die-cast aluminum with brushed aluminum housing finish for 1 duplex receptacles. Bottom plate with two knockouts for centered or offset installation. 12 x 102 mm extension piece as indicated.

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 and armoured cable connections. Reducing washers are not allowed.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA C22.2 No. 18.1:13 (R2022), Metallic outlet boxes (Tri-national standard, with UL 514A and ANCE NMX-J-023/1).

.2 CSA C22.2 No. 45-M1981(R2008), Rigid Metal Conduit.

.3 CSA C22.2 No. 56 (R2022), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.4 CSA C22.2 No. 211.2:06 (R2021), Rigid PVC (Un-plasticized) Conduit.

.5 CAN/CSA C22.2 No. 227.1:19 (R20223, Electrical Non-metallic Tubing.

.6 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

.3 Submittals

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures for the following:

.1 Conduit fittings

.2 Fittings for hazardous locations.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

.4 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling.

Part 2 Products

2.1 GENERAL

.1 Material Requirements:

.1 Main Floor and lower level non-hazardous circuits: PVC

.2 Main floor to wet well hazardous circuits: Rigid Aluminum (threaded)

.3 Wet Well: Rigid Aluminum (threaded)

.4 Main floor to valve chamber hazardous circuits: Rigid Aluminum (threaded)

.5 Valve Chamber: Rigid Aluminum (threaded)

2.2 RIGID PVC CONDUIT

.1 Meets CSA C22.2 No. 211.2.

.2 Minimum conduit size: 19 mm, unless specifically indicated on the drawings or approved by the Contract Administrator.

2.3 FLEXIBLE METAL CONDUIT

.1 To CSA C22.2 No. 56, liquid-tight flexible metal.

.2 Minimum conduit size: 19 mm, unless specifically indicated on the drawings or approved by the Contract Administrator.

2.4 RIGID METAL CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, aluminum, threaded.

2.5 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller.

.2 Two-hole steel straps for conduits larger than 50 mm.

.3 Beam clamps to secure conduits to exposed steel work.

.4 Channel type supports for two or more conduits at 1.5 m oc.

.5 Threaded rods, 6 mm dia., to support suspended channels.

2.6 CONDUIT SPACERS

.1 PVC coated malleable iron spacers, CSA approved for the purpose.

.2 Aluminum channel may be utilized where conduits are grouped, however a non-metallic spacer must be provided between the aluminum channel and concrete.

2.7 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified.

.2 Coating: same as conduit.

.3 Factory "ells" where 90° bends are required for 25 mm and larger conduits.

.4 Watertight connectors and couplings for EMT. Set-screws are not acceptable.

2.8 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.9 FISH CORD

.1 Polypropylene.

Part 3 Execution

3.1 ROUTING

.1 Locate conduits containing communication and low voltage conductors away from conduits containing power wiring.

.2 Route conduits on existing or new pipe rack or suspended channels where possible.

.3 Avoid routes that would interfere with any potential maintenance activities such as but not limited to:

.1 Roof hatches.

.2 Mechanical Dampers.

.3 Building/Equipment door openings and hoists.

.4 Where not specifically shown in detail on the drawings, review proposed conduit routing with Contract Administrator prior to installation. Comply with all routing changes requested by the Contract Administrator.

3.2 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits in finished areas.

.3 Surface mount conduits except in mechanical and electrical service rooms and in unfinished areas.

.4 Use rigid aluminum threaded conduit except where specified otherwise.

.5 Use explosion proof flexible connection for connection to explosion proof motors.

.6 Install conduit sealing fittings in hazardous areas. Fill with compound. Refer to hazardous are location plan drawings.

.7 Minimum conduit size for lighting and power circuits: 19 mm.

.8 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.9 Mechanically bend steel conduit over 19 mm dia.

.10 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.11 Install fish cord in empty conduits.

.12 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.13 Dry conduits out before installing wire.

.14 Install ground bonding wire in all conduits. Size bonding wire as per CEC Table 16.

.15 Underground Conduits

.1 Slope conduits to provide drainage.

.16 Surface Conduits

.1 Run parallel or perpendicular to building lines.

.2 Group conduits wherever possible on suspended or surface channels.

.3 Provide a minimum space of 12 mm between conduits.

.4 Do not pass conduits through structural members except as indicated.

.5 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

.6 Install spacers as required to provide a space between the conduits and the supporting surface, with a minimum space as follows:

.1 Above grade spaces not classified as CEC Category 1 or 2:

.1 Drywall / Wood surfaces: no space required

.2 Masonry / concrete surfaces: 6 mm

.2 Below grade spaces: 12 mm

.17 Colour Coding

.1 As per the City of Winnipeg Electrical Design Guide (510276-0000-47ER-0001)

3.3 PVC CONDUIT

.1 Concrete Penetrations:

.1 Seal and fire stop penetration around conduit with CSA approved assembly for the installation conditions.

.2 Maximum spacing between supports for rigid PVC conduit:

.1	27mm conduit	0.75 m
.2	35mm conduit	0.75 m
.3	41mm conduit	1.2 m
.4	53mm conduit	1.5 m
.5	63mm conduit	1.5 m
.6	78mm conduit	1.5 m
.7	91mm conduit and larger	2.0 m

3.4 METAL CONDUIT

.1 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.2 Mechanically bend conduits over 19 mm in diameter.

.3 Concrete Penetrations:

.1 Sleeves for Aluminum Conduit

.1 Install schedule 40 galvanized steel pipe, sized for free passage of conduit.

.2 Seal and fire stop penetration around conduit with CSA approved assembly for the installation conditions.

.2 Maximum spacing between supports for rigid metallic conduit:

.1	16mm conduit:	1.0 m
.2	21mm conduit:	1.5 m
.3	27mm conduit	1.5 m
.4	35mm conduit	2.0 m
.5	41mm conduit and larger	2.5 m

3.5 LIQUID-TIGHT FLEXIBLE CONDUIT

.1 Use as raceways at all motors, pipe-mounted control devices, and other devices subject to movement or water.

.2 At all motors provide a short length before connecting to the motor terminal box. Minimum length shall be 450 mm plus four times the conduit diameter.

.3 Provide a separate ground wire within flexible conduit, bonded to motor frames and system ground.

3.6 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended or surface channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

.7 Provide stand-of conduit clamp / clip.

3.7 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.

3.8 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel. Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.

.5 Do not place conduits is slabs in which slab thickness is less than 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

3.9 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

.1 Run conduits 25 mm and larger below slab and encased in 75 mm concrete envelope. Provide 50 mm of sand over concrete envelope below floor slab.

3.10 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

3.11 INSTALLATIONS IN CATEGORY 1 LOCATIONS

.1 Arrange to provide drainage at frequent intervals to suitable locations.

.2 Equip with approved fittings to permit the moisture to drain out of the system.

.3 Install the conduit with a minimum of 12 mm space from the supporting surface.

.4 Install every joint to be water-tight.

.5 Where conduit leaves a warm room and enters a cooler atmosphere, seal the conduit and arrange the conduit in a manner to avoid condensation accumulation at the seal.

3.12 INSTALLATIONS IN CATEGORY 2 LOCATIONS

.1 Comply with all requirements of Category 1 locations.

3.13 INSTALLATIONS IN HAZARDOUS ZONE 1 LOCATIONS

.1 Explosion proof conduit sealing fittings:

.1 Install sealing fittings as indicated and on all new conduit installations to meet CEC requirements.

.2 Add sealing compound following manufacturer’s instructions.

3.14 INSTALLATIONS IN HAZARDOUS ZONE 2 LOCATIONS

.1 Explosion proof conduit sealing fittings:

.1 Install sealing fittings as indicated and on all new conduit installations to meet CEC requirements.

.2 Add sealing compound following manufacturer’s instructions.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.1 No.126.1-17 (R2022), Metal Cable Tray Systems.

.2 CAN/CSA C22.1 No.126.2-02 (R2022), Non Metallic Cable Tray Systems.

.3 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

.3 National Electrical Manufacturers Association (NEMA)

.1 NEMA VE 1-2017, Metal Cable Tray Systems.

.2 NEMA VE 2-2024, Cable Tray Installation Guidelines.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals 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.

.4 Identify types of cable trays used.

.5 Show actual cable tray installation details and suspension system.

Part 2 Products

2.1 CABLE TRAY

.1 Cable tray and fittings: to NEMA VE 1 and CAN/CSA C22.1 No. 126.1.

.2 Trays: Ladder with 300mm rung spacing, aluminum, 152mm wide with depth of 101 mm.

.3 Load rating of 75kg/m with a 2.4m (8’) support spacing

.4 Fittings: horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion joints and reducers where required, manufactured accessories for cable tray supplied.

.1 Radii on fittings: 610 mm minimum.

.5 Barriers where different voltage systems are in same cable tray.

.6 Ground cable trays with #2 AWG bare copper conductor attached to each tray section in accordance with CEC requirements.

.7 Fire stop system at penetrations.

2.2 SUPPORTS

.1 Provide splices for a continuously grounded system as required.

.2 Support as per NEMA VE 2 to achieve required load ratings.

Part 3 Execution

3.1 INSTALLATION

.1 Install complete cable tray system in accordance with NEMA VE 2.

.2 All cable tray installations shall be installed in accordance with manufacturer's requirements and the requirements of the current version of the Canadian Electrical Code.

.3 Provide barriers between different system voltages.

.4 Maintain fire separations with approved products.

.5 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.47-13 (R2023), Air-Cooled Transformers (Dry Type).

.2 CSA C9:17 (R2022), Dry-Type Transformers.

.3 CAN/CSA-C802.2-18 (R2023), Minimum Efficiency Values for Dry Type Transformers.

.4 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

.3 National Electrical Manufacturers Association (NEMA)

.4 Canada's Energy Efficiency Act and Energy Efficiency Regulations

1.3 ACTION AND INFORMATIONAL 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 dry type transformers and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00, Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for dry type transformers for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store and protect dry type transformers from nicks, scratches, and blemishes.

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 DESIGN DESCRIPTION

.1 XFMR-L75.

.1 Type: ANN.

.2 3 phase, 45kVA, 600V:120/208V, 60Hz

.3 Voltage taps: Minimum two taps above and two taps below at 2.5% increments, full capacity.

.4 Insulation Class: 220°C

.5 Temperature rise: 150°C

.6 Basic Impulse Level (BIL): standard.

.7 Hipot: standard.

.8 Average sound level: standard.

.9 Impedance at 17 degrees C: standard.

.10 Enclosure: NEMA 1.

.11 Mounting: bottom (as indicated on drawings).

.12 Finish: in accordance with Section 26 05 00 – Common Work Results for Electrical.

.13 Copper windings.

.14 Lifting hooks for lifting complete transformer assembly.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Label size: in accordance with the Electrical Design Guide (510276-0000-47ER-0001), Revision 05.

.3 Indicate equipment identifier, KVA rating, primary and secondary voltage.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for transformers installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Contract Administrator.

.2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 INSTALLATION

.1 Mount dry type transformers up to 75 kVA as indicated on drawings.

.2 Mount dry type transformers above 75 kVA on floor.

.3 Ensure adequate clearance around transformer for ventilation.

.4 Install transformers in level upright position.

.5 Remove shipping supports only after transformer is installed and just before putting into service.

.6 Loosen isolation pad bolts until no compression is visible.

.7 Make primary and secondary connections in accordance with wiring diagram.

.8 Energize transformers after installation is complete.

.9 Make conduit entry into bottom 1/3 of transformer enclosure.

3.3 TESTING

.1 Utilize test form provided. Complete test form in full.

.2 Perform an insulation-resistance test. Individually test each winding with all other windings grounded, and test winding to winding, with both windings ungrounded. The test voltage shall be 1000 VDC, unless otherwise indicated by the manufacturer. The test duration shall be one minute.

.3 Measure and record the voltage on the primary and secondary of the transformer. Adjust the tap position as required. Record final tap position and voltage.

Schedule 26 12 17-1: Transformers

Identifier	Location	Size	Voltage	Enclosure Type
XFMR-L75	Main Floor	45 kVA	600:120/208V, 3Ø	CSA NEMA 1

3.4 CLEANING

.1 Progress Cleaning:

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by dry type transformers installation.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCE STANDARDS

.1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE C37.30.1-2022, IEEE Standard Requirements for AC High-Voltage Air Switches Rated Above 1000 V.

.2 ANSI/IEEE C37.30.1a-2017, IEEE Standard Requirements for AC High-Voltage Air Switches Rated Above 1000 V – Amendment 1: Criteria for acceptance.

.3 ANSI/IEEE 141-1993, IEEE Recommended Practice for Electric Power Distribution for Industrial Plants.

.2 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.31:23, Switchgear Assemblies.

.2 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.3 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

1.3 ACTION AND INFORMATIONAL 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 interlock systems 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, labelled with manufacturer's name and address.

Part 2 Products

2.1 INTERLOCK SYSTEMS

.1 Kirk key interlocks Type F for normal power breaker and standby power breaker to prevent:

.1 Standby power breaker closing unless normal power breaker is open.

.2 Normal power breaker closing unless standby breaker is open.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for interlock systems installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 CLEANING

.1 Progress Cleaning:

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for recycling.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International)

.1 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 CSA C22.2 No.29-15 (R2019), Panelboards and Enclosed Panelboards.

.2 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

1.3 ACTION AND INFORMATIONAL 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 panelboards 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 Manitoba, Canada.

.2 Include on drawings:

.1 Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00, Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for panelboards for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store and protect panelboards from nicks, scratches, and blemishes.

.2 Replace defective or damaged materials with new.

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.

.2 208 V panelboards: bus and breakers rated as indicated on 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 Minimum of 2 flush locks for each panel board.

.6 Two keys for each panelboard and key panelboards alike.

.7 Copper bus with neutral of equal ampere rating of mains.

.8 Mains: suitable for bolt-on breakers.

.9 Trim with concealed front bolts and hinges.

.10 Trim and door finish: baked enamel.

.11 Isolated ground bus.

.12 Include grounding busbar with minimum 3 terminals for bonding conductor equal to breaker capacity of the panel board.

2.2 BREAKERS

.1 Breakers: to Section 26 28 16.02, Moulded Case Circuit Breakers.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00, Common Work Results for 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, mounted in plastic envelope at inside of panel door.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for panelboards installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed Departmental Representative.

3.2 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height specified in Section 26 05 00, Common Work Results for Electrical or as indicated.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus with respective neutral identified.

3.3 CLEANING

.1 Progress Cleaning:

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by panelboard installation.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCE STANDARDS

.1 Electrical Equipment Manufacturers Association of Canada (EEMAC)

.2 Canadian Standards Association (CSA International)

.1 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.3 City of Winnipeg

.1 Electrical Design Guide (510276-0000-47ER-0001), Revision 05

.2 City of Winnipeg Automation Design Guide (612620-0013-40ER-0001), Revision 03

.3 Identification Standard

.4 Winnipeg Electrical By-law including Technical Interpretations, latest edition

1.3 ACTION AND INFORMATIONAL 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 motor control centres 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 Manitoba, Canada.

.2 Indicate on 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.

.4 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, and cleaning procedures.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00, Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for motor control centre for incorporation into manual.

.1 Include data for each type and style of starter.

1.5 EXTRA STOCK MATERIALS

.1 Submit maintenance materials in accordance with Section 01 78 00, Closeout Submittals.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect motor control centres from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SUPPLY CHARACTERISTICS

.1 MCC-L74: 600 VAC, 600A, 60 Hz, Wye connected, 3 Phase, 3 Wire (or as indicated on drawings).

2.2 GENERAL DESCRIPTION

.1 Compartmentalized vertical sections with common power busbars.

.2 Floor mounting, free standing, enclosed dead front.

.3 Indoor CSA gasketed enclosure.

.4 Suitability for Service Entrance: Yes.

.5 Wiring class: Class 1, Type B-D or B-T as shown on the drawings.

.6 Compartment Nameplates:

.1 White background with black letters.

.2 Identification as indicated on the Drawings.

.7 Nameplates for Control Equipment Flush Mounted on Compartments:

.1 White background with black letters. Black background with white text will not be accepted.

.2 Identification as indicated on the Drawings.

.3 Locations as shown on the Drawings

.8 SCCR: 65 kA minimum.

.9 Acceptable manufacturer:

.1 Schneider Electric Model 6.

2.3 VERTICAL SECTION CONSTRUCTION

.1 Independent vertical sections fabricated from rolled flat steel sheets bolted together to form rigid, completely enclosed assembly.

.2 Each vertical section divided into compartment units, height as indicated.

.3 Each unit to have complete top and bottom steel plate for isolation between units.

.4 Horizontal wireways, equipped with cable supports, across top and bottom, extending full width of motor control centre, isolated from busbars by steel barriers.

.5 Vertical wireways c/w doors for load and control conductors extending full height of vertical sections, and equipped with cable tie supports. Installation wiring to units accessible with doors open and units in place.

.6 Openings, with removable cover plates, in side of vertical sections for horizontal wiring between sections.

.7 Incoming cables to enter at top.

.8 Provision for outgoing cables to exit via top or bottom with terminals.

.9 Removable lifting means.

.10 Provision for future extension of both ends of motor control centre including busbars without need for further drilling, cutting or preparation in field.

.11 Divide assembly for shipment to site, as indicated complete with hardware and instructions for re-assembly.

.12 Provide all spaces complete with bussing hardware and other accessories required so that additional combination starter units can be readily installed. Provide barriers to isolate the space from all buswork.

.13 Provide barriers to isolate all buswork to prevent accidental contact when starter units are removed or spaces are provided. Barriers shall also provide phase-to-phase isolation of the vertical bus.

.14 Master nameplate lamacoid: text as follows:

.1 Line 1 is to be MCC identifier as indicated on the Drawings, for example

.2 “MCC-L74”.

.3 Line 2 is to be the voltage, for example “600V, 3-Phase”.

.4 Line 3 is to be the rating, for example “600A, 3-Wire”.

2.4 SILLS

.1 Continuous channel iron floor sills for mounting bases with 19 mm diameter holes for bolts.

2.5 BUSBARS

.1 Main horizontal and branch vertical, three phase and neutral high conductivity plated aluminum 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: as indicated.

.2 Branch vertical busbars: 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.

.5 Bus supports: with high dielectric strength, low moisture absorption, high impact material and long creepage surface designed to discourage collection of dust.

2.6 GROUND BUS

.1 Copper ground bus extending entire width of motor control centre.

.1 Size: 6 x 25 mm (1/4" x 1")

.2 Plating: Tin

.3 Location: Top

.2 Vertical ground bus strap, full height of section, tied to horizontal ground bus, engaged by plug-in unit ground stab.

.1 Material: tin plated copper.

2.7 TRANSIENT VOLTAGE SURGE SUPPRESSOR/SURGE PORTECTION DEVICE

.1 Supply and install a Transient Voltage Surge Suppressor (TVSS) where shown on the drawings.

.2 Requirements:

.1 TVSS units and all components shall be designed, manufactured, and tested in accordance with the latest applicable UL standard (ANSI/UL 1449 3rd Edition).

.2 Voltage: Refer to drawings.

.3 Maximum Continuous Operating Voltage (MCOV): The MCOV shall not be less than 115% of the nominal system operating voltage.

.4 The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.

.5 Protection Modes – The TVSS must protect all modes of the electrical system being utilized. The required protection modes are:

.1 3Ø, 3W System: L-L, and L-G

.2 1Ø, 3W Wye System: L-L, L-N, L-G, and N-G

.6 Nominal Discharge Current (In) – All TVSSs applied to the distribution system shall have a 20kA In rating regardless of their TVSS Type (includes Types 1 and 2) or operating voltage. TVSSs having an In less than 20kA shall be rejected.

.7 ANSI/UL 1449 3rd Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 3rd Edition VPR for the device shall not exceed the following:

.1 L-N, L-G, N-G:

.1 120/208 V: 700V

.2 600 V: 1500V

.2 L-L:

.1 120/208 V: 1200V

.8 TVSS Design

.1 Maintenance Free Design – The TVSS shall be maintenance free and shall not require any user intervention throughout its life. TVSSs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. TVSSs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. TVSSs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

.2 Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable TVSS modules shall not be accepted.

.3 Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method.

.4 Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall utilize low impedance conductors.

.5 Monitoring Diagnostics – Each TVSS shall provide the following integral monitoring options:

.1 Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of each protection mode on each phase.

.6 The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.

.7 Overcurrent Protection

.1 The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection

element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.

.8 Surge Current Capacity – The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

.1 600V Equipment – Service Entrance: 240 kA

.2 600V Equipment – Not Service Entrance: 120 kA

.9 Installation Requirements:

.1 The TVSS shall be installed immediately following the load side of the main breaker or main switch.

.2 The MCC shall be capable of re-energizing upon removal of the TVSS.

.3 Utilize a breaker, appropriately rated as directed by the TVSS manufacturer, to connect the TVSS to the MCC. The TVSS shall be located directly adjacent to the circuit breaker.

.4 The TVSS shall be included and mounted within the MCC by the manufacturer of the MCC where shown on the drawings.

.1 The complete MCC including the TVSS shall be CSA/cUL listed.

2.8 POWER METER (MCC-L74.PM)

.1 Where indicated on the drawings, provide a microprocessor based multifunction power meter.

.2 Requirements:

.1 Multifunction electrical measurement on 3 phase power systems.

.2 User programmable for voltage range to any PT ratio.

.3 Integrated display.

.4 Accept a direct voltage input range of up to 347 Volts Line to Neutral, and a range of up to 600 Volts Line to Line.

.5 Accept a current input of up to 5 Amps nominal, 10 Amps full scale.

.6 Programmable for current to any CT ratio. The use of DIP switches for selecting

.7 fixed ratios shall not be acceptable.

.8 Maximum burden of 0.0625 VA at 10 Amps.

.9 The meter shall have an accuracy of +/- 0.25% or better for volts and amps, and

.10 1.5% for power and energy functions.

.11 The meter shall provide true RMS measurements of voltage, phase to neutral and phase to phase; current, per phase and neutral.

.12 Function Requirements:

.1 Volts, Amps, kW, kVAR, PF, kVA (per phase)

.2 Frequency, kWh, kVAh, kVARh

.3 Harmonics measurement, individual, even, and odd, up to 15th.

.13 Operating Temperature:

.1 -20°C to +60°C ambient.

.3 Communications ports:

.1 RS-485 supporting Modbus/RTU.

.2 10 Mbps or 10/100 Mbps Ethernet supporting Modbus/TCP.

.4 Acceptable Products:

.1 Schneider Electric PM8000 series.

.2 Or approved equal in accordance with B8

2.9 VOLTAGE MONITORING RELAY, ESL-L742

.1 Requirements,

.1 Suitable for direct connection to MCC bus having nominal operating voltage of 600 V line-to-line.

.2 Adjustable nominal input voltage via potentiometer from 500 V to 600V.

.3 Undervoltage trip point:

.1 Adjustable from 88% to 92% of nominal voltage.

.2 Voltage unbalance:

.1 Adjustable from 2% to 10%.

.3 Phase loss detection:

.1 Triggered upon ≥ 15% unbalance.

.2 Response time ≤ 200 msec.

.4 Trip delay:

.1 Adjustable from 1 to 30 sec.

.5 Automatic reset (restart) delay:

.1 Adjustable from 0.6 to 64 sec.

.2 Adjustable random restart delay from 3 to 15 sec.

.6 Faults stored in non-volatile memory.

.1 Storage of the last 10 faults.

.7 Status and faults displayed on LED readout.

.8 Remote reset input.

.9 CSA approved.

.4 Relay output:

.1 Equipped with, at minimum, one Form C electromechanical dry contact output for monitoring.

.2 Relay contact to be normally open, held-closed during normal operation, and open upon an alarm condition.

.3 Actuate relay on any of the following:

.1 Phase A-B, B-C, or C-A voltage less than 575 V.

.2 Voltage unbalance greater than 10%.

.4 Rated at 10A resistive @ 250 VAC, 6A inductive (0.4 PF) @ 250 VAC.

.5 Mechanical life of 1x107 operations.

.5 Acceptable products:

.1 Littlefuse DLMHBRAAA.

.2 Or approved equal in accordance with B8.

2.10 MOTOR STARTERS AND DEVICES

.1 Equip the MCC with combination starters as specified and shown on the drawings.

.2 Refer to Section 26 29 10 – Motor Starters to 600 V.

2.11 STARTER UNIT COMPARTMENTS

.1 Units EEMAC size 5 and smaller, circuit breaker units 225A and smaller, plug-in type with self-disconnect. Guide rail supports for units to ensure that stabs make positive contact with vertical bus. Provision for units to be installed or removed, off load, while buses energized.

.2 Unit mounting:

.1 Engaged position - unit stabbed into vertical bus.

.2 Withdrawn position - unit isolated from vertical bus but supported by structure. Terminal block accessible for electrical testing of starter.

.3 Provision for positive latching in either engaged or withdrawn position and padlocking in withdrawn position.

.4 Stab-on connectors free-floating tin-plated clips, self-aligning, backed up with steel springs.

.3 External operating handle of circuit switch interlocked with door to prevent door opening with switch in "on" position. Provision for 3padlocks to lock operating handle in "off" position and lock door closed.

.4 Hinge unit doors on same side.

.5 Overload relays manually reset from front with door closed.

.6 Pushbuttons and indicating lights mounted on door front.

.7 Devices and components by one manufacturer to facilitate maintenance.

.8 Pull-apart terminal blocks for power and control to allow removal of starter units without removal of field wiring.

.9 Control wiring shall be extended from each starter module to the control terminal section, including all auxiliary contacts. A multi unit style terminal block having screw type terminal connections shall be installed on standoff supports on back plate.

.10 All terminals shall be number coded or otherwise suitably identified to indicate which section or module of the MCC they are associated with and their function.

.11 Complete control wiring diagrams for each starter with conductor identification clearly shown shall be affixed to the interior cover of the starter section or provide a book of wiring diagrams for all starters in each MCC.

.12 Primary and secondary high rupturing capacity (HRC) fusing shall be installed on the control transformer.

.13 Equip door of each individual unit with a removable plate replaceable with similar plate complete with pushbuttons, pilot lights or selector switches as required. Use pilot lights of push-to-test type and push button of heavy-duty oil tight construction.

2.12 WIRING IDENTIFICATION

.1 Provide wiring identification in accordance with Section 26 05 00, Common Work Results for Electrical.

2.13 EQUIPMENT IDENTIFICATION

.1 Identify Motor Control Centre with nameplates as follows:

.2 Nameplates:

.1 Lamacoid 3 mm thick plastic lamacoid nameplates, white face, black lettering, mechanically attached with self tapping screws.

2.14 NAMEPLATE SIZES

.1 Motor control centre main nameplate 70 x 120 mm 1 line 40 mm high letters

.2 Individual compartment nameplates 30 x 90 mm 3 lines 5 mm high letters

.3 Compartment Device namplates 30 x 25 mm 2 lines 3 mm high letters

.2 Wording on nameplates to be approved by Contract Administrator prior to manufacture.

.3 Allow for average of twenty-five (25) letters per nameplate.

.4 Identification to be English.

2.15 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 exterior light grey to ANSI 61 grey enamel, unless otherwise specified.

.2 Paint interior white, unless otherwise specified.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during construction.

.3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

2.16 SOURCE QUALITY CONTROL

.1 Provide manufacturer's type test certificates including short circuit fault damage certification up to short circuit values specified under bus bracing.

.2 Contract Administrator to witness standard factory testing of complete motor control centre including operation of switches, circuit breakers, starters and controls.

2.17 SPARE PARTS

.1 One (1) set of fuses of each type and size.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for motor control centres installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Contract Administrator.

.2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 INSTALLATION

.1 Provide housekeeping pad below the MCC lineups as per the drawings.

.2 Set and secure motor control centre in place on channel bases, rigid, plumb and square to building floor and wall.

.3 Make field power and control connections as indicated.

.4 Ensure correct overload heater elements are installed.

.5 Coordinate concrete pad with bevelled edges as shown on the Drawings, sized to suit MCCs, install and level channel sills and mount MCCs.

3.3 TESTING

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results – For Electrical.

.2 Utilize test forms to be provided by the Contract Administrator. Complete test forms in full.

.3 Provide separate completed test forms for each MCC starter section.

3.4 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Ensure moving and working parts are lubricated where required.

.3 Operate starters in sequence to prove satisfactory performance of motor control centre during 8 hours period.

3.5 CLEANING

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

.2 Section 26 29 03 – Control Devices.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Indicate detail construction, dimension, capacities, weights and electrical performance characteristics of equipment or material.

Part 2 Products

2.1 MATERIALS - GENERAL

.1 NEMA 4X rated enclosure for all locations except within electrical rooms and control rooms.

.2 NEMA 12 rated enclosures for devices within electrical rooms or control rooms unless otherwise specified.

.3 Door: hinged, minimum 3 point latching, with padlocking means.

.4 Door interlocks

.5 Control devices as indicated in 26 29 03 – Control Devices.

2.2 DISTRIBUTION PANEL (DP-L71)

.1 600V, 400A, 3 Phase, 4 Wire, 25kA (or as indicated on drawings)

.2 Service entrance rated

.3 Breakers shall be provided and installed before shipping

.4 5052 Aluminum Construction

.5 Type 12 Enclosure (or as indicated on drawings)

.6 Bottom–Mount Design (free standing)

.7 Certified to cULus Standards

.8 Dead Front Cover

.9 Bottom, top, and side cable entry capable

.10 Hinges with Removable Pins

.11 Manufacturer: Schneider or approved equal

2.3 DISTRIBUTION PANEL (DP-L72)

.1 600V, 600A, 3 Phase, 4 Wire, 25kA (or as indicated on drawings)

.2 Breakers shall be provided and installed before shipping.

.3 5052 Aluminum Construction

.4 Type 4 Weatherproof Enclosure (or as indicated on drawings) c/w enclosure heater.

.5 Provide additional enclosure attached to DP-L72 to allow for the installation of the load bank current transformers as indicated on drawings.

.6 Bottom–Mount Design (free standing)

.7 Certified to cULus Standards

.8 Dead Front Cover

.9 Bottom, top, and side cable entry capable.

.10 Stainless Steel Hinges with Removable Pins

.11 Door c/w 3 Point SS Pad-Lockable Handle

.12 Manufacturer: Schneider or approved equal

.13 Seal all conduit sleeves/cable entries to prevent cold air from entering the enclosure through the conduit sleeve.

2.4 VFD ENCLOSURE (VFD-L01 AND VFD-L02)

.1 600V, 200HP, (or as indicated on drawings)

.2 5052 Aluminum Construction

.3 Type 12 Enclosure (or as indicated on drawings)

.4 Bottom–Mount Design (free standing)

.5 Certified to cULus Standards

.6 Bottom, top, and side cable entry capable.

.7 Stainless Steel Hinges with Removable Pins

.8 Door c/w 3 Point SS Pad-Lockable Handle

.9 Disconnects as indicated on drawings.

.10 Load side filters as indicated on drawings.

.11 Selector Switches (HS-L010-1, HS-L020-1):

.1 Standard 3 position, maintained, labelled as indicated on drawings.

.12 Emergency Stop Pushbuttons (HSS-L010-4, HSS-L020-4):

.1 Supply and install two-position maintained emergency stop operator stations on enclosure door of each VFD enclosure.

.2 Requirements:

.1	Type:	Push-Pull / Twist to release
.2	Ingress Protection:	NEMA 4X
.3	Contact Life:	1,000,000 cycles
.4	Mechanical Life:	250,000 cycles
.5	Contact Rating:	10 A
.6	Contact Configuration:	As shown on the drawings
.7	Illumination:	Not required unless otherwise indicated.

.3 Acceptable Products:

.1 Schneider Electric Harmony 9001 K Series,

.2 Allen-Bradley 800H series,

.3 Or approved equal in accordance with B8.

.13 Process Meters (VIC-L010-1 & VIC-L010-2 for VFD-L01. VIC-L020-1 & VIC-L020-2 for VFD-L02.)

.1 Display digital reading of process value and provide control of output relays based on input.

.2 Display:

.1 Dual-line 6-digit

.2 Type: Alpha-numeric, LED.

.3 Update rate: 5/second (200 ms) minimum.

.4 Character colour: red.

.3 Features:

.1 Internal 24V dc loop power supply for providing loop power to external devices.

.4 Analog Inputs:

.1 0-20 mA, 4-20 mA, +/- 10V, 0-5V, 1-5V field selectable.

.2 Input impedance:

.1 Voltage ranges: > 500k Ω.

.2 Current ranges: 50 - 100 Ω.

.5 Discrete Inputs:

.1 Allows for external interlock of output relays

.6 Output relays:

.1 Qty 4, Form C, unless otherwise noted.

.2 Electrical rating: 3 Amps at 30 VDC and 125/250 VAC resistive.

.7 Analog Outputs:

.1 Isolated 4-20 mA

.2 Settable to input process variable

.8 Mounting: panel mount, 1/8 DIN (92 mm x 45 mm) cutout.

.9 Power supply: 85-265 VAC.

.10 Manufacturer and model:

.1 Precision Digital PD6000-6R7

.2 Or approved equal in accordance with B8.

.11 Mount process meters on VFD enclosure door such that they can be accessed for programming without entering the VFD enclosure.

Part 3 Execution

3.1 INSTALLATION

.1 Assemble enclosures in accordance with manufacturer's instructions and mount on concrete housekeeping pad.

.2 Mount equipment in enclosure.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Switches, receptacles, wiring devices, cover plates and their installation.

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-C22.2 No.42:10 (R2022), General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CSA-C22.2 No.42.1:13 (R2022), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA-C22.2 No.55:15 (R2020), Special Use Switches.

.4 CSA-C22.2 No.111-18 (R2023), General-Use Snap Switches (Trinational standard with UL 20 and NMX-J-005-ANCE)

.5 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

Part 2 Products

2.1 SWITCHES

.1 15 A, 120 V, single pole, double pole, three-way, four-way industrial grade switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111 as required.

.2 Manually-operated general purpose ac switches with following features:

.1 Terminal holes approved for No. 10 AWG wire.

.2 Silver cadmium oxide contacts.

.3 Fully enclosed with urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 Brown toggle.

.3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.4 Switches of one manufacturer throughout project.

.5 Acceptable materials: Hubbell 1200 Series or equivalent.

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 or Brown urea moulded housing.
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Break-off links for use as split receptacles.
.4 Eight back wired entrances, four side wiring screws.
.5 Triple wipe contacts and rivetted grounding contacts.

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

.1 Brown urea 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 Acceptable materials: Hubbell 5252 or equivalent.

.6 Receptacles located in hazardous areas shall be rated for the area and suitable for connected/disconnecting of equipment while circuit is live.

2.3 COVER PLATES

.1 Stainless steel or PVC cover plates for wiring devices.

.2 Cover plates from one manufacturer throughout project.

.3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 Stainless steel, vertically brushed, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.

.5 Weatherproof double lift spring-loaded stainless steel or PVC cover plates, complete with gaskets for duplex receptacles as indicated on the drawings.

.6 Weatherproof spring-loaded stainless steel or PVC cover plates complete with gaskets for single receptacles or switches as indicated on the drawings.

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.

.4 Mount lighting fixture receptacles local to fixtures.

.3 Cover plates:

.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

.4 Install a permanent label or lamacoid for all wiring devices indicating the circuit(s) contained within.

.1 Example: L75-2 (Panel L75, circuit 2)

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International)

.1 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 CSA C22.2 No. 5:16 (R2021), Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2016).

.2 City of Winnipeg

.1 Electrical Design Guide (510276-0000-47ER-0001), Revision 05

.2 Winnipeg Electrical By-law including Technical Interpretations, latest edition

1.3 ACTION AND INFORMATIONAL 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 circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Include time-current characteristic curves for breakers with ampacity of 100 A and over.

.4 Certificates:

.1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit 2 copies of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.

.1 Production certificate of origin must be submitted to Departmental Representative for approval.

.2 Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.

.3 Any work of manufacturing, assembly or installation to begin only after acceptance of production certificate of origin by Departmental Representative. Unless complying with this requirement, Departmental Representative reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.

.4 Production certificate of origin must contain:

.1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.

.2 Licensed dealer's name and address and person of distributor responsible for Contractor's account.

.3 Contractor's name and address and person responsible for project.

.4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.

.5 Name and address of building where circuit breakers will be installed.

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, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store and protect circuit breakers from nicks, scratches, and blemishes.

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Ground-fault circuit-interrupters, Circuit breakers, and Moulded-case circuit breakers: to CSA C22.2 No. 5

.2 Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation.

.3 Common-trip breakers: with single handle for multi-pole applications.

.4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.5 Circuit breakers with interchangeable trips as indicated.

2.2 DP-L71 MAIN BREAKER

.1 Requirements as stated below or as indicated on Single Line Diagram:

.1 Frame Size: 400 Amps

.2 Sensor Rating: 350 Amps Trip

.3 Interrupting Rating: 25 kA @ 600 VAC

.4 Trip Unit Type: Electronic LSI, Factory Sealed

.5 Long Time PU: 0.42 – 1.00 A * Sensor Rating (Adjustable)

.6 Long Time Delay: 0.5 – 24 sec (Adjustable)

.7 Short Time PU: 1.5 – 10 * LTPU (Adjustable)

.8 Short Time Delay: 0.0 to 0.4 sec (Adjustable)

.9 Instantaneous: 2 – 15 * Sensor Rating (Adjustable)

.10 Poles: 3

.11 Model: Schneider Electric PowerPact P series with Micrologic 5.3 A (Ammeter) series trip unit or approved equal in accordance with B8.

2.3 DP-L71 BRANCH BREAKERS

.1 Requirements as stated below or as indicated on Single Line Diagram:

.1 Frame Size: 400 Amps

.2 Sensor Rating: 350 Amps Trip

.3 Interrupting Rating: 25 kA @ 600 VAC

.4 Trip Unit Type: Electronic LSI, Factory Sealed

.5 Long Time PU: 0.42 – 1.00 A * Sensor Rating (Adjustable)

.6 Long Time Delay: 0.5 – 24 sec (Adjustable)

.7 Short Time PU: 1.5 – 10 * LTPU (Adjustable)

.8 Short Time Delay: 0.0 to 0.4 sec (Adjustable)

.9 Instantaneous: 2 – 15 * Sensor Rating (Adjustable)

.10 Poles: 3

.11 Model: Schneider Electric PowerPact P series with Micrologic 5.3 A (Ammeter) series trip unit or approved equal in accordance with B8.

2.4 MCC-L74 MAIN BREAKERS

.1 Requirements as stated below or as indicated on Single Line Diagram:

.1 Frame Size: 400 Amps

.2 Sensor Rating: 400 Amps Trip

.3 Interrupting Rating: 65 kA @ 600 VAC

.4 Trip Unit Type: Electronic LSI, Factory Sealed

.5 Long Time PU: 0.42 – 1.00 A * Sensor Rating (Adjustable)

.6 Long Time Delay: 0.5 – 24 sec (Adjustable)

.7 Short Time PU: 1.5 – 10 * LTPU (Adjustable)

.8 Short Time Delay: 0.0 to 0.4 sec (Adjustable)

.9 Instantaneous: 2 – 15 * Sensor Rating (Adjustable)

.10 Poles: 3

.11 Model: Schneider Electric PowerPact P series with Micrologic 5.3 A (Ammeter) series trip unit or approved equal in accordance with B8.

.11 Main breakers shall be Kirk Key interlocked to prevent simultaneous energization of both breakers at once. The Alternate/Bypass breaker shall be Normally Open when the Normal breaker is closed.

2.5 MCC-L74 VFD BRANCH BREAKERS

.1 Requirements as stated below or as indicated on Single Line Diagram:

.1 Frame Size: 400 Amps

.2 Sensor Rating: 350 Amps

.3 Interrupting Rating: 65 kA @ 600 VAC

.4 Trip Unit Type: Electronic LSI, Factory Sealed

.5 Long Time PU: 0.42 – 1.00 A * Sensor Rating (Adjustable)

.6 Long Time Delay: 0.5 – 24 sec (Adjustable)

.7 Short Time PU: 1.5 – 10 * LTPU (Adjustable)

.8 Short Time Delay: 0.0 to 0.4 sec (Adjustable)

.9 Instantaneous: 2 – 15 * Sensor Rating (Adjustable)

.10 Poles: 3

.11 Model: Schneider Electric PowerPact P series with Micrologic 5.3 A (Ammeter) series trip unit or approved equal in accordance with B8.

2.6 THERMAL MAGNETIC BREAKERS < 100A

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

.2 Requirements as stated below or as indicated on Single Line Diagram:

.1 Trip Rating: As shown on the drawings.

.2 Interrupting Rating: 65 kA @ 600 VAC

.3 Type: Thermal Magnetic

.4 Poles: As shown on the drawings.

.5 Model: Schneider Electric PowerPact H series or approved equal in accordance with B8.

2.7 OPTIONAL FEATURES

.1 As indicated on drawings.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install circuit breakers as indicated.

.2 On circuit breakers with adjustable protection settings, set the protection settings as per the specifications and/or drawings.

3.3 CLEANING

.1 Progress Cleaning:

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for fused and non-fused disconnect switches.

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA C22.2 No.4:16 (R2020), Enclosed and Dead-front Switches.

.2 CSA C22.2 No.39:13 (R2022), Fuse holder Assemblies.

.3 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Indicate:

.1 Mounting method and dimensions.

.2 Enclosure types.

.3 Current rating.

.4 For fused disconnects, indicate fuse type.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Fusible, non-fusible, horsepower rated disconnect switch in CSA Enclosure, to CAN/CSA C22.2 No.4 sized as per drawings.

.2 Provision for padlocking in off switch position by three locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Quick-make, quick-break action.

.5 ON-OFF switch position indication on switch enclosure cover.

.6 Fuses: size as indicated on drawings; Fuse type references L1, L2, J1, R1, etc. have been adopted for use in this specification. Fuses to be product of one manufacturer:

.1 Class L fuses.

.1 Type L1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.2 Type L2, fast acting.

.2 Class J fuses.

.1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.2 Type J2, fast acting.

.3 Class R -R fuses.

.1 Type R1, (UL Class RK1), time delay, capable of carrying 500% of its rated current for 10 s minimum, to meet UL Class RK1 maximum let-through limits

.2 Type R2, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.3 Type R3, (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits

.4 Class C fuses.

.7 Fuse holders: to CSA C22.2 No.39 relocatable and suitable without adaptors, for type and size of fuse indicated.

.8 Install fuses in mounting devices immediately before energizing circuit

.9 Ensure correct fuses fitted to physically matched mounting devices.

.1 Install rejection clips for Class R fuses.

.10 Ensure correct fuses fitted to assigned electrical circuit

.11 Where UL Class RK1 fuses are specified, install warning label "Use only UL Class RK1 fuses for replacement" on equipment

.12 Label fused disconnects with maximum fuse size. Ex. “MAX. 30A FUSE”

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Indicate name of load controlled on size 4 nameplate.

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches as indicated and in accordance with the manufacturer’s recommendations.

.2 Mount securely such that top of switch is a maximum of 1600 mm (63”) above finished floor. Provide a minimum of 1000 mm (39”) clear floor space in front of the switch.

3.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00, Common Work Results – Electrical.

.2 Nameplate for each disconnect switch Size 8 engraved in accordance with Section 26 05 00, Common Work Results – Electrical. Indicate disconnect equipment number, voltage, phase and MCC source feed.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International)

.1 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 CSA C22.2 No.14-18, Industrial Control Equipment.

.2 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

.3 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 1-2022, Industrial Control and Systems: General Requirements.

.2 NEMA ICS 2-2000 (R2020), Controllers, Contactors and Overload Relays Rated 600 V.

1.3 ACTION AND INFORMATIONAL 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 contactors and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00, Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for contactors for incorporation into manual.

.3 Include operating information required for start-up, synchronizing and shut-down of generating units.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location, off ground, indoors, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect contactors from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 CONTACTORS

.1 Contactors: to CSA C22.2 No.14.

.2 Electrically held and controlled by pilot devices as indicated and rated for type of load controlled. Half size contactors not accepted.

.3 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.

.4 Mount in NEMA 4 Enclosure when external to MCCs.

.5 Include following options in cover:

.1 Red or Green indicating lamp, as indicated.

.2 Stop-Start pushbutton, as indicated.

.3 Hand-Off-Auto selector switch, as indicated.

.4 On-Off selector switch, as indicated.

.6 Control transformer: in accordance with Section 26 29 03, Control Devices, factory wired and installed in contactor enclosure.

2.2 EQUIPMENT IDENTIFICATION

.1 Identify equipment in accordance with Section 26 05 00, Common Work Results for Electrical.

.2 Size 4 nameplate as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Install contactors and connect power wires and auxiliary control devices.

.2 Identify contactors with nameplates or labels indicating panel and circuit number.

.3 Test contactors in accordance with 26 05 00, Common Work Results for Electrical.

3.2 CLEANING

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.3 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by contactor installation.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International)

.1 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 CSA C22.2 No.14-18, Industrial Control Equipment.

.2 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

.3 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 1-2022, Industrial Control and Systems: General Requirements.

1.3 ACTION AND INFORMATIONAL 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 control devices 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 Manitoba, Canada.

.2 Include schematic, wiring, interconnection diagrams.

1.4 QUALITY ASSURANCE

.1 Conduct tests in accordance with Section 26 05 00- Common Work Results for Electrical.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for control devices for incorporation into manual.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors, off ground, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect control devices from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 AC CONTROL RELAYS

.1 Control Relays: to NEMA ICS 1 CSA C22.2 No.14.

.2 Convertible contact type: contacts field convertible from NO to NC, permanent magnet latched electrically held, double-voltage type with sliding barrier to permit access to contacts only or coil only, with pneumatic, solid state timer. Coil rating: overlap type.

2.2 RELAY ACCESSORIES

.1 Standard contact cartridges: normally-open - convertible to normally-closed in field.

2.3 PUSHBUTTONS

.1 Operator mushroom type. Black, with 1-NO and 1-NC, labels as indicated. Stop pushbuttons coloured red, labelled "Stop".

2.4 SELECTOR SWITCHES

.1 Standard maintained 2 position or 3 position as indicated on drawings.

.2 Labelled as indicated on drawings.

2.5 INDICATING LIGHTS

.1 Standard, full voltage, type, lens colour: as indicated, supply voltage: as indicated, lamp voltage: labels as indicated.

.2 Labelled as indicated on drawings.

2.6 EMERGENCY STOP PUSHBUTTONS

.1 Supply and install enclosed two-position maintained emergency stop operator stations as indicated on drawings.

.2 Provide emergency stop boxes for mounting of switches for all field located emergency stops.

.3 Requirements:

.1	Type:	Push-Pull / Twist to release
.2	Ingress Protection:	NEMA 4X
.3	Contact Life:	1,000,000 cycles
.4	Mechanical Life:	250,000 cycles
.5	Contact Rating:	10 A

.6 Contact Configuration: As shown on the drawings

.7 Illumination: Not required unless otherwise indicated.

.4 Acceptable Products:

.1 Schneider Electric Harmony 9001 K Series,

.2 Allen-Bradley 800H series,

.3 Or approved equal in accordance with B8.

2.7 CONTROL AND RELAY PANELS

.1 CSA Type 4 sheet steel enclosure with hinged padlock able access door, accommodating relays timers, labels, as indicated, factory installed and wired to identified terminals.

2.8 CONTROL CIRCUIT TRANSFORMERS

.1 Single phase, dry type.

.2 Primary: 600V, 60 Hz ac.

.3 Secondary: 120 V, AC. (or as indicated on drawings)

.4 Rating: 50VA. (or as indicated on drawings)

.5 Secondary fuse: 3A. (or as indicated on drawings)

.6 Close voltage regulation as required by magnet coils and solenoid valves.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for control devices installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Contract Administrator.

.2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 INSTALLATION

.1 Install pushbutton stations, control and relay panels, and control devices.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results for Electrical.

.2 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at time and check out operation of section.

.3 Upon completion of sectional test, undertake group testing.

.4 Check out complete system for operational sequencing.

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.

.3 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 CSA C22.2 No.14-18, Industrial Control Equipment.

.1 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 1-2022, Industrial Control and Systems: General Requirements.

.2 NEMA ICS 2-2000 (R2020), Controllers, Contactors and Overload Relays Rated 600 V.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Indicate:

.1 Mounting method and dimensions.

.2 Starter size and type.

.3 Layout of identified internal and front panel components.

.4 Enclosure types.

.5 Wiring diagram for each type of starter.

.6 Interconnection diagrams.

1.4 EXTRA MATERIALS

.1 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 3 fuses.

.7 10% indicating lamp bulbs used.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

Part 2 Products

2.1 MATERIALS

.1 Starters: to NEMA ICS 2-2000

2.2 FULL VOLTAGE MAGNETIC STARTERS

.1 UL/CSA listed, NEMA size as shown on the drawings.

.1 Smallest size of starter: NEMA size 1, unless otherwise indicated

.2 IEC rated starters are not acceptable.

.2 Short Circuit Current Rating (SCCR):

.1 The Short Circuit Current Rating (SSCR) of the assembly must equal or exceed the rating of the MCC or panel it is fed from.

.3 Magnetic of size, type, rating and enclosure type as indicated with components as follows:

.1 All coils to be epoxy coated.
.2 Contactor solenoid operated, rapid action type.
.3 Motor overload protective device in each phase, manually reset from outside enclosure.
.4 Wiring and schematic diagram inside starter enclosure in visible location.
.5 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
.6 Transient suppressors shall be supplied for all coils in each individual starter unit.

2.3 FULL VOLTAGE REVERSING 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 Intelligent electronic motor overload protective relay complete with a Modbus/TCP communication interface to connect to the control system PLC.
.1 Acceptable Product: Schneider Electric Tesys T
.3 Wiring and schematic diagram inside starter enclosure in visible location.

.4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.2 Combination type starters to include motor circuit interrupter.

.3 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 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

2.4 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with secondary fuse, installed in with starter as indicated.

.2 Size control transformer for control circuit load plus 20% spare capacity.

2.5 FINISHES

.1 Apply finishes to enclosure in accordance with Section 26 05 00, Common Work Results - Electrical.

2.6 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00, Common Work Results - Electrical.

.2 Magnetic starter designation label, white plate, black letters, size 4 engraved as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Install starters, connect power and control as indicated.

.2 Ensure correct fuses and overload device elements installed.

3.2 MOTOR STARTER TESTING

.1 Perform tests in accordance with Section 26 05 00, Common Work Results – For Electrical.

.2 Perform complete testing of motor starter operation, including but not limited to:

.1 Simulating a soft starter module fault to ensure the starter can be reset and put back into operation.

.2 Manual startup and shutdown.

.3 Automatic startup and shutdown.

.3 Utilize test forms to be provided by the Contract Administrator. Complete test forms in full. Submit test results to the Contract Administrator.

.4 Contract Administrator and/or City of Winnipeg will be required to witness motor starter testing in person. Provide a minimum of two (2) weeks notice prior to performing testing of motor starters.

.5 Provide separate completed test forms for each starter.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00, Common Work Results - Electrical and manufacturer's instructions.

.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 SECTION INCLUDES

.1 Technical requirements related to the design and supply of Variable Frequency Drives (VFD), including all equipment, manufacture, assembly, factor, wiring, inspection, testing and delivery.

1.2 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.3 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International)

.1 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 City of Winnipeg

.1 Electrical Design Guide (510276-0000-47ER-0001), Revision 05

.2 City of Winnipeg Automation Design Guide (612620-0013-40ER-0001), Revision 03

.3 Winnipeg Electrical By-law including Technical Interpretations, latest edition

.3 NEMA, National Electrical Manufacturer Association

.4 IEEE, The Institute of Electrical and Electronics Engineers

.5 Other, Local Power Utility and Telephone Utility Guidelines for Harmonic Distortion.

1.4 DESIGN REQUIREMENTS

.1 Provide equipment layout drawing detailing:

.1 The dimensions, physical arrangement of major components, and the degree of compartmentalization and physical segregation provided between components.

.2 Front layout of the panel.

.3 When air-cooled systems are provided, the following shall also be shown:

.1 air inlet and outlet passages

.2 cooling fans

.3 filters

1.5 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00, Submittal Procedures.

.2 Submit shop drawings including:

.1 Panel layout.

.2 Wiring diagrams:

.1 AutoCAD versions of the VFD schematic drawings will be provided upon request.

1.6 PARTS AVAILABILITY

.1 Guarantee that parts for the drive units be available for a minimum of ten years from time of delivery.

1.7 DESIGN REQUIREMENTS

.1 Ventilation system designed for ambient temperature range of 10°C to 35°C, temperature not to exceed 25°C.

Part 2 Products

2.1 VARIABLE FREQUENCY DRIVES

.1 Variable speed controller shall be electronic adjustable frequency and voltage output unit.

.2 Designed to operate standard squirrel cage induction motor with a 1.15 S.F. or definite purpose motors meeting NEMA MG1 Part 31.

.3 Harmonic loading will not exceed a motor service factor of 1.0.

.4 Products shall comply with IEEE standard 519.

.5 CSA certified.

.6 The VFD shall employ a minimum of 6-pulse pulse width modulated (PWM) system utilizing insulated Gate Bipolar Transistors (IGBT) power switching device and come complete with line reactors.

.7 Be capable of re-accelerating the driven equipment, following voltage dips greater than 20% of the rated input power supply, of up to 5 seconds duration, without the need to come to a complete stop. Vendor shall indicate the maximum time delay before re-acceleration begins following restoration of the supply voltage.

.8 Be capable to continue operation without coming to a standstill or resulting in process shutdown, following any momentary voltage dips in the input power supply, auxiliary power supply, or both, of less than 20% rated voltage, which last for less than 0.5 second.

.9 Designed to provide output requirements dictated by the speed/torque characteristics of motor and driven equipment over the entire speed range. The motors may be supplied by others.

.10 VFD shall convert the line input power to adjustable AC voltage and frequency output power. The output power shall be controlled such that permissible volts/Hertz ratio is not exceeded throughout the specified operating speed range, over a voltage range of ±10% and frequency variation of ± 5%.

.11 The VFD output frequency shall not deviate more than ± 1% of any given set point within the operating frequency range.

.12 The VFD shall be provided with radio interference suppression and limit radio interference values to within the limits of local code requirements.

.13 Input Run Command signals will be a 24Vdc discrete signal.

.14 Input frequency setting signal will be 0-10 VDC and 4-20 mA.

.15 Output speed and current monitoring signals will be 4-20 mA.

.16 Enclosure:

.1 VFD shall be installed in Type 12 floor mounted enclosure within the electrical room, refer to Section 26 27 16, Electrical Cabinets and Enclosures.

.2 Filters to be provided for any forced air-cooled enclosures as required by the supplier. VFD(s) shall be suitable for the location installed and shall be able to operate under these conditions with no special cleaning requirements.

.17 Operational features:

.1 Integral flush mounted keypad on enclosure door for programming, monitoring, and operating the drive, accessible through password or other acceptable security measure only.

.2 Integral selector switches and pushbuttons, where shown on the drawings:

.1 heavy duty, oil-tight, 30mm.

.18 Diagnostic features:

.1 Integral long life LED indicating lights on enclosure door as indicated on drawings.

.19 Motor protection:

.1 Vibration monitoring as indicated on drawings 1-0241L-E0010-001, 1-0241L-E0010-002, 1-0241L-E0012-001, 1-0241L-E0012-002, refer to Section 26 27 16, Electrical Cabinets and Enclosures.

.20 As supplied by one of the following acceptable manufacturers:

.1 Schneider Electric

.1 This manufacturer was standardized by the City via RFP 756-2013. No alternates or substitutes will be accepted.

2.2 TERMINALS

.1 Terminals as follows (or as indicated on drawings):

.1 Feed-through: Phoenix Contact 3046184 or approved equal in accordance with B8,

.2 Potential earth: Phoenix Contact 3046207 or approved equal in accordance with B8,

.3 Fused: Phoenix Contact 3046142 with 3036806 or approved equal in accordance with B8,

.4 End plate: Phoenix Contact 3047141 or approved equal in accordance with B8

.5 Any and all other terminals required to make a fully functional system as indicated on the drawings.

2.3 COOLING SYSTEM

.1 Perform heat load analysis to determine air-cooling requirements.

.2 Air-cooled converters shall meet the following:

.1 Redundant cooling fans

.2 Cooling fan operates when pump is started from VFD or bypass system or when enclosure reaches hi temperature.

.3 Provide adjustable hi temperature switch, with minimum range 10°C to 30°C.

2.4 WIRING

.1 Utilize the following wire colours for the types of voltage/signals indicated:

.1	120VAC Line:	Black
.2	120VAC Control:	Red
.3	120VAC Neutral:	White
.4	24VDC Supply:	Blue
.5	24VDC Control:	Blue
.6	24VDC Common:	Brown
.7	24VAC Supply:	Black
.8	24VAC Control:	Red
.9	24VAC Neutral:	White
.10	10VDC Supply:	Blue
.11	0-10VDC Signal:	Blue
.12	10VDC Common:	Brown
.13	Intrinsically Safe:	Light Blue
.14	4-20mA Signal:	White (+), Black (-)

.2 All conductors shall be securely fastened to terminals at both ends; no splices are allowed inside the panel.

.3 No more than two (2) conductors may be terminated under each terminal screw. All internal panel conductors shall be connected to the same side of a terminal block, and external conductors to the other side. The only exception is for fused terminals which require connection to the field side for internal wiring.

.4 All wires and cables inside the VFD panels shall be identified on both ends with non-erasable markers from.

.5 Identification shall follow the supplied documents, such as wiring diagrams.

.1 Label both ends of each wire.

.2 Utilize machine printed non-slip labels.

.3 Wherever possible wire labels shall be positioned to be read from the panel opening without removal of wire duct covers or other wiring.

.6 Individual conductors or wires exiting a cable shall be identified using non-erasable markers.

.7 The routing of all analog, digital, and power cable wiring inside VFD panels shall be segregated as much as possible, in distinct wiring ducts, by the type of signal they are carrying. All wires shall be physically protected by wiring ducts with covers. The wiring ducts shall be of sufficient size to be filled to a maximum of 50% when all wires are inside.

.8 All analog signal wiring shall be 18 AWG shielded twisted pairs such as Belden No. 8760, or an approved equivalent in accordance with B8. Shield wires exiting the jacket must be covered with a black heat shrink, and the overall cable at the jacket end must also be covered with a heat shrink.

.9 All 24 VDC or 120 VAC discrete signal panel wiring shall be 16 AWG TEW stranded conductor.

.1 Increase the size of power wiring, 12 AWG minimum.

.10 The sizes and colours of wires shall be in accordance with the CSA and the Canadian Electrical Code.

.11 The panel builder shall group and form wiring into a loop when going from a fixed part of the panel to a door. Each end of the loop shall be properly supported.

2.5 PROGRAMMING AND COMMISSIONING

.1 Electrical subcontractor shall be responsible for programming and commissioning of all variable frequency drives. Consultant shall provide contractor with project specific VFD initial settings to be entered into the drives, all other settings shall be determined by the electrical subcontractor.

.2 Electrical subcontractor shall allow for settings to be adjusted as required during commissioning.

.3 Ethernet Patch Cords

.1 Requirements:

.1 CAT-6.

.2 Jacket colour: Blue.

.4 Wiring Duct

.1 All wires shall be run in narrow slot wiring duct such as such as Panduit or an approved equivalent in accordance with B8

.2 Wiring Duct shall be installed on both sides of the panel and between the DIN rails.

.3 Wire or cable, connected to internal device or arriving from external device, shall be uncovered by Wiring Duct for a maximum of 10 cm.

.4 120 VAC wires cannot share wiring duct with 10 VDC, 24 VDC or 4-20 mA wires, but can cross their path.

2.6 SPARE PARTS

.1 Provide, at minimum, the following spare parts:

.1 One cooling fan.

.2 All control fuses.

.3 One N.O. and N.C. contact block for control switches.

.4 One form “C” relay.

.2 Spare parts to be provided in a sealed plastic bag taped to side of enclosure interior.

Part 3 Execution

3.1 INSTALLATION

.1 VFD cabinets shall be mounted in such a way that there is adequate room for ventilation and no build up of heat. The minimum clearance in front of VFDs is 1 m.

3.2 CONFIGURATION

.1 Submit settings sheet for review.

.2 Configure VFD parameters as specified on settings sheet.

.3 Include settings sheets in the O&M manuals.

3.3 TESTS

.1 VFD units are to be factory tested prior to shipment. Provide confirmation from factory of actual tests completed and results.

.2 Confirm VFD capability to continue operation without coming to a standstill, following any momentary voltage dips in the input power supply, auxiliary power supply or both of less than 20% rated voltage, which last for less than 0.5 seconds.

.3 Confirm VFD capability to automatically re-accelerate following loss of voltage for up to five seconds.

.4 Field testing:

.1 Provide on-site start-up, fine-tuning, commissioning, operator training, and instruction.

.2 Full-load functional test of the VFD shall be performed. The test shall prove the correct operation of all control functions, auxiliaries, protective systems, alarms and metering.

.3 Ensure shaft to ground voltages do not exceed 1.5 V at any speed or load requirement.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 City of Winnipeg

.1 Electrical Design Guide (510276-0000-47ER-0001), Revision 05

.2 Winnipeg Electrical By-law including Technical Interpretations, latest edition

1.3 DESCRIPTION OF SYSTEM & SITE

.1 Provide a dual fuel natural gas/LP gas generator with an alternator operating at 347/600V that is rated for 400kW/500kVA (natural gas), 300k/375kVA (LP Gas) c/w Automatic Transfer switch and load bank to supply electrical power at 600 Volts, 3 Phase, 3 wire with sufficient capacity to supply all critical loads. Generator shall consist of a liquid cooled engine, a synchronous AC alternator, weather and sound attenuated enclosure, and system controls with all necessary accessories for a complete operating system, including but not limited to the items as specified hereinafter.

.2 The generator shall have sufficient capacity to operate the following loads:

.1 One (1) Lift pump, rated 200 HP, controlled by a PLC and Variable Frequency Drive Starter.

.2 One (1) dry-type transformer rated 45kVA, with 80% load.

.3 One (1) duct heater rated 32 kW.

.4 One (1) duct heater rated 23 kW.

.5 One (1) unit heater rated 10 kW.

.6 One (1) exhaust fan rated 3/4 hp.

.7 One (1) domestic water pump 1.5 hp.

.8 One (1) chain hoist 2.4 hp

.3 Submit the generators rated power output from -40 to +40 ˚C ambient temperature at 240 meters above sea level elevation.

.4 Submit the generator’s sound level in dBA at 7 meters based on the configuration specified.

.5 The generator shall meet site noise requirements of 70 dBA or less, at 7 meters assuming no installed sound barriers beyond the generator enclosure.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

.1 An electric generating system, consisting of a prime mover, generator, governor, coupling and all controls, must have been tested, as a complete unit, on a representative engineering prototype model of the equipment to be sold.

.2 Conform to applicable CSA standards and NFPA 110 requirements.

.3 Underwriters Laboratories listing (UL2200) for a stationary engine generator assembly.

1.5 MANUFACTURER QUALIFICATIONS

.1 These systems shall be supplied by an original equipment manufacturer (OEM) who has been regularly engaged in the production of engine-alternator sets, automatic transfer switches, and associated controls for a minimum of 25 years, thereby identifying one source of supply and responsibility.

.2 The manufacturer shall have printed literature and brochures describing the standard series specified, not a one of a kind fabrication.

.3 Manufacturer's authorized service representative shall meet the following criteria:

.1 Certified, factory trained, industrial generator technicians

.2 Service support 24/7

.3 Service location within 250 kilometres

.4 Service & repair parts in-stock

.5 Offer optional remote monitoring and diagnostic capabilities.

.4 Basis-of-Design Product: Subject to compliance with requirements, provide Kohler Power Systems; 400REZX Series, maximum load at 80% or comparable product by one of the following:

.1 Cummins Power Generation.

.2 Generac.

.5 Source Limitations: Obtain packaged engine generators and auxiliary components through one source from a single manufacturer.

1.6 SUBMITTALS

.1 Engine Generator specification sheets
.2 Automatic Transfer Switch specification sheets
.3 Load Banks
.4 Controls specification sheets
.5 SPD specification sheets
.6 Installation / Layout dimensional drawings
.7 Wiring schematics
.8 Sound data
.9 Emission Certification
.10 Warranty Statement
.11 Alternator thermal damage and decrement curves
.12 Generator protective device time current curves
.13 Generator impedance values to be used for power system analysis by others

Part 2 ENGINE

2.1 ENGINE RATING AND PERFORMANCE

.1 The prime mover shall be a liquid cooled, turbocharged after-cooled engine of 4-cycle design. It will have adequate horsepower to achieve rated kW output at an operating speed of 1800 RPM.

.2 The engine shall support a 80% load step.

.3 The generator system shall support generator start-up and load transfer within 10 seconds. The generator shall accept load steps, 200 HP motor with a variable speed drives starter with a maximum frequency dip of 10 Hz.

2.2 ENGINE OIL SYSTEM

.1 Full pressure lubrication shall be supplied by a positive displacement lube oil pump. The engine shall have a replaceable oil filter(s) with internal bypass and replaceable element(s).

.2 The oil shall be cooled by an oil cooler which is integrated into the engine system.

.3 The engine oil pan will contain a 120VAC thermostatically controlled crankcase oil heater.

.4 All lines and hoses for the oil system shall be heat traced and insulated to prevent freezing during winter months.

2.3 ENGINE COOLING SYSTEM

.1 The engine is to be cooled with a unit mounted radiator, fan, water pump, and closed coolant recovery system. The coolant system shall include a coolant fill box which will provide visual means to determine if the system has adequate coolant level. The radiator shall be designed for operation in 35 degrees C ambient temperature.

.2 The engine shall have a unit mounted, thermostatically controlled water jacket heater(s) to aid in quick starting. The wattage shall be as recommended by the manufacturer to suit the environmental conditions stated in paragraph 1.1.3 above.

.3 Engine coolant and oil drain extensions, equipped with pipe plugs and shut-off valves, must be provided to the outside of the mounting base for cleaner and more convenient engine servicing.

.4 A radiator fan guard must be installed for personnel safety that meets UL and OSHA safety requirements.

2.4 ENGINE STARTING SYSTEM

.1 Starting shall be by a solenoid shift, DC starting system.

.2 The engine’s cranking batteries shall be lead acid. The batteries shall be the largest available by the manufacturer for this generator size. The batteries supplied shall meet NFPA 110 cranking requirements of 90 seconds of total crank time. Battery specifications (type, amp-hour rating, and cold cranking amps) are to be provided in the submittal.

.3 The generator shall have an engine driven, battery charging alternator with integrated voltage regulation.

.4 The generator shall have an automatic dual rate, float equalize, 10-amp battery charger. The charger must be protected against a reverse polarity connection. The chargers charging current shall be monitored within the generator controller to support remote monitoring and diagnostics. The battery charger is to be factory installed on the generator and suitable for operation in the environmental conditions stated in paragraph 1.1.3 above or provided with supplemental heat as required. Due to line voltage drop concerns, a battery charger mounted in the transfer switch will be unacceptable.

.5 Thermostatically controlled battery blanket heaters are to be provided to maximize the batteries cold cranking capabilities.

2.5 ENGINE FUEL SYSTEM – DUAL FUEL (NATRUAL GAS / LP GAS)

.1 Fuel: Dual Fuel LP gas or Natural gas with vapor withdrawal system.

2.6 ENGINE CONTROLS

.1 Engines that are equipped with an electronic engine control module (ECM) shall monitor and control engine functionality and seamlessly integrate with the generator controller through digital communications. ECM monitored parameters shall be integrated into the generator controllers NFPA 110 alarm and warning requirements. All ECM fault codes shall be displayed at the generator controller in standard language – fault code numbers are not acceptable.

.2 For engines without ECM functionality or for any additional generator controller monitoring, sensors are to be conditioned to a 4-20ma signal level to enhance noise immunity and all sensor connections shall be sealed to prevent corrosion.

.3 Engine speed shall be controlled with an integrated isochronous governor function with no change in alternator frequency from no load to full load. Steady state regulation is to be 0.25%.

2.7 ENGINE EXHAUST & INTAKE

.1 The manufacturer shall supply its recommended stainless steel, flexible connector to couple the engine exhaust manifold to the exhaust system. A rain cap will terminate the exhaust pipe after the silencer. All components must be properly sized to assure operation without excessive back pressure when installed.

.2 The manufacturer shall supply a critical grade exhaust silencer as standard. For applications with site specific sound requirements (reference section 1.1), the silencer shall be selected to achieve site sound levels.

.3 For generators in a weather or sound attenuated enclosure, all exhaust piping from the turbo-charger discharge to the silencer shall be thermally wrapped to minimize heat dissipation inside the enclosure.

.4 The engine intake air is to be filtered with engine mounted, replaceable, dry element filters.

Part 3 ALTERNATOR

.1 The alternator shall be the voltage and phase configuration as indicated in paragraph 1.1.1 above, and with sufficient capacity as indicated in 1.1.2 above.

.2 The alternator shall be a 4 pole, revolving field, stationary armature, synchronous machine. The excitation system shall utilize a brushless exciter with a three-phase full wave rectifier assembly protected against abnormal transient conditions by a surge protector. Photo-sensitive components will not be permitted in the rotating exciter.

.3 The alternator shall include a permanent magnet generator (PMG) for excitation support. The system shall supply a minimum short circuit support current of 300% of the rating for 10 seconds.

.4 Three phase alternators shall be 10 lead, broad range capable of supporting voltage reconnection. All leads must be extended into a NEMA 1 connection box for easy termination. A fully rated, neutral grounding connection must be included by the generator manufacturer but not installed. The generator neutral shall remain isolated from ground.

.5 The alternator shall use a single, sealed bearing design. The rotor shall be connected to the engine flywheel using flexible drive disks. The stator shall be direct connected to the engine to ensure permanent alignment.

.6 The alternator shall meet temperature rise standards of UL2200 (120 degrees C). The insulation system material shall be class "H" capable of withstanding 130 degrees C temperature rise.

.7 The alternator shall be protected against overloads and short circuit conditions by advanced control panel protective functions. The control panel is to provide a time current algorithm that protects the alternator against short circuits. To ensure precision protection and repeatable trip characteristics, these functions must be implemented electronically in the generator control panel -- thermal magnetic breaker implementation are not acceptable.

.8 An alternator strip heater shall be installed to prevent moisture condensation from forming on the alternator windings. A topical coating shall also be applied to the alternator windings to provide additional protection against the entrance of moisture.

Part 4 CONTROLS

.1 The generator control system shall be a fully integrated microprocessor-based control system for standby emergency engine generators meeting all requirements of NFPA 110 Level 1.

.2 The generator controller shall provide integrated and digital control over all generator functions including: engine protection, alternator protection, speed governing, voltage regulation and all related generator operations. The generator controller must also provide seamless digital integration with the engine’s electronic engine control module (ECM) if so equipped.

.3 The control system shall provide an environmentally sealed design including encapsulated circuit boards and sealed automotive style plugs for all sensors and circuit board connections. The use of non-encapsulated boards, edge cards, and pc ribbon cable connections are considered unacceptable.

.4 Circuit boards shall utilize surface mount technology to provide vibration durability. Circuit boards that utilize large capacitors or heat sinks must utilize encapsulation methods to securely support these components.

.5 Provide a predictive maintenance algorithm that energizes an alarm contact when maintenance is required.

.6 Diagnostic capabilities should include time-stamped event and alarm logs, ability to capture operational parameters during events, and simultaneous monitoring of all input or output parameters.

.7 In addition to standard NFPA 110 alarms, the application loads should also be protected through instantaneous and steady state protective settings on system voltage, frequency, and power levels.

.8 The control system shall provide pre-wired customer use I/O: 2 relay outputs (user definable functions), communications support Modbus via RS485, Ethernet TCP/IP, or an optional modem. Additional I/O must be an available option.

.9 A remote annunciator panel which communicates with the generator control system through a digital communication link, and powered from the generator control system must be an available option.

.10 Customer I/O shall be software configurable providing full access to all alarm, event, data logging, and shutdown functionality. In addition, custom ladder logic functionality inside the generator controller shall be supported to provide application support flexibility. The ladder logic function shall have access to all the controller inputs and customer assignable outputs.

.11 The controller shall output the following signals, via 25VDC Signal Form C contact outputs rated 2 amps @ 30 VDC/250VAC each:

.1 Generator Run Status

.2 Generator not in Auto

.3 Generator trouble (warning)

.4 Generator trouble (shutdown)

.5 Propane solenoid valve open command, powered from generator controls

.12 The controller shall be configured to receive and act on the following signals, via 25VDC Signal Form C contact inputs rated 2 amps @ 30 VDC/250VAC each:

.1 Generator Run

.2 ATS Connected to Utility

.3 ATS Connected to Generator

.4 ATS Not in Auto (Fault)

.13 The control panel will display all user pertinent unit parameters including: engine and alternator operating conditions; oil pressure and optional oil temperature; coolant temperature and level alarm; fuel level (where applicable); engine speed; DC battery voltage; run time hours; generator voltages, amps, frequency, kilowatts, and power factor; alarm status and current alarm(s) condition per NFPA 110 Level 1.

.14 The engine oil low level sensor shall be configured such that an alarm condition will occur before oil pressure decreases to levels that will result in engine damage.

.15 Provide fused terminal and feed through terminal at 24VDC to power propane supplier emergency shut off valve.

Part 5 ENGINE / ALTERNATOR PACKAGING

.1 The engine/alternator shall be isolated from the generator frame with rubber isolators. The packaging shall not require the addition of external spring isolators.

.2 A mainline, thermal magnetic circuit breaker carrying the CSA mark shall be factory installed. The breaker shall be rated between 100 to 125% of the rated ampacity of the generator. The line side connections are to be made at the factory. Output lugs shall be provided for load side connections.

.3 The generator shall include:

.1 Generator Main Molded Case Circuit breaker

.1 One (1) LSI rated 3-pole branch circuit breaker, with a 400 amp frame, and 400 amp trip unit, adjustable from 100 amps to 400 amps, capable of having a shunt trip installed.

.2 Auxiliary Contacts: Qty 1 Form A and Qty 1 Form B dry-contacts or Qty 1 Form C dry-contact

.4 The generator shall include a unit-mounted 120 volt convenience outlet.

5.2 ENCLOSURE

.1 The generator shall be packaged with a sound attenuating weather protective enclosure with the following:

.1 Tight fitting weather proof enclosure suitable for location in outdoor extreme weather environments from -40°C to 40°C.

.2 The enclosure must allow the generator set to operate at full load in an ambient of 40°C with no additional de-rating of the electrical output.

.3 Enclosure to be fully insulated suited for extreme winter conditions, and maintain a temperature of +10°C inside when not in operation, as per CSA 282.

.4 Insulate (entire enclosure including doors) with minimum 25 mm thick insulation. Seal all gaps to restrict entrance of snow.

.5 Access to the controller and main line circuit breaker must meet the requirements of the Canadian Electrical Code.

.2 The enclosure and air discharge hood shall be completely lined with 3 inches (76 mm) of fiberglass and perforated aluminum. This material must be of a self-extinguishing design.

.3 The enclosure shall be made of steel with a minimum thickness of 14 gauge.

.1 Include lockable and removable access doors on each side of the unit for servicing. Minimum requirements are two doors per side.

.2 Flush mounted door latches

.3 Stainless Steel hinges and hardware

.4 Provide 8 keys

.5 Sealed openings around perimeter of skid base.

.4 The enclosure shall be coated with electrostatic applied powder paint. The enclosure shall also have a fade, scratch and corrosion resistant powder baked finish with a minimum Paint Thickness of 2.5 mil (0.06 mm).

.5 The enclosure shall utilize an upward discharging radiator hood.

.6 Thermostatically controlled space heater factory installed within enclosure designed to maintain minimum internal temperature at 40 deg F (4 deg C).

.7 Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.

1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.

2. Automatic Dampers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating.

3. Ventilation: Provide temperature-controlled exhaust fan interlocked to prevent operation when engine is running.

.8 Interior Lights with Switch: Factory-wired, vapor-proof fixtures within housing; arranged to illuminate controls and accessible interior. Arrange for external electrical connection.

.1 AC lighting system and connection point for operation when remote source is available.

.2 DC lighting system for operation when remote source and generator are both unavailable.

.9 Convenience Outlets: Factory wired, GFCI. Arrange for external electrical connection.

.10 All ventilation and combustion air openings shall be equipped with motorized dampers.

.1 Motorized dampers on both ventilation intake and exhaust openings to minimize rain and snow entry. Motorized dampers are to be closed when generator is not in operation to maintain 40°C temperature inside the enclosure. Dampers to operate with generator power to open, and spring return to close.

.11 Silencers mounted on top of the generator enclosure.

.12 All auxiliary equipment mounted within enclosure which require utility power such as block heaters, battery chargers, and receptacles, are to be supplied from a panelboard or loadcentre located within the enclosure complete with circuit breakers for each load. Power supply to panelboard or loadcentre to be provided by the Contractor and may be single phase or 3 phase, 208/120 volts.

Part 6 AUTOMATIC TRANSFER SWITCH

6.1 GENERAL

.1 The automatic transfer switch shall be rated as follows:

.1 600 volts
.2 600 amps (minimum)
.3 25 kA symmetrical interrupting capacity
.4 3 Pole, 3 wire, 3 phase
.5 Non-Switched Neutral
.6 60Hz
.7 NEMA 2 enclosure (indoor rated)

6.2 MECHANICAL REQUIREMENTS

.1 Mechanically interlocked, electrically operated, mechanically held, solenoid operated contactors used for transfer switch. Motor actuated switches are not acceptable.

.2 Switching mechanisms lubricated for the expected life of the transfer switch.

.3 All contacts, coils, springs, and control elements shall be conveniently removable from the front of the transfer switch without major disassembly or disconnection of power conductors.

.4 The contact transfer time shall not exceed one-sixth of a second.

6.3 TRANSFER SWITCH CONTROL SYSTEM

.1 The control module shall direct the operation of the transfer switch. The module's sensing and logic shall be a built-in microprocessor-based system for maximum reliability, minimum maintenance, and inherent digital communications capability. The control settings shall be stored in non-volatile EEPROM. The module shall contain an integral battery-backed programmable clock and calendar. The control module shall have a keyed disconnect plug to enable the control module to be disconnected from the transfer mechanism for routine maintenance.

.2 The control module and all associated controls and relays shall be protected by a Surge Protection Device (SPD) with a safety listing of UL 1449 3rd Edition as a type 4 SPD, and under UL 1283 as an electromagnetic filter, maximum rated surge current of 120kA per phase, all modes of protection (L-N, L-G, N-G).

.3 The control module shall be mounted separately from the transfer mechanism unit for safety and ease of maintenance. Interfacing relays shall be industrial control grade plug-in type with dust cover.

.4 The control module shall include a user interface keypad with tactile feedback pushbuttons and light-emitting diode status indication. These features shall be user accessible when the enclosure door is closed:

.1 Keypad pushbuttons:

.1 Start/end system test

.2 Set/end exercise

.3 End time delay

.4 Lamp test/service reset

.2 Light-emitting diode status indicators:

.1 Contactor Position: Normal, Emergency

.2 Source Available: Normal, Emergency

.3 Not in automatic mode

.4 Four stage time delay remaining

.5 Exercise: load, no load, set/disabled

.6 Test: load, no load

.7 Load control active: peak shave, load shed, pre/post-transfer signal

.8 In-phase monitor/Off delay active

.5 Generator engine start gold flashed contact rated 2 amps @ 30 VDC/250VAC.

.6 One Programmable alarm contact output, and two transfer switch position contact outputs, rated 2 amps @ 30 VDC/250 VAC.

.7 The transfer switch controller shall output the following signals to the local control system, via five contact outputs rated 2 amps @ 30 VDC/250 VAC each:

.1 Running on alternate power

.2 Standby power not available

.3 Running on utility power

.4 Utility power not available

.5 Transfer Switch Fault

6.4 OPERATION

.1 All phases of normal and all phases of emergency shall be monitored for over and under voltage and single phase of normal and emergency for over- and under-frequency. In addition, the controller shall use anti-single phasing protection that detects regenerative voltage (using the phase angle of the source) to determine a failed source condition.

.2 Voltage and frequency sensing:

.1 Undervoltage pick-up set at 90% of nominal voltage, adjustable 85% - 100% of nominal voltage.

.2 Undervoltage dropout set at 90% of pickup voltage, adjustable 75% - 98% of pickup voltage.

.3 Overvoltage dropout set at 110% of nominal voltage, adjustable 105% - 135% of nominal voltage.

.4 Overvoltage pick-up set at 95% of dropout voltage, adjustable 85% - 100% of nominal voltage.

.5 Voltage dropout time set at 0.5 seconds adjustable 0.1 – 9.9 seconds.

.6 Voltage accuracy: 2%.

.7 Under frequency pick-up set at 90% of nominal frequency, adjustable 85% - 95% of nominal frequency.

.8 Under frequency dropout set at 99% of pick-up frequency, adjustable 95% - 99% of pick-up frequency.

.9 Over frequency dropout set at 101% of pick-up frequency, adjustable 101% - 105% of nominal frequency.

.10 Over frequency pick-up set at 110% of nominal frequency, adjustable 105% - 120% of nominal frequency.

.11 Frequency accuracy: 1%

.3 Time Delays:

.1 Time delay for engine start to delay initiation of transfer for momentary source outages: Range 0-6 seconds. Factory set at 3 seconds.

.2 Time delay for transfer to standby: Range 0-60 minutes. Factory set at 1 second.

.3 Time delay for transfer back to normal: Range 0-60 minutes. Factory set at 15 minutes.

.4 Time delay for engine cool down: Range 0-60 minutes. Factory set at 5 minutes.

.5 Failure to acquire standby source: Range 0-60 minutes. Factory set at 1 minute.

.6 Pre-transfer to normal signal: Range 0-60 minutes. Factory set at 3 second.

.7 Pre-transfer to standby signal: Range 0-60 minutes. Factory set at 3 second.

.8 Post-transfer to normal signal: Range 0-60 minutes. Factory set at 0 minute.

.9 Post-transfer to standby signal: Range 0-60 minutes. Factory set at 0 minute.

.4 User terminals shall be available to connect a normally open contact that, when closed, signals the control module to start and transfer load to the engine-generator. Opening these contacts shall initiate a retransfer and engine cool down sequence. The load shall be transferred to an available utility source immediately if the generator source should fail.

.5 The following features shall be built into the control module logic. These features shall be enabled at the factory or in the field.

.1 Phase rotation sensing programmable ABC or CBA.

.2 In-phase monitoring shall continuously monitor the contactor transfer times, source voltage, frequency and phase angle to provide a self-adjusting, zero crossing contactor transfer signal. A flashing LED on the user interface panel shall indicate active in-phase monitoring.

.3 The control module must be upgradeable with the following options:

.1 Preferred source switch

.2 Supervised transfer control switch

.3 Line to neutral voltage monitoring

.4 PC based communication application

.5 Provide a programmable input/output (I/O) module with two inputs and six outputs rated 2 amps @ 30 VDC/250 VAC

Part 7 RESISTIVE LOAD BANK

7.1 GENERAL

.1 Permanent, outdoor, weatherproof, remote-controlled, forced-air-cooled, resistive unit capable of providing a balanced three-phase, delta-connected load to engine generator at 100% rated-system capacity. Unit shall be capable of selective control of load in 25 percent steps and with minimum step changes of approximately 5 and 10 percent available.

.2 Resistive Load Elements: Corrosion-resistant chromium alloy with ceramic and stainless-steel supports. Elements shall be double insulated and designed for repetitive on-off cycling. Elements shall be mounted in removable aluminized-steel heater cases. Galvanized steel is prohibited. Element's maximum resistance shall be between 100 and 105 percent of rated resistance.

.3 Load Bank Heat Dissipation: Integral fan with totally enclosed motor shall provide uniform cooling airflow through load elements. Airflow and coil operating current shall be such that, at maximum load, with ambient temperature at the upper end of specified range, load bank elements operate at not more than 50 percent of maximum continuous temperature rating of resistance elements.

.4 Load-Element Switching: Remote-controlled contactors switch groups of load elements. Contactor coils are rated 120 V. Contactors shall be located in a separate NEMA 250, Type 3R enclosure within load-bank enclosure, accessible from exterior through hinged doors with tumbler locks.

.5 Contactor Enclosures: Heated by thermostatically controlled strip heaters to prevent condensation.

.6 Load Bank Enclosures: NEMA 250, Type 3R, aluminized steel complying with NEMA ICS 6. Louvers at cooling-air intake and discharge openings shall prevent entry of rain and snow. Openings for airflow shall be screened with 1/2-inch- (13-mm-) square, galvanized-steel mesh. Components other than resistive elements shall receive exterior epoxy coating with compatible primer.

.7 Protective Devices: Power input circuits to load banks shall be fused, and fuses shall be selected to coordinate with generator circuit breaker. Fuse blocks shall be located in contactor enclosure. Cooling airflow and overtemperature sensors shall automatically shut down and lock out load bank until manually reset. Safety interlocks on access panels and doors shall disconnect load power, control, and heater circuits. Fan motor shall be separately protected by overload and short-circuit devices. Short-circuit devices shall be noninterchangeable fuses with 200,000 A interrupting capacity.

.8 Control Sequence: Control panel should automatically maintain a minimum 50% load on the generator, based on the load measured by the remotely mounted CT. The CT should be provided by the load bank manufacturer. The load bank should receive control signals from the local PLC or generator controller to remove load from the generator during cooldown mode.

Part 8 ADDITIONAL PROJECT REQUIREMENTS

8.1 FACTORY TESTING

.1 Before shipment of the equipment, the engine-generator set shall be tested under rated load for performance and proper functioning of control and interfacing circuits. Tests shall include:

.1 Verify voltage & frequency stability.

.2 Verify transient voltage & frequency dip response.

.3 Load test the generator for 30 minutes.

8.2 FACTORY ACCEPTANCE TEST (FAT)

.1 Witness Factory Acceptance Tests (FAT) are required for the Individual Engine Generator Sets and Incorporated Controls as well as for the Integrated Generator System/Controls and Generator Switchgear.

.2 The FAT for the Individual Engine Generator Sets and Incorporated Controls shall be carried out at the generator set Manufacturer's factory prior to packing and shipment to Site.

.3 The Individual Engine Generator Set and Incorporated Controls FATs shall include, but not be limited to, the following for each engine generator set:

.1 Starting test,

.2 Starting battery capacity test,

.3 Verification of the correct functioning of all engine protection shutdowns and alarms,

.4 Engine speed governor functionality verification,

.5 Alternator excitation functionality verification,

.6 Alternator Voltage regulator functionality (no-load, ¼ load, ½ load, ¾ load, full load),

.7 A block load application test of the engine generator set at "block load" nameplate rating, the block load shall be applied in a single step,

.8 A full load run test at the generator set nameplate KVA/KW rating. Test duration shall be a minimum of six (6) hours at full capacity after both engine and alternator temperatures have stabilized. For the purposes of this test temperature stability shall be defined as $\Delta t \leq 0.5$ °C/hr for both engine and generator. In accordance with the requirements of CSA C282 this test may be run at 1.0 Pf if the alternator has been previously tested at the factory to full capacity at 0.8 Pf. If the alternator has not been factory load tested at 0.8 Pf, the FAT test shall be conducted at 0.8 Pf.

.9 Prior to proceeding with the Individual Engine Generator Sets and Incorporated Controls FAT tests the manufacturer shall provide, in writing, a written

Inspection and Test Plan. The Inspection and Test Plan shall include a detailed list of the tests to be performed, test procedures, sample data forms, and a testing schedule with anticipated test dates. Provide a minimum of two (2) weeks notice to the Contract Administrator before the tests are scheduled commence.

.10 The Integrated Generator System/Controls and Generator Switchgear FAT should preferably be carried out at the generator set Manufacturer's factory. The location for this testing shall be subject to the agreement of the Contract Administrator or designate.

.11 The Integrated Generator System/Controls and Generator Switchgear FAT shall include, but not be limited to, the following:

.1 Verification of automatic generator set automatic starting, synchronization, and connection of the engine generator sets to the generator switchgear bus,

.2 Verification of Asynchronous governor functionality (no-load, ¼ load, ½ load),

.3 Verification of demand and load sharing between the two (2) engine generator sets at the above loadings,

.4 Verification of correct operation of generator switchgear protection relay systems,

.5 Verification of automatic shutdown and disconnection of the engine generator sets from the generator switchgear bus.

.12 Prior to proceeding with the Integrated Generator System/Controls and Generator Switchgear FAT tests the manufacturer shall provide, in writing, a written Inspection and Test Plan. The Inspection and Test Plan shall include a detailed list of the tests to be performed, test procedures, sample data forms, and a testing schedule with anticipated test dates. Provide notice a minimum of two weeks before the tests are scheduled commence.

8.3 OWNER'S MANUALS

.1 Three (3) sets of owner's manuals and one electronic copy on USB flash drive, specific to the product supplied must accompany delivery of the equipment. General operating instructions, preventive maintenance, wiring diagrams, schematics and parts exploded views specific to this model must be included. Also provide list of recommended spare parts.

8.4 SHIPMENT

.1 Ship the generator, transfer switch, and load bank to the greatest extent possible to the installation address indicated in the tender package. Deliver on a date determined and defined by the Installing contractor.

.2 Clearly define in your quotation, any assembly work that must be done in the field by others. Provide the installing contractor clear instructions as to generator, transfer switch, and load bank handling and installation procedures.

8.5 INSTALLATION

.1 The complete electrical generating system including all external fuel connections shall be installed by the electrical contractor in accordance with requirements of CEC, NFPA, and the manufacturer's recommendations as reviewed by the Engineer.

.2 All penetrations into and out of the transfer switch shall be sealed to prevent the ingress of cold air during winter months.

.3 Equipment Mounting:

1. Install packaged engine generators on cast-in-place concrete equipment bases as per manufacturer and design described in structural contract.

2. Coordinate size and location of concrete bases for packaged engine generators mounted on grade. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

.4 Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

.5 Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

8.6 SERVICE

.1 Supplier of the generator, automatic transfer switch and associated items shall have permanent service facilities in this trade area. These facilities shall comprise a permanent force of factory trained service personnel on 24 hour call, experienced in servicing this type of equipment, providing warranty and routine maintenance service to afford the owner maximum protection. Delegation of this service responsibility for any of the equipment listed herein will not be considered fulfillment of these specifications. Service contracts shall also be available.

8.7 WARRANTY

.1 The standby electric generating system components, complete generator and instrumentation panel shall be warranted by the manufacturer against defective materials and factory workmanship for a period of five (5) years. Such defective parts shall be repaired or replaced at the manufacturer's option, free of charge for parts, labour and travel.

.2 The warranty period shall commence when the standby power system is first placed into service. Multiple warranties for individual components (engine, alternator, controls, etc.) will not be acceptable. Satisfactory warranty documents must be provided. Also, in the judgment of the specifying authority, the manufacturer supplying the warranty for the complete system must have the necessary financial strength and technical expertise with all components supplied to provide adequate warranty support.

8.8 START-UP AND CHECKOUT

.1 The supplier of the electric generating plant and associated items covered herein shall provide factory trained technicians to checkout the completed installation and to perform an initial start-up inspection to include:

.1 Ensuring the engine starts (both hot and cold) within the specified time.

.2 Verification of engine parameters within specification.

.3 Verify no load frequency and voltage, adjusting if required.

.4 Test all automatic shutdowns of the engine-generator.

.5 Perform a 100% load test of the electric plant for 30 minutes, ensuring full load frequency and voltage are within specifications.

.6 Test all operations of the automatic transfer switch.

.7 Each load step of the load bank shall be cold resistance checked to verify proper calibration of resistive load steps and proper ohmic value.

.8 Test operation of the load bank with generator in operation and all other loads disconnected, verify load bank adds load to generator incrementally.

.9 Simulate a utility power outage by disconnecting the main service breaker and test the operation of the system including the automatic transfer switch, generator and load bank for a duration of 30 minutes while supplying building load. Verify generator voltage and frequency is stable without fluctuations, within specifications and record results.

8.9 DEMONSTRATION AND TRAINING

.1 Provide demonstration by factory trained representative in use and maintenance of Generator set Systems.

.1 Allocate a minimum of two (2) separate 8-hour for training sessions. The date foreach training session will be set by the Contract Administrator. Note that the training sessions will NOT be on two (2) successive days.

.2 Training shall include, but not be limited to the following items:

.1 Overall system description and theory of operation,

.2 Automatic operation,

.3 Manual operation,

.4 Safeties and protective relaying,

.5 Recommended system check lists and log sheets in accordance with the requirements of CSA C282,

.6 Recommended preventive maintenance,

.7 Instruction on the operation of the assembly and major components within the assembly.

8.10 FINAL ACCEPTANCE

.1 If required by final field testing/commissioning results make adjustments/or changes such that an efficient and fully operational installation is achieved. Such adjustments or requirements shall be to the supplier’s account. Final acceptance by the Contract Administrator will be conditional upon fulfillment of all requirements.

.2 For equipment subject to inspection by a government ministry, department, or agency, submit original copies of the test data reports and all other documentation required for the final field inspection of the equipment by the government ministry, department or agency.

.3 Following completion of the work, issue a history docket comprised of the quality certificates, inspection and test records, and all other relevant documents related to manufacture and testing for the Contract Administrator’s record files.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 Institute of Electrical and Electronics (IEEE)

.1 IEEE Standard 519

.3 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

1.3 GENERAL REQUIREMENTS

.1 All PWM AC Variable Frequency Drives above 30 HP (22 kW) shall be equipped with harmonic mitigation equipment to prevent power system problems resulting from high levels of harmonic distortion.

.2 Demonstration of compatibility between the harmonic mitigation equipment and the VFD must be available upon request.

.3 The harmonic mitigation equipment and all of its components shall be manufactured and tested in accordance with the latest applicable standards of UL, CSA, Manitoba Hydro, and NEMA.

1.4 GUARANTEE

.1 Harmonic mitigation equipment shall be warranted to be free of defects in materials and workmanship for a period of 3 years from the date of shipment.

1.5 TESTING

.1 Factory Performance Testing: Manufacturer must be capable of factory testing for harmonic mitigating performance and energy efficiency under actual variable frequency drive loads. A detailed description of the program and a sample test report must be provided at time of quotation.

1.6 SHOP DRAWINGS

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

.2 Drawings to include enclosure dimensions and ratings, weights, mounting requirements, cable entry locations, horsepower rating, voltage, ampacity, heat dissipation at full load and noise rating.

Part 2 Product

2.1 KEY REQUIREMENTS:

.1 The harmonic mitigation equipment shall treat all of the characteristic low frequency harmonics generated by a 3-phase, diode bridge rectifier load (5^{th}, 7^{th}, 11^{th}, 13^{th}, etc.).

.2 The characteristic harmonics shall be suppressed without the need for individual tuning or the requirement to phase shift against other harmonic sources.

.3 Harmonic mitigation shall be by passive inductor network. Active electronic components shall not be used.

.4 Power factor shall be > 0.95 in operating range from 30% to full load.

.5 **To ensure compatibility with engine generators, the harmonic mitigation equipment must not use capacitors. The capacitors shall be provided with switching contactors, which completely removes any generator incompatibility potentials**.

.6 The harmonic mitigation equipment shall not resonate with system impedances or attract harmonic currents from other harmonic sources.

.7 The harmonic mitigation equipment in combination with the Variable Frequency Drive shall meet all requirements as outlined in IEEE std 519 (both 1992 and 2014 editions) for individual and total harmonic voltage and current distortion. The Point of Common Coupling (PCC) for all voltage and current harmonic calculations and measurements shall be the input terminals to the harmonic mitigation equipment.

.8 Total Harmonic Voltage Distortion (THVD) shall meet the requirements of Table 10.2 of IEEE std 519 by not exceeding 5% and by limiting the individual harmonic voltage distortion to less than 3%. These limits shall apply while operating on either utility supply or generator supply when applicable. The harmonic mitigation equipment vendor shall not be responsible for pre-existing voltage distortion caused by other harmonic sources.

.9 Total Demand Distortion (TDD) of the current at the input terminals of the harmonic mitigation equipment shall not exceed the limits as defined in Table 10.3 of IEEE std 519 but shall not exceed 8% even when Table 10.3 allows for more relaxed limits. For single-phase applications, the TDD must not exceed 12%.

.10 The full load efficiency of the harmonic mitigation equipment / VFD combination shall be greater than 96%. The harmonic mitigation equipment itself shall have efficiency no less than 99%.

2.2 BASIC REQUIREMENTS:

.1 All wiring shall be copper.

.2 Insulation class: 220°C system. Temperature rise: 130°C

.3 Anti-vibration pads shall be used between the reactor or transformer core and the enclosure.

.4 Ventilated, sprinkler proof NEMA-3R enclosure.

.5 Overload tolerance of 200% rated current for a maximum of three minutes.

.6 Warranty length to extend to the life of the drive with which the reactor is installed.

.7 Inductance characteristics:

.1 Minimum 95% L at 110% load

.2 Minimum 80% at L 150% load

2.3 OPTIONS

.1 Submit for approval before shipment certified production test results with serial numbers for harmonic mitigation performance and energy efficiency under actual variable frequency drive loading.

2.4 ACCEPTABLE MANUFACTURER

.1 Subject to compliance with all of the contract documents and specifications, the acceptable product and manufacturer is:

.1 Lineator AUHF by Mirus International Inc. or Approved Equal.

Part 3 Execution

3.1 INSTALLATION

.1 The harmonic mitigation equipment shall be handled, stored and installed in accordance with the manufacturer's recommended installation practices as found in the installation, operation, and maintenance manual. Installation shall comply with all applicable codes.

3.2 ACCEPTANCE

.1 Harmonic compliance shall be verified with onsite field measurements of both the voltage and current harmonic distortion at the input terminals of the harmonic mitigating equipment with and without the equipment operating.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results.

.2 Section 01 33 00 - Submittal Procedures.

.3 Section 01 45 00 - Quality Control.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI C82.1-2004 (S2020), Electric Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.

.2 ANSI C82.4:2017, Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps.

.2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE C62.41-1991, Surge Voltages in Low-Voltage AC Power Circuits.

.3 American Society for Testing and Materials (ASTM)

.1 ASTM F1137-88(1993), Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.4 United States of America, Federal Communications Commission (FCC)

.1 FCC (CFR47) EM and RF Interference Suppression.

.5 Canadian Standards Association (CSA International).

.1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations, latest edition adopted by the City of Winnipeg.

.6 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

.2 City of Winnipeg Electrical Design Guide (510276-0000-47ER-0001), Revision 05

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with Section 01 33 00, Submittal Procedures.

.2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Engineer.

.3 Photometric data to include: VCP Table and spacing criterion.

Part 2 Products

2.1 LAMPS

.1 Lamps shall be as indicated on luminaire schedule on drawings.

2.2 LED DRIVER

.1 LED Driver: CSA certified, energy efficient type, IC electronic.

- .1 Rating: 120 V, 60 Hz.
- .2 Totally encased and designed for 40 degrees Celsius ambient temperature.
- .3 Start-up ambient temperature of -20°C for indoor luminaires, and -40°C for outdoor luminaires.
- .4 Power factor: minimum 95% with 95% of rated lamp lumens.
- .5 Harmonics: 10 % maximum THD.
- .6 Estimated lifespan equal or greater than LED lamps of respective luminaire.
- .7 Sound rated: Class A.
- .8 Mounting: integral with luminaire.

2.3 FINISHES

.1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

2.4 LUMINAIRES

.1 As indicated in luminaire schedule.

Part 3 Execution

3.1 INSTALLATION

.1 Locate and install luminaires as indicated.

.2 Provide adequate support to suit ceiling system.

3.2 WIRING

.1 Connect luminaires to lighting circuits:

.2 Install rigid PVC conduit or TECK90 cable for luminaires.

3.3 LUMINAIRE SUPPORTS

.1 For suspended ceiling installations support luminaires independently of ceiling.

.2 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors (Nylon shields not acceptable) or as recommended by Anchor Construction Industrial Building Products Ltd for the specific surface & equipment being installed.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 If there is potential of Asbestos Electrical Contractor must use a proper collection boot and HEPA vacuum whenever drilling of holes in facility.

.5 All steel channel support for wall and surface mounted luminaires to be PVC coated strut.

.6 All RGS conduit stem threaded on both sides shall be PVC coated. All hardware shall be rated for the application environment.

3.4 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for emergency lighting systems.

1.2 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

.2 Section 01 33 00 - Submittal Procedures.

.3 Section 26 05 21 - Wires and Cables (0-1000 V).

.4 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.141:15 (R2020) Emergency Lighting Equipment.

.2 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations, latest edition adopted by the City of Winnipeg.

.2 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

.2 City of Winnipeg Electrical Design Guide (510276-0000-47ER-0001), Revision 05

1.4 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00, Submittal Procedures.

.2 Data to indicate system components, mounting method, source of power and special attachments.

1.5 WARRANTY

.1 For batteries, the 12 months warranty period prescribed in subsection GC32.1 of General Conditions "C" is extended to 120 months, with no-charge replacement during the first 5 years and pro-rate charge on the second 5 years.

Part 2 Products

2.1 EQUIPMENT

.1 Egress sign/Battery Unit

.1 Emergency lighting equipment: to CSA C22.2 No.141.

.2 Supply voltage: 120 V, ac.

.3 Output voltage: 12 V dc.

.4 Operating time: 60 min.

.5 NEMA 1 rated

.6 Momentary push button test switch

.7 Signal lights: solid state, for 'AC ON' and 'Charge'.

.1 Battery: sealed, maintenance free.

.8 Charger: fully automatic, current limited charger.

.9 Battery protection: a low voltage battery protection circuit to disconnect the load when the battery reaches the end of discharge.

.10 Lamp heads: integral on unit and remote, fully adjustable.

.11 Lamp type: As indicated on drawings.

.12 Large magnum terminal screw type connectors for remote load connection.

.13 Automatic Self Testing Feature that test once a month, every 6 months and 12 months c/w visual and audible alarm and should indicate the following at a minimum:

.1 Battery Failure

.2 Battery Disconnect

.3 Charger Failure

.4 Lamp Failure

.5 Service Alarm

.6 AC on

.7 Charger on

.14 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.

.15 Finish: Grey.

.16 Required Options:

.1 Automatic test self-diagnostic

.2 A.C./D.C. Terminal block capable of accepting #10 AWG Cu. Wire

.3 Audible alarm, Audible emergency

.4 Lamp disconnect (internal)

.2 Remote Lamp Heads

.1 Supply voltage: 12 V dc

.2 CSA C22.2 No.141:15 approved

.3 Rated for wet location

.4 Polycarbonate enclosure, fully gasketed housing

.5 Fully adjustable lamps

.6 Double heads

.7 Black color

2.2 WIRING OF REMOTE HEADS

.1 Conduit: in accordance with Section 26 05 34, Conduits, Conduit Fastenings and Conduit Fittings.

.2 Conductors: in accordance with Section 26 05 21, Wires and Cables 0-1000 V, sized in accordance with manufacturer's recommendations to minimize voltage drop.

Part 3 Execution

3.1 INSTALLATION

.1 Install unit equipment and remote mounted fixtures.

.2 Direct/aim heads.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 03 30 00 - Cast-in-Place Concrete

.2 23 11 26 - Facility Liquid-Petroleum Gas Piping.

.3 26 05 00 - Common Work Results - Electrical

1.2 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI).

.2 American Petroleum Institute (API).

.1 API RP 651-[1997], Cathodic Protection of Aboveground Petroleum Storage Tanks.

.2 API STD 653- [R01], Tank Inspection, Repair, Alteration, and Reconstruction.

.3 ASTM International (ASTM).

.1 ASTM C 618-[01], Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

.4 American Society of Mechanical Engineers (ASME).

.1 ASME Boiler & Pressure Vessel Code (BPVC) Section VIII Division I.

.5 Canadian Council of Ministers of the Environment (CCME).

.1 CCME-PN1326- [2004], Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products.

.6 Department of Justice Canada (Jus).

.1 Canadian Environmental Protection Act, 1999 (CEPA).

.7 CSA Group (CSA)

.1 CAN/CSA B149.1:20, Natural Gas and Propane Installation Code.

.2 CAN/CSA B149.2:20, Propane Storage and Handling Code.

.8 The Master Painters Institute (MPI).

.1 Architectural Painting Specification Manual - [September 2002].

.9 National Research Council Canada (NRC)

.1 National Fire Code of Canada [2015] (NFC).

.10 Transport Canada (TC).

.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

.11 Underwriters' Laboratories of Canada (ULC).

.1 ULC/ORD-C58.9- [97], Secondary Containment Liners for Underground and Aboveground Tanks.

.2 ULC/ORD-C107.4- [92], Ducted Flexible Underground Piping Systems for Flammable and Combustible Liquids.

.3 ULC/ORD-C107.7- [93], Glass-Fibre Reinforced Plastic Pipe and Fittings.

.4 ULC-S601-[2000], Aboveground Horizontal Shop Fabricated Steel Tanks.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Indicate details of construction, appurtenances, and installation.

.3 Shop drawings to detail and indicate following as applicable to project requirements. Submit manufacturers product data to supplement shop drawings.

.1 Size, materials and locations of lifting lugs.

.2 Tanks capacity.

.3 Size and location of fittings.

.4 Environmental compliance package accessories.

.5 Decals, type size and location.

.6 Accessories: provide details and manufacturers product data.

.7 Size, material and location of manholes.

.8 Size, materials and locations of railings, stairs, ladders and walkways.

.9 Finishes.

.10 Electronic accessories: provide details and manufacturers product data.

.11 Insulation types, locations and RSI values.

.12 Identification, name, address and phone numbers of corrosion expert where applicable. Note: Grading drawings to be stamped by licenced corrosion expert.

.13 Piping, values and fittings: type, materials, sizes, piping connection details, valve shut-off type and location, cathodic protection system complete with stamp of corrosion expert indicating that design complies with standards, Federal and Provincial regulations.

.14 Anchors: description, material, size and locations.

.15 Concrete: type, composition and strength.

.16 Size and location of site pads.

.17 Level gauging: type and locations, include:

.1 Reporting systems, types of reports and report frequency.

.2 Maximum number of tanks to be monitored.

.3 Number of probes required and sizes.

.4 Provide details and manufacturer's product data.

.18 Ancillary devices: provide details and manufacturer's product data.

.19 Leak detection system, type and locations, and alarm system.

.20 Grounding and bonding: provide details of design, type, materials and locations.

.21 Corrosion protection: provide details of design, type, materials and locations.

.22 Field-erected AST overfill-protection systems: provide details of design, type, materials and locations.

.4 Provide maintenance data for tank appurtenances for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 TANKS: CONVENTIONAL STEEL

.1 Above ground liquid propane storage tank

.2 Capacity: 3785.4 L (1000 usgal)

.3 Horizontal tanks: ULC-S601, BPVC-Section VIII-Division I

.4 Connections: Refer to drawings

.5 Finishes:

.1 Exterior of tank: polyester powder paint. Colour per Contract Administrator.

.6 Acceptable product: Manchester Tank as supplied by Federated Co-Operatives Limited or approved equal in accordance with B8.

2.2 CONCRETE

.1 In accordance with Section 03 30 00 - Cast-in-Place Concrete.

2.3 PIPING, VALVES AND FITTINGS

.1 In accordance with Section 23 11 26 - Liquid-Petroleum Gas Piping.

.2 Mechanical joints on buried primary piping is not permitted.

.3 Piping located below product level equipped with either manual or automatic shut-off at storage tank.

2.4 LIQUID LP-GAS VAPORIZER

.1 Supply direct fired liquid propane vaporizer in which heat required to vaporize LP gas liquid is furnished by an open flame directly applied to a heat exchange surface, which in turn contacts the LP gas liquid to be vaporized.

.2 An automatic 9VDC re-ignitor shall re-light the pilot flame in case of outage. No external electrical supply shall be required.

.3 Acceptable product: Algas SDI 40/40H vaporizer as supplied by Federated Co-Operatives Limited or approved equal in accordance with B8.

2.5 LEVEL GAUGING

.1 Tank level gauging and indicator: Mechanical float apparatus within tank magnetically coupled to external fuel level indicator.

.1 Gauge and gauge opening shall be protected against liquid overflow and possible liquid and vapour release.

2.6 GROUNDING AND BONDING

.1 To Section 26 05 00 - Common Work Results - Electrical.

2.7 CORROSION PROTECTION

.1 Steel storage tank systems.

.1 Cathodic protection installed, designed by corrosion expert.

2.8 PRODUCT TRANSFER

.1 ASTs with normal vent and separate emergency vent.

.1 Liquid- and vapour-tight connection on fill pipes for flammable products.

2.9 TANK BOTTOM WATER

.1 Disposed of in accordance with applicable provincial or territorial regulations, guidelines and policies.

Part 3 Execution

3.1 INSTALLATION

.1 Install tank in accordance with CAN/CSA-B149 and National Fire Code of Canada and manufacturer's recommendations.

.2 Position tank using lifting lugs and hooks, and where necessary use spreader bars. Do not use chains in contact with tank walls.

.3 Install tanks using licensed installers.

.4 Provide certification of installation to Contract Administrator.

3.2 FIELD QUALITY CONTROL

.1 Test tank for leaks in presence of authority having jurisdiction.

3.3 TOUCH-UP

.1 Where coating is damaged, touch-up with original coating material.

3.4 LEVEL GAUGE SYSTEM

.1 Provide leak and vapour proof caulking at connections.

.2 Shield capillary and tubing connections in heavy duty 50 mm polyethylene pipe.

.3 Calibrate system.

3.5 LEAK DETECTION SYSTEM

.1 Install in accordance with manufacturer's recommendations.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 This section covers items common to sections of Division 40. This section supplements requirements of Division 1.

1.2 RELATED SECTIONS

.1 Section 01 91 13 – General Commissioning Requirements

.2 Section 01 91 13.13 – Commissioning Plan

.3 Section 01 91 13.16 – Commissioning Forms

.4 Section 01 91 13.18 – Commissioning Training

.5 Section 01 78 00 – Closeout Submittals

.6 Section 01 33 00 – Submittal Procedures

.7 Section 01 74 11 – Cleaning

1.3 CODES AND STANDARDS

.1 Do complete installation in accordance with the latest adopted version of CSA C22.1 except where specified otherwise.

.2 Comply with all laws, ordinances, rules, regulations, codes, and orders of all authorities having jurisdiction relating to this Work.

.3 City of Winnipeg Electrical Design Guide (510276-0000-47ER-0001), Revision 05,

.4 City of Winnipeg Automation Design Guide (612620-0013-40ER-0001), Revision 03,

1.4 DRAWINGS AND SPECIFICATIONS

.1 The intent of the Drawings and Specifications is to include all labour, products, and services necessary for complete Work, tested and ready for operation.

.2 These Specifications and the Drawings and Specifications of all other divisions shall be considered as an integral part of the accompanying Drawings. Any item or subject omitted from either the Specifications or the Drawings, but which is mentioned or reasonably specified in and by the others, shall be considered as properly and sufficiently specified and shall be provided.

.3 Provide all minor items and Work not shown or specified but which are reasonably necessary to complete the Work.

.4 If discrepancies or omissions in the Drawings or Specifications are found, or if the intent or meaning is not clear, advise the Contract Administrator for clarification before submitting Bid, in accordance with B5.

1.5 CARE, OPERATION AND START-UP

.1 Instruct City maintenance and operating personnel in the operation, care and maintenance of systems, system equipment and components.

.2 Provide these services for such period, and for as many visits as necessary to put equipment in operation and ensure that operating personnel are conversant with all aspects of its care and operation.

1.6 PERMITS, FEES AND INSPECTION

.1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Notify Contract Administrator of changes required by Electrical Inspection Department prior to making changes.

.4 Furnish a Certificate of Final Inspection and approvals from inspection authority to the Contract Administrator.

1.7 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with the manufacturer's written instructions.

.2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.

.3 Minimum enclosure type to be used is NEMA 12 unless otherwise specified.

1.8 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 indoor switchgear and distribution enclosures light grey to ANSI 61 grey enamel, unless otherwise specified.

.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.

1.9 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates as follows:

.1 Nameplates:

.1 Lamacoid 3 mm thick plastic lamacoid nameplates, white face, black lettering, mechanically attached with self tapping screws.

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
Size 8	35 x 100 mm	3 lines	5 mm high letters

.2 Lamacoid Requirements as per the City of Winnipeg Electrical Design Guide, Revision 05, Section 2.3 – Identification.

.3 Wording on nameplates and labels to be approved by Contract Administrator prior to manufacture.

.4 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.2 Allow for minimum of twenty-five (25) letters per nameplate and label.

.3 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

.4 Identify equipment with Size 3 labels engraved as directed by Contract Administrator. Eg. “CP-L81”

.5 Lamacoid equipment identification structure shall be as per the City of Winnipeg Electrical Design Guide, Revision 05, Section 2.3 – Identification, Table 2-1: Lamacoid requirements.

1.10 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings on both ends of conductors.

.1 Wire tags to be heat shrink type with black letters on white background.

1.11 SUBMITTALS

.1 Prior to delivery of any Products to job Site and sufficiently in advance of requirements to allow ample time for checking, submit Shop Drawings for review as specified in Division 1.

.2 Submit Shop Drawings (including Product Data) for all equipment as required in each Section of this Specification.

.3 Prior to submitting the Shop Drawings to the Contract Administrator, the Contractor shall review the Shop Drawings to determine that the equipment complies with the requirements of the Specifications and Drawings.

.4 The term “Shop Drawing” means drawings, diagrams, illustrations, schedules, performance characteristics, brochures and other data, which are to be provided by the

Contractor to illustrate details of a portion of the Work. Indicate materials, methods of construction and attachment of support wiring, diagrams, connections, recommended installation details, explanatory notes and other information necessary for completion of Work. Where equipment is connected to other equipment, indicate that such items have been coordinated, regardless of the section under which the adjacent items will be supplied and installed. Indicate cross-references to Design Drawings and Specifications. Adjustments made on Shop Drawings by the Contract Administrator are not intended to change the contract price. If adjustments affect the value of the Work state such in writing to the Contract Administrator prior to proceeding with the Work.

.5 Manufacture of Products shall conform to revised Shop Drawings.

1.12 RECORD DRAWINGS

.1 The Contractor shall keep one (1) complete set of white prints at the Site during work, including all addenda, change orders, Site instructions, clarifications, and revisions for the purpose of Record Drawings. As the Work on-site proceeds, the Contractor shall clearly record in Red Pencil all as-built conditions, which deviate from the original Contract Documents. Record Drawings to include circuiting of all devices, conduit and feeder runs (complete with conductor size and number) and locations of all electrical equipment.

1.13 O&M MANUAL

.1 Operations and Maintenance Manuals

.1 Refer to Section 01 78 00 for general O&M Manual requirements.

.2 In addition to the general requirements, provide the following information:

.1 Table of Contents – Arrange contents sequentially by systems under Section numbers. Label tabs of dividers between each to match section numbers in the Table of Contents.

.2 Systems Descriptions – A brief synopsis of each system typed and inserted at the beginning of each section. Include sketches and diagrams where appropriate.

.3 Manuals containing all pertinent information, drawings and documents of the Contractor's supply and/or documentation included with the instruments supplied by others, such as:

.1 Mechanical drawings of the equipment.

.2 Installation drawings and procedures.

.3 Instrument model numbers.

.4 Equipment specifications.

.5 Detailed utility requirements.

.6 Replacement parts list with model numbers.

.7 Recommended preventative maintenance frequency.

.8 Troubleshooting procedures.

.9 Procedures for dismantling.

.10 Procedure to operate the equipment/instruments.

.11 Recommended cleaning procedure.

.12 Recommended list of supplies to be used in conjunction with the operation and maintenance of the equipment.

.13 Recommended spare parts list

.4 A copy of all wiring diagrams complete with wire coding.

.5 Include type and accuracy of instruments used.

.6 Set of final reviewed Shop Drawings clearly indicating make, model, and any selected options or accessories that were included in the final construction.

.7 Testing documentation including:

.1 Loop Check Report

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Not used

1.2 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI) / American Society of Mechanical Engineers (ASME).

.1 ANSI/ASME B16.1-2005, Gray Iron Pipe Flanges and Flanged Fittings.

.2 ANSI/ASME B16.5-2003, Pipe Flanges and Flanged Fittings.

.3 ANSI/ASME B16.11-2005, Forged Steel Fittings, Socket-Welding and Threaded.

.4 ANSI/ASME B16.25-2007, Buttwelding Ends.

.5 ANSI/ASME B16.34-2004, Valves Flanged, Threaded and Welding End.

.2 American Water Works Association (AWWA)

.1 AWWA C210-15 – Standard for Liquid-Epoxy Coatings and Linings for Steel Water Pipe and Fittings.

.2 AWWA C213-22 – Fusing-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings.

.3 ANSI/AWWA C508 – Swing-Check Valves for Waterworks Service, 2-in. Through 48-in. (50-mm through 1,200 mm) NPS

.4 ANSI/AWWA C517-16 – Resilient-Seated Cast-Iron Eccentric Plug Valves.

1.3 ACTION AND INFORMATIONAL 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 datasheets for valves and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Shop drawings to include:

.1 Assembly drawings and material list

.2 Details of all parts and principal dimensions.

.3 Details of the electrically driven operators, their electrical connections and power requirements.

.4 Electrical actuator wiring diagrams.

1.4 CLOSEOUT SUBMITTALS

.1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements:

.1 Delivery materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Deliver valves to site using loading methods which do not damage casings or coatings.

.3 Clearly tag valves, stating size, type, coatings and mating parts.

.3 Store on site until ready for incorporation in the work using methods recommended by manufacturer to prevent damage, undue stresses, or weathering.

1.6 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials / Spare Parts:

.2 Furnish the following spare parts:

.1 Valve seats: one for every 5 valves each size, minimum 1.

.2 Discs: one for every 5 valves each size, minimum 1.

.3 Stem packing: one for every 5 valves each size, minimum 1.

.4 Valve handles: 2 of each size.

.5 Gaskets for flanges: one for every 5 flanged joints.

.3 Tools:

.1 Furnish special tools for maintenance of systems and equipment.

Part 2 Products

2.1 GENERAL

.1 Scope

.1 Supply, install and satisfactorily operate all valves. In general, include all manual and power operators, floor stands, wrenches, chains, extension stems, stem guides, operating nuts, floor boxes, valve boxes, wall thimbles and auxiliaries.

.2 Supply and install all external piping and electrical connections to this equipment and all concreting for foundation bases in accordance with the respective Sections for such work.

.2 Coordination

.1 Where equipment is supplied with larger power requirement than that specified, coordinate with the Electrical Sections of these Specifications to ensure compatibility with electrical and control components without extra cost to the City.

.3 Appurtenances and Accessories

.1 Supply and install all appurtenances, fittings, connecting piping and accessories necessary for the proper functioning of the equipment, whether indicated on the Drawings or specified herein, or not.

.4 Suppliers

.1 Provide valves of the same type, size range and service from a single manufacturer.

.5 Provide new, unused valves for the work.

.6 Valve materials to be free from defects or flaws, with true alignment and bores.

.7 Unless otherwise indicated, valves shall be the same size as the pipe run in which they are to be installed.

.8 Clearly mark valve bodies in raised lettering to indicate the valve type, rating, and where applicable, the direction of flow. Conform to MSS SP25.

.9 Valves to open counter-clockwise.

2.2 DRAWINGS

.1 Refer to Process and Instrumentation Diagram for all valve references.

2.3 VALVE ENDS

.1 In pipe runs less than DN 50 diameter provide valves with female threaded ends, unless indicated otherwise. Threads to conform to ANSI B1.20.1.

.2 Valves in pipe runs equal to or greater than DN 50 diameter to be flanged unless indicated otherwise.

.3 For cast iron body valves, drill flanges to Class 125 pattern conforming to ANSI B16.1. For steel body valves, flanges to be Class 150 pattern or Class 300 pattern conforming to ANSI B16.5 or as noted.

.4 Lug style body valves shall have tapped holes, suitable for the bolt spacing of the pipe flanges placed on either side.

.5 End flanges for gate valves to be integral with the gate valve body and be faced and drilled in accordance with ANSI B16.1, Class 125 flanges.

2.4 BALL VALVES

.1 Up to DN 50:

.1 Two piece stainless steel body
.2 Type 316 SS wetted parts to ASTM A351 Gr CF8M
.3 Blowout proof stem
.4 69 bar (1000 psi) WOG
.5 Full port
.6 RPTFE seat and packing
.7 Quarter turn, locking lever handle
.8 NPT connection

.9 Acceptable product: Flow-Tek S80, Kitz 53F, Trueline N-620 or approved equal in accordance with B8.

2.5 CHECK VALVES

.1 Swing check valve designed, manufactured and testing in accordance with ANSI/AWWA C508.

.2 Valve body and cover shall be constructed of ASTM A536 ductile iron with fusion bonded epoxy coating on interior and exterior surfaces.

.3 Valve body shall be full flow equal to nominal pipe diameter at all points through the valve.

.4 The valve disc and seating surface shall be designed to minimize travel and slamming. The disc shall be-one piece construction and contain alloy steel and nylon reinforcement in the flexible hinge area. The flex portion of the disc shall be warranted for twenty-five years.

.5 The top access port shall be full size allowing removal of the disc without removing the valve from the line.

.6 The valve disc shall be independently cycle tested 1,000,000 times in accordance with with ANSI/AWWA C508 and shall remain drip tight at high and low pressures. The test results shall be applicable to sludge applications.

.7 Valve shall be provided with flanges in accordance with ANSI B16.1 Class 125.

.8 Acceptable products: Val-Matic swing-flex check or approved equal in accordance with B8.

2.6 PLUG VALVES

.1 Valve shall meet ANSI/AWWA C517 – Resilient-Seated Cast-Iron Eccentric Plug Valves.

.2 Cast iron body to ASTM A126 Class B

.3 Welded nickel seat

.4 Permanently lubricated radial shaft bearings of 316 SS

.5 Flanges to ANSI-B16.1, Class 125

.6 One piece construction plug c/w EPDM coating

.7 Adjustable packing

.8 Thrust washers of 316 SS and Teflon

.9 Drip tight shut-off up to rated working pressure

.10 Pressure rating to 1,200 kPa (175 psi) for valves up to DN 300

.11 Minimum open area of 80%

.12 Manual Actuators

.1 DN 150 and larger: Totally enclosed, grease packed gear actuator with position indicator and handwheel.

.13 Acceptable Products: Val-Matic Cam-Centric series #5800R, DeZurik Model PEC (Eccentric), Pratt Ball Centric, Victaulic AWWA series 365, or approved equal in accordance with B8.

2.7 FLOW CONTROL VALVE (FV-B80)

.1 Flow control valve in Offtake Structure 3

.2 Size: DN 150 (6”)

.3 Connection: raised face flanges, ANSI B16.5 Class 150

.4 Pressure rating: ASME Class 150

.5 Design Flow: 50 L/s

.6 Differential pressure: 227.5 kPa (33 psi) @ design flow

.7 Standard port: 90° V port

.8 Construction: SS316

.1 Body: ASTM A351 Gr CF8M
.2 Ball: ASTM A351 Gr CF8M
.3 Stem: ASTM A479 Gr 316
.4 Seat & packing: Tek-Fil
.5 Handle: SS304

.9 Electric actuator:

.1 Control type: quarter-turn, modulating
.2 Torque: 250 Nm (2,212 in-lbf)
.3 Temperature rating: -30°C to +70°C
.4 Manual override handwheel

.10 Acceptable Products: Bray/Flow-Tek RF15 series v-control ball valve or approved equal in accordance with B8.

2.8 ELECTRIC ACTUATORS

.1 Operation: designed to provide precise quarter-turn electric operation.

.2 Supply Rotork IQT electric valve actuators in accordance with E15 – Standardized Electric Valve Actuators.

.3 Electrical:

.1 Voltage: 120 VAC, single phase, 60 Hz
.2 Control voltage: 24 VDC
.3 Control signal: 4-20 mA

2.9 SHOP FINISHES

.1 All unfinished iron and steel work on the valves shall be thoroughly cleaned and painted.

.2 All valves identified on the drawings as requiring epoxy coating shall be coated on the interior and exterior with manufacturer's standard epoxy coating. Fusion Bonded Epoxy to AWWA C213 or Liquid Epoxy to AWWA C210.

Part 3 Execution

3.1 PREPARATION

.1 All valves shall be shop prepared, primed and coated. Field painting of valves shall only be required to touch up damaged coatings.

.2 Valve and piping arrangement indicated in the drawings is based on typical dimensions for valves of the specified type. Make the necessary modifications in piping to allow for discrepancies between valve dimensions shown and those supplied for the work.

.3 Field measure and check all equipment locations, pipe alignments, and structural installation prior to installation of valves. Ensure that valve locations and orientations provide suitable access to manual operators and that sufficient space and accessibility is available for electric actuators.

.4 Where conflicts are identified, inform the Contract Administrator and complete any necessary piping modifications at no cost to the City.

3.2 VALVE INSTALLATION

.1 In horizontal pipe runs, other than in locations where space does not permit, mount all valves with the actuator at the top. In no case install a valve with the operator shaft pointing down.

.2 Do not over torque bolts to correct for misalignment when joining valves to pipe or fittings.

.3 Support valves in position using temporary supports until valves are fixed in place.

.4 Permanently support valves to prevent transmission of loads to adjacent pipework and/or equipment.

.5 In general, pipe supports and hangers are not shown on drawings unless for indication purposes only.

.6 Install gate valves in the closed position.

.7 Install all valves in accordance with manufacturer's recommendations.

.8 Plug Valves

.1 Horizontal installation: Install valve such that seat is downstream and when valve is open, plug is located at the top.

.2 Vertical installation: Install valve such that seat is at the top of the valve.

3.3 ACTUATOR INSTALLATION

.1 Electrical connections to be made by Electrical sub-Contractor.

3.4 IDENTIFICATION TAGS

.1 Fit each valve and control mechanism with Lamacoid 3 mm thick plastic engraving sheet, coloured face, black or white core as directed. Attach the tag with stainless steel chain. Tags shall incorporate equipment name and tag number.

3.5 VALVE TESTING

.1 Valves shall be testing in accordance with manufacturer’s recommendation, and:

.1 operate valves under simulated and/or real process conditions to ensure operation as intended,

.2 valves to be pressure tested in conjunction with the pipes in which the valves are installed.

3.6 CERTIFICATION

.1 On completion of installation and testing of all equipment, submit the manufacturer's certification of the correctness of the installation to the Engineer.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 This section covers supply, installation and testing of a 1200mm x 1200mm stainless steel slide gate with 4 sides sealing for submerged applications and associated accessories for operation to be installed in the wet well. The contractor shall furnish all labor, materials, equipment and incidentals required to install and field test the gate shown on the Contract Drawings and specified herein.

1.2 REFERENCES

.1 Definitions

.1 Design Head: The maximum differential head that will be applied on the gate under worst case conditions, measured from the gate invert.

.2 Seating Head: Head applied on a wall mounted gate, in the direction that pushes the gate against the wall it is installed on.

.3 Unseating Head: Head applied on a wall mounted gate in the direction pulling the gate away from the wall it is installed on.

.4 Operating Head: The highest differential head that is to be applied on the gate when it needs to be operated, measured from the gate invert.

.2 Reference Standards

.1 ANSI/AWWA C561 – Fabricated Stainless Steel Slide Gates.

.2 ANSI/AWWA C542 – Electric Motor Actuators for Valves and Slide Gates.

.3 ASTM A240/A240M – Standard Specification for Chromium and Chromium Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.

.4 ASTM A276 – Standard Specification for Stainless Steel Bars and Shapes.

.5 ASTM A582/A582M - Standard Specification for Free-Machining Stainless Steel Bars.

.6 ASTM A790/790M - Standard Specification for Seamless and Welded Ferritic / Austenitic Stainless Steel Pipe.

.7 ASTM B179 - Standard Specification for Aluminum Alloys in Ingot and Molten Forms for Castings from All Casting Processes.

.8 ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

.9 ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications.

.10 ASTM D4020 - Standard Specification for Ultra-High-Molecular-Weight Polyethylene Molding and Extrusion Materials.

.11 ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

1.3 SUBMITTALS

.1 Shop Drawings

.1 The slide gate manufacturer shall submit, for acceptance by the Contract Administrator, shop drawings of the equipment supplied under this section including stainless steel slide

gate, frames, lift operators, electric actuator, stems, wall brackets, maximum uplift loads at the base of the pedestal, minimum required electrical operator torque, stem cover and its markings etc. Drawings must indicate all dimensions that will allow the Contract Adminstrator to ensure coordination with dimensions of the installation environment. Drawings will also show sufficient details to determine compliance with the requirements, including the stainless steel plate thickness used for all components. Drawings shall also include certification that the slide gate supplied meet all requirements of the latest edition of AWWA C561.

.2 Design Calculations

.1 The gate manufacturer shall submit, for acceptance by the Contract Administrator, design calculations demonstrating compliance with the design requirements of these specifications and those of the latest edition of AWWA C561. In particular, calculations shall be submitted for the following gate components:

.1 Slide
.2 Seat contact pressure
.3 Frame
.4 Stem, stem connection
.5 Lifting nut
.6 Manual actuator operating force / torque
.7 Electric actuator load / torque
.8 Anchors

.3 Test Reports

.1 The gate manufacturer shall submit upon request, for information, the leakage and operation test reports specific to the gate being supplied, demonstrating their compliance with the maximum leakage rate and maximum operating force allowed.

.4 Installation, Operation and Maintenance Manual

.1 The gate manufacturer shall provide a manual containing all relevant manufacturer's brochures and technical literature detailing correct installation procedure and recommended installation, operating and maintenance instructions. Manuals shall be bound with the project title and gate description identified on the front cover. One set of manuals shall be provided for each size of gate. Final payment for slide gate will not be made until the above information has been provided to the Contract Administrator. The manual shall also contain the detailed information on the terms of the 5 year warranty on the product.

.5 Provide the following information to the Contract Administrator prior to the delivery of slide gate and operator assemblies:

.1 A certified copy of the Chemical and Physical Analysis on all materials used in the manufacture of the slide gate, stems, operator and accessories or certification that the materials used are in strict accordance with this specification.

.2 Copies of the shop test reports for Performance and Leakage tests. Included on the report shall be the signature of the official who is responsible for the gate assembly and testing.

1.4 QUALITY ASSURANCE

.1 Qualifications

.1 The gate supplied under this section shall be standard products of a manufacturer regularly engaged in the design and manufacturing of water control gate. The specifications are based on FONTAINE-AQUANOX Series 20 Slide Gate manufactured by ISE Metal Inc.

.2 Standards and Certifications

.1 The gate supplied under this section shall conform to all requirements of the latest edition of ANSI/AWWA C561. The slide gate manufacturer must maintain an ISO-9001 certification and also a company certification for its welding operations from the CWB or AWS.

1.5 DELIVERY

.1 The manufacturer shall use due and customary care in preparing the gate and accessories for shipment.

1.6 WARRANTY

.1 The slide gate and manual operating accessories shall be covered by a five (5) year warranty from the manufacturer against defects in materials, design and workmanship. The warranty period will start from the date of delivery of the equipment to the installation site.

Part 2 Products

2.1 EQUIPMENT

.1 Manufacturers

.1 Gate supplied shall be FONTAINE-AQUANOX Series 20 Slide Gate, as manufactured by ISE Metal Inc. or approved equal.

.2 Description

.1 The gate shall be installed in the wet well to elevation shown in the drawings. Design gate opening size is 1200mm inside diameter.

.2 The gate shall be upwards opening of the 4 sides sealing type designed for submergence in storm water applications. They shall have flow control capability by allowing only flow through the open area in partial opening situations. As specified in the gate schedule, each gate shall be open-frame design and rising stem configuration.

.3 The gate shall be designed and manufactured in strict compliance with the latest version of the AWWA C560 standard.

.3 Performance and Design

.1 Slide

.1 The slide consisting of a flat plate with welded reinforcing ribs shall be designed to withstand the seated design head of 10m and unseated design head of 3m with a maximum deflection of 1/720 of the gate opening width or 1/16 in (1.6mm) whichever is less and with stresses in the slide limited to 25% of the ultimate tensile, compressive, and shear strength and 50% of the yield strength, whichever is less.

.2 Minimum material thickness of all members of the slide shall be ¼ in (6mm).

.2 Frame

.1 The gate frame shall be made of formed plates or structural members creating the clear opening of the specified dimensions in a rigid one-piece unit. The mounting and bolting flange of the frame to the wall shall be separate and independent from the seating and sealing plane of the slide.

.2 The frame shall be designed to mount to a curved wall surface (ie in front of flush pipe inside a round manhole - RMX) of inner diameter as shown on the drawings.

.3 The bottom of the frame will be of the flush invert type.

.4 Stresses in the frame under design head shall not exceed 25% of the ultimate tensile, compressive, and shear strength and 50% of the yield strength, whichever is less.

.5 Minimum material thickness of all members of the frame shall be ¼ in (6mm).

.3 Guiding and Seating

.1 The slide shall seat and travel on guides made of ultra high molecular weight polyethylene (UHMWPE) designed to perform for the life of the slide gate without replacement.

.2 The slide shall be kept in positive contact with the guides on both its upstream and downstream faces, all along its travel in the gate clear opening by an elastomeric cord. Above the gate clear opening, the guides shall extend high enough to ensure that the slide is supported on a minimum of 1/2 of its height when fully opened.

.3 The low friction guides shall be secured to the frame by bolted retainers permitting field adjustment of the contact pressure with the slide.

.4 Gate frame designed as channel shaped guides with added UHWPE pads simply bolted inside the channel, not providing adjustment of the slide contact pressure by bolts will not be allowed.

.5 The surface of contact on the side seats shall be large enough to limit the stress under the design head to 600 psi (4137 KPa) without considering the top and bottom seats as load bearing.

.4 Sealing

.1 The guides combined with the elastomeric cord will provide sealing on both sides of the opening.

.2 The compression cord shall push and close the UHMWPE seal as the gate opens to prevent grit and dirt to penetrate the guiding slot. Wide channel shaped guiding slots allowing accumulation of dirt and grit will not be accepted.

.3 Sealing at the top section of the gate will also be achieved with a UHMWPE seat maintained in contact by an elastomeric cord.

.4 At the gate invert, the slide shall close on a flush invert rubber seat/seal secured in the bottom member of the gate frame. Bottom seals attached to the slide and rubbing against the side seals will not be allowed, nor will rubber seals that are not flush bottom.

.5 Under the design seating or unseating head specified in the gate schedule, the slide gate shall restrict leakage to a maximum of 0.04 gpm/ft (0.5 l/min/m) of clear opening perimeter. Manufacturer shall be able to demonstrate that the sealing system will retain its performance even after 25,000 operating cycles.

.5 Stem Connection

.1 In the case of a gate with rising stem, the stem or its extension will be connected to the slide by means of a pinned connection.

.2 Stem connection design shall limit the stress under the design load to a maximum of 25% of the ultimate tensile, compressive, and shear strength and 50% of the yield strength. The stem connection design load shall be the thrust and torque developed when a 80lbs (356N) efforts is applied the crank or handwheel (for a manual actuator), or 1.5 times the thrust and torque developed with the actuator in stalled condition (for electric motors).

.6 Stem

.1 The stem configuration shall be rising the type specified in the schedule. The threads shall be machine rolled ACME left hand threads with double entry to minimize the number of turns required for operation and provide gate opening by counter clockwise rotation of the manual actuator. Surface finish of the machined threads will be 32 micro inch (0.813 μm) or better.

.2 For a manually operated gate with rising stem, the stem shall be equipped with an adjustable stop collar to prevent over-closing the gate and potentially damaging components.

.3 The stem shall be sized so that its critical buckling load (as determined by the Euler column formula) is higher than the design compression load, defined as the vertical force developed by a 80lbs (356N) effort applied on the crank or handwheel (for a manual actuator), or 1.5 times the thrust and torque developed with the actuator in stalled condition (for electric motors).

.4 Stem top shall be marked with high visibility paint and shall be visible through the stem cover on the top of the operator.

.7 Couplings

.1 The required stem extensions shall be joined together or to the threaded stem by means of a bolted connection, passing through both pipe and stem.

.8 Stem guides

.1 Guides will be provided as required to meet the stem buckling design criteria and positioned per the manufacturer's recommendations to ensure that the length to radius of gyration ratio (l/r) does not exceed 100. The guides shall incorporate a UHMWPE bushing supported by a stainless steel wall bracket adjustable in both horizontal and vertical directions.

.4 Manual Actuators

.1 Operation

.1 Manual actuator of the proper type and mounting location, as listed in the gate schedule or shown on the drawings, shall be provided by the gate manufacturer.

.2 The effort required on the manual device to operate the gate shall not exceed 40 lbs (178 N), while to start the gate in motion from the fully closed position with the design pressure, the required effort shall not exceed 60 lbs (267 N).

.3 Indication of the opening direction of rotation shall be clearly marked in a permanent manner on the crank.

.4 The operator shall be equipped with AWWA 2" x 2" (51mm x 51mm) square operating nut to allow for drill actuator use once crank is removed.

.2 Crank Operated Gearboxes

.1 The gearbox, comprising a lift nut and thrust bearing assembly (as described below), shall be fully enclosed in a casted housing with seals around the lift nut

and around the input pinion shaft. The input pinion shaft shall be supported on ball or tapered roller bearings.

.2 The removable crank, equipped with a revolving grip shall engage on the input shaft of the gearbox and have a minimum radius of 12" (305mm).

.3 Actuator Lift Nut and Thrust Bearings

.1 The gate shall include a thrust bearing assembly comprising a threaded bronze lift nut to engage the operating stem. This assembly must be enclosed in a machined stainless steel housing or be an integral part of the gearbox when supplied.

.2 Needle roller thrust bearings shall be provided above and below the lift nut to support the operating efforts in closing and opening the gate.

.3 The length of thread engagement shall be sufficient to ensure that the maximum pressure on the projected area of thread contact does not exceed 2000 psi (13.8 MPa) at normal maximum operating load and that the PV (pressure velocity) factor does not exceed 30,000. The PV factor is calculated by multiplying the pressure on the projected area of thread contact in psi by the surface velocity in ft/min at the pitch diameter of the threads. For a non-rising stem gate, the actuator lift nut shall be keyed to prevent rotation relative to the threaded stem.

.4 Mounting

.1 The thrust bearing assembly or the gearbox shall be mounted on a pedestal.

.2 Pedestal height shall be such that the hand crank or input shaft of the gearbox is located approximately 36" (900mm) above the operating floor.

.5 Stem Cover

.1 A rising stem gate, whether manual or motorized shall be equipped with stem cover with acrylic window with gradations in centimeter increments for the entire range of gate operation. The cover shall bear graduation in both inches and centimeters to indicate the position of the gate. Also, markings indicating top of stem position in fully open and fully closed gate position shall be placed on the stem cover.

.6 Painting

.1 The operator shall be surface prepared to SSPC-SP10 (near-white blast) and painted with two coats of Intergard FP, Amerlock 2 Epoxy Coating or an approved equivalent high-build epoxy. Epoxy coatings shall be 150 µm per coat dry film thickness. It shall also be coated with one finish coat of polyurethane enamel. Polyurethane enamel coatings shall be 100 µm per coat dry film thickness. Field touch-up chips and scratches with coating(s) to match the shop applied coating(s).

.5 Portable Electric Actuator

.1 Portable Electric Actuator shall be supplied complete with a tripod, safety torque clutch release and 2" (51 mm) square nut adapter. Portable Electric Actuator shall be designed to be used in horizontal position. Acceptable product: Eibenstock Electric Drill Model EHB 32/2.2 R/RL complete with Mach III Torque Limiter with 51mm square nut adaptor or approved equal.

.6 Anchor Bolts

.1 The quantity, size and location of anchor bolts shall be determined by the gate manufacturer and shown on the submittal drawings. The minimum required load capacity of the anchors used for design must also be indicated on the drawings. Anchorage shall

be done with adhesive anchor system such as Hilti HIT-HY200 with stainless steel threaded rods or approved equal. Anchor installers shall be trained in anchor installation and shall provide training completion certificates prior to commencing the work.

.7 Materials

Slide, Frame and Yoke	Stainless Steel	ASTM A240, grade 316L or 304L
Side Seal/Guides and Top Seal	Ultra High Molecular Weight Polyethylene (UHMWPE)	ASTM D4020
Flush Invert Bottom Seal	Ethylene Propylene (EPDM)	ASTM D2000
Compression Cord	Ethylene Propylene (EPDM)	ASTM D2000
Wall Gasket	Ethylene Propylene (EPDM)	ASTM D2000
Bolts and Hardware	Stainless Steel	ASTM F593, grade 316
Stem	Stainless Steel	ASTM A582, grade 316 or 304
Thrust Nut and Lift Nut	Aluminum Bronze or Manganese Bronze	ASTM B505, C95800 ASTM B584, C86300
Stem Couplings	Stainless Steel	ASTM A582, grade 316
Stem Guide Bracket	Stainless Steel	ASTM A582, grade 316
Stem Guide Bushing	Ultra High Molecular Weight Polyethylene (UHMWPE)	ASTM D4020
Crank	Aluminum	ASTM B209, 6061-T6
Pedestal	Stainless Steel	ASTM F593, grade 316
Gearbox Housing	Cast Iron	ASTM A48 35B/40B
Square Nut	Cast Aluminum	ASTM B179
Stem Cover	Clear PVC	
Stem Cover Cap	PVC	

2.2 FACTORY TESTS

.1 The gate shall be tested in the factory for leakage and for operating force. Leakage shall be measured at the unseating design pressure. Operating force shall be measured with and without the design pressure. Factory test reports shall be available on request for all gate supplied.

Part 3 Execution

3.1 SHOP TESTING

.1 The fully assembled gate shall be shop inspected, adjusted and tested for operation and leakage at the design head before shipping.

3.2 DELIVERY AND SHIPPING

.1 The Contract Administrator will examine the slide gate assembly, frame, stem, operator and accessories upon delivery and will reject any equipment that is found to be damaged to the extent that, in the Contract Administrator's opinion, it cannot be put to the use for which it was intended. The Contractor shall arrange with the gate supplier to repair any superficially damaged equipment to the satisfaction of the Contract Administrator.

.2 It shall be the responsibility of the Contractor to negotiate any claims for damage with the carrier and to make arrangements to have any rejected equipment replaced as soon as possible at no extra expense to the Contract Administrator.

3.3 INSTALLATION

.1 It is the responsibility of the Contractor to handle, store and install the gate in strict accordance with the manufacturer's instructions and recommendations. The Contractor shall review the installation drawings and instructions before proceeding to the installation of the gate.

.2 The gate assemblies must be installed on a true vertical plane, square and plumb. The operating stem shall be accurately aligned with the gate guides and properly greased.

3.4 FIELD TESTING

.1 After installation, the gate must be field tested by the Contractor, in the presence of the Contract Administrator, to ensure compliance with the requirements of these specifications. The gate shall be operated on its complete open-close cycle to confirm operation without binding, scraping or distorting. Operating effort on the crank, handwheel or T-wrench shall be observed or measured. In the case of motorized actuators, the operating torque shall be noted, and the initial set-up of each actuator shall be done in accordance with the instructions in the manual.

.2 The Contractor shall coordinate and arrange for a qualified field representative of the slide gate supplier/manufacturer to be present prior to and during field testing. The field representative shall complete required adjustments prior to field testing. If the gate fails the field leakage test, the field representative shall undertake adjustments, replacements or other modifications prior to repeating the test. The sequence shall be repeated until the gate passes the allowable leakage test. The Contract Administrator shall incur no additional costs for adjustments undertaken due to misalignment of the slide gate wedges and seats.

.3 Each gate shall be water tested by the Contractor and sealing performance shall be observed. Acceptable leakage criteria shall be as per latest version of AWWA C560.

.4 The Contractor shall supply a detailed report of the field tests to the Contract Administrator for review.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Vertical, single stage, end suction, centrifugal pumps specifically for municipal, institutional, commercial, and industrial sewage applications. Pumps will be FLYGT A-C Custom Pump as manufactured by Xylem Water Solutions.

.2 Each pump unit shall include:

.1 Pump support frame

.2 Suction elbow

.3 Flanged connections

.4 Pump motor and support frame

.5 Extended drive shaft, couplings, intermediate support bearings, guards

.6 Power and control cables

.7 All necessary hardware, gaskets, etc. required to install two complete pumping units in the packaged sewage lift station dry well.

.8 Up to two (2) working days of testing, commissioning and training per this section and Section 01 91 13 – General Commissioning Requirements.

.2 Related Requirements

.1 40 32 13.14, Packaged Sewage Lift Station, Dry Well Type.

.2 40 91 00 – Automation – Process Measurement Devices.

1.2 REFERENCE STANDARDS

.1 Not used.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.

.3 Shop Drawings.

.1 Submit shop drawings to indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.

.2 Wiring and schematic diagrams.

.3 Dimensions and recommended installation.

.4 Pump performance and efficiency curves.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals, include:

.1 Manufacturers name, type, model year, capacity and serial number.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list with names and addresses.

1.4 QUALITY ASSURANCE

.1 Unit responsibility. Pump(s), complete with motor, base, coupling, extended drive shaft, 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.

.2 The vertical dry-pit solids-handling pump(s) specified in this section shall be furnished by and be the product of one manufacturer.

.3 Pumps are to be engineered and manufactured under a written Quality Assurance program. The Quality Assurance program is to be in effect for at least ten years, to include a written record of periodic internal and external audits to confirm compliance with such program.

.4 Pump(s) are to be manufactured under the certification of ISO-9001:2000.

1.5 PERFORMANCE

.1 The pump(s) shall be designed for continuous operation under normal service with a minimum of six (6) starts per hour.

.2 Operation criteria:

.1 Nominal speed: maximum 1200 rpm.

.2 Pump motors will be operated on variable frequency drive.

.3 Performance based on full size, non-trimmed impeller, operated at reduced speed to meet required duty point(s).

	Flow (L/s)	**TDH (m)**	**Static head (m)**	**NPSHa (m)**
Design Condition	181.6	40.9	14.7	7.25
Secondary Condition	(* 202)	39.2	13.3	7.06

.4 * Manufacturer to state the flow rate for of the secondary condition at the total dynamic head indicated.

.5 Pumped liquid: raw sewage with a maximum temperature of 18°C.

.3 Suction size: DN200 (8”).

.4 Discharge size: DN200 (8”).

.5 Pump efficiency at BEP: minimum 75%.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURES

.1 Pump(s) shall be the product of Xylem Water Solutions.

2.2 PROCESS PUMP

.1 Design:

.1 Rotation:

.1 The pump will be clockwise rotation when looking at the pump from the drive end.

.2 Impeller:

.1 The impeller shall be single-suction enclosed type with two vanes, made of Ductile Iron. Impeller be specifically designed with smooth water passages to prevent clogging by stringy or fibrous materials, and shall be capable of passing solids having a maximum sphere size of 76 mm (3”).

.2 The impeller is to be dynamically balanced and shall be keyed and secured to the shaft by a 18-8 stainless steel nut locked in place. It shall be readily removed without the use of special tools.

.3 Volute Casing:

.1 The Casing shall be close-grained cast iron conforming to ASTM A48 Class 30 of sufficient strength, weight and metal thickness to ensure long life, accurate alignment, and reliable operation. The volute shall have smooth fluid passages large enough at all points to pass any size solid which can pass through the impeller and provide smooth unobstructed flow.

.2 The volute shall be flanged tangential discharge and capable of rotation in 45 degree increments to accommodate piping orientation.

.3 Casing shall be split perpendicular to the shaft, with removable suction cover and stuffing box cover. Machined fit for these parts shall be accurately aligned and identical so that casing may be installed for either clockwise or counterclockwise direction of rotation.

.4 The volute shall be furnished with large cleanout openings located at the impeller centerline, to allow access to the impeller. Volute priming, drain and minimum ½ inch pressure gauge connections shall be provided. Flanges shall be 125 lbs. faced flanges per ANSI drilling and slotted for ease of assembly and disassembly.

.5 The casing shall be designed to permit the removal of the rotating assembly without disturbing the suction or discharge piping. The casing shall be hydrostatically tested to 1.5 times the design head or 1.25 times the shutoff head whichever is greater.

.4 Wear Rings:

.1 Wear rings shall be provided on both the impeller and fronthead so that clearances can be maintained throughout the life of the rings and minimize recirculation.

.2 Impeller wear rings shall be replaceable 11.5-14% chrome steel “L” shaped axial or face-type and mounted on impeller to provide a renewable surface opposite the suction cover wear plate.

.3 Suction cover wear rings shall be replaceable 11.5-14% chrome steel and provide a minimum of ¼ inch wear surface. It shall be installed with its wear surface parallel to the end of the impeller nut.

.4 Wear rings shall be attached to the impeller and suction cover using an interference fit and loctite.

.5 Wear ring clearance adjustment shall have provisions for adjustment of axial clearance. This adjustment shall be made through the use of shims placed between the frame and outboard bearing housing.

.5 Suction Cover:

.1 The Suction Cover shall be removable to allow access to the impeller. It shall be ASTM A48 Class 30 Cast Iron and drilled for ANSI 125 lb. flanges. The mounting holes shall be slotted for ease of assembly and disassembly.

.2 Suction gauge connections shall be drilled & tapped next to the suction flange to accommodate a ½ inch IPS pipe fitting.

.6 Stuffing Box Cover:

.1 Stuffing box cover shall be made of ASTM A48 Class 30 close-grained cast iron with integral stuffing box and shall be designed to accept either packing or mechanical seal.

.2 Packing: stuffing box shall consist of five (5) rings of graphite-impregnated packing, a Teflon seal cage, and a split-type gland to permit easy removal and access to packing. Sealing liquid connection to stuffing box shall be tapped in a convenient location.

.3 Mechanical Seal: A John Crane type 21 double mechanical seal (or approved equal in accordance with B8) shall be installed in the stuffing box.

.4 Dynamic seal: stuffing box shall be fitted with a single stage, Dynamic Seal capable of balancing our positive suction heads.

.1 Throttle Bushing: a throttle bushing and sleeve shall be placed in the stuff box cover. Both pieces shall be made of 316 stainless steel with a NI-CR-Boron coating to a hardness of 58-63 RC (approximately 650 BHN).

.2 The Dynamic Seal expeller shall be made of nodular iron, ASTM 536 or 304 stainless steel. A pressure relief connection with elbow, fittings, and tubing shall be provided in the seal cover to bleed liquid back to the suction cover of the pump.

.3 Static Seal: Dual static seals, provided with the grease cavity between them, shall be installed in the seal cover to prevent leakage along the shaft, when the pump is not running. A positive means for adding grease shall be provided in the seal cover. Seals shall contact a 316 stainless steel sleeve with a Ni-Cr-Boron coating to a harness of 58-63 RC (approximately 650 BHN). Equiseal® Dynamic Seal shall be manufactured by Xylem Flygt or approved equal in accordance with B8.

.7 Bearing Frame Assembly:

.1 The Bearing housing shall be one-piece rigid cast iron construction. Frame shall be provided with cast iron bearing housing at the outboard end, and a cast iron end cover at the inboard end. Both ends of the frame shall be provided with lip type grease seals and labyrinth type deflectors to prevent the entrance of contaminants.

.2 Bearing frame shall be designed so that complete rotating assembly can be removed from the casing without disconnecting suction or discharge piping.

.3 Frame shall be provided with a ¾ inch IPS pipe tapped hole, located as low as possible to drain the leakage from the packing gland.

.4 Jacking bolts for external impeller adjustments are required.

.5 Zerk-type grease fittings for bearing lubrication shall be supplied at the bearing housing.

.6 The pump shaft shall be high-strength carbon steel, AISI #1045 minimum, accurately machined, tapered at the impeller end and sufficiently sized to transmit full driver output. It shall be protected from the pumped liquid by a shaft sleeve in the stuffing box area. A seal shall be provided, by a synthetic rubber "O" ring, between the shaft and shaft sleeve to prevent leakage of pumped liquid out and/or air into the pump.

.7 Shaft sleeve for Packing: a renewable shaft sleeve used with packing shall be of a corrosion resistant 400 series stainless steel with 500 Brinell hardness. The sleeve provided shall extend through the stuffing box and under the gland.

.8 Shaft sleeve for Mechanical seal: a renewable shaft sleeve used for mechanical seals shall be 300 series stainless steel positive adhesive sealed to prevent leakage between the shaft and the sleeve, shall protect the shaft through the sealing box area. The sleeve provided shall extend through the stuffing box and under the gland.

.9 Inboard bearing – inboard bearings shall be single row, radial type suitable for all loads encountered in the service conditions.

.10 Outboard bearing – outboard bearings shall be axial thrust, angular contact, double row ball suitable for thrust loads in two directions.

.11 Bearings shall be designed for an L10 life of 100,000 hours per AFBMA at best efficiency point.

.12 Bearing Lubrication: bearings shall be grease lubricated with provisions for the addition and relief of grease.

.13 Bearing Locking: the outboard bearing shall be locked to the shaft with a nut and lock washer. The lock washer shall have a key seat tab on its ID to prevent it from turning and a set of tabs on its OD, one of which will align with a notch in the nut to prevent it from loosening.

.8 Provision only for the installation of vibration and temperature sensors (by others) on pump outboard (drive-end) bearing only.

.1 Vibration sensor: IMI model 641B61 XY (by others).

.2 Temperature sensor: 100Ω RTD (by others).

.3 See Section 40 91 00 – Automation – Process Measurement Devices for mounting details.

.9 Pedestal Base, Suction Elbows and Coupling Guard

.1 Model 250 with intermediate shafting: Intermediate line shafting of the flexible type shall be of the size (diameter, length, number of and joint) as recommended by the shaft manufacturer to provide continuous 24hr duty at any speed within the range specified and max. torque. Couplings shall be universal joint type to permit removal of the pump rotating element without dismantling other sections of shafting, any intermediate bearing, and without removing driver. One slip

spline, to allow for endwise movement, and the necessary steady bearings shall also be provided for each shaft.

.2 Suction Elbow: Each pump shall be provided with a clean-out type cast iron reducing suction elbow which is bolted directly to the pump suction flange. A 100 mm (4 inch) minimum handhole clean-out shall be provided with a removable cover. The inner surface shall generally conform to the curvature and radius of the suction elbow. A ½ inch tapped hole for pressure gauge connection shall be provided in the elbow near the suction flange. A 2 inch tapped hole shall be provided in the side of the elbow for use in applying water pressure to unclog the pump in case of blockage.

.3 Coupling: Couplings shall be of the manufacturer's choice and of flexible type. Coupling hubs shall be secured to the driver and driven shafts by a set screw located over the key.

.4 Coupling Guard: Guard shall be all-metal completely enclosing the coupling.

.5 The coupling shall be a standard-flexible type and secured to the driver and driven shafts by a setscrew located over the keyway.

.10 Fits and Hardware:

.1 The volute/casing, suction cover, stuffing box cover, and frame shall be manufactured with concentric shoulder fits to assure accurate alignment. All machined bolts, nuts, and capscrews shall be of the hex-head type and will not require the use of any special tools.

.11 Paint:

.1 Prior to paint: blast and clean per SSPC-SP10.

.2 Primer: primer paint with one coat of Carboline Carboguard 890, DFT or 4-6 mils.

.3 Top Coat: Apply top coat with Carboline Carboguard 890, DFT of 4 to 8 mils.

.4 Color Navy Grey. Total DFT of 8 to 16 mils.

.12 Vibration Limitations (Field):

.1 The limits of vibration as set forth in the standards of the Hydraulic Institute shall govern.

2.3 INTERMEDIATE DRIVE SHAFT

.1 A universal joint type intermediate shafting shall be provided to transmit power between the motor and the pump.

.1 Each section of shafting shall consist of one (A) section just above the pump and one or more (B) sections depending upon the distance to be spanned. The number of sections shall be as recommended by the shafting manufacture. The (A) Section shall have a telescoping splined slip member which will permit removal of the pump shaft and impeller with out removing any section of intermediate shafting.

.2 Calculations shall be submitted to determine both a lateral and torsional critical speed analysis of the entire shafting assembly including the motor, the shafting, and the pump to identify that the first lateral critical speed shall be at least 25% above the maximum pump speed. Other exciting frequencies such as universal joint 2X and vane-passing excitation shall also be avoided by placing these at least 20% above or below running RPM.

.3 No torsional natural frequency shall occur within a range extending from 20% below to 20% above any exciting resonant frequency.

.4 Lengths shall also be determined to place the u-joints in accessible positions for lubrication.

.2 Intermediate shafting shall be manufactured utilizing metallic DOM tubing only.

.3 The drive shaft assembly shall be capable of withstanding the applied torque produced by the motor with a safety margin of no less than 2 times over the expected motor peak torque covering the entire range and speed as specified. The driveshaft assembly shall be designed to operate below its critical speed. The 1/2 critical speed and potential excitation by impeller vanes shall also be avoided.

.4 Shafting shall be precision dynamically balanced to 1/2 once inch per 10 pounds of shaft weight per end. Units shall be balanced at the maximum running RPM. Where multiple shafts are required per system, whenever possible, the shafts shall be balanced as a unit and match marked to ensure proper in-field installation.

.5 Approved Manufacturer: Johnson Power Ltd. or approved equal in accordance with B8.

2.4 MOTOR

.1 General Requirements:

.1 Power supply: 575V, 3 phase, 60 Hz.

.2 Power rating: 150 kW (200 hp) (Note: motor sized for maximum pump bhp at 100% nominal speed with full size, non-trimmed impeller plus a 5% margin.)

.3 Nominal speed: 1,200 rpm.

.4 Efficiency: NEMA premium efficiency.

.5 Starts per hour: minimum 6.

.6 CSA Specification Conformance: C22.2 NO. 100.

.7 Inverter duty for VFD compatibility

.8 Suitable for full voltage or reduced voltage starting.

.9 Reverse rotation capability.

.10 Motor winding high temperature switch – wired to a junction box with terminal blocks mounted to the motor.

.11 Heavy duty grease-lubricated anti-friction bearings with an AFBMA B10 rating of 100,000 hours.

.12 Electrically insulated non-drive end bearing or housing suitable for inverter/VFD application.

.13 Provision only for the installation of vibration and temperature sensors (by others) on motor non-drive end bearing only.

.1 Vibration sensor: IMI model 641B61 XY (by others)

.2 Temperature sensor: 100Ω RTD (by others)

.3 See Section 40 91 00 – Automation – Process Measurement Devices for mounting details.

.14 Motor shaft grounding ring suitable for inverter/VFD application.

.1 Approved product: AEGIS SGR bearing protection ring or approved equal in accordance with B8.

.15 Painted according to manufacturer's standard coating system.

.16 Approved manufacturers:

.1 Baldor,

.2 General Electric,

.3 Toshiba,

.4 U.S. Electric,

.5 WEG,

.6 Westinghouse,

.7 Or approved equal in accordance with B8.

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 data sheet.

3.2 FACTORY TESTING

.1 A certified factory performance test shall be performed on each pumping unit in accordance with Hydraulic Institute Standards, latest edition. Tests shall be sufficient to determine the curves of head, input horsepower, and efficiency relative to capacity from shutoff to 150% of design flow. A minimum of six points, including shutoff, shall be taken for each test. At least one point of the six shall be taken as near as possible to each specified condition.

3.3 INSTALLATION

.1 Make piping and electrical connections to pump and motor assembly and controls as indicated.

.2 Ensure pump and motor assembly do not support piping.

3.4 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:

.1 Check power supply.

.2 Check starter protective devices.

.2 Start-up, check for proper and safe operation.

.3 Check settings and operation of hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.

.4 Adjust impeller shaft stuffing boxes, packing glands.

3.5 START-UP

.1 General:

.1 In accordance with Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS: General Requirements, supplemented as specified herein.

.2 Procedures:

.1 Check power supply.

.2 Check starter O/L heater sizes.

.3 Start pumps, check impeller rotation.

.4 Check for safe and proper operation.

.5 Check settings, operation of operating, limit, safety controls, over-temperature, audible/visual alarms, other protective devices.

.6 Test operation of hands-on-auto switch.

.7 Test operation of alternator.

.8 Adjust shaft stuffing boxes.

.9 Adjust leakage flow rate from pump shaft stuffing boxes to manufacturer's recommendations.

.10 Check base for free-floating, no obstructions under base.

.11 Run-in pumps for 12 continuous hours.

.12 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.

.13 Adjust alignment of piping and conduit to ensure full flexibility.

.14 Eliminate causes of cavitation, flashing, air entrainment.

3.6 PV - PROCESS PUMPS

.1 Application tolerances:

.1 Flow: plus 10%; minus 0%.

.2 Pressure: plus 10%; Minus 5%.

.2 PV Procedures:

.1 Fill sump at rate slower than capacity of pump #1.

.2 Record levels at which pump #1 starts and stops. Determine flow rate by observing time taken to down water level.

.3 Fill sump at rate faster than capacity of pump #1 but slower than capacities of pumps #1 and #2 operating in parallel.

.4 Record levels at which pumps start and stop - water level rising and water level falling.

.5 Verify operation of alternator.

.6 Adjust water level controls as necessary.

.7 Fill sump at rate faster than capacities of pumps #1 and #2 operating in parallel.

.8 Record levels at pump starts and stops - water level rising and falling.

.9 Check operation of alternator.

.10 Adjust level controls as necessary.

.11 Check level at which high water level alarm starts and stops. Adjust as necessary.

.3 Check removability of pumps for servicing without interfering with installation or operation of other equipment.

.4 Verify non-clog capability and maximum size of solids, using procedures recommended by manufacturer.

3.7 REPORTS

.1 In accordance with Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS: reports, supplemented as specified.

.2 Include:

.1 PV results on approved PV Report Forms.

.2 Product Information report forms.

.3 Pump performance curves (family of curves) with final point of actual performance.

3.8 TRAINING

.1 In accordance with Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS: Training of O&M Personnel, supplemented as specified.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B31.3-2014, Process Piping

.2 American National Standards Institute/American Water Works Association (ANSI/AWWA)

.1 ANSI/AWWA C206-03, Field Welding of Steel Water Pipe.

.3 American Welding Society (AWS)

.1 AWS C1.1-2000 (R2006), Recommended Practices for Resistance Welding.
.2 AWS Z49.1-2005, Safety Welding, Cutting and Allied Process.
.3 AWS W1-2000 (R2006), Welding Inspection Handbook.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 48.2-92, Spot Radiography of Welded Butt Joints in Ferrous Materials.

.5 Canadian Standards Association (CSA International)

.1 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.
.2 CSA B51-09, Boiler, Pressure Vessel and Pressure Piping Code.
.3 CSA W117.2-01 (R2006), Safety in Welding, Cutting and Allied Processes.
.4 CSA W178.1-08, Certification of Welding Inspection Organizations.
.5 CSA W178.2-08, Certification of Welding Inspectors.

.6 Pipe Fabrication Institute (PFI)

.1 ES-3 – Fabrication Tolerances
.2 ES-24 – Pipe Bending Tolerances
.3 ES-31 – Standard for Protection of Ends of Fabricated Piping Assemblies

1.2 DEFINITIONS

.1 Pipespool: As used in this specification, pipespool means a unit of fabricated piping consisting of pipe, fittings, flanges, and other components integral to the assembly.

1.3 SCOPE

.1 This section covers the requirements for materials, fabrication, and erection of above ground steel piping and components in the Valve Chamber. Erection shall consist of complete installation of piping systems as per the Contract drawings.

.2 Supply and install includes all piping, piping components, bolts, nuts, gaskets, etc. for process piping and related examination, inspection and testing.

.3 Fabrication and erection of piping shall be in accordance with the applicable requirements of ASME B31.3 – Process Piping, and Canadian and Provincial Acts and Regulations.

.4 Supply, at no extra cost all required fittings, offsets and pipe lengths for process piping systems on drawings where one type of pipe may not fit/suit the intended operation of the system. Supply and install only after receiving approval from the Contract Administrator.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.1 Product Data:

.2 Shop drawings for review for all items included in this Section.

.3 Quality control programs, schedules, procedures, test results, certifications, and affidavits shall be provided as required by the applicable requirements of ASME B31.3 – Process Piping, and the Canadian and Provincial Acts and Regulations.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 – Closeout Submittals.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Safely deliver all materials to the site. Handle materials at all times with care to avoid damage. Load, unload and move materials into place by means of hoists, ropes or skidways in such a manner as to avoid shock. Do not drop materials or roll them against one another.

.3 Properly store and protect equipment on site against weather, damage and theft to the satisfaction of the Contract Administrator.

.4 Precautions shall be taken during handling, fabrication, storage, loading, and installation to protect flange surface finishes and all ends from damage. All ends shall be capped when delivered.

.5 Piping which has been coated with paint prior to erection shall be handled with care to avoid damage to coatings. Slings protected with fabric or hose sleeves shall be used for lifting.

.6 Shipping protection provided for pipe, pipespools, and piping components shall be visually inspected by Contractor when material is received at the site before unloading from truck. Any damaged or deficient protection shall be brought to the attention of the Contract Administrator for resolution.

Part 2 Products

2.1 NOTCH TOUGHNESS

.1 Notch toughness requirements shall be in accordance with ASME B31.3.

2.2 SUBSTITUTIONS

.1 Any material substitution requests shall be submitted in writing to Contract Administrator for approval in accordance with B8. Substitution shall be avoided where the substitution would

negate previous weld procedure qualifications accepted by Contract Administrators and/or Authorities having Jurisdiction or would require additional qualification and acceptances.

2.3 PROCESS PIPING – VALVE CHAMBER

.1 Pipe, DN150 to 500: Carbon steel ASTM A53, ERW, Black, XS wall thickness except pipe lengths passing through concrete wall or ceiling shall be schedule 40.

.2 Fittings: Carbon steel, butt-weld, ASTM A234-WPB, XS wall thickness.

.3 Fittings (Grooved): Cast fittings ductile iron conforming to ASTM A536, Grade 65-45-12. Segmentally welded fittings or pipe conforming to ASTM A53 grade B, XS wall thickness.

.4 Flanges: Carbon steel, ASTM A105, B16.5, slip-on, 150#, flat-face.

.5 Flange gaskets: full face, neoprene, 3 mm thick.

.6 Flange bolting: ASTM A193-B8M Class 2 Type 316 stainless steel bolts, ASTM A194 8M Type 316 stainless steel heavy hex nuts coated with anti-galling compound.

.7 On mechanically coupled pipe ends, grooved ends shall be formed by roll forming that does not reduce the pipe wall thickness at the groove. Cut grooves shall not be permitted.

.8 Couplings: flexible coupling, ductile iron, ASTM A536 Gr. 65-45-12, epoxy coated, EPDM flush-type gasket, zinc plated carbon steel bolts and heavy hex nuts.

.9 Acceptable products:

.1 Couplings (Rigid): Victaulic styles W07, 107V
.2 Couplings (Flex): Victaulic style W77
.3 Couplings (Fittings): Victaulic AGS
.4 or approved equal in accordance with B8.

2.4 FINISH

.1 All valve chamber piping and fittings shall be epoxy coated on the interior and exterior. Coatings shall be liquid epoxy or as an alternative, fusion bonded epoxy.

.2 Field applied coatings and touch-up for valve chamber piping shall be a liquid epoxy.

.3 Liquid Epoxy Coatings

.1 Liquid epoxy coatings shall conform to AWWA C210.
.2 All coatings shall be applied in a minimum of two (2) or more layers a minimum of 5 mils dry film thickness for each coat. Final coating dry film thickness shall be minimum 16 mils or the thickness recommended by the manufacturer for immersion service.
.3 Interior pipe linings shall be 100% solids liquid epoxy product. Approved products:
.1 International Enviroline 230,
.2 International Bar-Rust 234P,
.3 Specialty Polymer Coatings SP-7888,
.4 Or approved equal in accordance with B8.

.4 Exterior pipe linings for all exposed steel piping, valves, and actuators shall be Polyamide Epoxy. Approved products:

.1 International Enviroline 230,

.2 International Bar-Rust 234P,

.3 Specialty Polymer Coatings SP-7888,

.4 Tnemec Series N140F Pota-Pox Plus,

.5 PPG Amerlock 2,

.6 Or approved equal in accordance with B8.

.4 Fusion Bonded Epoxy Coatings

.1 Fusion bonded epoxy coatings shall conform to AWWA C213 for steel components and AWWA C116 for ductile iron fittings.

.2 The final minimum coating thickness shall be greater than 16 mils or the thickness recommended by the manufacturer for immersion service.

Part 3 Execution

3.1 FABRICATION

.1 The piping drawings and documents identify the standard components to be included in fabricated piping such as flanges and fittings.

.2 Drawings

.1 Detail drawings made by the Contractor for pipespools or assemblies shall include all necessary information, including but not limited to the following:

.2 Dimensions

.3 Weld Locations

.4 Branch Type

.5 Integral Attachments

.6 List of Materials

.7 Welding Processes

.8 Welding Procedure Numbers

.9 Welding Filler Metal

.10 Preheat and Postweld Heat Treatment

.11 Special Cleaning

.12 Painting Requirements

.13 NDT and other Special Requirements

.14 ASME B31.3 Identification if applicable

.15 Pipespool or Assembly Number

.3 Accuracy

.1 Contractor is responsible for the accuracy of their shop detail drawings and their fabrication. Contract Administrator approval is not required for shop details.

.4 Tolerances

.1 Pipespool tolerances shall be as defined in PFI Standards ES-3 and ES-24 except as noted below.

.2 Alignment of flange faces or ends prepared for welding by others shall not deviate from the indicated position measured across any diameter by more than 0.8 mm (1/32”).

.5 Branch Connections

.1 Lines that connect to a main line or header, including instrument connections, vents, and drains, are considered branch lines. The type of branch connections selected shall be in accordance with the piping material specifications.

.2 Required reinforcement shall be clearly identified on piping drawings and documents.

.3 Material for branch reinforcement shall be of the same composition as the base material of the pipe. It shall meet the notch toughness and other applicable requirements specified for the pipe to which it is attached.

.4 Fabricated branch connections shall be directly joined to the header with full penetration welds. Reinforcing pads, if required, shall be added after visual inspection, other required inspections, and completion and acceptance of any repairs.

.5 Reinforcing pads or saddles shall be provided with 1/4 NPT vent holes. If the pad or saddle is provided in more than one piece, each piece shall be provided with a 1/4 NPT vent. Insulated piping ventholes shall be fitted with 1/4 inch std wt nipples, length to extend 1" beyond final insulation.

.6 Branch connections shall not be installed over girth welds.

.7 Particular care shall be taken to provide proper root gaps and welds at weldolets, elbolets, sockolets, and threadolets as recommended by the manufacturers installation procedures.

.6 Pipe

.1 Longitudinal seams in adjoining lengths of welded pipe shall be staggered and located to clear openings and external attachments.

.2 Pipe lengths used in spool fabrication shall be selected to minimize field welds. When necessary to use more than one length of pipe in a straight section of spool, the shortest length shall not be less than 300 mm (12”) or one pipe diameter whichever is greater. Heat affected zones shall not be touching.

.7 Flanges

.1 Protection of flange face surface finish is required. Precautions shall be taken throughout handling and fabrication operations to protect the gasket surface finish of the flanges.

.8 Joint Preparation

.1 The use of backing rings is strictly prohibited.

.2 Threaded Joints

.1 Threaded joints shall be tapered pipe threads in accordance with ASME B1.20. Threaded connections in pieces requiring heat treatment shall be protected from damage by heat. Where threaded couplings or nipples are welded to pipespools, the thread must be checked for fit and roundness after welding or heat treatment by using a thread gauge. If threads are not acceptable, chase the threads with a tap or die. Clean the threads with cutting oil and a suitable solvent.

.3 Socket Weld Joints

.9 Weld dimensions and gaps for socket welding pipe joints shall not be less than the minimum requirements of ASME B31.1 and B31.3. The gap between pipe end and fitting shall not exceed 3 mm (1/8") after welding.

.10 Welding and Post-Weld Heat Treatment

.1 Welding and post-weld heat treatment shall be in accordance with this Specification, and satisfy requirements of the codes and regulatory agencies having jurisdiction over the work. Welding shall be in accordance with approved welding procedures registered by or acceptable to the Authority having Jurisdiction.

.2 Welding shall be performed by certified welders or welding machine operators holding a current pressure welders authorization issued by or acceptable to the Authority having Jurisdiction. The welder or welding machine operator shall not perform welding utilizing procedure for which he has not been duly authorized.

.3 Submit Welding Procedure Specifications (WPS), and matching Procedure Qualification Records (PQR), to Contract Administrator for approval. Procedures shall not be submitted for approval until they have been registered with or accepted by the Authority having Jurisdiction. Evidence of this registration or acceptance shall accompany each WPS and PQR submitted to Contract Administrator.

.4 Welding shall not be performed on any line that has been postweld heat treated.

.11 Cleaning

.1 After completion of fabrication and heat treatment, piping shall be free of loose scale, weld spatter, sand, chips, oil, grease, and other foreign material. Each pipespool shall be visually inspected to ensure proper cleanliness.

.12 Welded Carbon Steel Sleeves for CFRP Terminations at Flanges

.1 Welded carbon steel sleeves for termination of the CFRP wrap shall be fabricated and connected to the in-service RAS system piping in accordance with the requirements of ASME PCC-2 Article 2.10, including:

.1 Weld Procedures and Welder Qualifications

.1 Welding procedures and welders shall be qualified using the setup detailed in Mandatory Appendix I and testing requirements outlined in paragraph 4.2.

.2 Examination

.1 All in-service welds made in the field shall be examined for hydrogen cracking after welding by magnetic particle or liquid penetrant methods in accordance with ASME B31.3, paragraphs 344.3 or 344.4. Welds shall be examined 24 hr to 72 hr after welding has been completed.

3.2 PIPE INSTALLATION

.1 Submit procedure for bolting of flanged joints to Contract Administrator for approval. Contractor shall be responsible for completeness of his procedure, and shall not perform bolting operations until the procedure is approved. Procedure shall include bolt lubrication and preservation proposed for use in assembly.

.2 Pipe, pipespools, and in-line components shall be inspected internally for foreign material during final installation. Material shall be removed prior to installation and bolting or welding in place.

.3 End protectors shall not be removed from piping and equipment until ready for final connection. Weld end and gasket surfaces shall be inspected for damage when covers are removed. Contract Administrator shall be informed of any damage. Repairs shall not be made without approval of Contract Administrator.

.4 Gaskets shall be protected from damage until final installation is completed.

.5 Piping shall be properly supported to prevent excessive deflection during handling and installation.

.6 Permanent deformation resulting from improper handling shall be brought to the attention of Contract Administrator for resolution.

.7 Bolting - The use of washers or other packing to use up excessive length of flange bolts is not acceptable. The length of machine and stud bolts shall be such that nuts are fully engaged with a minimum of two full threads protruding and that studs are centered.

.8 Bolting shall be checked for proper grade and marking prior to installation. Bolting not properly identified with the required ASTM material grade shall not be used.

.9 Threaded joints shall be made up using thread compounds or teflon tape.

.10 No thread compounds or teflon tape shall be used on threaded joints which are to be seal welded. Plugged connections shall be checked during erection to ensure the plugs comply with line class requirements.

.11 Supports, guides, anchors, pads, and other appurtenances shall be installed as required by the piping drawings. Field installed pads on random piping shall be provided with vent holes.

3.3 FLANGE ISOLATION KITS

.1 Flange isolation kits shall be used where noted, where dissimilar metal piping or fittings are joined.

.2 Each isolation kit shall be a double flange isolation kit with insulating sleeves and washers for each flange of the bolted connection.

.3 Bolt sleeves and washers shall be comprised of G10 or G11 glass-reinforced epoxy.

.4 Acceptable product: GPT Industries – LineBacker, Lamons Manufacturing – Isoguard or approved equal in accordance with B8.

3.4 PIPE THROUGH WALLS, FLOORS AND CEILINGS

.1 Unless otherwise specified, pipes through walls, floors and roofs of concrete or similar material shall be set in suitable openings. Suitable pipe connections shall be provided on both sides of the opening to permit ready dismantling of the pipelines with wall or floor sleeves, packed, as detailed on the Drawings.

.2 Suitable wall/floor sleeves shall be furnished to eliminate leakage. The wall sleeves shall be cast directly in the walls or floors as may be permitted by the Contract Administrator. "Puddle collars" shall be an integral part of the casting and, in the case of fabricated or mill steel pipe, shall be of

stainless steel plate not less than 10 mm thick welded around the entire periphery of the pipe. The wall piece shall be of the same material as its respective pipe with protective coating on the inside only. "Puddle Collars" shall have a radius minimum of 100 mm larger than the outside diameter of the sleeve.

.3 For pipe passing through concrete block walls, a 6.4 mm thick strip of non-bituminous type joint filler shall be placed between the pipe and the grout to provide for pipe expansion. The joint filler shall be sponge rubber equal to ASTM D1752, Type 1.

.4 Special wall pieces and nozzles shall be furnished as required and as shown on the Drawings. For pipes passing through double walls, the joint filler shall be same as specified.

.5 Install compressible rubber packing between cored hole and piping when pipes pass through cored holes in concrete walls or floors.

.6 Contractor to confirm required Link-Seal model with the vendor for the applicable pipe and pipe sleeve prior to ordering.

.7 Acceptable Products: Garlock Link-Seal modular pipe sealing system model S-316, LS-316 (EPDM) with Century-Line (HDPE) sleeve or approved equal in accordance with B8.

3.5 PROTECTION OF OPENINGS

.1 Protect equipment and system openings from dirt, dust and other foreign materials.

.2 Thoroughly clean piping, ducts and equipment of dirt, cuttings, and other foreign substances prior to being put into operation.

3.6 EQUIPMENT PIPING CONNECTIONS

.1 Where equipment connections are a different size from the piping serving it, all associated isolating valves and fittings to be the larger pipe size unless specifically indicated otherwise on the drawings.

3.7 INSPECTION AND TESTING

.1 All Inspection and testing shall:

.1 Be in accordance with ASME B31.3, Category D fluid service.

.2 Be performed by a specialist qualified in accordance with CSA 178.1 and 178.2.

.3 Include detailed weld inspection reports to Contract Administrator.

.2 Acceptance criteria for visual and radiographic weld inspection shall follow ASME B31.3, para. 341.3.2, Table 341.3.2. Any rejected welds shall be repaired or replaced.

.3 Acceptance criteria for magnetic particle examination shall follow ASME B31.3, para 344.3.2. Any rejected welds shall be repaired or replaced.

.4 Magnetic particle examination providers shall be certified in accordance with CAN/CGSB-48.9712.

.5 Shop fabricated pipe spools shall be hydrostatically pressure tested to 1379 kPag (200 psig) at the Contractor's fabrication shop.

.6 Perform inspection and testing prior to painting.

.7 Installed piping shall be leak tested and examined in service. Contract Administrator shall be informed of any leaks. Repairs shall not be made without approval of Contract Administrator.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 03 30 00 - Cast-in-Place Concrete

.2 03 41 00 - Precast Structural Concrete

.3 40 05 51 – Process Valves

.4 40 91 00 – Automation – Process Measurement Devices

.5 40 94 43 - Programmable Logic Controller and Process Control Narrative

.6 E18 – Supply and Installation of Temporary Shoring

.7 E19 – Shaft Excavation and Support

1.2 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)/American Water Works Association (AWWA)

.1 ANSI/AWWA C500-[09], Metal-Seated Gate Valves for Water Supply Service (Includes Addendum C500a-95).

.2 ANSI/AWWA C504-[10], Rubber-Seated Butterfly Valves.

.3 ANSI/AWWA C508-[09], Swing-Check Valves for Waterworks Service, 2 inch (50 mm) through 24 inch (600 mm) NPS.

.2 ASTM International (ASTM)

.1 ASTM C 478M-[11], Standard Specification for Precast Reinforced Concrete Manhole Sections [Metric].

.3 CSA Group (CSA)

.1 CAN/CSA-A257 Series-[09], Standards for Concrete Pipe.

.2 CSA B70-[06], Cast Iron Soil Pipe, Fittings and Means of Joining.

1.3 SCHEDULING

.1 Coordinate supply and installation of this section with all other Divisions.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's instructions, printed product literature and data sheets for packaged sewage lift station 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 Manitoba, Canada.

.2 Submit drawings for civil, structural, hydraulic, mechanical and electrical elements.

1.5 CLOSEOUT SUBMITTALS

.1 Provide in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: Provide operation and maintenance data for sewage lift station for incorporation into manual.

.3 Include information as follows:

.1 Record drawings, wiring diagrams, electrical schematics of equipment as installed.

.2 Interconnections with numbers and wire sizes.

.3 Certified pump characteristic curves.

.4 Detailed operation and maintenance instructions.

.5 Parts list comprising complete schedule clearly identified to facilitate re-ordering.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations.

.2 Store and protect packaged sewer lift station from damage.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 DESCRIPTION

.1 This section describes the design, fabrication, pre-assembly and supply of a pre-fabricated fiberglass reinforced plastic (FRP) sewage pump station or sewage lift station (the station) for burial in the vertical position.

.2 The station shall consist of an all FRP tank, including top and bottom, all internal piping, including valves, electric dry-pit solids-handling pump, and other components and accessories necessary for reliable operation.

.3 All materials in the station shall be of a non-corrosive nature as much as possible in order to minimize long term corrosion.

.4 The station shall be pre-assembled, to the extent practicable, with all equipment installed allowing economical shipment to site and reducing installation time and start-up costs, except for the following:

.1 Process pumps, motors and drive shafts (shipped to site separately)

.2 Electrical hook-ups.

.3 Other equipment as indicated as indicated on the Drawings.

.5 Equipment and installation including as follows:

.1 Supply and installation of packaged sewage lift station in accordance with manufacturer's recommendations.

2.2 DRY WELL STRUCTURE

.1 Main Chamber

.1 The main chamber shall be a vertical cylinder made integrally with a reinforced bottom capable of withstanding a full hydrostatic head from the exterior of the tank while the station is completely empty.

.2 Bottom shall be cored for stiffness with solid sections where pump pedestal anchor bolts are located. These bolts are to be permanently laminated into this solid section and sealed.

.3 The shell section shall be made of FRP using the filament winding process. This process provides maximum strength to weight ratio.

.4 Materials for construction are detailed in section 2.2.6.1. This chamber shall also be constructed to handle the external ground loads for the specific application and also withstand both corrosive environments of liquids and vapours inside and outside the dry well.

.5 Filament wound external reinforcing ribs shall be provided for additional strength against buckling and also provide a method of securing the support lugs. Quantity and size of these ribs shall be calculated for each application.

.6 The interior finish is to be a smooth, bright white moulded finish for ease of cleaning.

.2 Service Platforms

.1 Each intermediate platform shall be capable of withstanding a concentrated load of 200kg plus additional dead weight as indicated:

.1 Motor platform: dead weight of two pump motors.

.2 Platforms shall be constructed of non-corrosive materials such as FRP, marine grade aluminium or stainless steel. All bolting hardware shall be 304 SS minimum. Any bolting through the tank wall is to be sealed and laminated over on the exterior to prevent internal or external seepage and prevent turning of bolts from the inside.

.3 Hinged access hatches within the platforms shall be provided as indicated on the drawings. Hatches shall be sized to allow for the removal of the pumps and motors.

.4 Provide full or partial access platforms at locations shown on the drawings. Access platforms located to facilitate operation and maintenance of equipment:

.1 Valves.

.2 Flow meter.

.3 Motors.

.4 We well site glass level gauge.

.3 Access Ladder

.1 Access ladder shall provide safe access to the station bottom and the intermediate platforms. Ladder construction and its supports shall be capable of holding two people at one time or 227 kg (500 lbs).

.2 Ladder design shall meet all safety requirements of the Workmen's Compensation Board and safety codes of Manitoba and the local authority having jurisdiction.

.3 Material: aluminium, stainless steel or FRP,

.4 Influent and Discharge Connections

.1 All piping connections smaller than DN 80 (3") through the tank wall shall be threaded NPT pipe fittings.

.2 All nozzle connections DN 80 (3") and larger on the tank wall shall be fabricated from FRP and laminated to the tank wall with inside and outside lay-ups using laminating resins equivalent to the resin used in the shell construction.

.3 Two connection types are acceptable, one being a full face flange the other a machined spigot. Machined spigots, flanges, and their attachment layups are to be made using alternate layers of chopped strand mats and woven roving with an overall glass content between 30% -40 %.

.1 Full face FRP flange shall be of a 50 psi design for the inlet and 200 psi design for the discharge, as per standards described in section 2.2.5.

.2 Machined spigot shall be 13 mm (1/2") thick minimum. A 150 mm (6") long portion of the machined end is required for proper fit-up to field connections.

.5 Interior Supports

.1 Provide Unistrut metal framing at all locations indicated on the drawings.

.2 Acceptable product: Unistrut P1000 series 1-5/8"x1-5/8" 12 ga SS304.

.6 Design Standards

.1 The following design standards shall be used for FRP fabrication where applicable:

.1 AMEC 4S-10.01, Manufacture and Installation for FRP Structures.

.2 AMEC 4S-10.02, FRP Pressure Pipe, Fittings and Flanges.

.3 Canadian Government Standard, RTP-1 (safety factor of 4 only).

.2 A safety factor of (4) on the minimum ultimate tensile strength of the laminate shall be used in designing the wall, bottom and roof thickness of the station, taking into account all normally imposed loads arising from floatation, soil pressures, normal backfill, handling loads, operating loads and static loads imposed by equipment used in hoisting the pumps in and out of station

.7 Construction

.1 Materials

.1 The white interior finish shall a premium isopthalic NPG gelcoat. Resin for the corrosion liner and structural layers shall be a premium grade isopthalic polyester

at minimum. Glass fibre reinforcing materials other than the surfacing veil is to be commercial Grade “E” type glass.

.2 Laminate Construction

.1 All FRP laminates shall have a corrosion liner on surfaces that are exposed to the corrosive environment and a structural laminate. The tank shell and its external reinforcing ribs shall use the helical filament winding process for the structure. The structural laminate shall be by the hand lay-up/ spray-up method for all sections or parts other than the tank shell.

.3 Corrosion Liner

.1 The surface of the liner exposed to the corrosive medium shall be resin rich reinforced with a “C” grade surfacing veil. The veil shall be saturated with white pigmented resin or an ISO-NPG white gelcoat. This layer is to be 0.25 mm (0.01”) minimum thickness.

.2 The liner behind the surfacing veil shall have a minimum thickness of 2.54 mm (0.10") and shall be reinforced with not less than 20% and not more than 30% by weight of non continuous chopped strand mat. The inside surface is to be a smooth moulded surface with a bright white finish. Corrosion liner shall be free of air and voids for optimum corrosion resistance.

.4 Structural Laminates

.1 Once the liner is completed and cured, the remainder of the wall thickness of FRP laminates shall be built up to provide sufficient strength to meet the mechanical requirements. The tank shell shall be filament wound in a helical pattern, while the top and base are to be fabricated using the hand lay-up or spray-up methods.

.2 Hand Layup Construction

.1 In hand lay-up laminates, alternate layers of chopped stand mat and woven roving, saturated in catalysed resin, shall be added until the required of layers have been applied or the required wall thickness has been obtained. The exterior of the laminate shall consist of a chopped strand mat. Glass content shall be between 30% and 50% by weight. Laminate should be properly wetted out and rolled out, free of air voids as per design specifications.

.3 Filament Winding Construction

.1 Filament wound structural laminates provide superior strength to weight ratio by a higher glass content than hand lay-up or chop-hoop winding methods. Filament wound laminates shall be constructed by saturating continuous strand glass roving in a controlled pattern over the corrosion liner on a suitable mould. The rovings shall be applied at an angle to the axis of the mould. This winding angle shall be selected by the fabricator to obtain the desired hoop and longitudinal properties required for each application. It shall be uniform throughout the entire length and thickness of the product. Each cover or bi-directional layer is to consist of two complete layers of continuous rovings. As many of these covers will be applied as is required to provide adequate thickness for the mechanical loads of each application. The winding pattern shall be regular and shall produce a dense laminate without unreinforced resin pockets or air

bridging between the rovings. Glass content shall be between 60% to 70% by weight.

.5 Surface Finish

.1 Inside: All inside surfaces should be smooth and free of cracks and crazing. The inside surface will be pigmented or gelcoated to a bright white finish. All surfaces other than those made in contact with the mould surface shall be coated with air-inhibited resin or gelcoat, this includes any cut edges of laminates.

.2 Outside: All external surfaces are to be resin coated with an air inhibited resin coat, including any drilled holes, ground areas or cut edges. The portion of the station to be above ground level shall be painted with forest green colour high UV gelcoat. Above ground portions may also be painted with a polyurethane base type paints. Different colours are acceptable as requested by end user.

.6 Lifting Lugs

.1 A minimum of (4) lifting lugs are required capable of handling the entire weight of the station. These lugs will also be capable of handling a lift from the horizontal position to the vertical position.

.2 Material can be mild steel epoxy coated, galvanized or stainless steel. It is critical that the shape of the lugs is such that they cannot pull out of the fibreglass overlay. The overlay can be hand lay-up or filament wound in conjunction with the top external reinforcing rib. This eliminates the need for bolting through the station shell.

.3 For larger station, 3.05 m (10') – 3.65 m (12') in diameter larger custom designed lifting trunnions will be required.

.7 Anchoring Lugs

.1 A sufficient number of lugs shall be provided to secure the pre-fabricated station to the concrete base. Materials and design shall be similar to those of the lifting lugs, with the exception that a bolt through lug is not allowed near the station bottom, unless a base support skirt is part of the tank.

.2 Lugs shall be designed in such a manner to fit over 22 mm (7/8") diameter “J” type anchors imbedded in the concrete slab or wedge or epoxy type anchors. The bottom external reinforcing rib shall be placed as near to the bottom as possible in order to encapsulate this rib in the second concrete pour.

.3 Concrete shall be poured to 150 mm (6") above the bottom rib. This second pour provides additional ballast and anchoring. It is critical that the second pour of concrete be sufficiently anchored to the main concrete base. The combination of the hold down lugs, encapsulation of the bottom rib in concrete and the loading of the backfill material over the concrete base will provide adequate ballast against buoyancy in a full hydrostatic head scenario.

.8 Piping

.1 Suction Piping (Dry Well)

.1 All piping shall be schedule 10 stainless steel.

.2 All flanges shall be full and flat face type and have ANSI B16.1, class 125 drilling.

.2 Discharge Piping:

.1 Discharge piping runs from each pump discharge connection to a header onto which the vertical risers and valves connect to.

.2 All piping shall be schedule 10 stainless steel.

.3 All flanges shall be full and flat face type and have ANSI B16.1, class 125 drilling.

.3 Provide adequate pipe supports for all piping.

.9 Valves

.1 In accordance with Section 40 05 51 – Process Valves.

.10 Flow Meter

.1 In accordance with Section 40 91 00 – Automation – Process Measurement Devices.

.11 Station Lighting

.1 Supplied and Installed by Electrical sub-Contractor.

2.3 PUMPS

.1 Provide two (2) vertical, dry-pit solids handling pumps per Section 40 10 10 – Process Pumps.

2.4 PUMP CONTROL SYSTEM

.1 Supplied by others in accordance with Section 40 94 43 - Programmable Logic Controller and Process Control Narrative.

2.5 PACKAGE SYSTEM

.1 Fiberglass reinforced plastic enclosure complete with components specified.

2.6 SOURCE QUALITY CONTROL

.1 Perform operational tests on pumps at factory to check for excessive vibration, for leaks in piping or seals and for correct operation of automatic control system and auxiliary equipment.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for sewage lift installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Contract Administrator.

.2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 EXCAVATION BACKFILLING AND COMPACTION

.1 Excavate, backfill and compact in accordance with E18 – Supply and Installation of Temporary Shoring, and E19 – Shaft Excavation and Support, and as indicated.

3.3 CONCRETE

.1 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.

3.4 EQUIPMENT INSTALLATION

.1 Install packaged sewage lift station dry well in accordance with manufacturers' instructions.

3.5 FIELD QUALITY CONTROL & TESTING

.1 After completion of installation, demonstrate functional operation of systems, including sequence of operation, to approval of Contract Administrator.

.2 Test in presence of Contract Administrator and representative from equipment supplier.

.3 Provide labour and ancillary equipment necessary to fulfil tests. Water supply for pump testing and commissioning in accordance with E40 – Water Supply for Commissioning Work.

.4 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 Verify pump performance meets requirements in Section 40 10 10 – Process Pumps.

.5 Packaged sewage lift station controls per Section 40 94 43 - Programmable Logic Controller and Process Control Narrative.

.5 Replace equipment found defective.

.1 Repeat test until equipment is accepted by Contract Administrator.

3.6 DEMONSTRATION

.1 Operating Personnel Training

.1 Provide on site training by qualified personnel for designated operating personnel prior to final commissioning.

.1 Schedule and deliver training in accordance with training plan approved in writing by Contract Administrator.

.2 Include training for designated City personnel on routine maintenance procedures, minor repairs, replacement of parts, including disassembly of major components.

.3 Include safety precaution procedures for systems.

3.7 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 40 05 01 – Common Work Results for Automation

1.2 DEFINITIONS

.1 FAT: Factory Acceptance Test

1.3 DESIGN REQUIREMENTS

.1 Develop a demonstration and test procedure, along with test forms, for the FAT.

1.4 SUBMITTALS

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

.2 Submit the following for review at least 15 Working Days prior to FAT.

.1 Detailed test procedure and test forms for review.

.1 Incorporate all changes to the procedure and test forms requested by the Contract Administrator.

.3 Submit the following, to be received on the date of the FAT:

.1 Detailed listings of all control logic and software utilized to implement the control sequences, for the scenarios demonstrated as part of the FAT. Listings are to be neatly organized and commented as required. All supporting documents, including variable listings are to be included.

1.5 CLOSEOUT SUBMITTALS

.1 Include all FAT documentation and test forms in the O&M manuals.

1.6 DEMONSTRATION AND TESTING

.1 The purpose of testing is to ensure all status signals, alarm signals, and interlocks defined in the CentrePort Phase 1A Lift Station Control Narrative (“Control Narrative”) within the PLC are conveyed to the City’s SCADA HMI system via the cellular communication link. This shall be performed in conjunction with the Contract Administrator and/or City of Winnipeg personnel. The Contract Administrator is responsible for PLC programming, the Contractor is responsible for constructing the PLC panels and assisting in simulating signals and testing.

.2 The location of the FAT will be in a Contractor-supplied facility, within Winnipeg, Manitoba, Canada.

.3 Correct deficiencies at no additional cost and re-test until satisfactory performance is obtained.

.4 Acceptance of tests during the FAT will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.

1.7 COMPLETION OF FAT

.1 The FAT is considered to be complete only when full approval of the Contract Administrator has been received by the Contractor. The FAT results shall be sealed by a professional engineer licensed to practice in Manitoba.

.2 Schedule additional re-tests at no additional cost until approval is obtained.

Part 2 Products

2.1 NONE USED.

.1 None Used.

Part 3 Execution

3.1 DEMONSTRATION SYSTEM

.1 Setup the complete automation system in the Contractor's facility, in a manner to allow for the complete and expeditious testing of the system and associated programming.

3.2 PROCEDURES

.1 All tests shall be documented.

.2 Produce test forms to allow for recording the results of the simulations and tests.

.3 All points to the SCADA system will be tested with the assistance of City personnel.

.4 Advise Contract Administrator of the date of testing. Contract Administrator may, at their discretion, observe factory acceptance testing based on the completeness of the submittal or other factors.

.1 Demonstration tests to include:

.1 Testing of all discrete physical inputs with the use of wire jumpers.

.1 Confirm that the City's SCADA system is able to see the state transition.

.2 Confirm that the light on the front of the control panel illuminates (where a light is provided).

.2 Testing of all discrete outputs by forcing the outputs in the PLC software and confirming the output is active using a pilot light or multi-meter.

.1 Confirm that the City's SCADA system is able to see the state transition.

.3 Testing of all analog inputs by using a 4-20mA or 0-10V process simulator (multi-meter with signal generating functions).

.1 Test the input at 0%, 50%, and 100% of full scale.

.2 Test the under range (0.0 - 3.9 mA) and overrange (20.1 – 24.0 mA) operation.

.3 Confirm that the City's SCADA system as able to see each of the 0%, 50%, and 100% of full scale values as they are tested.

.4 Testing of all analog outputs by forcing the outputs in the PLC software and measuring the value with a multi-meter.

.1 Test the output at 0%, 50%, and 100% of full scale.

.2 Confirm that the City's SCADA system as able to see each of the 0%, 50%, and 100% of full scale values as they are tested.

.5 Testing of physical pushbuttons, selector switches, and pilot lights on the control panel(s).

.6 Testing of the PSTN (dial-up) modem by providing a temporary external telephone line connection to the modem and allowing for the City's SCADA system to dial out and connect to the PSTN modem for confirmation that the PLC status and alarm signals can be read.

.1 Testing of all status and alarm signals is not required. Test only a small sample of signals, including at least two discrete points and two analog points.

.7 Testing of control/interlock functions

.1 Testing of pump operation in PLC Mode.

.2 Testing pump operation in local mode when controlled by LIC-L100-1.

.3 Testing pump operation in local mode when controlled by LIC-L100-2.

.8 Testing of panel mounted local HMI.

.9 Testing of DNP3 parameters.

.2 Demonstration tests need not include:

.1 Connection of instruments to the control panel.

.2 Configuration of instruments.

.5 The Contract Administrator may request additional tests and simulations at the FAT. No additional payment shall be made for additional minor tests.

.6 The Contract Administrator will review the system, simulations, and test results. Incorporate comments and feedback from the Contract Administrator into the system design.

3.3 Evaluation

.1 All evaluations will be pass/fail.

.2 The Contractor is expected to ensure that all required demonstrations are fully operable and meet required specifications, prior to the FAT. Upon failure of a required demonstration in the FAT, the Contractor shall provide subsequent re-tests to the satisfaction of the Contract Administrator.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 40 05 01 – Common Work Results for Automation

1.2 SUBMITTALS

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

.2 Submit commissioning plans and procedures, in writing, at least 20 Working days prior to commissioning.

1.3 CLOSEOUT SUBMITTALS

.1 Final Report:

.1 Include measurements, final settings and certified test results.

.2 Include completed commissioning forms

.3 Bear signature of commissioning technician and supervisor

.4 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments and modifications as set during commissioning and submit to the Contract Administrator in accordance with Section 01 78 00 – Closeout Submittals.

.5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

1.4 COMMISSIONING FORMS

.1 The Contract Administrator will provide a base set of standard commissioning forms. Additional forms will be required and must be prepared by the Contractor.

.2 Supplement the provided forms as required to make a complete commissioning report package. Utilize the specifications, drawings, and Functional Requirements Specification as the basis for preparation of the additional commissioning forms.

1.5 COMMISSIONING

.1 Carry out commissioning under direction of the Commissioning Agent and in the presence of representatives of the Contract Administrator and the City.

.2 Inform, and obtain approval from the Contract Administrator in writing at least 14 days prior to commissioning or each test. Indicate:

.1 Location and part of system to be tested or commissioned.

.2 Testing/commissioning procedures, anticipated results.

.3 Names of testing/commissioning personnel.

.3 Correct deficiencies and re-test until satisfactory performance is obtained.

.4 Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.

.5 Perform tests as required.

1.6 COMPLETION OF COMMISSIONING

.1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by the Contract Administrator.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 STATUS PRIOR TO COMMISIONING

.1 Prior to commissioning, ensure that the following is completed:

.1 Installation of all panels and completion of all wiring connections.
.2 Testing wiring for continuity from the field device to the control panel.
.3 Automation panels are cleaned (interior and exterior)

3.2 PROCEDURES

.1 Provide a minimum of one qualified electrician to assist in testing and commissioning of the control system.

.2 Contractor shall assist in testing each I/O point from the instrument to the City's SCADA HMI.

.1 Test both states of discrete points.
.2 Test, at minimum, two values for analog points.
.3 Test all control and interlock functions.
.4 Test pump operation in auto mode.
.5 Test pump operation in manual mode when controlled by LIC-L100-1.
.6 Test pump operation in manual mode when controlled by LIC-L100-2.

.3 Test each piece of equipment individually for complete functionality.

.4 Completely test the E-Stop functionality of each piece of equipment, as provided.

.5 All deficiencies unrelated to PLC programming must be corrected by the Contractor.

.6 Commission each system using procedures prescribed by the Contract Administrator.

.7 The Contractor is reminded that this facility is critical to operation of the City's wastewater pumping station.

3.3 CHECKLISTS, FORMS, AND REPORTS

.1 Complete checklists, forms, and reports for each instrument, loop, and control device.

.1 Instrument Loop Checklist.

.2 Discrete Device Checklist.

3.4 DEMONSTRATION

.1 Demonstrate to the Contract Administrator operation of systems including sequence of operations under all potential conditions, start-up, shut-down interlocks and lock-outs.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 40 05 01 – Common Work Results for Automation

1.2 REFERENCES

.1 NEMA 250-2024, Enclosures for Electrical Equipment (1000 Volts Maximum).

.2 Canadian Standards Association (CSA International).

.1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations, latest edition adopted by the City of Winnipeg.

.3 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

.2 City of Winnipeg Electrical Design Guide (510276-0000-47ER-0001), Revision 05

.3 City of Winnipeg Automation Design Guide (612620-0013-40ER-0001), Revision 03

1.3 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00, Submittal Procedures.

Part 2 Products

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer.

.2 External trim materials to be corrosion resistant.

.3 Operating conditions: -40 to +55°C with 5 - 95% RH (non-condensing) unless otherwise specified.

2.2 EMERGENCY STOP PUSHBUTTONS (HSS-L010-2, HSS-L020-2, HSS-L010-3, HSS-L020-3)

.1 Supply and install enclosed two-position maintained emergency stop operator stations for the lift pumps P-L01 & P-L02 as indicated on the drawings.

.2 Requirements:

.1	Type:	Push-Pull / Twist to release
.2	Ingress Protection:	NEMA 4X
.3	Contact Life:	1,000,000 cycles
.4	Mechanical Life:	250,000 cycles

.5 Contact Rating: 10 A

.6 Contact Configuration: As shown on the drawings

.7 Illumination: Not required unless otherwise indicated.

.3 Acceptable Products:

.1 Schneider Electric Harmony 9001 K Series,

.2 Allen-Bradley 800H series,

.3 Or approved equal in accordance with B8.

Part 3 Execution

3.1 INSTALLATION

.1 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.

.2 Readily accessible to allow for unhindered operation and servicing.

.3 Wall installation:

.1 Located as shown on the drawings.

.2 Securely mounted.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Process instrumentation.

1.2 RELATED SECTIONS

.1 Section 40 05 01 – Common Work Results for Automation

1.3 REFERENCES

.1 National Electrical Manufacturer's Association (NEMA)

.1 NEMA 250-2003, Enclosures for Electrical Equipment (1000 Volts Maximum).

.2 Canadian Standards Association (CSA International).

.1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations, latest edition adopted by the City of Winnipeg.

.3 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

.2 City of Winnipeg Electrical Design Guide (510276-0000-47ER-0001), Revision 05

.3 City of Winnipeg Automation Design Guide (612620-0013-40ER-0001), Revision 03

1.4 SUBMITTALS

.1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 01 33 00 – Submittal Procedures.

.2 Manufacturer's Instructions:

.1 Include manufacturer's installation instructions for specified equipment and devices in O&M Manuals.

Part 2 Products

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer.

.2 External trim materials to be corrosion resistant.

.3 Operating conditions: 0 +5°C with 5 - 95% RH (non-condensing) unless otherwise specified.

.4 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

2.2 FLOAT SWITCHES (LSHH-L101, LSH-L501, LSH-L560, LSH-V502, LSL-L560)

.1 Requirements:

.1 Suspended mechanical float switch complete with sway rings
.2 Fluid: Wastewater
.3 Temperature Range: 0°C to +50°C
.4 Output: Form C dry contact
.5 Protection: IP68
.6 Approvals: CSA or cUL

.2 Acceptable products:

.1 Flygt ENM-10,
.2 Or approved equal in accordance with B8.

2.3 LEVEL TRANSMITTERS (LIT-L100-1, LIT-L100-2)

.1 Application: Differential pressure cell for measurement of wet well level via hydrostatic head pressure measurement.

.2 Service:

.1 Fluid: Wastewater
.2 Fluid Temperature: -10°C to 50°C
.3 Sensing range: 0 – 12 meters of Water Column
.4 Calibration range: 0 - 10 meters of Water Column

.3 Sensor/Transmitter:

.1 Enclosure Material: Die-cast aluminum

.2 Seal Diaphragm: Stainless Steel,

.3 Measuring cell filling: Silicone oil,

.4 Ingress Protection: IP66,

.5 Power Supply: 10.5 – 45 Vdc (loop powered),

.6 Output Signal: 2 wire, 4-20 mA with HART,

.7 Electrical Connection: Screwed gland ½-14 NPT, screw terminals,

.8 Accuracy: ≤ 0.065%

.9 Display: Included

.10 Explosion protection: None

.11 Mounting Flange: ASME B16.5, 76.2 mm (3 inch), Class 150

.4 Manifold: Block and bleed

.5 Acceptable Products:

.1 Siemens SITRANS P DS III,

.2 This product was standardized by the City via RFP 449-2014. No alternates or substitutes will be accepted.

.6 Purchase or Quotation:

.1 All requests for purchase or quotation shall reference RFP 449-2014 to receive standardized pricing that the City has negotiated with the vendor.

.2 Contact: Trans-West Company Inc., 126 Bannister Road, Winnipeg, MB.

.3 The Bidder's bid price shall reflect the discounted equipment price. The City will review the purchase price for standardized equipment to ensure the applicable discount factor has been applied.

2.4 ELECTROMAGNETIC FLOWMETERS (FE/FIT-L012)

.1 Service:

.1 Fluid: Raw sewage (wastewater)
.2 Fluid Temperature: -10°C to 50°C
.3 Ambient Temperature: 0° to 40°C
.4 Ambient Pressure: 0 to 100 kPa

.2 Accuracy:

.1 ±0.4% ±1 mm/sec

.3 Sensor Requirements:

.1 Internal diameter: 350 mm
.2 Flange material: Stainless Steel
.3 Flange type: Class 150
.4 Electrodes: Hastelloy C
.5 Grounding: Grounding Rings (to be included)
.6 Area Classification: Unclassified
.7 Enclosure Rating: NEMA 4X
.8 Approvals: CSA of equivalent
.9 All flow tubes shall be hydrostatically tested to 1.5 times their rated pressure.
.10 Provide epoxy paint coating for the entire flow sensor.

.4 Transmitter Requirements:

.1 Mounting: Integral to flow sensor
.2 Conduit/cable Entry: 12mm (1/2") NPT
.3 Display Language: English
.4 Local Display: LCD
.5 Local Control: Keypad
.6 SENSORPROM Memory Unit to be included.

.7 Programming and configuration:

.8 Fully configurable via transmitter keypad

.9 Configurable via HART field communicator on 4-20mA output loop (HART field communicator not included)

.10 Units of Operation:

.1 Flow rate: l/s

.2 Flow totalizer: m3

.11 Power Supply: 24 Vdc

.12 Output:

.13 4-20 mA with HART for flow rate

.14 Pulse output for flow totalization

.15 Enclosure Rating: NEMA 4X

.6 Acceptable products:

.1 Siemens SITRANS F M MAG 3100W series flow sensor,

.2 Siemens SITRANS F M MAG 6000 series transmitter,

.3 Siemens Remote Wall Mount Kit FDK:085U1053,

.4 Siemens Cable Kit,

.5 This product was standardized by the City via RFP 449-2014.

No alternates or substitutes will be accepted.

.7 Purchase or Quotation:

.1 All requests for purchase or quotation shall reference RFP 449-2014 to receive standardized pricing that the City has negotiated with the vendor.

.2 Contact: Trans-West Company Inc., 126 Bannister Road, Winnipeg, MB

2.5 HVAC FILTER DIFFERENTIAL PRESSURE SWITCH (PDSH-L660)

.1 Requirements:

.1	Type:	Electro-mechanical
.2	Dry Contact:	SPDT, rated for at least 0.2 Amps at 24VDC
.3	Operating Temperature:	0°C to +35°C, minimum
.4	Set Point:	125 Pa (0.5 “w.c) (adjustable)
.5	Pressure Range:	As Required
.6	Enclosure Rating:	NEMA 4 or NEMA 4X
.7	Approvals:	CSA or cUL
.8	Mounting:	Duct or Wall

.2 Acceptable products:

.1 United Electric H100K-540,

.2 Dwyer ADPS-04-1-N,

.3 Or approved equal in accordance with B8.

2.6 HVAC AIR FLOW SWITCH (FSL-L600, FSL-L610)

.1 Requirements:

.1	Type:	Electro-mechanical

.2	Dry Contact:	SPDT, rated for at least 0.2 Amps at 24VDC
.3	Operating Temperature:	0°C to +35°C, minimum
.4	Enclosure Rating:	NEMA 4 or NEMA 4X
.5	Approvals:	CSA or cUL
.6	Mounting:	Duct

.2 Acceptable products:

.1 In accordance with B8.

2.7 BEARING VIBRATION SENSORS (VT-L010-1, VT-L010-2, VT-L020-1, VT-L020-2)

.1 Requirements:

.1 Measurement Range of 0.0 to 25.4 mm/s pk.

.2 Output shall be 4-20mA

.3 Mounting shall be 1/4-28 UNF

.2 Acceptable products:

.1 IMI Model 641B61XY or approved equal

2.8 BEARING TEMPERATURE SENSORS (TE-L010-1, TE-L010-2, TE-L020-1, TE-L020-2)

.1 Requirements:

.1 RTD's: 100 ohm platinum element with strain minimizing construction, 3 integral anchored lead wires. Coefficient of resistivity: 0.00385 ohms/ohm degrees C.

.2 1/8” NPT mounting with integral grease zerk.

2.9 TEMPERATURE TRANSMITTER (TT-L010-1, TT-L010-2, TT-L020-1, TT-L020-2)

.1 Requirements:

.1	Mounting:	Wall
.2	Protection:	NEMA 4 or IP67 Enclosure
.3	Power Supply:	Loop powered
.4	Output Signal:	4-20 mA, 2-wire
.5	Accuracy:	0.2 degrees C over range of 0 to 70 degrees C.
.6	Stability:	0.02 degrees C drift per year.

.2 Acceptable products:

.1 Siemens SITRANS TH300.

2.10 TEMPERATURE SENSOR WITH INTEGRAL TRANSMITTER (TT-L671, TT-L681, TT-L691, TT-L692)

.1 Requirements:

.1 RTD's: 100 ohm platinum element with strain minimizing construction, 3 integral anchored lead wires. Coefficient of resistivity: 0.00385 ohms/ohm degrees C.

.2	Mounting:	Wall
.3	Protection:	NEMA 4 or IP67 Enclosure
.4	Power Supply:	Loop powered
.5	Output Signal:	4-20 mA, 2-wire
.6	Accuracy:	0.2 degrees C over range of 0 to 70 degrees C.
.7	Stability:	0.02 degrees C drift per year.
.8	Sensor:	Integral ceramic probe, 100 mm in length.

.2 Acceptable products:

.1 Siemens SITRANS TH300.

2.11 TEMPERATURE SENSOR WITH INTEGRAL TRANSMITTER – FOR HAZARDOUS AREAS (TT-V672)

.1 Requirements:

.1 RTD's: 100 ohm platinum element with strain minimizing construction, 3 integral anchored lead wires. Coefficient of resistivity: 0.00385 ohms/ohm degrees C.

.2	Mounting:	Wall
.3	Protection:	NEMA 4 or IP67 Enclosure
.4	Power Supply:	Loop powered
.5	Output Signal:	4-20 mA, 2-wire
.6	Accuracy:	0.2 degrees C over range of 0 to 70 degrees C.
.7	Stability:	0.02 degrees C drift per year.
.8	Sensor:	Integral ceramic probe, 100 mm in length.
.9	Protection:	Hazardous area rating that meets or exceeds the requirements as indicated on drawings when connected to an approved intrinsically safe circuit

.2 Acceptable products:

.1 Siemens SITRANS TH300.

2.12 AMBIENT TEMPERATURE SWITCHES – DUAL SWITCH OUTPUT (TSH-L600)

.1 Requirements:

.1 Functionality: Field adjustable switches, independently adjustable.
.2 Outputs: Qty 2, SPDT dry contacts. (Dual setpoints)
.3 Operating Temperature: -40°C to +40°C minimum.
.4 Sensor: Local.
.5 Mounting: Wall.
.6 Enclosure Rating: NEMA 4X.
.7 Approvals: CSA or cUL.

.2 Acceptable products:

.1 United Electric 120 Series,
.2 Or approved equal in accordance with B8.

2.13 COMBUSTIBLE AND TOXIC GAS DETECTOR & SENSOR (AIT-L550, AE-L550-1 and AE-L550-2)

.1 Requirements:

.1 Dual Sensor Capability for Hydrogen Sulfide (H_2S) toxic gas and Methane Gas (CH_4)combustible gas detection application

.2 Transmitter mounting: wall mounted c/w mounting bracket kit.

.3 Sensor:

.1 H2S Sensor, remote wall mounted at 600mm above finished floor c/w junction box and mounting bracket kit.

.2 Methane IR Sensor, remote ceiling mount c/w junction box and mounting bracket kit.

.4 Local LCD display showing PPM and % LEL .

.5 Alarms: Integral Horn and Status Indicator Lights (green, yellow and red LEDs).

.6 Power supply: 24 VDC

.7 Analog Output: Two (2) 4 – 20 mA

.8 Enclosure ingress rating: NEMA 4X

.9 Factory calibrated sensor, ready to perform immediately after installation.

.10 Operating temperature range: -40°C to +60°C

.11 Approvals: CSA or cUL

.12 Local pushbuttons or infrared remote controller to facilitate on-site configuration and calibration.

.13 Outputs:

.1 Qty 3 dry-contact, output form C relays, configurable.

.1 Relay 1 function: Gas Alarm status (set for 10 PPM)

.2 Relay 2 function: Gas Alarm status (set for 20%LEL)

.3 Relay 3 function: Gas Detector Fail/Trouble status

.2 Provide H_2S CH_4 gas calibration kit for testing the gas sensor.

.3 Acceptable products:

.1 MSA Ultima X5000.

.2 The supply of gas detection equipment for the City of Winnipeg has been standardized under RFP 123-2014. No alternates or substitutes will be accepted.

.4 Purchase or Quotation:

.1 All requests for purchase or quotation shall reference RFP 123-2014 to receive discount pricing that the City has negotiated with the Vendor.

.2 Contact: Tundra Process Solutions LTD, 3200-118 Ave. SE, Calgary, AB, T2Z 3X1.

.3 The price shall reflect the discounted equipment price. The City will review the purchase price for standardized equipment to ensure the applicable discount factor has been applied.

.5 STANDARDIZED GAS DETECTION SYSTEMS

.1 Field Setup, Commissioning:

.1 Field setup and commissioning of the gas detection systems may be performed by MSA under the Standardization Agreement. Coordinate with MSA as required to understand the capabilities and limitations of MSA's field setup and commissioning services and provide all remaining services to provide a complete commissioning and start-up.

.2 The Contractor may provide field setup and commissioning services for the gas detection system via alternate means, provided that this does not result in a reduction of the services or quality of work.

.3 Where MSA is utilized to provide field setup and commissioning, their scope of work has been standardized as follows:

.1 Provide the services for a factory-trained instrument technician to setup and commission the gas detection instruments and controllers, as requested by the City. It is expected that setup and commissioning will be required for some, but not all, of the equipment.

.2 Qualification:

.1 The personnel provided shall be a factory trained and certified technologist, with a minimum of one year of experience working with the products proposed.

.3 Services:

.1 Provide a full eight hours of on-site labor, for each allocated day, to setup and commission the gas detection systems.

.2 Provide all travel and tools required.

.2 Training:

.1 Local Training Session:

.1 Overview

.1 Provide instruction to designated City personnel in the operation and maintenance of the gas detection equipment.

.2 Location

.1 The location of the training will be in the City of Winnipeg, in a facility provided by the City.

.3 Travel

.1 Provide all travel, meals and accommodations at no additional cost.

.4 Submittals

.1 Submit the names and qualifications of the proposed instructors.

.2 Submit training proposal complete with hour by hour schedule including brief overview of content of each training segment a minimum of 30 Working Days prior to the anticipated date of beginning of training.

.5 Quality Assurance

.1 Provide competent instructors thoroughly familiar with all aspects of the gas detection equipment.

.2 The Contract Administrator may reject instructors it determines to not be qualified.

.3 In the event that the training provided is not satisfactory, reduction of payment may be applied.

.6 Duration

.1 The training shall be a minimum of eight (8) hours in duration, excluding coffee and lunch breaks.

.2 Each session shall be assumed to be independent of other training sessions, and not necessarily aligned with other on-site work or training.

.7 Materials

.1 Provide equipment, visual and audio aids, and materials.

.2 Supply manual for each trainee, describing in detail the information included in each training program.

.8 Attendees

.1 The attendees are expected to include, but not be limited to:

.1 Electrical and instrumentation maintenance personnel and

.2 Operations personnel.

.9 Content

.1 Overview of the equipment.

.2 Equipment maintenance training including:

.1 Installation,

.2 Configuration,

.3 Troubleshooting, and

.4 Preventative maintenance

.10 Number of Sessions:

.1 Provide a minimum of two (2) sessions.

.3 The contact for all quotations and purchases:

Darren Bye
Operations Manager,
Measurement & Analytical 11061-269 St Acheson, AB
T7X 6E1 Telephone: 587-689-2158
Mobile: 780-239-7009
E-mail: dbye@tundrasolutions.ca

.4 Quotations and orders:

.1 Reference the following in all quotation requests, quotations \ proposals, purchase orders, and invoices:

.1 This Bid Opportunity number; and

.2 A statement indicating:

"This request / purchase order is subject to the Terms and Conditions of City of Winnipeg Request for Proposal RFP 123-2014."

Part 3 Execution

3.1 INSTALLATION

.1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

.2 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.

.3 Install in a manner to allow easy removal of the transducer and cable assembly for maintenance purposes.

.4 Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.

.5 Electrical:

.1 Complete installation in accordance with Section 26 05 01 - Common Work Results – Electrical.

.2 Provide complete conduit/cable system to link instrumentation and the control panel(s).

.3 Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems.

.4 Maximum conduit fill not to exceed 40%.

.5 Design drawings do not show conduit layout.

3.2 TEMPERATURE SWITCHES AND SENSORS

.1 Stabilize to ensure minimum field adjustments or calibrations.

.2 Mount in readily accessible location to allow for quick easy replacement and servicing without special tools or skills.

.3 Duct installations:

.1 Do not mount in dead air space.

.2 Locate within sensor vibration and velocity limits.

.3 Securely mount extended surface sensor used to sense average temperature.

.4 Thermally isolate elements from brackets and supports to respond to air temperature only.

.5 Support sensor element separately from coils, filter racks.

.4 Averaging duct type temperature sensors.

.1 Install averaging element horizontally across the ductwork starting 300 mm from top of ductwork. Each additional horizontal run to be no more than 300 mm from one above it. Continue until complete cross-sectional area of ductwork is covered. Use multiple sensors where single sensor does not meet required coverage.

.5 Field adjust setpoint on temperature switches as per the drawings.

.6 Make adjustments as directed by the Contract Administrator.

3.3 PRESSURE SWITCHES AND TRANSMITTERS

.1 Mount in readily accessible location to allow for quick easy replacement and servicing without special tools or skills.

.2 Field adjust setpoint on pressure switches as per the drawings.

.3 Make adjustments as directed by the Contract Administrator.

3.4 INSPECTION AND INSTRUCTION

.1 Provide for a factory-trained representative who shall give instructions regarding the installation of the equipment.

.2 The factory-trained representative shall visit the site as required to ensure that the installation work is being performed in a proper and workmanlike manner. Allow for a minimum of one (1) full working day.

.3 The factory-trained representative shall be present to supervise the commissioning, initial operation, and functional testing of the equipment.

3.5 IDENTIFICATION

.1 Identify field devices with lamacoids. Install in a conspicuous location.

3.6 TESTING AND COMMISSIONING

.1 Calibrate and test field devices for accuracy and performance in accordance with Section 40 80 11 - Automation Commissioning.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Process Control Devices including damper actuators.

1.2 RELATED SECTIONS

.1 Section 40 05 01 – Common Work Results for Automation

1.3 REFERENCES

.1 National Electrical Manufacturer's Association (NEMA).

.1 NEMA 250-2021, Enclosures for Electrical Equipment (1000 Volts Maximum).

.2 Canadian Standards Association (CSA International).

.1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations, latest edition adopted by the City of Winnipeg.

.3 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

.2 City of Winnipeg Electrical Design Guide (510276-0000-47ER-0001), Revision 05

.3 City of Winnipeg Automation Design Guide (612620-0013-40ER-0001), Revision 03

1.4 SUBMITTALS

.1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 01 33 00, Submittal Procedures.

.2 Manufacturer's Instructions:

.1 Include manufacturer's installation instructions for specified equipment and devices in O&M Manuals.

Part 2 Products

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer.

.2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight assembly.

.3 Operating conditions: 0 – 32 degrees C with 5 - 95% RH (non-condensing) unless otherwise specified.

.4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.

.5 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

2.2 ELECTRONIC DAMPER ACTUATORS, ON/OFF, FAIL LAST (XV-L60-1, XV-L61-1,)

.1 Requirements:

.1 Direct mount proportional type.

.2 Fail in last position.

.3 Torque as indicated on the mechanical drawings.

.4 Damper actuator to drive damper from full open to full closed in less than 150 seconds.

.5 Damper actuator to drive damper from full closed to full open in less than 150 seconds.

.6 Angle of Rotation: 90° minimum, adjustable with mechanical stops.

.7 Direction of Rotation: Field configurable, mount actuator to damper to match electrical drawings with respect to open and closed signal wiring.

.8 Shaft Diameter: 8.0mm to 16.0mm (3/8” to 5/8”).

.9 Electrical Connection: 0.9 metres (3 ft), 18 AWG, plenum rated cable (or as indicated on drawings).

.10 Overload protection: Required.

.11 Auxiliary Switches: Not required (integral switches only).

.12 Power supply as indicated on the drawings

.13 Operating range: Open/Closed control.

.14 Position Feedback: Integral open/closed feedback limit switches.

.15 Operating Temperature: -30°C to +50°C.

.16 Housing: IP66 or better.

.17 CSA or cUL.

.18 Acceptable Manufacturer:

.1 Schischeck

.1 RedMax or ExMax quarter turn actuator complete with 2 integrated auxiliary switches.

.2 Or approved equal in accordance with B8.

2.3 ELECTRONIC DAMPER ACTUATORS, ON/OFF, SPRING RETURN, HAZARDOUS AREAS (XV-V60-1, XV-V61-1,)

.1 Requirements:

.1 Direct mount proportional type.

.2 Fail closed (spring return).

.3 Torque as indicated on the mechanical drawings.

.4 Damper actuator to drive damper from full open to full closed in less than 150 seconds.

.5 Spring return to closed.

.6 Angle of Rotation: 90° minimum, adjustable with mechanical stops.

.7 Direction of Rotation: Field configurable, mount actuator to damper to match electrical drawings with respect to open and closed signal wiring.

.8 Shaft Diameter: 8.0mm to 16.0mm (3/8” to 5/8”).

.9 Electrical Connection: 0.9 metres (3 ft), 18 AWG, plenum rated cable (or as indicated on drawings).

.10 Overload protection: Required.

.11 Auxiliary Switches: Not required (integral switches only).

.12 Power supply as indicated on the drawings

.13 Operating range: Open/Closed control.

.14 Position Feedback: Integral open/closed feedback limit switches.

.15 Operating Temperature: -30°C to +50°C.

.16 Housing: IP66 or better.

.17 CSA or cUL.

.18 Hazardous area rated: Zone 2 Group IIB, T2B or better.

.19 Acceptable Manufacturer:

.1 Schischeck

.1 RedMax or ExMax quarter turn actuator complete with 2 integrated auxiliary switches.

.2 Or approved equal in accordance with B8.

2.4 ELECTRIC DUCT HEATER CONTROL (HCE-L64)

.1 Modulating 0-10 VDC signal from Temperature Controller TY-L641, integral to duct heater.

2.5 ELECTRIC DUCT HEATER CONTROL (HCE-L65)

.1 Modulating 0-10 VDC signal from Temperature Controller TY-L651, integral to duct heater.

2.6 UNIT HEATER CONTROLLER (TC-L631)

.1 Temperature controlled by wall mounted thermostat provided by unit heater manufacturer.

2.7 PROCESS METERS (LIC-L100-1, LIC-L100-2)

.1 Display digital reading of process value and provide control of output relays based on input.

.2 Display:

.1 Type: Alpha-numeric, LED.

.2 Update rate: 5/second (200 ms) minimum.

.3 Character colour: red.

.3 Features:

.1 Internal 24V dc loop power supply for providing loop power to external devices.

.4 Analog Inputs:

.1 0-20 mA, 4-20 mA, +/- 10V, 0-5V, 1-5V, 0-10V, field selectable.

.2 Input impedance:

.1 Voltage ranges: > 1 M Ω.

.2 Current ranges: 50 - 100 Ω.

.5 Discrete Inputs:

.1 Allows for external interlock of output relays

.6 Output relays:

.1 Qty 4, Form C, unless otherwise noted.

.2 Electrical rating: 3 Amps at 30 VDC and 125/250 VAC resistive.

.7 . Analog Outputs:

.1 Isolated 4-20 mA.

.2 Settable to input process variable.

.8 Mounting: panel mount, 1/8 DIN (92 mm x 45 mm) cut out.

.9 Power supply: 24 V dc.

.10 Manufacturer and model:

.1 Precision Digital PD6000-7H7.

.2 Or approved equal in accordance with B8.

Part 3 Execution

3.1 INSTALLATION

.1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

.2 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.

.3 Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.

.4 Electrical:

.1 Complete installation in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Install communication wiring in conduit or utilizing ACIC cabling.

.1 Provide complete conduit /cable system to link instrumentation and the control panel(s).

.2 Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems.

.3 Maximum conduit fill not to exceed 40%.

.4 Design drawings do not show conduit layout.

.5 Terminate devices with leads in junction boxes with terminals.

.1 Wire nuts are not permitted.

.2 Protect leads in flexible conduit.

3.2 IDENTIFICATION

.1 Identify devices with lamacoids. Mount in a conspicuous location.

3.3 TESTING AND COMMISSIONING

.1 Calibrate and test control devices for accuracy and performance in accordance with Section 40 80 11, Automation Commissioning.

3.4 UNIT HEATER CONTROL

.1 Temperature controlled by wall mounted thermostat provided by unit heater manufacturer. Mount thermostat in the location shown on the drawings.

3.5 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 40 05 01 – Common Work Results for Automation

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 C22.2 No.205:17 (R20022), Signal Equipment.

.2 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations, latest edition adopted by the City of Winnipeg.

.2 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

.2 City of Winnipeg Electrical Design Guide (510276-0000-47ER-0001), Revision 05

.3 City of Winnipeg Automation Design Guide (612620-0013-40ER-0001), Revision 03

.3 International Electrotechnical Commission (IEC)

.1 IEC 61131, Programmable Controllers

1.3 DEFINITIONS

.1 PLC: Programmable Logic Controller

1.4 PLC SYSTEM DESCRIPTION

.1 The PLC consists of a controller and an I/O expansion module, mounted in control panel.

.2 Two separate PLC panels are to be constructed, CP-L81 and CP-F81 as indicated on the drawings.

.3 The City utilizes a remote SCADA system that interfaces with the pumping station control system PLC via cellular and PSTN (telephone) links using DNP3 protocol.

.4 The Contractor’s responsibility on the SCADA system is limited to:

.1 Provision of an interface in the PLC for the SCADA system.

.2 Testing of all status, alarm signals, and analog points between the PLC and the City’s SCADA system via the cellular network during the Factory Acceptance Test. This work will be performed in conjunction with the Contract Administrator and/or the City of Winnipeg.

.3 Testing of all status, alarms, and DNP3 points in the mapping list between the PLC and the City's SCADA system via the cellular and PSTN network during commissioning. Functional check for control/interlock functions and individual points to the city's SCADA during commissioning. Ensure that DNP3 Communications are according to city’s SCADA requirement. This work will be

performed in conjunction with the Contract Administrator and/or the City of Winnipeg.

1.5 SYSTEM ARCHITECTURE – CP-L81

.1 Single PLC

.1 Local I/O modules.

.2 No remote I/O.

.3 A minimum of 20% spare shall be provided within the chassis for the future addition of modules. Alternatively, space can be provided within the control panel for the addition of another PLC chassis in the future.

.4 Connected to the following:

.1 MDM01 – Cellular modem (supplied by the City).

.2 MDM02 – PSTN (telephone) modem.

.3 Local panel mounted HMI.

1.6 SYSTEM ARCHITECTURE – CP-F81

.1 Single PLC

.1 Local I/O modules.

.2 No remote I/O.

.3 A minimum of 20% spare shall be provided within the chassis for the future addition of modules. Alternatively, space can be provided within the control panel for the addition of another PLC chassis in the future.

.4 Connected to the following:

.1 MDM01 – Cellular modem (supplied by the City).

1.7 DESIGN REQUIREMENTS

.1 Design and implement a complete operating PLC system.

.2 The consequences of system failure could be significant, and thus a high level of care, attention to detail, and testing is expected.

.3 The Contract Administrator will review the overall design. Make changes as requested by the Contract Administrator at no additional cost.

1.8 SUBMITTALS

.1 All submittals to be in accordance with Section 01 33 00, Submittal Procedures.

.2 Submit product datasheets.

1.9 O&M MANUALS

.1 Include the following in the O&M Manuals:

.1 Product datasheets.

.2 Hardware and software user manuals.

Part 2 Products

2.1 PROGRAMMABLE LOGIC CONTROLLER

.1 These products were standardized by the City via RFP 756-2013. No alternates or substitutes will be accepted.

.2 Part or Model numbers shall be as shown on the Control Panel drawings. Suitable product shall be a Schneider Electric M580 PLC system.

.3 Provide all required hardware for a complete installation.

.4 Modularity

.1 The construction of the PLC is to be an integrated processor, power supply, and I/O unit, utilizing additional separated I/O expansion modules that are located adjacent to the main unit on DIN rail as required.

.5 Self-Tests, Diagnostics and Failure Modes

.1 Integrity of controller hardware and software to be constantly monitored by an intrinsic series of continuously running self-tests and diagnostics.

.2 Immediately report abnormal results as system alarms.

.3 Have predictable failure mode upon an error. At a minimum, faults are to generate a system alarm.

.4 Equipment may have the ability to diagnose degradations to performance that may not yet adversely affect operator functions or be a permanent failure. When such conditions are automatically noted, the system is to journal the event in the Historian and have the capability to report such information selectively, as either a system alarm or a message on the programming workstation.

.6 Processor:

.1 Schneider Electric BMEP583020 CPU

.7 Memory

.1 Expandable Flash: 4 GB

.2 System Memory RAM: 10 kB

.3 Program RAM: 12 MB

.4 Data RAM: 1024 kB

.8 Integrated Ethernet Port:

.1 Quantity: 3

.2 Speed: 10/100 Mbps

.3 Connection: RJ45 connector

.4 Supported protocols:

.1 HTTP

.2 BOOTP/DHCP

.3 FTP

.4 NTP

.5 SMTP

.6 SBNO
.7 QoS
.8 RSTP
.9 Modbus/TCP
.10 EtherNet/IP

.9 Integrated USB Ports:

.1 Qty 1, USB Port
.1 Connector: Type Mini-B
.2 Standard: USB 2.0
.3 Speed: 480 Mbps (full speed).

.10 Visual Indicators:

.1 Run LED (RUN),
.2 Error LED (ERR),
.3 Input Output (I/O) LED,
.4 Download LED (DL),
.5 Backup LED (BKP),
.6 Sec LED, (SEC)
.7 Ethernet Mod Status LED (ETH MS)
.8 Ethernet Net Status LED

.11 Power Supply

.1 Redundancy: Required.
.2 Requirements:
.1 Supply Voltage: 10 to 30 VDC
.2 Supply Protecting: Integral fuse or breaker.
.3 Output Voltage: As required.
.4 Output Current: As required.
.5 Integrated protection against overloads, short circuits, and overvoltages.

.12 On-board Inputs and Outputs:

.1 Discrete Inputs (DI):
.1 Channels: 32
.2 Voltage: 12/24 VDC.
.3 Current sinking.
.4 Meet IEEE C37.90.1 surge withstand capability.
.5 Indicating LEDs: Channel status (on/off) for each channel.
.2 Discrete Outputs (DO):
.1 Channels: 16
.2 Type: Form A SPST Relay (dry contact)
.3 Max switching voltage: 240 VAC
.4 Isolation:
.1 Isolated in groups of 4

.2 Logic to contact: 1500 VAC (1 min.)
.3 Chassis to contact: 1500 Vac (1 min.)
.4 Output group to output group: 1500 VAC (1 min.)
.5 Contact rating:
.1 3 A, 30 VDC or 250 VAC (Resistive),
.2 1000 VAC between open contacts,
.3 12 A maximum per common.
.6 Max switching load:
.1 5 A, 30 VDC (150 W Resistive)
.2 5 A, 250 VAC (1250 VA Resistive)
.7 Service Life:
.1 2x107 mechanical
.2 1x105 at 5 A, 30 VDC or 250 VAC
.8 Indicating LEDs: Channel status (on/off) for each channel.

.3 Universal Discrete Inputs/Outputs (DIO):
.1 Voltage: 24 VDC
.2 Inputs: Current sourcing.
.3 Outputs: Current sourcing.
.4 Channels: 8
.5 Indicating LEDs: Channel status (on/off) for each channel.

.4 Analog Inputs (AI)
.1 Channels: 14 external + 2 internal
.2 Type: Single ended
.3 4 – 20mA inputs and one 0 - 32.768V input for battery voltage monitoring.
.4 Input impedance:
.1 20 kΩ for 0 – 10V inputs,
.2 60 kΩ for 0 - 32.768V inputs,
.3 250 Ω for 0 - 20mA inputs,
.5 Resolution:
.1 15 bits over the 0 – 10V measurement range
.2 14 bits over the 0 - 5V measurement and 0-20mA measurement range.
.6 Accuracy:
.1 +/- 0.1% at 25 °C.
.2 +/- 0.2% over temperature range.
.7 Response time: 100ms typical for 10% to 90% signal change.

.5 Analog Outputs (AO)
.1 Channels: 4
.2 Type: Single ended, 0-20mA
.3 Maximum load resistance:
.1 925 Ω with 24VDC input voltage
.2 375 Ω with 12VDC input voltage

.3 250 Ω with input voltage at power supply turnoff

.4 Resolution: 12 bits

.5 Accuracy:

.1 +/- 0.15% at 25°C.

.2 +/- 0.25% over temperature range.

.6 Response time: 0.5ms to 2ms for 10% to 90% signal change.

.13 Expansion I/O Modules:

.1 Discrete Input Module, 24 VDC, 16 point:

.1 Channels: 16

.2 Voltage: 24 VDC

.3 Current sinking.

.4 Power Requirements: 5V (supplied from controller via ribbon cable)

.5 Indicating LEDs: Channel status (on/off) for each channel.

.6 Mounting: 35mm DIN rail

.14 Required Accessories:

.1 Include all accessories including cables, terminators, backplanes, memory, batteries, and other components required to make the system operable.

.15 Acceptable Products:

.1 Controller: Schneider Electric Modicon M580.

.2 No alternates or substitutes will be accepted.

Part 3 Execution

3.1 HARDWARE INSTALLATION

.1 Install the PLC and associated components in Control Panel CP-L81 and CP-F81 as per manufacturer instructions and recommendations.

3.2 PLC PROGRAMMING SERVICES

.1 PLC Programming is in the scope of the Contact Administrator

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 40 05 01 – Common Work Results for Automation

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations, latest edition adopted by the City of Winnipeg.

.2 CSA C22.2 NO. 286:17, Industrial Control Panels and Assemblies

.2 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

.2 City of Winnipeg Electrical Design Guide (510276-0000-47ER-0001), Revision 05

.3 City of Winnipeg Automation Design Guide (612620-0013-40ER-0001), Revision 03

1.3 GENERAL REQUIREMENTS

.1 All Control Panels shall be built by a CSA/cUL-approved manufacturer and shall bear the CSA/cUL seal with the manufacturer's file number.

.2 All Control Panels shall be factory assembled and pre-wired. The Control Panel wiring shall be verified at the manufacturer's factory and completely tested before being shipped to the site.

.3 Supply, install, wire and test all components inside the Control Panels according to the specifications herein and the drawings.

1.4 SUBMITTALS

.1 Prior to construction:

.1 Submit product datasheets, and wait for approval, prior to construction of the Control Panels.

.1 AutoCAD drawings of the control panel can be provided to the Contractor if they are required to prepare their own drawing set due to CSA requirements.

.2 Submit stamped red-line mark-ups of the proposed modifications to the control panels. If significant modifications are proposed/required, AutoCAD drawings will be supplied to the Contractor for revision.

.2 Prior to shipment:

.1 Submit electronic pictures of enclosure exterior and interior, including door interior.

.1 Pictures to be of sufficient resolution to read component labels.

.2 As-built drawings:

.1 Submit as-built drawings. Minor changes may be made via red-line mark-ups.

.2 Draft significant changes on AutoCAD drawings.

.3 Do not ship control panel until approval from Contract Administrator is received.

1.5 INSPECTION

.1 A factory inspection of the control panels will be performed at the discretion of the Contract Administrator based upon the pre-shipment submittals.

.2 If requested, demonstrate and test the control panel in presence of the Contract Administrator designated representative.

Part 2 Products

2.1 GENERAL

.1 Construction of the control panels is required, in accordance with the supplied drawings.

.2 Control devices of each category shall be of same type and manufacturer.

2.2 ENCLOSURES

.1 Install lamacoids as per the control panel layout drawings.

.2 All indoor control panels shall be NEMA 12 or as shown on drawings.

.3 All enclosure angles and cut-outs shall be free of dents, gouges or weld marks, and shall present a clean, smooth appearance.

.4 No screws, fittings or other fastenings shall be used on external panel faces, which must be free of any marks, scratches or defaults.

.5 The door is to be a minimum fourteen (14) gauge steel plate, full height and flush with adjacent surfaces.

.6 The exterior of the control panel shall be painted ANSI 61 grey.

.7 The interior of the control panel shall be painted gloss white.

.8 All control panel doors shall be 900 mm (36 inches) wide maximum.

.9 All control panel doors shall open through 180 degrees without restriction.

.10 All control panels of a depth greater than or equal to twelve (12) inches shall be equipped with a LED lighting device located in the cabinet’s upper portion with a door switch. Whenever the door is opened, the lighting system shall automatically be activated.

.11 Enclosure brand shall be Hoffman or an approved equal in accordance with B8.

2.3 POWER SOURCE

.1 Each power source must be protected by a CSA approved circuit breaker or fuse.

.2 The location of each power source must be clearly shown.

.3 Panels powered by more than 1 electrical source shall display on their door; “Caution: This panel is electrically powered by more than one source”.

2.4 COMPONENTS

.1 Unless written approval for use of unapproved components is received from the owner, all electrical materials (e.g., conduit, fittings, wireways, etc.) shall be CSA or cUL approved.

.2 Rails (DIN Rails)

.1 Rails used must be DIN Rail style TS 35mm, slotted.

.2 When used to mount terminals, rails shall be mounted on straight raisers (Rail support / Mounting feet) so as to raise them to the same height as the highest adjacent wiring duct.

.3 Raisers (Rail support / Mounting feet) shall not be used when rail hosts heavy components.

.3 Terminals

.1 Requirements:

.1 TS-35 DIN Rail mounting.

.2 Voltage rating:

.1 600V for general control circuits.

.2 600V for power circuits.

.3 Manufacturer: Phoenix Contact or approved equal in accordance with B8.

.2 Terminal blocks shall be designed for the size of the wires to be connected to them. Terminal blocks used for analog, digital, and power cables shall be identified and physically separated from each other.

.3 Each terminal shall bear an identification number on both sides.

.4 Drawings and templates supplied may not detail all hardware components such as labels, stoppers, rail lifters, end plates, separators, etc. The supplier must supply and install such components when required.

.4 Ground Bus Bar

.1 Supply a ground bus bar in each control panel as indicated on the drawings.

.2 Requirements:

.1 Tapped holes with screws.

.2 Bar to have sufficient connection points for all cables entering the control panel, plus 25% spare.

.3 Maximum one wire termination per screw.

.5 Pushbutton, Switch and Indicator Light

.1 When required, all control panel pushbuttons, switches and indicator lights shall be at least NEMA 12 (or better)-type devices.

.2 Manufacturer to be Schneider Electric or approved equal in accordance with B8.

.6 Programmable Logic Controllers

.1 As per section 40 94 43.

.7 Touch-screen HMI

.1 Screens shall adhere to the City of Winnipeg HMI Layout and Animation Guide.

.8 Annunciator Light Panel

.1	Lights:	LED, Full Voltage, 30 x 30mm, colour and arranged as indicated on the drawings, engraved text as indicated on the drawings,
.2	Ratings:	24 VDC,
.3	Approvals:	CSA,
.4	Manufacturer:	IDEC SLC30 series. No substitutions will be accepted.

.9 General Purpose Relays

.1	Coil Voltage:	DPDT or as shown on drawings
.2	Indication:	LED
.3	Diode:	Provided
.4	Contact arrangement:	As per drawings
.5	Contact Rating:	5A (120 VAC), 5A (24 VDC)
.6	Approvals:	CSA
.7	Manufacturer:	Omron or approved equal in accordance with B8.

.10 24 VDC Uninterruptible Power Supply

.8	Input:	100 - 240 VAC
.9	Output:	24 VDC, 10 A (adjustable 22.5-29.5 VDC)
.10	Battery:	12 Ah
.11	Monitoring outputs:	24 VDC, Alarm, Battery Mode, Battery Charge
.12	Manufacturer:	Phoenix Contact QUINT-UPS/24DC/10 (2320225) with QUINT-BAT/PB/24DC/12AH (1274119) or approved equal in accordance with B8.

.11 Process Meters (LIC-L100-1, LIC-L100-2)

.1 Refer to specification 40 92 00 – Automation – Primary Control Devices.

.12 Cellular Modem:

.1 Supplied by City.

.13 PSTN Modem:

.1	Type:	PSTN modem / Ethernet Switch
.2	Protocol:	PPP (point-to-point)
.3	Maximum data rate:	56 kbps

.4 Compatibility: V.90, V.34, V.32, V.32 bis, V.22 bis, V.21

.5 Ports:

.1 Ethernet:

.1 Quantity: 5

.2 Speed: 10/100 Mbit (automatic negotiation)

.3 Connector: RJ45

.2 Telephone:

.1 Line (input), Phone (output)

.2 Connector: RJ11

.6 Supply Voltage: 24 Vdc

.7 Operating Temperature: -40 to +75°C

.8 Mounting: 35mm DIN Rail

.9 Approvals: CSA

.10 Model: Phoenix Contact PSI-DATA/BASIC-MODEM/RS232 (2313067) or approved equal in accordance with B8.

.8 Grounding

.1 All control panel components shall be adequately grounded in accordance with the component manufacturer, especially control system components.

.2 Firmly bond all panel mounted devices on or within the panels to ground. Provide supplementary bonding conductors for back panels and doors. Attach a separate bonding conductor to all devices that are not firmly fastened to the panels with screws for such devices as case mounted instruments, meters, etc.

.3 Where ground bars are installed on to the rear or side wall of the enclosure, seal screw penetrations to maintain enclosure rating.

.4 Refer to the City of Winnipeg Automation and Electrical Design Guides for additional grounding and bonding requirements.

.9 Wiring

.1 Panel wiring shall be installed in a near and orderly manner.

.2 All conductors shall be securely fastened to terminals at both ends; no splices are allowed inside the panel.

.3 No more than two (2) conductors may be terminated under each terminal screw. All internal panel conductors shall be connected to the same side of a terminal block, and external conductors to the other side. The only exception is for fused terminals which require connection to the field side for internal wiring.

.4 All wires and cables inside the control panels shall be identified on both ends with non-erasable markers.

.5 Identification shall follow the supplied documents, such as wiring diagrams.

.1 Label both ends of each wire.

.2 Utilize machine printed non-slip labels. Wrap-around or self-adhesive markers shall not be permitted.

.3 Wherever possible wire labels shall be positioned to be read from the panel opening without removal of wire duct covers or other wiring.

.6 Individual conductors or wires exiting a cable shall be identified using nonerasable markers.

.7 The routing of all analog, digital, and power cable wiring inside control panels shall be segregated as much as possible, in distinct wiring ducts, by the type of signal they are carrying.

.8 All wires shall be physically protected by wiring ducts with covers. The wiring ducts shall be of sufficient size to be filled to a maximum of 50% when all wires are inside.

.9 All analog signal wiring shall be 18 AWG shielded twisted pairs such as Belden No. 8760, or an approved equivalent. Shield wires exiting the jacket must be covered with a black heat shrink, and the overall cable at the jacket end must also be covered with a heat shrink.

.10 All 24 VDC or 120 VAC discrete signal panel wiring shall be 14 AWG TEW stranded conductor.

.1 Increase the size of power wiring, 12 AWG minimum.

.11 All 120 VAC power wiring shall be 14 AWG TEW stranded conductor, minimum.

.12 All 24 VDC and 24 VAC power wiring shall be 12 AWG TEW stranded conductor, minimum.

.13 The sizes and colours of wires shall be in accordance with the CSA and the Canadian Electrical Code.

.14 The panel builder shall group and form wiring into a loop when going from a fixed part of the panel to a door such that there is sufficient slack to minimize strand fatigue and breaking. Each end of the loop shall be properly supported.

.15 Ethernet Patch Cords

.1 Requirements:

.1 Cat-6A.

.2 Jacket colour: Blue.

.16 Wiring Duct

.1 All wires shall be run in narrow slot wiring duct such as such as Panduit or an approved equivalent in accordance with B8.

.2 Wiring Duct shall be installed on both sides of the panel and between the DIN rails.

.3 Wire or cable, connected to internal device or arriving from external device, shall be uncovered by Wiring Duct for a maximum of 10 cm.

.4 120 VAC wires cannot share wiring duct with 10 VDC, 24 VDC or 4-20 mA wires, but can cross their path.

.5 All DC, AC, and thermocouple wiring shall be routed in separate wireways to prevent signal interference.

.17 Wire ties shall be non-metallic.

.18 Wiring shall be arranged to be readily accessible for inspection and maintenance.

.19 The wiring arrangement shall not interfere with access to panel-mounted devices or spaces for future equipment.

.10 Overcurrent Protection

.1 Panel-mounted devices and all control circuits shall be protected by appropriately sized fuses or circuit breakers.

.11 Internal Lighting

.1 Difficulties resulting from electrical noise generated by fluorescent lamps shall be corrected.

.12 Cooling and Heating Systems

.1 Control panels shall be designed for the environmental conditions of the installation location. Cooling and heating systems shall be in accordance with the specific NEMA rating required by NEMA ICS 6 and NEMA 250.

Part 3 Execution

3.1 COMPONENT INSTALLATION

.1 Components on the front of the panel shall be identified with an individual permanent nameplate installed in an organized manner. The nameplate must identify the component's function.

.2 Each component inside the control panel shall be identified with a nameplate corresponding to the drawings.

.3 All non-DIN rail mountable devices in the control panel shall be mechanically affixed to the back panel with either tapped or self-tapping screws.

.4 All control devices shall be mounted so that any component can be replaced without removing the sub-panel or other components.

.5 Components and/or auxiliary instruments mounted at the rear of the panel shall be readily accessible and their installation shall not be affected by, or interfere with the removal of any panel instrument.

.6 Nameplates shall be made of lamacoid material with a white background and engraved black letters for internal and external components. Nameplates must resist harsh industrial conditions.

.7 Supply and install all required fuses.

.8 Control devices must be spaced adequately to allow for cooling, replacement, servicing, and wiring access.

.9 Control devices shall be grouped according to voltage and function to reduce electrical noise.

.10 Cutouts for instruments shall be within the tolerances specified by the instrument manufacturer.

.11 If cutouts are specified for future instruments, the cutouts shall be covered by removable steel plates 3 mm (1/8 inch) thick. The cover plates shall be finished and painted with the same paint as applied to the front panel.

.12 If any panel-mounted item is not available for installation before the panel is scheduled for shipment, wiring from the terminal block to the panel location for the item shall be completed, wire ends shall be formed exactly to the configurations required, and identifying sleeves shall be applied, ready for connection.

.13 Panel areas designated for future equipment shall be kept clear of stiffening members, rear-mounted equipment, wiring, and all other interferences.

.14 Ample space shall be provided for the entrance of external cables into the panel and for routing the cables to terminating points within the panel.

3.2 IDENTIFICATION

.1 Perform terminal identification using a computerized device. Handwriting is not acceptable.

.2 Label wires and terminals as shown on drawings.

.3 Install label above each terminal block with terminal block name.

3.3 TESTING

.1 Testing of the control panels shall be completed to the greatest extent possible prior to the FAT, and shall include at minimum:

.1 Provide a signed and dated inspection sheet with all tests performed listed on it.

.2 The list of the various test procedures described hereunder is not restrictive, and does not relieve the control panel manufacturer of his responsibility to perform any other work that is not mentioned but requested to verify the good operation of the control panels.

.3 Isolate all instruments and components of the control panels as required to protect them from any damage during tests.

.4 Provide the services of qualified personnel as well as tools and equipment required to perform all tests and inspection of the control panels.

.5 Tests to include:

.1 Power supply functionality

.2 PLC component functionality

.3 Point to point tests of all inputs and outputs

.4 Power terminal voltage verification

.5 Relays and switches functionality

.6 Receptacle and lighting functionality

.7 Modem and Ethernet switch functionality.

.6 If the panel is modified after tests have been performed, tests shall be repeated at no additional cost.

3.4 SHIPMENT

.1 If any panel-mounted item is not available for installation before the panel is scheduled for shipment, wiring from the terminal block to the panel location for the item shall be

completed, wire ends shall be formed exactly to the configurations required, and identifying sleeves shall be applied, ready for connection.

.2 Shipment of any panel having shortages of equipment shall be approved in writing by the City.

3.5 SPARE COMPONENTS

.1 Supply two spares of each fuse type and rating. Place in a clear plastic bag and attach to the panel door interior.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 40 05 01 – Common Work Results for Automation

1.2 SUBMITTALS

.1 Submit training proposal complete with hour-by-hour schedule including brief overview of content of each segment to the Contract Administrator, 30 working days prior to anticipated date of beginning of training.

.1 List name of trainers, and type of visual and audio aids to be used.

1.3 QUALITY ASSURANCE

.1 Provide competent instructor(s) thoroughly familiar with all aspects of the instrumentation system installed in the facility.

.2 Contract Administrator reserves right to approve instructors.

1.4 INSTRUCTION

.1 Provide instruction to designated personnel in adjustment, operation, maintenance and pertinent safety requirements of the system installed.

1.5 TRAINING MATERIALS

.1 Provide equipment, visual and audio aids, and materials necessary for training.

.2 Supply manual for each trainee, describing in detail data included in the training program.

.1 Review contents of manual in detail to explain aspects of operation and maintenance (O&M).

1.6 TRAINING PROGRAM

.1 Operations Training

.1 Location: CentrePort Lift Station.
.2 Duration: Four hours.
.3 Number of trainees: Coordinate with Contract Administrator prior to training.
.4 Audience: Operations and maintenance personnel.
.1 Content:
.1 General system overview.
.2 Description of system components.
.3 Presentation of the control panels and system operation.
.4 Presentation on the pump VFD starters and system operation.

1.7 MONITORING OF TRAINING

.1 Contract Administrator to monitor training program and may modify schedule and content.

.2 In the event that the Contract Administrator or City are unsatisfied with the training, make changes to the training program as required and repeat the training.

Part 2 PRODUCTS

2.1 GENERAL

.1 Not Applicable.

Part 3 Part 3 EXECUTION

3.1 TRAINING

.1 Provide on-site training to City personnel, as indicated above.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 40 05 01 – Common Work Results for Automation

1.2 MAINTENANCE SERVICES

.1 Not required.

1.3 SUPPORT SERVICES

.1 Duration:

.1 The duration of support services is to extend during the Warranty period (one year past Total Performance)

.2 Requirements:

.1 Provide telephone support for all products supplied (during regular business hours).

.2 Respond to emergency service calls (during regular business hours).

.3 Telephone Support:

.1 Telephone support to utilize service personnel knowledgeable in the products and have the required troubleshooting skills.

.2 No payment will be made for telephone support during the warranty period.

.4 Emergency Service Calls:

.1 Respond to service calls from the City when the system is not functioning correctly.

.2 Qualified control personnel to be available to provide on-site service upon a critical failure, whenever required.

.1 A critical failure is the inability to operate of any critical system supplied by the Vendor.

.2 Critical systems include, but are not limited to:

.1 Communication networks,

.2 PLC system, and

.3 Instrumentation.

.3 Perform work continuously until system is restored to a reliable operating condition.

.4 Response Time:

.1 The response time to emergency service calls is to be less than four hours.

.5 Record each service call request, when received separately on approved form and include:

.1 Serial number identifying component involved.

.2 Location, date and time call received.

.3 Nature of trouble.

.4 Names of personnel assigned.

.5 Instructions of work to be done.

.6 Amount and nature of materials used.

.7 Time and date work started.

.8 Time and date of completion.

.6 Costs:

.1 If the issue is determined to be due to poor workmanship or defect of the Contractor, no payment will be made to the Contractor.

.2 If the issue is determined to be due to failure of a physical component supplied, and covered under manufacturer's warranty, the Contractor will be paid for the service call.

.3 If the issue is determined to be due to an issue outside of the Contractor's responsibility, the Contractor will be paid for the service call.

.4 Payment will be based upon the rates specified in Form B.

.5 If the service call is subsequent to Total Performance, submit an invoice, based upon the established rates to the City.

Part 2 Part 2 Products

2.1 NOT APPLICABLE.

.1 Not applicable.

Part 3 Part 3 Execution

3.1 NOT APPLICABLE.

.1 Not applicable.

END OF SECTION