City of Winnipeg
Perimeter Road Pumping Station 2024 Upgrades

June 19, 2024
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No. 4968 Date: June 19,2024

Prepared by MPE, a division of Englobe

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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 Specifications 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 review is complete.

.3 Present shop drawings, product data, samples and mock-ups in SI Metric units.

.4 Where items or information is not produced in SI Metric units converted values are acceptable.

.5 Review submittals prior to submission to Contract Administrator. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract. 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 drawings" as defined in the City’s General Conditions for Construction (Revision 2020-01-31) means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

.2 Submit drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada if requested.

.3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

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

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

.6 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.

.7 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.

.8 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.

.9 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 Documents.

.6 Details of appropriate portions of Work as applicable:

.1 Fabrication.

.2 Layout, showing dimensions, including identified field dimensions, and clearances.

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating weight.

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Relationship to adjacent work.

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

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

.12 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.

.13 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 [3] years of date of contract award for project.

.14 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 project contract complete with project name.

.15 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 Material Safety Data Sheets concerning impedances, hazards and safety precautions.

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

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

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

.19 Delete information not applicable to project.

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

.21 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 SAMPLES

.1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.

.2 Deliver samples prepaid to Contract Administrator's.

.3 Notify Contract Administrator in writing, at time of submission of deviations in samples from requirements of Contract Documents.

.4 Where colour, pattern or texture is criterion, submit full range of samples.

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

.6 Make changes in samples which Contract Administrator may require, consistent with Contract Documents.

.7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.6 MOCK-UPS

.1 Erect mock-ups in accordance with 01 45 00- Quality Control .

1.7 PHOTOGRAPHIC DOCUMENTATION

.1 Submit electronic progress photographs to the Contract Administrator.

.2 Frequency of photographic documentation: weekly & as directed by Contract Administrator.

.1 Upon completion of: foundation prior to backfill, reinforcing steel prior to concrete casting, framing and other works prior to concealment.

1.8 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, submit Workers' Compensation Board status.

.2 Submit transcription of insurance immediately after award of Contract.

1.9 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.

1.10 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.

1.11 CLOSEOUT SUBMITTALS

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

1.12 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

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This specification is to supplement the health and safety requirements contained in the Section D of the Tender Documents, and the City of Winnipeg's "General Conditions for Construction".

1.2 REFERENCE STANDARDS

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

.2 Province of Manitoba

.1 The Workers Compensation Act RSM 1987. - Updated 2013.

.3 General Conditions for Construction, City of Winnipeg, Revision 2020-01-31.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit copies of reports or directions issued by federal, provincial, and territorial health and safety inspectors.

.3 Submit copies of incident and accident reports.

.4 Submit WHMIS SDS - Safety Data Sheets where indicated in individual sections..

.5 The Contract Administrator will review Contractor's site-specific Health and Safety Work Plan and provide comments to Contractor within three (3) business days.

.6 The Contract Administrator's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

1.4 SAFETY ASSESSMENT

.1 Perform site specific safety hazard assessment related to project.

1.5 MEETINGS

.1 Schedule and administer Health and Safety meeting with the Contract Administrator prior to commencement of Work.

1.6 REGULATORY REQUIREMENTS

.1 Do work in accordance with all applicable regulatory requirements.

1.7 GENERAL REQUIREMENTS

.1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

.2 The Contract Administrator and the City may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.8 RESPONSIBILITY

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

.2 Contractor will be responsible and assume the role prime contractor as described in the Manitoba Workplace Safety and Health Act.

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

1.9 COMPLIANCE REQUIREMENTS

.1 Comply with the Workers Compensation Act, Workplace Safety Regulation, Manitoba.

.2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.10 UNFORSEEN HAZARDS

.1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province of Manitoba and advise the Contract Administrator verbally and in writing.

.2 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, advise the Health and Safety Co-ordinator and follow procedures in accordance with Acts and Regulations of Province of Manitoba and advise the Contract Administrator verbally and in writing.

1.11 HEALTH AND SAFETY CO-ORDINATOR

.1 Employ and assign to Work, a competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:

.1 Have site-related working experience.

.2 Have working knowledge of occupational safety and health regulations.

.3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform work.

.4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.

.5 The Health and Safety Co-ordinator’s contact information should be prominently displayed in the construction site office.

1.12 POSTING OF DOCUMENTS

.1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of the Province of Manitoba and in consultation with the Contract Administrator.

1.13 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by the Contract Administrator.

.2 Provide the Contract Administrator with written report of action taken to correct non-compliance of health and safety issues identified.

.3 The Contract Administrator may issue a stop Work Order if non-compliance of health and safety regulations is not corrected.

1.14 POWDER ACTUATED DEVICES

.1 Use powder actuated devices only after receipt of written permission from the Contract Administrator.

1.15 WORK STOPPAGE

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

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 INSPECTION

.1 Allow the Contract Administrator access to 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 Work is designated for special tests, inspections, or approvals by the Contract Administrator or inspection authorities.

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections, or approvals before such is made, uncover such Work at no additional cost and have inspections or tests satisfactorily completed and make good such Work.

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

1.2 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies will be engaged by the Contract Administrator for purpose of inspecting and/or testing portions of Work. The Contract Administrator will be copy furnished of 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 The maximum allowed markup by the Contractor is 10% of the inspection/testing subcontractor cost. If additional inspection and/or tests are required due to defective Work by the Contractor, the additional costs will be borne by the Contractor.

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

.4 Employment of inspection/testing agencies does not relax the Contractor’s responsibility to perform Work in accordance with Contract Documents.

.5 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.

.2 Co-operate to provide reasonable facilities for such access.

1.4 REJECTED WORK

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

.2 Make good other Contractor's work damaged by such removals or replacements of the defective work promptly.

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

1.5 REPORTS

.1 Submit four [4] copies of 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.

.2 Provide copies to subcontractor of work being inspected or tested, manufacturer or fabricator of material being inspected or tested.

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 SUBMITTALS

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

.2 Submittals to include but are not limited to:

.1 Site plan as described in Part 1.2.

.2 Shop Drawings, including scaffolding and/or platforms as described in Part 1.3.

1.2 INSTALLATION AND REMOVAL

.1 Prepare and submit site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.

.1 Identify areas which have to be gravelled to prevent tracking of mud.

.2 Indicate use of supplemental or other staging area.

.2 Provide construction facilities in order to execute work expeditiously.

.3 Remove from site all such work after use.

.4 Restore grassed areas damaged from construction activities.

1.3 SCAFFOLDING AND TEMPORARY PLATFORMS

.1 Scaffolding in accordance with:

.1 CAN/CSA-S269.2 – Access Scaffolding for Construction Purposes

.2 C.C.S.M.c W210 – Manitoba, The Workplace Safety and Health Act

.2 Provide and maintain scaffolding and/or platforms in accordance with Section 01 33 00 – Submittal Procedures where requested on the Drawings.

1.4 SITE STORAGE/LOADING

.1 Confine work and operations of employees to the scope of the Contract Documents. Do not unreasonably encumber premises with products.

.2 Do not load or permit to load any part of Work with weight or force that will endanger Work.

.3 All construction materials shall be stored at designated storage areas. Stored combustible materials shall be separated by clear space to prevent fire spread and allow access for manual fire fighting equipment, including fire hoses, extinguishers, hydrants, etc.

.4 Pressurized dry chemical fire extinguishers of suitable capacity or equally effective extinguishers as per NFPA 10 shall be provided where:

.1 Flammable liquids are stored or handled.

.2 Welding or flame cutting is performed.

1.5 CONSTRUCTION PARKING

.1 Parking will be permitted on the Site provided it does not disrupt performance of the Work or access by the City.

.2 Provide and maintain adequate access to project site including fire route access.

1.6 OFFICES

.1 Provide office heated to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.

.2 Provide marked and fully stocked first-aid case in a readily available location.

.3 Subcontractors to provide their own offices as necessary. Direct location of these offices.

.4 Supply temporary office facilities for the Contract Administrator on Site, meeting the following requirements:

.1 Minimum floor area of 20 square metres, with windows and a door entrance complete with suitable lock satisfactory to the Contract Administrator.

.2 Suitable for all-weather use and capable of maintaining a temperature range between 20 and 25 degrees C.

.3 Equipped with fluorescent lights and 120 volt ac electrical wall outlets.

.4 Furnished with one desk, one filing cabinet, and two chairs, all satisfactory to the Contract Administrator.

.5 All of the temporary structures provided by the Contractor for this project shall be stabilized in a sufficient manner to prevent the temporary structure from being overturned by wind forces as defined in the National Building Code (NBC). The stabilization provided shall be designed by a Professional Engineer registered in the Province of Manitoba. Detailed drawings and design notes for the stabilization works bearing the Engineer’s seal shall be provided to the Contract Administrator for review.

.6 Maintain in clean condition.

.7 The Contractor shall be responsible for installation, maintenance, removal, operating costs, and service installation costs for the field office as described herein.

1.7 EQUIPMENT, TOOL, AND MATERIALS STORAGE

.1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.

.2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

1.8 SANITARY FACILITIES

.1 The Contractor shall provide sanitary facilities for work force in accordance with governing regulations and ordinances.

.1 The Contractor shall post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.9 PROTECTION AND MAINTENANCE OF TRAFFIC

.1 Provide access and temporary relocated roads as necessary to maintain traffic.

.2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by the Contract Administrator.

.3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs

.4 Protect travelling public from damage to person and property.

.5 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.

.6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor shall be responsible for repair of damage to roads caused by construction operations.

.7 Construct access and haul roads necessary.

.8 Haul roads shall be constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided.

.9 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.

.10 Dust control should be adequate to ensure safe operation at all times.

1.10 DISPOSAL OF WASTE MATERIALS

.1 Spoiled and waste materials shall not be dumped, under any circumstances, in any locations other than those approved by the local authorities. Any cost for permits and fees for disposing of waste materials shall be at the Contractor’s expense.

.2 Disposal of all excavated and waste materials shall be in accordance with the requirements of the appropriate provincial regulatory agencies.

.3 When working anywhere within the Works, the Contractor shall at the end of each day remove the rubbish and leave the Site in a clean and tidy state, to the satisfaction of the Contract Administrator. If this is not done, the City may clean the Site and deduct such costs from the Contract, amount of which will be determined by the Contract Administrator.

1.11 FACILITY ELECTRICAL SUPPLY AND DISTRIBUTION

.1 If service interruptions are necessary, such interruptions shall be made only at times approved by the Contract Administrator.

1.12 WARNINGS AND TRAFFIC SIGNS

.1 All Work affecting Site access must be authorized by the Contract Administrator. Provide a minimum of one week notice to the Contract Administrator when Work will affect Site access.

.2 When Work is performed within public areas, provide and erect adequate warning signs as necessary to give proper warning. Place signs sufficiently in advance to enable public to respond to directions.

.3 Provide and maintain signs and other devices required to indicate construction activities or other temporary or unusual conditions resulting from the Work.

1.13 CLEAN-UP

.1 Remove construction debris, waste materials, packaging material from work site daily.

.2 Clean dirt or mud tracked onto paved or surfaced roadways.

.3 Store materials resulting from demolition activities that are salvageable.

.4 Stack stored new or salvaged material not in construction facilities.

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 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International)

.1 CSA-O121-M1978(R2003), Douglas Fir Plywood.

1.2 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from site all such work after use.

1.3 HOARDING

.1 Erect temporary site enclosures using construction grade lumber framing and exterior grade fir plywood to CSA O121.

.2 Provide hoarding and ventilation for the building as required to maintain operation of the pumping station.

1.4 GUARD RAILS AND BARRICADES

.1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs, and any other fall hazards.

.2 Provide as required by governing authorities.

1.5 WEATHER ENCLOSURES

.1 Provide weather tight closures to unfinished door and window openings, tops of shafts, and other openings in floors and roofs. Provide protection for the interior of the pumping station and existing equipment during re-roofing works (during removal of existing roof and installation of the new roof).

.2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.

.3 Design enclosures to withstand wind pressure and snow loading, if applicable.

1.6 DUST TIGHT SCREENS

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

.2 Maintain and relocate protection until such work is complete.

1.7 ACCESS TO SITE

.1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

1.8 PUBLIC TRAFFIC FLOW

.1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect public.

1.9 FIRE ROUTES

.1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.10 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 Protect surrounding private and public property from damage during performance of Work.

.2 Be responsible for damage incurred.

1.11 PROTECTION OF BUILDING FINISHES

.1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with the Contract Administrator locations and installation schedule three (3) Business Days prior to installation.

.4 Be responsible for damage incurred due to lack of or improper protection.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Approved: 2006-03-31

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit written request in advance of cutting or alteration which affects:

- .1 Structural integrity of elements of Project.
- .2 Integrity of weather-exposed or moisture-resistant elements.
- .3 Efficiency, maintenance, or safety of operational elements.
- .4 Visual qualities of sight-exposed elements.
- .5 Work of the City or separate Contractor.

.3 Include in request:

- .1 Identification of Project.
- .2 Location and description of affected Work.
- .3 Statement on necessity for cutting or alteration.
- .4 Description of proposed Work, and products to be used.
- .5 Alternatives to cutting and patching.
- .6 Effect on Work of City or separate contractor.
- .7 Written permission of affected separate contractor.
- .8 Date and time work will be executed.

1.2 MATERIALS

.1 Required for original installation.

.2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00- Submittal Procedures.

1.3 PREPARATION

.1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

.2 After uncovering, inspect conditions affecting performance of Work.

.3 Beginning of cutting or patching means acceptance of existing conditions.

.4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of Project from damage.

.5 Provide protection from elements for areas which are to be exposed by uncovering Work; maintain excavations free of water.

1.4 EXECUTION

.1 Execute cutting, fitting, and patching including excavation and fill to complete Work.

.2 Fit several parts together, to integrate with other Work.

.3 Uncover Work to install ill-timed Work.

.4 Remove and replace defective and non-conforming Work.

.5 Remove samples of installed Work for testing.

.6 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.

.7 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

.8 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

.9 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.

.10 Restore work with new products in accordance with requirements of Contract Documents.

.11 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.12 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material with approved fire stopping assembly.

.13 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.

.14 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

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 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris.

.2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by the Contract Administrator. Do not burn waste materials on Site.

.3 Clear snow and ice from access to building, bank/pile snow in designated areas only and remove from Site.

.4 Make arrangements with and obtain permits from Authorities having jurisdiction for disposal of waste and debris.

.5 Provide on-site containers for collection of waste and debris.

.6 Provide and use marked separate bins for recycling. Refer to Section 01 74 19- Waste Management and Disposal.

.7 Dispose of waste materials and debris off site.

.8 Clean interior areas prior to start of finishing work and maintain areas free of dust and other contaminants during finishing operations.

.9 Store volatile waste in covered metal containers and remove from premises at end of each working day.

.10 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

.11 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

.12 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.2 FINAL CLEANING

.1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.2 Remove waste products and debris other than that caused by others and leave Work clean and suitable for occupancy.

.3 Prior to final review remove surplus products, tools, construction machinery and equipment.

.4 Remove waste products and debris.

.5 Remove waste materials from site at regularly scheduled times or dispose of as directed the Contract Administrator. Do not burn waste materials on site.

.6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.7 Vacuum clean and dust building interiors, behind grilles, louvres, and screens.

.8 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

.9 Clean roofs, downspouts, and drainage systems.

.10 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

.11 Remove snow and ice from access to building.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling or reuse in accordance with Section 01 74 19-Waste Management and Disposal.

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 SECTION INCLUDES

.1 Text, schedules, and procedures for systematic Waste Management Program for construction, deconstruction, demolition, and renovation projects that may include:

.1 Diversion of Materials;

.2 Materials Source Separation Program (MSSP); and

.3 Canadian Governmental Responsibility for the Environment Resources.

1.2 DEFINITIONS

.1 Clean Waste: Untreated and unpainted; not contaminated with oils, solvents, sealants or similar materials.

.2 Construction Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction.

.3 Materials Source Separation Program (MSSP): Consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.

.4 Recyclable: Ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

.5 Recycle: Process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.

.6 Recycling: Process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form; recycling does not include burning, incinerating, or thermally destroying waste.

.7 Salvage: Removal of structural and non-structural materials from deconstruction/disassembly projects for the purpose of reuse or recycling.

.8 Source Separation: Acts of keeping different types of waste materials separate beginning from the first time they become waste.

1.3 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures.

1.4 MATERIALS SOURCE SEPARATION PROGRAM

.1 Prepare Material Source Separation Program and have ready for use prior to Project start up.

.2 Implement Material Source Separation Program for waste generated on Project in compliance with approved methods and as reviewed by Contract Administrator. Provide

on Site facilities for collection, handling and storage of anticipated quantities of reusable and recyclable materials.

.3 Provide containers to deposit reusable and recyclable materials.

.4 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.

.5 Locate separated material(s) in area(s) which minimize material damage.

.6 Collect, handle, store on Site and transport off site, salvaged materials in separate condition.

.7 Transport to approved and authorized recycling facility.

.8 Collect, handle, store on Site and transport off site, salvaged materials in combined condition.

.9 Ship material(s) to Site operating under Certificate of Approval or as directed by the City of Winnipeg.

.10 Materials must be immediately separated into required categories for reuse or recycling.

1.5 WASTE PROCESSING SITES

.1 Identify appropriate waste processing sites, based on municipal requirements, as required.

1.6 STORAGE, HANDLING AND PROTECTION

.1 Store materials to be reused, recycled, and salvaged in locations as directed by Contract Administrator.

.2 Unless specified otherwise, materials for removal become Contractor's property.

.3 Protect, stockpile, store, and catalogue salvaged items.

.4 Separate non salvageable materials from salvaged items. Transport and deliver non salvageable items to licensed disposal facility.

.5 Protect structural components not removed for demolition from movement or damage.

.6 Support affected structures. If safety of building is endangered, cease operations and immediately notify Contract Administrator.

.7 Protect surface drainage, mechanical and electrical from damage and blockage.

.8 Separate and store materials produced during dismantling of structures in designated areas.

.9 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.

.10 On Site source separation is recommended.

.11 Remove co-mingled materials to offsite processing facility for separation.

.12 Provide waybills for separated materials.

1.7 DISPOSAL OF WASTES

.1 Do not bury rubbish or waste materials.

.2 Do not dispose of waste, volatile materials, mineral spirits, oil, paint thinner or excavation material into waterways, storm or sanitary sewers.

.3 Remove materials from deconstruction as deconstruction/disassembly Work progresses.

.4 Prepare project summary to verify destination and quantities on a material by material basis as identified in pre demolition material audit.

.5 Dispose of waste in accordance with Municipal and Provincial regulations.

1.8 USE OF SITE AND FACILITIES

.1 Execute Work with least possible interference or disturbance to normal use of premises.

.2 Maintain security measures established by existing facility and provide temporary security measures approved by Contract Administrator as required.

1.9 SCHEDULING

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 APPLICATION

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

3.2 CLEANING

.1 Remove tools and waste materials on completion of Work and leave Work area in clean and orderly condition.

.2 Clean-up Work area as Work progresses.

.3 Source separate materials to be reused/recycled into specified sort areas.

END OF SECTION

Part 1 General

1.1 OPERATION AND MAINTENANCE MANUALS

.1 General

.1 Provide operation and maintenance manuals in accordance with Section E22, Appendix H, and 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.

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] days after completion of applicable item of work.

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

.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 one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.

.7 Cross-reference to warranty certificates as applicable.

.8 Starting point and duration of warranty period.

.9 Summary of maintenance procedures required to continue warranty in force.

.10 Cross-Reference to specific pertinent Operation and Maintenance manuals.

.11 Organization, names and phone numbers of persons to call for warranty service.

.12 Typical response time and repair time expected for various warranted equipment.

.3 Contractor's plans for attendance at four (4) and nine (9) month post-construction warranty inspections.

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

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

.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 for occupancy.

.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 Related Requirements

.1 477-2024 Bid Opportunity

.3 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 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. 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.

.2 Contractor assists 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 with each other as intended in accordance with Contract Documents and design criteria.

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

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

1.3 COMMISSIONING OVERVIEW

.1 Section 01 91 13.13- Commissioning (Cx) Plan.

.2 For Cx responsibilities refer to Section 01 91 13.13- Commissioning (Cx) Plan.

.3 Cx to be a line item of Contractor's cost breakdown.

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

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

.6 The Contract Administrator will issue Interim Acceptance Certificate when:

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

.2 Equipment, components and systems have been commissioned.

.3 O&M training has been completed.

1.4 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.

1.5 PRE-CX REVIEW

.1 Before Construction:

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

.1 Adequacy of provisions for Cx.

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

.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 shelf-ready.

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

.6 Submit complete start-up documentation the 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 the Contract Administrator for review and approval.

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

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

1.6 CONFLICTS

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

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

1.7 ACTION AND INFORMATIONAL SUBMITTALS

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

.1 Submit no later than four (4) weeks after award of Contract:

.1 Name of Contractor's Cx agent.

.2 Draft Cx documentation.

.3 Preliminary Cx schedule.

.2 Request in writing to the 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 the Contract administrator where not specified and obtain written approval at least eight (8) weeks prior to start of Cx.

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

1.8 COMMISSIONING DOCUMENTATION

.1 Refer to Section 01 91 13.16- Commissioning (Cx) 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 the Contract Administrator.

1.9 COMMISSIONING SCHEDULE

.1 Provide detailed Cx schedule as part of construction schedule in accordance with 477-2024 Bid Opportunity D17, 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.

1.10 COMMISSIONING MEETINGS

.1 Convene Cx meetings following project meetings: 477-2024 Bid Opportunity D17, 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, Contract Administrator to call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues 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 subcontractors and relevant manufacturer representatives are present at 60 % and subsequent Cx meetings and as required.

1.11 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.

1.12 WITNESSING OF STARTING AND TESTING

.1 Provide twenty-one (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.

1.13 MANUFACTURER'S INVOLVEMENT

.1 Factory testing: manufacturer to:

.1 Coordinate time and location of testing.

.2 Provide testing documentation for approval the Contract Administrator.

.3 Arrange for the Contract Administrator to witness tests.

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

.2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with the 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.

.2 Ability to interpret test results accurately.

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

1.14 PROCEDURES

.1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting 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.

.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 the Contract Administrator after distinct phases have been completed and before commencing next phase.

.4 Document require tests on approved PV forms.

.5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected the 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 the Contract Administrator.

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

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

.1 Rejected equipment to be remove from site and replace with new.

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

1.15 START-UP DOCUMENTATION

.1 Assemble start-up documentation and submit to the 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.

1.16 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 to the 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 interim acceptance.

1.17 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.

1.18 START OF COMMISSIONING

.1 Notify the Contract Administrator at least twenty-one (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.

1.19 INSTRUMENTS / EQUIPMENT

.1 Submit to the 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.

1.20 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.

1.21 WITNESSING COMMISSIONING

.1 The Contract Administrator and the City shall witness activities and verify results.

1.22 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 to the Contract Administrator within five (5) days of test and with Cx report.

1.23 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.

1.24 DEFICIENCIES, FAULTS, DEFECTS

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

.2 Report problems, faults or defects affecting Cx to the Contract Administrator in writing. Stop Cx until problems are rectified. Proceed with written approval from the Contract Administrator.

1.25 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 the Contract Administrator.

1.26 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.

1.27 TRAINING

.1 In accordance with Section 01 91 13.83- Commissioning (Cx) – Training and section E20.

1.28 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

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

1.29 OCCUPANCY

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

1.30 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 the Contract Administrator.

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

1.31 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.

1.32 CITY'S PERFORMANCE TESTING

.1 Performance testing of equipment or system by the 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

.1 477-2024 Bid Opportunity.

1.2 REFERENCE STANDARDS

.1 American Water Works Association (AWWA)

.2 Hydraulic Institute (ANSI/HI)

.1 9.6.3 [17], Rotodynamic Pumps – Guideline for Operating Region

.2 9.6.4 [16], Rotodynamic Pumps for Vibration Measurements and Allowable Values

.3 14.6 [22], Rotodynamic Pumps for Hydraulic Performance Acceptance Tests

.3 National Fire Protection Association (NFPA)

.1 NFPA 820 [16], Fire Protection in Wastewater Treatment and Collection Facilities

.4 Public Works and Government Services Canada (PWGSC)

.1 PWGSC - Commissioning Guidelines CP.4 -3rd edition-[03] .

1.3 GENERAL

.1 Provide a fully functional pumping system:

.1 Systems, equipment and components meet user'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 Optimized life cycle costs.

.4 Complete documentation relating to installed equipment and systems.

.2 Term "Cx" in this section means "Commissioning".

.3 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.

.4 Acronyms:

.1 Cx - Commissioning.

.2 EMCS - Energy Monitoring and Control Systems.

.3 HMI – Human Machine Interface

.4 O&M – Operation and Maintenance.

.5 PI - Product Information.

.6 PLC – Programmable Logic Controller

.7 PV - Performance Verification.

.8 TAB - Testing, Adjusting and Balancing.

.9 WHMIS - Workplace Hazardous Materials Information System.

.10 WHMIS Safety Data Sheets (SDS).

.5 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.

1.4 DEVELOPMENT OF 100% CX PLAN

.1 Cx Plan to be 100% completed within eight (8) weeks of award of contract 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 the 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 the 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.

.1 Contract Administrator is responsible for:

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

.2 Monitoring operations Cx activities.

.3 Ensures Cx activities are carried out to ensure delivery of a fully operational pump station including:

.1 Review of Cx documentation from operational perspective.

.4 Witnessing, certifying accuracy of reported results.

.5 Witnessing and certifying TAB and other tests.

.6 Ensuring implementation of final Cx Plan.

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

.8 Ensuring implementation of Training Plan.

.2 Construction Team: contractor, subcontractors, suppliers and support disciplines, is 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 pump 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 PWGSC Cx Manager for administrative and coordination purposes.

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

.1 Demonstrations.

.2 Training.

.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 Day-To-Day operation and maintenance of 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.

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

.1 To include performance verification.

.1 Process Pumps M100PP, M200PP

.2 Variable Frequency Drive VFD-M100, VFD-M200

.3 Automatic Transfer System ATS-M7001

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

.4 Ensure that Cx participant:

.1 Could complete work within scheduled time frame.

.2 Available for emergency and troubleshooting service during first year of occupancy by user for adjustments and modifications outside responsibility of O&M personnel, including:

.1 Modify ventilation rates.

.2 Available for emergency and troubleshooting service during first year of occupancy by user for adjustments and modifications outside responsibility of O&M personnel, including:

.1 Modify ventilation rates.

.2 Changes to relay programming beyond level of training provided to O&M personnel.

.5 Provide names of participants to the 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 (M100PP, M200PP)

.2 Plumbing systems:

.1 Seal Water plumbing system and controls

.3 HVAC systems:

.1 HVAC systems

.1 Air conditioning unit (AC-M650-1, AC-M650-2)

.4 Fire and life safety systems:

.1 N/A

.2 Commission electrical systems and equipment:

.1 Low voltage below 750 V:

.1 Low voltage equipment.

.2 Low voltage distribution systems.

.3 Motor VFDs and protection relays.

.4 Motor control field devices.

.2 Emergency utility power transfer systems:

.1 Transfer relay.

.2 Transfer controls section of SWGR-M700.

.3 New controls on existing shunt trip breakers.

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.

.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 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 the Contract Administrator's satisfaction.

.2 Contractor to use approved check lists.

.3 Contract Administrator will 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 the Contract Administrator and does not form part of Cx specifications.

.6 Contract Administrator will 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 the Contract Administrator.

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

.1 No pre-Cx activities.

.4 Pre-Cx activities - ELECTRICAL:

.1 Utility Transfer System

.1 Transfer relay:

.1 Test of monitoring points

.2 Test of software interlocks

.3 Test of existing mechanical interlocks

.4 Test of manual operation of transfer relay.

.2 Automation systems including:

.1 Instrumentation calibration.

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

.3 Communications between the pumping station and the DCS system.

1.12 START-UP

.1 Start up components, equipment and systems.

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

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

.3 Performance Verification (PV):

.1 Approved Cx Agent to perform.

.1 Repeat when necessary until results are acceptable to the 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 reports.

.5 Contract Administrator reserves the 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 the 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, certify reported results of, Cx activities and forward to the 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 the Contract Administrator.

.2 Tests to be witnessed by the City and the 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 the Contract Administrator for review.

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

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: sixty (60) days before start of Cx.

.2 Cx procedures: three (3) months after award of contract.

.3 Cx Report format: three (3) months after contract award.

.4 Submission of list of instrumentation with relevant certificates: twenty-one (21) days before start of Cx.

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

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

.7 Notification of intention to start Cx of integrated systems: after Cx of related systems is completed fourteen (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, Contractor's Cx agent, and will monitor progress of Cx against this schedule.

1.19 CX REPORTS

.1 Submit reports of tests, witnessed and certified Cx agency to the 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 Interim 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 Refer to Section 01 91 13.18 – Commissioning Training.

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 the 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

.1 477-2024 Bid Opportunity

.2 Section 40 80 11 – Automation – Commissioning

.3 Bid opportunity appendix G – Example Commissioning Checklists

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 the Contract Administrator. Check lists will be required during Commissioning and will be included in Operation and Maintenance Manual (O&M) 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 Example commissioning forms have been provided as part of this Bid Opportunity. The contractor is to develop commissioning forms based on the provided examples. 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 Piping
  - .3 Valves
- .2 Plumbing System Commissioning Forms:
  - .1 Seal Water Systems
  - .2 Valves
- .3 HVAC System Commissioning Forms:
  - .1 Air Conditioning Unit
- .4 Low Voltage (below 750V) Commissioning Forms
  - .1 Low voltage equipment
  - .2 Low voltage distribution systems
  - .3 VFDs
  - .4 Motor control field devices
- .5 Emergency Power Generation Systems
  - .1 Utility transfer equipment
- .6 Automation systems and equipment:
  - .1 Process instrumentation calibration sheets.
  - .2 Process instrumentation loop checks
  - .3 Control panels

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

1.6 DEVELOPMENT OF NEW REPORT FORMS

.1 Contractor to develop appropriate verification forms and submit to the Contract Administrator for approval prior to use.

COMMISSIONING FORMS

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

.3 Strategy for Use:

.1 Commissioning agent provides project-specific Commissioning forms with Specification data included.

.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 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 Operations and Maintenance Manual in accordance with Section 01 78 00-Closeout Submittals.

1.7 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

.2 477-2024 Bid Opportunity

.3 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 See Section E20 of this bid opportunity.

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 troubleshooting.

.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 See Section E20 of this Bid Opportunity.

.2 Instructors to be responsible for content and quality.

.3 Training materials to include:

.1 "As-Built" Contract Documents.

.2 Operating Manual.

.3 Maintenance Manual.

.4 TAB and PV Reports.

.4 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 See Section E20 of this Bid Opportunity.

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

.3 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

1. GENERAL

1.1 RELATED SECTIONS

.1 Not Applicable

1.2 REFERENCES

.1 Canadian Standards Association (CSA):

.1 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.

.2 CAN/CSA-S157, Strength Design in Aluminum.

.3 CSA W47.2, Certification of Companies for Fusion Welding of Aluminum.

.4 CSA W59.2, Welded Aluminum Construction.

.5 CSA W55.3 - Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings

.2 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-1.108, Bituminous Solvent Type Paint.

.3 American Society for Testing and Materials (ASTM):

.1 ASTM A 307, Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.

.2 ASTM A668M Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use.

.3 ASTM A 490, Specification for Heat Treated, Steel Structural Bolts, 150 ksi (1035 Mpa) Tensile Strength.

.4 ASTM A 490M, Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3 for Structural Steel Joints Metric.

.5 ASTM B 209M, Specification for Aluminum and Aluminum-Alloy Sheet and Plate Metric.

.6 ASTM B 210M, Specification for Aluminum-Alloy Drawn Seamless Tubes Metric.

.7 ASTM B 211M, Specification for Aluminum and Aluminum-Alloy Bar, Rod and Wire Metric.

.8 ASTM B 316M Standard Specification for Aluminum and Aluminum-Alloy Rivet and Cold-Heading Wire and Rods Metric

.4 Aluminum Association, Inc. (AA):

.1 Designation System for Aluminum Finishes.

.5 American Welding Society (AWS):

.1 AWS A5.10, Specification for Bare Aluminum and Aluminum-Alloy Welding Electrodes and Rods.

1.3 SHOP DRAWINGS

.1 Shop Drawings:

.1 Submit shop drawings including fabrication and erection documents consisting of connection and design details, shop details, erection diagrams, erection procedures and material lists in accordance with Section 01330 – Submittals.

.2 Indicate cuts, copes, connections, holes, threaded fasteners, rivets, welds and other items. Indicate welds using welding symbols as shown in Appendix A of CSA W59.2.

.3 Submit description of methods, sequence of erection and type of equipment to be used in erecting structural aluminum.

1.4 SAMPLES

.1 Not Applicable.

1.5 QUALITY ASSURANCE

.1 Submit one copy of mill test reports showing chemical and physical properties and other details of aluminum to be incorporated into work, at least 4 weeks prior to fabrication of structural aluminum. Mill test reports shall be certified by metallurgists qualified to practice in the Province of Alberta, Canada.

2. PRODUCTS

2.1 MATERIALS

.1 Aluminum bar, rod, and wire: to ASTM B 211M.

.2 Aluminum and Aluminum-Alloy Extruded Bar, Rods, Wire, Shapes, and Tubes: to ASTM B 221M.

.3 Aluminum sheet or plate: to ASTM B 209M.

.4 Aluminum drawn tubes: to ASTM B 210M.

.5 Aluminum bolts and rivets: to ASTM B 316M

.6 Aluminum welding wire: to AWS A5.10.

.7 Stainless steel bolts: to AISI Steel Products Manual No. 13.

.8 Steel bolts: to ASTM A 668M.

.9 Bituminous paint: to CAN/CGSB-1.108, type 1, 2, without thinner.

.10 Galvanizing hot dip galvanize steel bolts to CAN/CSA-G164, minimum zinc coating of 600g/m^2.

.11 Grating:

.1 Aluminum Grating to be Type 30-102M.
.2 Bearing Bars: 6063T6
.3 Cross Bars: 6063T5
.4 Maximum allowable fibre stress: 82.82 Mpa
.5 Grating to have smooth top edge.
.6 Fasteners to be Type A fixing clip c/w stainless steel screw, nut, and washer.
.7 Size: 51 x 4.8 unless noted otherwise on drawings
.8 Hinges, fasteners and all hardware to be stainless steel

.12 Ladders:

.1 n/a

.13 Access Hatches:

.1 n/a

2.2 FABRICATION

.1 Fabricate in accordance with CAN/CSA-S157 and in accordance with shop drawings.

2.3 FINISHES

.1 Plain mill finish, unless otherwise indicated.

3. EXECUTION

3.1 GENERAL

.1 Structural aluminum work: in accordance with CAN/CSA-S157.

.2 Welding: in accordance with CSA W59.2.

.3 Companies to be certified under Division 1 or 2.1 of CSA W47.2 for fusion welding of aluminum and/or CSA W55.3 for resistance welding of structural components.

.4 Paint aluminum surfaces in contact with concrete with two (2) coats of alkali resistant

bituminous paint.

3.2 ERECTION

.1 Erect structural aluminum as indicated and in accordance with CAN/CSA-S157 and approved erection drawings.

.2 Field cutting or altering structural members: to approval of the Engineer.

3.3 FIELD QUALITY CONTROL

.1 Inspection and testing of materials and workmanship may be carried out by testing laboratory designated by Engineer.

.2 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by Engineer.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 The Contract Documents applied to the Work of this Section.

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM A53/A53M-18, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless;

.2 ASTM A269/A269M-15a, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service;

.3 ASTM A307-14e1, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength; and

.4 ASTM A108-18, Standard Specification for Steel Bar, Carbon and Alloy, Cold-finished.

.2 CSA Group

.1 CAN/CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel;

.2 CAN/CSA-G164-18, Hot Dip Galvanizing of Irregularly Shaped Articles;

.3 CAN/CSA-S16-14, Design of Steel Structures;

.4 CAN/CSA S167-17, Strength Design in Aluminum;

.5 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding; and

.6 CSA W59-18, Welded Steel Construction (Metal Arc Welding).

1.3 SUBMITTALS

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

.2 Product Data

.1 Submit Product Data

.2 Submit data sheets for all materials specified in this section.

.3 Submit certifications for Application Specialists to demonstrate compliance to the requirements of ANSI/NACE No.13.

.3 Shop Drawings:

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

.2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

.4 Certificates:

.1 Submit certifications for Application Specialists to demonstrate compliance to the requirements of ANSI/NACE No.13.

1.4 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 Fabricator and welders must be certified in accordance with CSA and the Canadian Welding Bureau.

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 Cover exposed stainless steel surfaces with pressure sensitive heavy protection paper or apply strippable plastic coating, before shipping to job Site.

.2 Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.

.3 Store materials off ground in a dry, well-ventilated area.

.4 Replace defective or damaged materials with new.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Remove from Site and dispose of packaging materials at appropriate recycling facilities and all other waste at appropriate point of disposal.

Part 2 Products

2.1 MATERIALS

.1 All material shall be subject to inspection and testing by the Contract Administrator.

.2 Steel sections and plates: to CSA G40.20/G40.21, Grade 300W/350W.

.3 Steel pipe: to ASTM A53/A53M, galvanized finish.

.4 Welding materials: to CSA W59.

.5 Welding electrodes: to CSA W48 Series.

.6 Bolts: Stainless Steel or to ASTM A325.

.7 Anchor bolts and fasteners: ASTM F1554 Grade 36 (galvanized); ASTM F3125 A325 (galvanized); ASTM A276, Type 316 stainless steel, of ample section to safely withstand the forces created by operation of the equipment or the load to which they may be subjected. Existing concrete shall be scanned for rebar location prior to ancho installation in order to avoid interfering and damaging the rebar.

.8 Aluminum: to CSA S157 and the Aluminum Association Specifications for Aluminum Structures.

.9 Aluminum plates: type 6061-T651. Aluminium plate shall have an approved raised multi-grip pattern.

.10 Aluminum welding: CAN W59.2.

.11 Stainless steel tubing: to ASTM A269, Type 302.

.12 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

.13 Paint: n/a

2.2 FABRICATION

.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Confirm measurements for all fabrications before fabricating.

.3 Use self-tapping shake-proof flat headed screws on items requiring assembly by screws or as noted.

.4 Where possible, fit and shop assemble Work, ready for erection.

.5 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

.6 Remove and grind smooth burrs, filings, sharp protrusions and projections from metal fabrications to prevent possible injury.

.7 Angle frames shall be of the same material as the cover plate (except for existing frames designated on the drawings for re-use), and cover plates shall be hinged and be supplied with lifting handles, as shown on the drawings. Exterior covers shall be supplied with a hasp for a padlock.

2.3 FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating six hundred (600) g/m2 to CAN/CSA-G164.

.2 Paint for shop primed ferrous metal surfaces: MPI EXT 5.1D Alkyd G5 (semigloss) finish, premium grade. Color schedule will be provided by the Contract Administrator.

.3 Zinc primer: zinc rich, ready mix.

.4 Galvanized Steel Schedule

.1 All steel frames supporting catwalks

.2 All Access ladders

.3 All Guardrails

2.4 ISOLATION COATING

.1 Isolate aluminum from following components, by means of bituminous paint:

.1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.

.2 Concrete, mortar and masonry.

.3 Wood.

2.5 ACCESS LADDERS

.1 Construct to PIP STE05501

2.6 STAIRS

.1 n/a

2.7 PIPE BOLLARDS

.1 Steel pipe: double strong, diameter as indicated, hot-dip galvanized.

.2 Concrete: Type HS or HSb sulphate resistant, minimum twenty (20) MPa.

.3 Install where indicated on drawings

2.8 GUARDRAILS, HANDRAILS AND GATES

.1 Guardrails: Steel pipe: diameter as indicated, hot-dip galvanized after fabrication.

.2 Fabricate and install pipe rails to be removable by bolting to frame

.3 Gates: n/a

.4 Standards: System shall have top and mid rail in accordance with OSHA Standards - 29 CFR 1910.29 (b)(1)(2)

.5 Width: As indicated on Drawings.

.6 Height:

.1 Top Rail: 1067 mm (42 inches), minimum.

.2 Bottom Rail: 533 mm (21 inches).

Part 3 Execution

3.1 ERECTION - GENERAL

.1 Do welding work in accordance with CSA W59 unless specified otherwise.

.2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.3 All connection to be bolted or welded in accordance with CSA.

.4 All bolts to be stainless steel or A325.

.5 Exposed fastening devices to match finish and be compatible with material through which they pass.

.6 Supply components for work by other trades in accordance with shop drawings and schedule.

.7 Make field connections with bolts to CSA S1, or weld.

.8 Install suitable trolleys on all monorail crane beams and ensure their proper and safe operation.

.9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

.1 Primer: maximum VOC limit 250g/L to GS-11.

3.2 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.3 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 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 General contractor shall arrange a meeting not less than thirty days prior to starting work.

.2 Attendance:

.1 General 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 PREAPARATION

.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. General 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 REFERENCES

1.2 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 specified equipment 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.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for specified equipment 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 Description of operation of systems at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for systems and component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.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 2 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 Site records:

.1 Contract Administrator will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

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

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection.

.8 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.

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

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Furnish spare parts as follows:

.1 One set of packing for each pump.

.2 One casing joint gasket for each size pump.

.3 One glass for each gauge glass.

.3 Provide one set of special tools required to service equipment as recommended by manufacturers.

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

1.5 DELIVERY, STORAGE AND HANDLING

.1 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 and protect all specified equipment and materials from nicks, scratches, and blemishes.

.3 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 mechanical equipment 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 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 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 -ACTION AND INFORMATIONAL SUBMITTALS.

.2 Manufacturer's Field Services:

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

3.5 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.

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

.5 Contract Administrator will record these demonstrations on video tape for future reference.

3.6 CLEANING

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

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

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

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

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 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 REFERENCE DOCUMENTS

.1 Pipe supports shall meet the requirements of ANSI/ASME B31.1-1995, Power piping.

.2 Duct hangers shall follow the recommendations of the SMACNA Duct Manuals.

1.2 GENERAL REQUIREMENTS

.1 Provide hangers and supports to secure equipment in place, prevent vibration, maintain grade, provide for expansion and contraction and to accommodate insulation; provide insulation protection saddles.

.2 Install supports of strength and rigidity to suit loading without unduly stressing building. Locate adjacent to equipment to prevent undue stresses in piping and equipment.

.3 Select hangers and supports for the service and in accordance with the manufacturer's recommended maximum loading. Hangers shall have a safety factor of 5 to 1.

.4 Fasten hangers and supports to building steel or inserts in concrete construction.

.5 Provide and set sleeves required for equipment, including openings required for placing equipment.

.6 Dielectrically isolate dissimilar metals.

.7 Pipe, duct and conduit supports are not all necessarily shown on the Contract Drawings. The Contractor is responsible to ensure sufficient supports are supplied, fabricated, and installed to properly secure all pipe, fittings, and equipment to satisfy manufacturer’s recommendations.

1.3 APPROVALS

.1 Obtain approval from the Engineer prior to drilling for inserts and supports for piping systems.

.2 Obtain approval from the Engineer prior to using percussion type fastenings.

.3 Use of perforated band iron, wire or chain as hangers is not permitted.

1.4 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 Manufacturers' Field Reports: manufacturers' field reports specified.

.7 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.

1.5 QUALITY ASSURANCE

.8 Pre-Installation Meeting:

.1 Convene pre-installation meeting one week prior to beginning work of this Section

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

.9 Health and Safety:

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

Part 2 Products

2.1 INSERTS

.1 Inserts shall be galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms.

.2 Size inserts to suit threaded hanger rods.

2.2 PIPE HANGERS AND SUPPORTS

.1 Hangers: Pipe sizes 15 mm to 40 mm: Adjustable wrought steel ring.

.2 Hangers: Pipe sizes 50 mm to 100 mm and Cold Pipe Sizes 150 mm Over: Adjustable wrought steel clevis.

.3 Hangers: Hot Pipe Sizes 150 mm: Adjustable steel yoke and cast-iron roll.

.4 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods, cast iron roll and stand for hot pipe sizes 150 mm and over.

.5 Wall Support: Pipe Sizes to 80 mm: Cast iron hook.

.6 Wall Support: Pipe Sizes 100 mm and Over: Welded steel bracket and wrought steel clamp, adjustable steel yoke and cast-iron roll for hot pipe sizes 150 mm and over.

.7 Vertical Support: Steel riser clamp.

.8 Floor Support: Pipe Sizes to 100 mm and All Cold Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange and concrete pier to steel support.

.9 Floor Support: Hot Pipe Sizes 150 mm and over: Adjustable cast iron roll and stand, steel screws and concrete pier or steel support.

.10 Design hangers so they cannot become disengaged by movements of supported pipe.

.11 Provide copper plated hangers and supports for copper piping or provide sheet lead packing between hanger or support and piping.

.12 Insulate all piping from dissimilar metal supports.

2.3 HANGER RODS

.1 Provide steel hanger rods, threaded both ends, threaded one end, or continuous threaded.

2.4 DUCT HANGERS AND SUPPORTS

.1 Hangers: Galvanized steel band iron or rolled angle and 10 mm rods.

.2 Wall Supports: Galvanized steel band iron or fabricated angle bracket.

.3 Vertical Support at Floor: Rolled angle.

2.5 FLASHING

.1 Steel Flashing: 0.55 mm galvanized steel.

.2 Lead Flashing: sheet lead, as follows:

.1 For Waterproofing: 25 kg/m^2.

.2 For Soundproofing: 5 kg/m^2.

.3 Lead Sheet Size:

.1 Roof Plumbing Vents: as required to provide base flashing overlap to ARCA detail.

.2 Floor Drains: minimum 920 x 920 mm and as specified.

.3 Other Locations: as specified.

.3 Safes: 25 kg/m^2 sheet lead or 200 micrometre neoprene.

.4 Caps: Steel, 0.70 mm thickness minimum, 1.6 mm thickness at fire resistance structures.

2.6 SLEEVES

.1 Pipes through Floors: Form with 1.2 mm galvanized steel.

.2 Pipes through Beams, Walls, Fire Proofing, Footings, Potentially Wet Floor: Form with steel pipe or 1.2 mm thickness galvanized steel.

.3 Round Ducts: Form sleeves with galvanized steel.

.4 Rectangular Ducts: Form sleeves with galvanized steel or wood.

.5 Size large enough to allow for expansion with continuous insulation.

2.7 FINISHES ON HANGER RODS, HANGERS, AND SUPPORTS

.1 All steel hanger rods, hangers and supports shall be galvanized or factory primed with alkyd red oxide primer to CAN/CGSB-1.40-M89.

Part 3 Execution

3.1 INSERTS

.1 Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.

.2 Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying piping over 100 mm or ducts over 1500 mm wide.

.3 Where concrete slabs form finished ceiling, finish inserts flush with slab surface.

.4 Where inserts are omitted, drill through concrete slab from below and provide rod with recessed square steel plate and nut above slab.

3.2 PIPE HANGERS AND SUPPORTS

.1 Support horizontal steel and copper piping as follows:

Nominal Pipe Size	Distance Between Supports	Hanger Rod Diameter
15 mm	1.8 m	10 mm
20 mm to 40 mm	1.8 m	10 mm
50 mm & 65 mm	3 m	10 mm
80 mm & 100 mm	3.6 m	16 mm
150 mm to 300 mm	4.3 m	22 mm
350 mm to 450 mm	6.1 m	25 mm

.2 Install hangers to provide minimum 12 mm clear space between finished covering and adjacent work.

.3 Place a hanger within 300 mm of each horizontal elbow.

.4 Use hangers which are vertically adjustable 40 mm minimum after piping is erected.

.5 Support horizontal soil pipe near each hub with 1.5 m maximum spacing between hangers.

.6 Support vertical piping at every other floor. Support vertical soil pipe at each floor at hub.

.7 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

.8 Where practical, support riser piping independently of connected horizontal piping.

3.3 LOW VELOCITY DUCT HANGERS AND SUPPORTS

.1 Hanger Minimum Sizes:

.1 Up to 750 mm wide: 25 x 1.6 mm at 3 m spacing.

.2 790 to 1200 mm wide: 40 x 1.6 mm at 3 m spacing.

.2 Horizontal Duct on Wall Supports Minimum Sizes:

.1 Up to 450 mm wide: 40 x 1.6 mm or 25 x 25 x 3 mm at 2.4 m spacing.

.2 480 x 1000 mm wide: 40 x 40 x 3 mm at 1.2 m spacing.

.3 Vertical Duct on Wall Supports Minimum Sizes at 3.65 m spacing:

.1 Up to 610 mm wide: 40 x 1.6 mm.

.2 640 to 900 mm wide: 25 x 25 x 3 mm.

.4 940 to 1200 mm wide: 30 x 30 x 3 mm.

.4 Vertical Duct Floor Supports Minimum Sizes, riveted or screwed to ducts:

.1 Up to 1520 mm wide: 40 x 40 x 3 mm.

3.4 EQUIPMENT BASES AND SUPPORTS

.1 Provide for major equipment, reinforced concrete housekeeping bases poured directly on structural floor slab 100 mm thick minimum, extended 100 mm minimum beyond machinery bedplates. Provide templates, anchor bolts and accessories required for mounting and anchoring equipment.

.2 Construct supports of structural steel members or steel pipe and fittings. Brace and fasten with flanges bolted to structure.

.3 Rigidly anchor ducts and pipes immediately after vibration connections to equipment.

3.5 FLASHING

.1 Flash and counter flash where mechanical equipment passes through weather or waterproofed walls, floors, and roofs.

.2 Flash vent and soil pipes projecting 75 mm minimum above roof membrane with lead worked 25 mm minimum into hub, 200 mm minimum clear on sides. For pipes through outside walls turn flange back into wall and caulk.

.3 Flash floor drains over finished areas with lead minimum 250 mm clear on sides. Fasten flashing to drain clamp device.

.4 Provide curbs for mechanical roof installations, minimum 200 mm high.

.5 Attach counter flashings to mechanical equipment and lap base flashings on roof curbs.

.6 All joints in counter flashings shall be flattened and soldered double seam. Storm collars shall be adjustable to draw tight to pipe with bolts. Caulk around the top edge. Use storm collars above all roof jacks.

.7 Screw vertical flange section of roof jacks to face of curb.

.8 Provide lead flashing around ducts and pipes passing from equipment rooms, installed according to manufacturer's data for sound control.

3.6 SLEEVES

.1 Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.

.2 Extend sleeves through potentially wet floors 25 mm above finished floor level. Caulk sleeves full depth and provide floor plate.

.3 Where piping or ductwork passes through floor, ceiling or wall, close off space between pipe or duct and construction with non-combustible insulation. Provide tight fitting metal caps on both sides and caulk.

.4 Install chrome plated escutcheons where piping passes through finished surfaces.

3.7 CLOSEOUT ACTIVITIES

.1 Commissioning Reports: in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: reports, supplemented as specified.

.2 Training: provide training in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Training of O M Personnel, supplemented as specified.

3.8 CLEANING

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

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

.4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.9 PROTECTION

.5 Protect installed products and components from damage during construction.

.6 Repair damage to adjacent materials caused by plumbing specialties and accessories installation.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 The hydrostatic and pressure testing procedures outlined in this section are applicable to all non-buried piping systems. Refer to Section 31 25 20 – Hydrostatic Pressure Testing for buried piping system.

.2 All water retaining or carrying pipes and structures, and all chemical solution components shall be tested for leakage.

.3 Where work is undertaken within existing structures or piping, they shall be pressure tested and disinfected prior to being put back into operation.

.4 All testing shall be as specified herein or elsewhere in these specifications or as directed by the City's Representative.

.5 The Contractor shall furnish the suitable temporary service connections, testing plugs or caps, pressure pumps, pipe connections, gauges, thrust supports, and all other required equipment and labour necessary for filling the pipeline or structure, expelling air, pumping to the required test pressure, and dewatering the line or structure without additional compensation.

1.3 REFERENCE STANDARDS

.1 All materials, equipment, substances, etc. that will come in contact with potable water shall conform to ANSI/NSF standards 60/61 and the manufacturers shall be included on the list of approved manufacturers published by ANSI/NSF.

.2 Hydrostatic testing procedures for PVC pipe systems, as outlined in *AWWA Manual M23 – PVC Pipe –Design and Installation*, latest edition.

.3 Hydrostatic testing procedures for steel pipe systems, as outlined in *AWWA Manual M11 – Steel Pipe – A Guide for Design and Installation*, latest edition.

1.4 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 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals, closeout submittals to include hydrostatic and pressure testing results and section of piping that was tested.

1.5 QUALITY ASSURANCE

.1 Pre-Installation Meeting:

.1 Convene pre-installation meeting one week prior to beginning work of this Section

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

.2 Health and Safety:

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

Part 2 PRODUCTS

2.1 WATER

.1 All water used for the hydrostatic and pressure testing will be supplied by the City from the distribution system at no cost to the Contractor. All water required for retesting, following the failure of the initial test, will be supplied by the City at the Contractor's expense. The water rate will be based on current residential rates.

.2 The Contractor shall be responsible for the supply and installation of all temporary pipework, pumps, water trucks or other equipment required to transport the water from the point of supply to the structure or piping to be tested.

.3 The Contractor shall provide the City and Contract Administrator with 48 hours of notice of his requirement for water for testing.

Part 3 Execution

3.1 CLEANING

.1 Prior to hydrostatic or pressure testing, all water retaining structures, pipework and conduits shall be thoroughly cleaned. All dirt and loose material shall be removed.

3.2 HYDROSTATIC TESTING OF FIBERGLASS AND OTHER PREFABRICATED RESERVOIRS

.1 An initial hydrostatic test shall be undertaken by the supplier prior to shipping and a certificate supplied to the City. A second hydrostatic test shall be completed after installation. Test duration shall be for 24 hours.

.2 The Contract Administrator shall be notified at least 48 hours before any testing begins, and the procedures and leak detection method shall be submitted in writing to the Contract Administrator for his review. Perform test in the presence of Contract Administrator.

.1 If any test shows leakage, or if leaks or persistently damp patches are visible, the structure shall be emptied, carefully examined, and all defects repaired by the method outlined elsewhere in these specifications or by other means approved by the Contract Administrator. Such tests shall be repeated until no leak or persistently damp patches are present.

3.3 HYDROSTATIC TESTING OF WATER RETAINING CONCRETE STRUCTURES

.1 Hydrostatic testing shall be carried out only after the structures have been completely constructed and structural concrete has achieved (28-day) design strength.

.2 Backfilling or damp proofing shall not be started until testing has shown the structures to be watertight.

.3 Prior to commencing the hydrostatic testing of structures, the Contractor shall repair all visible cracks in the walls, roof, and floor.

.4 The Contract Administrator shall be notified at least 72 hours before any testing begins, and the procedures and leak detection method shall be submitted in writing to the Contract Administrator for his review. Perform test in the presence of Contract Administrator.

.5 The Contractor shall ensure that the exterior surface of the water retaining structures which are being hydrostatically tested are maintained at a minimum temperature of 5 degrees Celsius during the entire testing period. The cost of heating and hoarding (if required) to achieve this minimum testing temperature shall be borne by the Contractor.

.6 Fill the water retaining structure to overflow level (which will be designated by a mark scored on the tank wall) at a rate of not more than 600mm (2 ft) per day. The test shall begin once the level is at overflow level and continue for 48 hours. There shall be no persistent damp areas on exterior walls or visible leakage at any point on the structure and no lowering of the water level during the test period. The Contract Administrator shall provide the sole determination for evaporation allowance.

.7 If any test shows leakage or if leaks or persistently damp patches are visible, the structure is to be emptied, carefully examined, and all defects repaired by the method outlined elsewhere in these specifications, or by other means approved by the Contract Administrator. Such tests to be repeated until no leak or persistently damp patches are present.

.8 Upon mutual agreement between the Contractor and the Engineer, the reservoir may be backfilled completely before the leakage test is undertaken. The leakage test is to then be performed by filling the structure to overflow elevation and monitoring water level for a period of not less than 48 hours. During this period, there shall be no lowering of the water level. If water level is found to drop during the test period, the Contractor is responsible for all costs incurred to bring the leakage within the allowable limits, including any excavation and backfilling required to facilitate repairs, if necessary.

3.4 PRESSURE TESTING OF PIPING

.1 Pressure testing shall be conducted on the piping to the pressures and durations as follows (or the maximum rated pressure of the pipeline, whichever is less):

.1 Steel pipe systems:
- .1 Test Pressure: 125% of design operating pressure
- .2 Test Duration: 2 Hours

.2 PVC pipe systems:
- .1 Test Pressure: 150% of design operating pressure
- .2 Test Duration: 1 Hour

.2 Where any section of piping is provided with concrete thrust blocks, do not conduct tests until at least 5 days after placing concrete or 2 days if high early strength concrete is used.

.3 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied, if necessary.

.4 Thoroughly examine exposed parts while under pressure and correct for leakage as necessary. Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.

.5 The amount of leakage during the test period shall be zero. Repeat hydrostatic test until all defects have been corrected and no loss of water is observed**.**

3.5 INSTRUMENTATION PROTECTION

.1 All instruments that have a maximum range of less than the hydrostatic or pneumatic test pressure noted above shall be removed or isolated during the pressure tests. On successful completion of the system test, the pressure shall be lowered to a pressure within the range of the instruments, and the isolated or removed instruments shall then be tested in accordance with other sections of these specifications.

3.6 SAFETY RELIEF VALVES

.1 All safety relief valves for water services shall be supplied with test gauges for hydrostatic testing purposes. Upon completion of the hydrostatic testing, the Contractor shall remove the test gauges and repressure the system to the relieving pressure of the relief valves to ensure that the valves are relieving at their setpoint.

3.7 DEFECTS AND REPAIRS

.1 Defects disclosed in the work shall be made good and retested or the work replaced without additional cost to the City.

.2 Repairs to the piping systems shall be made with new material. No caulking of screwed joints, cracks or holes will be accepted. Where it becomes necessary to replace pieces of pipe, such replacements shall be the same lengths as the defective pieces. Where the repairs are required to PVC pipe, the pipe shall be replaced as far as the first detachable

fitting in each direction from the defect. Under no circumstances shall a new section of pipe be installed with solvent welded couplings.

.3 Tests shall be repeated after any work has been replaced if, in the judgement of the Contract Administrator, it is necessary.

.4 All pressure testing shall be done in the presence of the Engineer or Contract Administrator.

3.8 CLOSEOUT ACTIVITIES

.1 Commissioning Reports: in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: reports, supplemented as specified.

.2 Training: provide training in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Training of O M Personnel, supplemented as specified.

3.9 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.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.10 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by hydrostatic and pressure testing.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM A126-[04(2009)], Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.2 ASTM B62-[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 International

.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 Efficiency Valuation Organization (EVO)

.1 International Performance Measurement and Verification Protocol (IPMVP).

.1 IPMVP [2007] Version.

.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.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meetings:

.1 Convene pre-installation meeting 1 week prior to beginning work of this Section, with contractor's representative and Contract Administrator to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building construction subtrades.

.4 Review manufacturer's written installation instructions and warranty 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 plumbing products and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS MSDS 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 Province of Manitoba, Canada.

.2 Indicate on drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions, construction and assembly details, and accessories.

.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 Manufacturers' Field Reports: manufacturers' field reports specified.

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 Bid Opportunity 477-2024 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 and protect plumbing materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS – GENERAL

.1 All materials to be new, free from defects and conforming to applicable reference standards.

.2 All materials, linings and coatings in contact with water to be NSF approved for potable water.

.3 Where any standard referenced has been superseded prior to bidding, the Contractor shall comply with the current standard.

2.2 SHUTOFF VALVES

.1 20mm diameter, bronze 2-piece body, chrome-plated brass ball, PTFE seats, solder joint, 4100 kPa CWP, handle operator, Crane 9300 Series.

2.3 STRAINERS

.1 Cast bronze “Y” type strainer.
.2 Certified to NSF/ANSI 372.
.3 Screen 20 Mesh stainless Steel.
.4 As indicated on Drawing – Equipment Schedule.
.5 Acceptable Manufacturers: Zurn.

2.4 PRESSURE REDUCING VALVES

.1 Adjustable from one hundred seventy-two (172) to five hundred seventeen (517) kPa (twenty-five (25) to seventy-five (75) pounds per square inch).
.2 As indicated on Drawing – Equipment Schedule.
.3 Acceptable Manufacturers: Watts.

2.5 SOLENOID VALVES

.1 Where mechanical seals require external seal water, supply one (1) solenoid valve per pump for the purpose of controlling seal water flow.
.2 Seal water solenoid valves are not required to be provided if the pumps utilize an internal sealed oil reservoir.
.3 Solenoid valves to operate off 120VAC, 60Hz supply.
.4 Provide one (1) flow switch with 24 VDC for each pump flush water system.

2.6 BASE MOUNTED CENTRIFUGAL JET PUMPS

.1 Balance all rotating parts.

.2 Pump construction shall permit complete servicing without disassembly of piping or motor connections.

.3 Casing: Class 30 cast iron volute rated for 1.5 times actual discharge working pressure.

.4 Impeller: Composite, dynamically balanced.

.5 Baseplate: high-grade heat-treated cast iron or reinforced heavy rolled steel which will restrict deflections to not more than 1.5 mm/m. Units with packing glands to include an integral drain rim.

.6 Acceptable Product: Grundfos JP15S-CI PS

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 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 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 PREPARATION

.1 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.

.2 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 pneumatic and electric actuators.

.3 Where conflicts are identified, inform the Contract Administrator and initiate the necessary piping modifications at no cost to the City.

3.4 INSTALLATION

.1 Install in accordance with National Plumbing Code of Canada, provincial codes, local authority having jurisdiction.

.1 Install all equipment in strict accordance with manufacturer’s and supplier’s instructions.

.2 Any damage resulting from either failure to observe the installation instructions or as a result of proceeding with the work without complete knowledge of how it is to be done will be the Contractor’s responsibility.

.3 Make equipment installation and connections by skilled tradesmen to the best standard.

.4 Carry out work to produce a neat, accurate, secure, functional installation.

.5 Repair at own expense, any damage done to the installation of materials while carrying out the work.

.6 Install supports and bases in advance of equipment installation in accordance with manufacturer's instructions.

.7 Generally pipe supports and hangers are not shown unless for indication purposes only.

3.5 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.

3.6 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 PRESSURE IDICATORS

.1 Isolation Valves

.1 Isolate all indicators from service to allow for removal and maintenance.

.2 Use 316 stainless steel ball valves on stainless steel and carbon steel piping, bronze body valves on copper piping, and PVC ball valves on PVC piping.

.3 Isolation valves diameter are to match equipment process connections.

3.9 START-UP

.1 General:

.1 In accordance with Section 01 91 13 - General Commissioning (Cx) 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.

.4 Water supply systems operational.

.3 Provide continuous supervision during start-up.

3.10 TESTING AND ADJUSTING

.1 General:

.1 Test and adjust plumbing specialties and accessories in accordance with Section 01 91 13 - General Commissioning (Cx) 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 Adjustments:

.1 Verify that flow rate and pressure meet design criteria.

.2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.

.4 Floor drains:

.1 Verify operation of trap seal primer.

.2 Prime, using trap primer. Adjust flow rate to suit site conditions.

.3 Check operations of flushing features.

.4 Check security, accessibility, removability of strainer.

.5 Clean out baskets.

.5 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.

.6 Access doors:

.1 Verify size and location relative to items to be accessed.

.7 Cleanouts:

.1 Verify covers are gas-tight, secure, yet readily removable.

.8 Pressure regulators, PRV assemblies:

.1 Adjust settings to suit locations, flow rates, pressure conditions.

.9 Strainers:

.1 Clean out repeatedly until clear.

.2 Verify accessibility of cleanout plug and basket.

.3 Verify that cleanout plug does not leak.

.10 Hose bibbs, sediment faucets:

.1 Verify that flow and pressure meet design criteria.

.2 Check for leaks, replace compression washer if required.

3.11 CLOSEOUT ACTIVITIES

.1 Commissioning Reports: in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: reports, supplemented as specified.

.2 Training: provide training in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Training of O M Personnel, supplemented as specified.

3.12 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.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.13 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 RELATED REQUIREMENTS

.1 Section 22 05 15 – Plumbing Specialities and Accessories.

.2 Section 23 05 00 – Common Work Results – Mechanical

.3 Section 23 05 93 – Testing, Adjusting and Balancing for HVAC

1.2 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers International (ASME)

.1 ANSI/ASME B16.15-13, Cast Copper 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, Cast Copper Alloy Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500.

.5 ASME B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.

.6 ASME B31.9-14, Building Services Piping.

.2 ASTM International (ASTM)

.1 ASTM A 307-, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 ASTM A 351/A 351M, Castings, Austenitic, for Pressure Containing Parts.

.3 ASTM B 32, Standard Specification for Solder Metal.

.3 American National Standards Institute/American Water Works Association (ANSI)/(AWWA)

.1 ANSI/AWWA C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.2 ANSI/AWWA C151/A21.51, 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, Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications.

.2 CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Safety Data Sheets (SDS).

.6 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).

.1 MSS-SP-67, Butterfly Valves.

.2 MSS-SP-70, Grey Iron Gate Valves, Flanged and Threaded Ends.

.3 MSS-SP-71, Grey Iron Swing Check Valves, Flanged and Threaded Ends.

.4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.

.7 National Research Council (NRC)

.1 National Plumbing Code of Canada (NPC).

.8 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.

.1 Administrative, temporary and procedural requirements for the use of materials and methods of construction.

Part 2 Products

2.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building.

.1 Above ground:

.1 PEX Piping to CSA B137.5

.2 Type L Copper Tubing to ASTM B88

2.2 FITTINGS

.1 Cast bronze threaded fittings, Class 125 and 250: to ANSI/ASME B16.15

.2 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

.3 NPS 1 ½ and smaller:

.1 PEX fittings to CSA B137.5

.2 Type L Copper Tubing to ASTM B88

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 BALL VALVES

.1 NPS 2 and under, screwed:

.1 Class 150.

.2 Bronze body, stainless ball, PTFE adjustable packing, brass gland and Buna-N seat, stainless steel lever handle.

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.

.1 Provide pipe supports at a maximum horizontal spacing to meet Manitoba Plumbing Code requirements.

.1 Copper Pipe: 3m

.2 PVC Pipe: 1.2m

.3 PEX: 0.8m

.2 Pipe supports shall be located at high elevation or close to the mounting service to avoid interference with other building systems.

.3 Routing shown on drawing is schematic in nature. Contractor shall field route small bore piping systems to avoid interferences, as required.

.4 Provide pipe support standoff from mounting surface, so pipe is not in direct contact. Fasteners shall be suitable for the substrate (ie: concrete, wood, metal, etc).

.5 Provide riser clamp pipe supports for all vertical piping risers.

.6 Completely seal pipe penetrations and provide an escutcheon cover at the main floor level between the dry well and the electrical room.

.7 Paint all metallic pipe supports to protect from corrosion.

.2 Install pipe work as shown on drawing and as specified herein.

.3 Assemble piping using fittings manufactured to ANSI 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 ball valves as indicated on the drawings or as directed by the Contract Administrator.

3.3 PRESSURE TESTS

.1 Conform to requirements of Section 23 05 00 – Common Work Results – Mechanical.

.2 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

3.4 FLUSHING AND CLEANING

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

3.5 PRE-START-UP INSPECTIONS

.1 Systems to be complete, prior to flushing, testing and start-up.

.2 Verify that system can be completely drained.

.3 Ensure that pressure booster systems are operating properly.

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

3.6 DISINFECTION

.1 Flush out, disinfect and rinse system to Provincial potable water guidelines.

.2 Upon completion, provide laboratory test reports on water quality for Contract Administrator approval.

3.7 START-UP

.1 Complete start-up and commissioning in accordance with section 01 91 13 – General Commissioning Requirements.

.2 Timing: start up after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.3 Certificate of static completion has been issued.

.4 Water treatment systems operational.

.3 Provide continuous supervision during start-up.

.4 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 Verify that all new piping accessories, valves and equipment are in good working condition.

.4 Check control, limit, safety devices for normal and safe operation.

.5 Confirm compliance with safety and health requirements.

.6 Check that water quality is consistent with supply standards, verifying that no residuals remain as a result of flushing and/or cleaning.

.5 Rectify start-up deficiencies.

3.8 PERFORMANCE VERIFICATION

.1 Timing:

.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 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Electrical Division 26

1.2 PRODUCT OPTIONS AND SUBSTITUTIONS

.1 Refer to Division 01 for requirements pertaining to product options and substitutions.

1.3 SCOPE

.1 Outdoor condensing unit package matched to fan coil.

.2 Indoor fan coil.

.3 Refrigerant piping and accessories.

.4 Condensate piping to drain.

.5 Controls

.6 Charge of refrigerant and oil.

.7 Start-up; test; put into operation.

1.4 QUALITY ASSURANCE

.1 Conform to requirements of CSA, UL, Provincial and Municipal Codes.

.2 Test and rate cooling system to ARI Standard 210.

.3 Units shall be product of manufacturer regularly engaged in production of refrigeration units and issues complete catalogue data on such products.

1.5 SUBMITTALS

.1 Submit with shop drawings, schematic layouts showing condensing units, fan coils, refrigerant piping and accessories required for complete system.

.2 Submit complete operating and maintenance instructions.

1.6 START-UP AND TESTING

.1 Supply and charge with the initial charge of refrigerant and oil for each refrigeration system. Losses of oil or refrigerant prior to acceptance of equipment or due to defects covered under guarantee shall be replaced. Supply to the City, one complete charge of refrigerant and lubricating oil in addition that placed in the system.

.2 Test entire system for leaks after completion of installation repair leaks, put system into operation and test equipment performance.

.3 Shut down system if initial start-up and testing takes place in winter and machines are to remain inoperative. Repeat start-up and testing operation at beginning of first cooling season.

.4 Provide cooling season start-up, winter season shut down for first year of operation.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Carrier, Mitsubishi, McQuay, LG

2.2 TYPE

.1 Condensing unit shall be self-contained, packaged, factory assembled, pre-charged with refrigerant and prewired suitable for outdoor use consisting of casing, compressor, condensing coil and fan, integral sub-cooling coil, controls, screens, crankcase heater, tubing package, control transformer. Condensing unit shall be suitable for cold weather operation to –30°C.

.2 Fan coils shall be mounted as indicated on drawings and equipment schedules, complete with cooling coil, fan, fan motor, condensate pump, microprocessor controls system, and integral temperature sensing. Unit cabinet shall be fully insulated for improved thermal and acoustical performance. Discharge and inlet grilles shall be high impact polystyrene.

2.3 COMPRESSOR

.1 Provide fully hermetic reciprocating or scroll type suitable for R-410a refrigerant, resiliently mounted with positive lubrication, crankcase heater, motor overload protection. Scroll compressor shall have high discharge gas temperature protection.

.2 Reciprocating compressor shall be equipped with crankcase heater.

.3 Compressor shall be installed on rubber vibration isolators and shall have internal spring isolation.

2.4 CONDENSER

.1 Coil: Seamless copper tubing with mechanically bonded aluminum fins.

.2 Fans: Horizontal discharge, direct drive propeller fans. Shaft and fan blades shall have inherent corrosion resistance.

.3 Motors: Permanently lubricated sleeve bearing motors with built-in thermal and overload protection.

.4 Cabinet: Construct of heavy gauge galvanized steel with baked enamel finish, easily removed access doors or panels.

.5 Fan and coil shall have PVC coated protection grille.

.6 Low Ambient Kit: Oversized accumulator, head pressure control valve, suitable for condenser operation with ambient air at –30°C.

2.5 CONTROLS AND SAFETIES

.1 Provide high and low pressure switches for compressor and low ambient lockout.

.2 A time delay control sequence provided through the fan coil board, thermostat or controller.

.3 Automatic outdoor fan motor protection.

.4 Compressor motor current and temperature overload protection.

.5 Fan coil shall have a microprocessor based control system which shall control space temperature, determine fan speed and run self-diagnostics. The unit shall have wireless infrared remote control to enter setpoints and operating conditions, controls shall sense return air temperature, have indoor coil freeze protection and have fan only operation option. Condensate pan shall have internal trap.

.6 Provide fan coil condensate pump to remove condensate from the drain pan when gravity drainage cannot be used. Pump design for quiet operation.

Part 3 Execution

3.1 PERFORMANCE

.1 Refer to equipment schedules on drawings.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association, (CSA International)

.2 Insulated Cable Engineers Association, Inc. (ICEA)

Part 2 Products

2.1 CABLE PROTECTION

.1 38 x 190 mm planks pressure treated, water repellent preservative.

Part 3 Execution

3.1 DIRECT BURIAL OF DUCTS IN TRENCHES

.1 After sand base in trenches is in place, lay ducts maintaining 75 mm clearance from each side of trench to nearest cable. Maintain a burial depth of 1M throughout its length. Do not pull ducts into trench.

.2 Provide offsets for thermal action and minor earth movements.

.3 Minimum permitted radius 6 times diameter of ducts or in accordance with manufacturer's instructions.

.4 Duct separation:

.1 As shown on drawings.

.5 After sand protective cover specified in Section 31 23 10 - Excavating, Trenching and Backfilling, is in place, install continuous row of 38 x 190 mm pressure treated planks as indicated to cover length of run.

3.2 CONCRETE ENCASED DUCTS IN TRENCHES UNDER VEHICULAR AREAS

.1 Follow steps 1 thru 5 as stated in item 3.1 above.

.2 Concrete encase with top and bottom reinforcements all ducts when running under or crossing vehicular traffic/ paved roadway areas

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Section E19 of this Bid Opportunity

.2 NETA ATS-2017, Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems, 2017 Edition

1.2 TESTING REPORT

.1 Prepare an overall inspection and test report that details all investigations and tests.

.2 The Contractor shall furnish five paper copies and two electronic copies on CD of each final report.

.1 The electronic copies of the report, including the test forms, shall be provided in PDF format.

.2 The Microsoft Word version of the all completed test forms provided to the Contractor shall also be included on the CDs.

.3 The report shall be neat and organized. Any omissions, inconsistencies, or incomplete work identified by the Contract Administrator shall be corrected and incorporated into the report in the appropriate section, and completely resubmitted.

.4 A draft of each report shall be completed and sent to the Contract Administrator for review a maximum of one month after the completion of the inspections at the Site.

.5 The final report shall be submitted a maximum of two weeks after the Contractor receives the mark-up of the draft report from the Contract Administrator.

.6 The report shall include the following:

.1 Summary of project.

.2 Testing Equipment.

.3 Detail the type, manufacturer, model, and last calibration date of all testing equipment.

.4 Description of equipment tested.

.5 Description of all tests.

.6 Typed inspection forms including:

.1 Identification of the testing organization.

.2 Equipment identification.

.3 Humidity, temperature, and other conditions that may affect the results of the tests/calibrations.

.4 Date of inspections, tests, maintenance, and/or calibrations.

.5 Identification of the testing technician.

.6 Indication of inspections, tests, maintenance, and/or calibrations performed and recorded, along with charts, and graphs as applicable. All measurements and readings taken shall be noted for inclusion in the report. Where repairs are made, measurements and readings before and after the repair shall be included.

.7 Indication of expected results, when calibrations are to be performed.

.8 Indication of "as-found" and "as-left" results, as applicable.

.7 Itemized list of all repaired deficiencies which shall include:

.1 Detailed description of the deficiency.

.2 The cost associated with the deficiency repair.

.8 Itemized list of all un-repaired deficiencies encountered which shall include:

.1 Detailed description of the deficiency.

Part 2 Products

2.1 NOT USED

.1 Not Used

Part 3 Execution

3.1 SCOPE OF TESTING

.1 Motors, pumps

.2 Motors, HVAC

.3 Utility switching system

.4 VFDs (including interlocks, permissives, lockouts, and warnings)

.5 Perform a harmonics measurement, at the following locations:

.1 Main switchgear service entrance.

3.2 INSPECTION, TESTING AND MAINTENANCE PROCEDURES

.1 General

.1 All tests are based on NETA (InterNational Electrical Testing Association) standard ATS-2003. Where manufacturer's specifications, tolerances, and/or published data are not available, refer to the appropriate tables in ATS-2003.

.2 Torque all accessible bolted electrical connections. Additional requirements apply as specified.

.3 Utilize all drawings for reference while performing the specified electrical inspection work. Where the existing installation deviates from that shown on the drawings, mark-up the drawings with red pen as required to reflect the installation. Include the marked-up drawings in the report.

.4 The scope of required drawing checks is limited to the equipment and components that are part of the electrical inspection work.

.5 Any repairs made that affect the accuracy of the drawings shall be marked up on the drawings.

.6 Drafting of drawings is not required.

.7 All inspection values, readings, corrections, and assessments shall be clearly recorded for inclusion within the report.

.8 Where corrections or repairs are made, record both as found/as left test readings on the inspection sheet. If space is not provided on the inspection form, record the readings in the Note fields or on a separate sheet.

.2 Inspection Forms

.1 The inspection forms to be completed by the Contractor are provided for

reference in PDF format.

.2 Microsoft Word form templates will be provided prior to the work being initiated.

.3 Make appropriate print-outs of the inspection forms and utilize for entry of data and test results on site.

.4 Utilizing the Microsoft Word form templates, enter the data recorded manually into the forms electronically.

.5 Complete the inspection forms in the entirety and include them in the report.

.6 Submit electronic PDF copies of the inspection forms.

.7 The scope of work required in the specifications is in no way limited by the inspection forms, or spaces provided. Provide additional pages, documents, and forms as required to provide a complete report.

.8 The inspection forms may be updated during the Work by the City or Contract Administrator. Utilize the latest forms provided.

.9 Perform insulation resistance temperature correction calculations.

3.3 CABLES, < 1000 V (ALSO FEEDERS IN CONDUIT)

.1 Inspection and testing shall be comprised of the following:

.1 For cables/wires 4/0 AWG or larger, inspect bolted electrical connections for high resistance using a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate and correct values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.

.2 Torque all accessible bolted electrical connections.

.3 Inspect compression applied connectors for correct cable match and indentation.

.4 Inspect grounding and cable/conduit support.

.5 Verify that visible cable bends meet or exceed the minimum allowable bending radius.

.6 Measure length of cable/conduit and record in meters.

.7 If cables/wires are terminated through window-type current transformers, inspect to verify that neutral and ground conductors are correctly placed and that shields are correctly terminated for operation of protective devices.

.8 Perform an insulation-resistance test on each conductor. Individually test each conductor with all other conductors and shields grounded. The test duration shall be one minute. Investigate resistances less than 1000 megaohms. The voltage

applied shall be 500 Vdc for 300 V rated cables, and 1000 Vdc for 600 V or 1000 V rated cables.

3.4 SURGE ARRESTORS, LOW VOLTAGE

.2 Inspection and testing shall be comprised of the following:

.1 Inspect physical and mechanical condition.

.2 Inspect anchorage, alignment, grounding, and required clearances.

.3 Clean the unit.

.4 Verify that arrestors are electrically connected in their specified configuration.

.5 Perform resistance measurements through bolted connections with a low resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.

.6 Verify that the ground lead on each device is individually attached to a ground bus or ground electrode.

.7 Verify that stroke counter, if present, is correctly mounted and electrically connected.

.8 Perform insulation-resistance tests for one minute from each phase terminal to the case.

.9 Equipment rated >= 600V, utilize a test voltage of 1000 VDC.

.10 Equipment rated < 600V, utilize a test voltage of 500 VDC.

.11 Test the grounding connection. Resistance between the arrester ground terminal and the ground system should be less than 0.5 ohm.

3.5 METERING DEVICES, DIGITAL

.3 Inspection and testing shall be comprised of the following:

.1 Inspect physical and mechanical condition.

.2 Torque all bolted connections

.3 Record the equipment nameplate data for inclusion in the report.

.4 Verify accuracy of voltage and current at a minimum of two points each.

.5 If required, calibrate meters in accordance with manufacturer’s published data.

3.6 MOTORS, INDUCTION, AC, 600 V

.4 Inspection and testing shall be comprised of the following:

.1 Prepare and submit a condition report of existing pump motors to the contractor administrator.

.2 Note the equipment nameplate data for inclusion in the report.

.3 Inspect physical and mechanical condition.

.4 Inspect anchorage, alignment, and grounding.

.5 Inspect air baffles, filter media, cooling fans, slip rings, brushes, and brush rigging. Air baffles and filter media should be clean. Cooling fans should operate. Slip ring wear and brushes should be within manufacturer's tolerances for continued use. Brush rigging should be intact.

.6 Clean the unit.

.7 Inspect bolted electrical connections for high resistance using a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.

.8 Verify the application of appropriate lubrication and lubrication systems.

.9 Verify the absence of unusual mechanical or electrical noise or signs of overheating.

.10 Perform insulation-resistance tests in accordance with ANSI/IEEE Standard 43. Test voltage shall be in accordance with manufacturer's published data or 500 Vdc.

.1 Where possible, test each winding separately. Ground all windings not under test.

.2 Ensure all cables and accessories are disconnected during the test.

.3 For motors <= 150kW (200 HP), the test duration is to be one (1) minute. Calculate the dielectric absorption ratio.

.4 Correct test results to 40 °C.

.5 Investigate readings below 100 megaohms. Investigate dielectric absorption ratios less than 1.4 and polarization index ratios less than 2.0 for Class B insulation and Class F insulation.

.11 Where it is not possible to perform an insulation resistance test separately on each winding, perform a winding resistance test on each winding using a low- resistance ohmmeter.

.12 Measure running voltage and current and evaluate relative to load conditions and nameplate full-load amperes. Utilize a true RMS meter.

.13 Perform insulation-resistance test on insulated bearings in accordance with manufacturer's published data, if applicable.

.14 Perform resistance tests on resistance temperature detector (RTD) circuits. RTD circuits should conform to design intent and/or machine protection device manufacturer's specifications.

3.7 MOTOR STARTERS, 600 V

.5 Inspection and testing shall be comprised of the following:

.1 Note the equipment nameplate data for inclusion in the report.

.2 Record all adjustable settings, size of overload, etc.

.3 Inspect physical and mechanical condition.

.4 Inspect anchorage, alignment, and grounding.

.5 Verify the unit is clean.

.6 Torque all accessible bolted power connections.

.7 Inspect contactors for evidence of overheating or stress.

.8 Visually inspect and exercise circuit breaker.

.9 If power fuses are present, record fuse size and type. Measure the resistance of each fuse. Investigate inconsistent resistance values.

3.8 CIRCUIT BREAKERS, INSULATED CASE/MOLDED CASE, 600 V

.1 Inspection and testing shall include the following:

.1 Note the equipment nameplate data for inclusion in the report.

.2 Record all adjustable settings.

.3 Inspect physical and mechanical condition.

.4 Inspect anchorage and alignment.

.5 Clean the unit.

.6 Torque all accessible bolted power connections.

.7 Operate the circuit breaker to insure smooth operation.

.8 Test all breakers utilizing the “Push-To-Trip” button, if equipped.

.9 Move operating handle to the off and on position.

.10 Restore breaker position to original position.

.2 For cables 4/0 AWG and larger, inspect bolted electrical connections for high resistance using a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.

.3 For breakers with a frame size greater or equal to 250A, or as specified elsewhere in the specification:

.1 Perform an insulation resistance test.

.2 Breakers rated < 600V, test voltage is to be 500 VDC.

.3 Breakers rated >= 600V, test voltage is to be 1000 VDC.

.4 Perform a contact/pole-resistance test.

3.9 PANELBOARDS, LOW VOLTAGE

.1 Inspection and testing shall be comprised of the following:

.1 Note the equipment nameplate data for inclusion in the report.

.2 Inspect physical and mechanical condition.

.3 Inspect anchorage, alignment, and grounding.

.4 Clean the unit.

.5 Inspect breakers and verify mechanical operation by exercising all circuit breakers.

.1 Record breaker data on the inspection form.

.2 Test all breakers utilizing the “Push-To-Trip” button, if equipped.

.3 Move operating handle to the off and on position.

.4 Restore breaker position to original position.

.6 Test main and feeder/load breakers with a frame size >= 250A, or with long, short, or ground fault settings and complete a separate inspection form for each.

.7 Torque all accessible bolted power connections including incoming, load neutral and ground connections.

.8 Perform insulation-resistance tests on each bus phase with all other phases grounded.

.9 The main breaker, if present, is to be open for the test. If no main breaker is present, disconnect the supply conductors.

.10 Open all load breakers.

.11 Test voltage for all 600/347 V panelboards to be 1000 Vdc.

.12 Test voltage for all 120/208 V panelboards to be 500 Vdc.

3.10 GROUNDING SYSTEM

.1 Inspection and testing shall be comprised of the following:

.1 Perform resistance tests between the main grounding electrode and grounded points in the electrical distribution system located in the main switchgear, MCCs, VFDs, etc. Investigate connections with a resistance greater than 0.5 milliohms.

END OF SECTION

Part 1 General

1.1 COORDINATION

.1 Coordinate size and depth of cabinets and enclosures with systems specified in other Sections which require enclosures.

.2 Coordinate installation and identification of cabinets and enclosures with painting of mechanical and electrical work specified in Division 09.

1.2 SHOP DRAWING AND PRODUCT DATA

.1 Indicate detail construction, dimension, capacities, weights and electrical performance characteristics of equipment or material.

2. Products

2.1 CABINETS AND ENCLOSURES - GENERAL

.1 Cabinets and Enclosures: to CSA C22.2 No. 40-M1989 and as follows:

.1 NEMA 3R rated enclosure for all outdoor locations except within hazardous areas.

.2 NEMA 12 rated enclosures for devices within electrical rooms or control rooms unless otherwise specified.

.3 NEMA 4X rated enclosure for all other locations except within electrical rooms and control rooms unless otherwise specified.

.4 Door: hinged, minimum 3 point latching, with padlocking means.

.5 Door interlocks

3. Execution

3.1 INSTALLATION

.1 Install surface or flush mounted cabinets at locations and heights indicated on drawings.

.2 Assemble enclosure in accordance with manufacturer's instructions.

.3 Mount equipment in enclosure.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Switches, receptacles, wiring devices, cover plates and their installation.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-C22.2 No.42-10 (R2015), General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CSA-C22.2 No.42.1-13 (R2017), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA-C22.2 No.55-15, Special Use Switches.

.4 CSA-C22.2 No.111-18, General-Use Snap Switches (Trinational standard with UL 20 and NMX-J-005-ANCE)

1.3 COORDINATION

.1 Coordinate installation of wiring devices and cover plates with site painting and finishing work specified in Division 09.

1.4 SHOP DRAWING AND PRODUCT DATA

.1 Provide manufacturer's literature including applicable reference standards, performance and test data for following products:

.1 All switches.
.2 All receptacles.
.3 All plates.
.4 All dimmers.
.5 All photocells.

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 alloy 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: Leviton specification grade, Hubbell specification grade

2.1 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 (8) back wired entrances, four (4) side wiring screws; and

.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; and

.3 Four (4) 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: Leviton specification grade, Hubbell specification grade.

2.1 COVER PLATES

.1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.

.2 Stainless steel or PVC cover plates for wiring devices.

.3 Cover plates from one manufacturer throughout Project.

.4 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.5 Stainless steel, vertically brushed, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.

.6 Weatherproof double lift spring-loaded stainless steel or PVC cover plates, complete with gaskets for duplex receptacles as indicated.

.7 Weatherproof spring-loaded stainless steel or PVC cover plates complete with gaskets for single receptacles or switches.

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 01 - 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 01 - 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: M73-2 (Panel M73, circuit 2)

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials for moulded-case circuit breakers and circuit breakers.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No. 5, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489 and NMX-J-266-ANCE-2016).

1.3 SUBMITTALS

.1 Submit product data in accordance with Contract Document.

.2 Include time-current characteristic curves for breakers with ampacity of ninety (90) A and over or with interrupting capacity of twenty-two thousand (22,000) A symmetrical (rms) and over at system voltage

.3 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.

.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.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers, and 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 with temperature compensation for forty (40) degrees Celsius ambient.

.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.

.1 Trip settings on breakers with adjustable trips to range from three (3) to eight (8) times current rating.

.5 Circuit breakers to have minimum symmetrical rms interrupting capacity rating matching panel board or switchboard containing breaker.

.6 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.

.7 Include:

.1 On-off locking device.

.2 Neutral and Ground bus bars, fully rated.

2.2 CB-52-A (UTILITY FEED 'B' HEADINGLY MAIN BREAKER)

.1 Requirements:

.1 Utilize existing breaker, modify as follows:

1. Sensor Rating: 900 Amps

2. Modify trip setting to match CB-52-B (UTILITY FEED 'A' RANNOCK MAIN BREAKER)

2.3 CB-M100 (PUMP M100PP FEEDER BREAKER)

.1 Requirements:

.1 Utilize existing breaker, modify as follows:

3. Sensor Rating: 800 Amps

2.4 CB-M200 (PUMP M200PP FEEDER BREAKER)

.1 Requirements:

.1 Frame Size: 400 Amps

.2 Sensor Rating: 300 Amps

.3 Interrupting Rating: 35 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 L series with Micrologic 3.3S series trip unit or approved equal in accordance with B7.

2.5 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:

.1 Trip Rating: As shown on the drawings.

.2 Interrupting Rating: 35 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 B7.

2.6 OPTIONAL FEATURES

.1 As indicated

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

.2 Identification: In accordance with Section 26 05 01 – Common Work Results – Electrical, provide lamacoid plate on or adjacent to each breaker showing load being fed. Example: “XFMR-M73”.

.3 Set adjustable trip settings according to coordination study.

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.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for fused and non-fused disconnect switches.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International):

.1 CAN/CSA C22.2 No.4-M89 (R2000), Enclosed Switches; and

.2 CSA C22.2 No.39-M89 (R2003), Fuseholder Assemblies

1.3 SUBMITTALS

.1 Submittals in accordance with contract documents.

.2 Indicate:

.1 Mounting method and dimensions.

.2 Enclosure types.

Part 2 Products

2.2 DISCONNECT SWITCHES (DS-M100, DS-M200).

.1 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 Auxiliary contact for switch status.

.6 ON-OFF switch position indication on switch enclosure cover.

.7 Category 1 locations: NEMA 4.

.8 Category 2 locations: NEMA 4x.

.9 Ordinary locations: NEMA 12.

.10 Acceptable Manufacturer: Square D, Eaton, Hubbell, Pass & Seymour, Leviton

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Indicate name of load controlled on size 4 nameplate.

Part 3 Execution

3.1 PROCEDURES

.1 Install disconnect switches as indicated and in accordance with the manufacturer's recommendations and as required by CSA C22.1.

.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.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No.14-10 , Industrial Control Equipment.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 1-2000(R2008), Industrial Control and Systems: General Requirements.

1.2 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.

1.3 QUALITY ASSURANCE

.1 Conduct tests in accordance with Section 26 05 01 - Common Work Results for Electrical.

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 control devices for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00- Common Product Requirements 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 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 CSA C22.2 No.14.

.2 Fixed contact plug-in type: general purpose heavy duty with two poles. Coil rating: 120V. Contact rating: 240V, 2A

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 2-NO and 2-NC contacts rated at 10A, AC/DC, labels as indicated. Stop pushbuttons coloured red. Start pushbuttons coloured green.

2.4 EMERGENCY STOP PUSHBUTTONS

.1 Operator mushroom type, 2-position, Push-Pull operator, Red, with 1-NO and 1-NC contacts rated at 10A, AC/DC, labels as indicated.

2.5 SELECTOR SWITCHES

.1 Maintained three (3) position labelled as indicated. heavy duty, thirty 30 mm, oil tight, operators wing lever contact arrangement as indicated, rated 120V, 10A, AC.

2.6 INDICATING LIGHTS

.1 Standard, full voltage, LED type, lens colour: as indicated, supply voltage: as indicated, lamp voltage: as indicated, labels as indicated.

2.7 CONTROL AND RELAY PANELS

.1 CSA Type 12 sheet steel enclosure with hinged padlockable 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: 120V, AC.

.4 Rating: 150 VA, or larger as required.

.5 Secondary fuse: ampacity as required.

.6 Close voltage regulation as required by magnet coils and solenoid valves.

2.9 IDENTIFICATION

.1 All control devices shall be labelled exactly as shown in 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 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 Contractor is responsible for installation, wiring, testing, and assisting the Contract Administrator in commissioning of the utility transfer relay equipment.

.2 Contractor shall supply all required cabling to connect hardware above.

3.3 INSTALLATION

.1 Install pushbutton stations, control and relay panels, and control devices.

.2 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical.

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 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 SCOPE

.1 **VFD supplier** shall design, manufacture, program, factory test, and deliver the VFDs in addition to assisting the division 26 contractor in the on-site commissioning of the VFDs.

.2 **Division 26 Contractor** shall install, wire and connect, and commission all VFD controllers as indicated on the Drawings.

1.3 REFERENCES

.1 CSA, Canadian Standards Association

.2 NEMA, National Electrical Manufacturer Association

.3 IEEE, The Institute of Electrical and Electronics Engineers

.4 Other, Local Power Utility and Telephone Utility Guidelines for Harmonic Distortion.

1.4 STANDARD MOTOR

.1 All VFDs supplied under this Contract shall meet or exceed the following Specifications.

.2 Provide a complete inventory (as specified) of spare cooling fans, and fuses, for each VFD supplied.

.3 The adjustable frequency controller shall be designed to operate standard squirrel cage induction motor with a 1.15 S.F. or definite purpose motors meeting National Electric Manufacturers Association (NEMA) MG1 Part 31.

.4 Harmonic loading will not exceed a motor service factor of one (1.0).

.5 Products shall comply with Institute of Electrical and Electronics Engineers (IEEE) Standard 519.

.6 VFD unit shall be Underwriters Laboratories (UL) listed and Canadian Standards Association (CSA) certified.

.7 VFD unit shall comply with applicable requirements of the latest standards of CSA, American National Standards Institute (ANSI), IEEE and the Canadian Electrical Code.

.8 The VFD for pump 1 shall utilize an existing bypass Reduced Voltage Motor Starter (RVMS) with a manual bypass switch located on the external starter cabinet. Instrument transformers for pump 1 shall be provided loose by the VFD supplier for contractor installation in the external RVMS cabinet. 120V control power to the VFD-M100 control section shall be provided from the existing control transformer and power conditioner located in the bypass cabinet.

1.5 DESIGN REQUIREMENTS

.1 The VFD enclosure shall be laid out and built according to, and in full compliance with, MPE Engineering's motor control detailed drawings:

.1 **1-0103-ECBD-M001-001** – VFD-M100 STANDALONE VFD ELEVATION

.2 **1-0103-EMCL-M001-001** – VFD-M100 MOTOR STARTER SCHEMATIC

.3 **1-0103-EMCL-M002-001** – PUMP M100PP BYPASS RVMS STARTER CABINET SCHEMATIC

.4 **1-0103-EWDG-M002-001** – PUMP M100PP MOTOR STARTER CONNECTION DIAGRAM

.5 **1-0103-EWDG-M003-001** – RLY-M1001 MOTOR PROTECTION RELAY WIRING DIAGRAM

.6 **1-0103-ECBD-M002-001** – VFD-M200 STANDALONE VFD ELEVATION

.7 **1-0103-EMCL-M003-001** – VFD-M200 MOTOR STARTER SCHEMATIC

.8 **1-0103-EWDG-M004-001** – PUMP M200PP MOTOR STARTER CONNECTION DIAGRAM

.9 **1-0103-EWDG-M005-001** – RLY-M2001 MOTOR PROTECTION RELAY WIRING DIAGRAM

.2 Provide equipment layout drawing detailing:

.1 The dimensions, physical arrangement of major components, and the degree of compartmentalization and physical segregation provided between components and different I/O types.

.2 Terminal block DIN rails shall include space for 10% spare terminals after what is shown on the drawings.

.3 Front layout of the panel

.4 Programming manuals for the equipment used

.5 When air-cooled systems are provided, the following shall also be shown:

.1 air inlet and outlet passages

.2 cooling fans

.3 filters.

1.6 SUBMITTALS

.1 Submit shop drawings including:

.1 Panel layout.

.2 Wiring diagrams:

.1 AutoCAD versions of the VFD schematic drawings will be provided upon request.

1.7 TESTS

.1 Factory testing:

.1 VFD units are to be factory tested prior to shipment. Testing shall be witnessed by CoW representatives. Provide confirmation of actual tests completed and results.

.2 Provide certified copies of production test results required by CSA and Electrical and Electronic Manufacturer’s Association of Canada (EEMAC), prior to acceptance of the equipment.

.2 Field testing:

.1 The VFD supplier shall provide on-Site start-up, fine-tuning, commissioning, operator training and instruction for a total of Two (2) working days.

.2 The VFD supplier shall provide Site functionality test reports indicating loading/current levels during testing as well as control point proving results.

.3 The VFD supplier shall ensure shaft to ground voltages do not exceed 1.5 V at any speed or load requirement.

.4 Allow for all costs and labour for as many trips as necessary to complete requirements.

.5 It is the intent of this Specification to provide a VFD installation that does not adversely affect the electrical system. Available upon request is information on the electrical system including:

.2 Single line Drawing.

.3 Additional information on electrical system layout and load profile.

.4 The VFD supplier can use this information to evaluate the predicted effect of the VFD installation on the electrical system and advise the Contract Administrator of these effects. For the purposes of analysis, the point of common coupling (PCC) will be taken as the secondary of the main distribution transformers.

.1 Provide certified copies of all production test results required by CSA and NEMA.

.2 Provide and complete the City of Winnipeg standard VFD test form.

1.8 EXTRA MATERIALS

.1 Provide assistance to the division 26 contractor in development of maintenance materials in accordance with Section 01 78 00 – Closeout Submittals.

.2 Provide listed spare parts for each different size and type of starter:

.1 Three (3) contacts, stationary.

.2 Three (3) contacts, movable.

.3 One (1) contacts, auxiliary.

.4 One (1) control transformers.

.5 One (1) operating coil.

.6 Two (2) fuses.

.7 Ten percent (10%) indicating lamp bulbs used

1.9 PARTS AVAILABILITY

.1 Guarantee that parts for the drive units be available for a minimum of ten years from time of delivery.

1.10 DESIGN REQUIREMENTS

.1 Ventilation system designed for ambient temperature range of 10°C to 35°C. temperature not to exceed 45°C.

Part 2 Products

2.2 VARIABLE FREQUENCY DRIVES (VFD-M100, VFD-M200)

.1 Variable Frequency Drives supplied by Schneider Electric: APM Low Harmonic Drives.

.1 Purchasing and/or quotes shall reference the City of Winnipeg RFP 756-2013 for the City of Winnipeg discount pricing.

.2 No alternates or substitutes will be accepted.

.3 Contact: Schneider Electric, 21 Omands Creek Blvd, Winnipeg, MB.

.4 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 Variable speed controller shall be electronic adjustable frequency and voltage output unit.

.3 The VFD shall employ a minimum 6-pulse pulse width modulated (PWM) inverter system utilizing Insulated Gate Bipolar Transistors (IGBT) power switching devices and come complete with line reactors.

.4 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.

.5 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.

.6 The drive shall be rated for continuous duty while operating a NEMA design induction motor of the sizes and operating voltages as indicated on the Drawings over the entire speed range. Drive output shall be sized for a one (1.0) motor service factor. The VFD shall have a current rating at least ten percent (10%) in excess of the motor full load amp rating. Overload service factors of one hundred ten percent (110%) for thirty (30) minutes and one hundred thirty-five percent (135%) for one (1) minute must be provided to ensure adequate safety margins. VFD selection shall be based on load current at constant torque ratings. Do not size VFD's based on variable torque maximums.

.7 Input voltage shall be as indicated on motor schedules and Drawings (line voltage variation plus or minus ten percent (±10%)) based on 347/600 volt systems (Not five hundred seventy-five (575) V). Line frequency variation plus or minus five percent (±5%). Output voltage shall vary with motor speed to nominal motor voltage. Speed stability shall be plus or minus one percent (±1%) of any given set point within the operating frequency range. Drive shall match torque characteristic of load.

.8 Input frequency setting signal will be selective between 4-20 mA or 0-10 v DC. Output speed monitoring signal shall be selective between 4-20 mA or 0-10 v DC.

.9 The VFD shall be provided with radio interference suppression and limit radio interference values to within the limits of local code requirements.

.10 VFD Input Run Command signals will be 24Vdc discrete signals. Provide two (2) 24Vdc relay in the VFD control compartment.

.11 Enclosure:

.1 Drive shall be installed in standalone enclosures as indicated on Drawings. Filters to be provided for any forced air-cooled enclosures as required by the supplier. VFD(s) shall be suitable for mounting in a typical building electrical room and shall be able to operate under these conditions with no special cleaning requirements. VFD cabinets shall be mounted in such a way that there is adequate room for ventilation and no buildup of heat.

.2 The VFD enclosures shall include a door disconnect switch or other means to prevent the opening of the panels while live.

.12 Protective devices to be incorporated are:

.1 Motor Protection Relay

.1 Model: SEL 710-5

.2 Product Number: 071050E1A6X9X2A87A680

.3 VFD supplier to provide protection relay programming and mapping for software monitoring over ethernet

.4 Protection relay panel mounted and connected as shown on drawings

.2 CTs and PTs for protection relay monitoring as outlined in the drawings

.1 Provide pump 1 instrument transformers loose for contractor installation to the external bypass cabinet.

.2 Provide pump 2 instrument transformers within VFD enclosure.

.3 Fast acting electronic circuit board protective devices for protection of electronic components.

.4 Three percent (3%) Line reactor (integrated with modular drive).

.5 Drive output filter (integrated with modular drive).

.6 Integral electronic motor overload protection adjustable up to one hundred fifty percent (150%) of motor rating for sixty (60) seconds.

.7 Overcurrent instantaneous trip up to two hundred fifty percent (250%).

.8 Programmable short-circuit protection.

.9 Programmable ground fault protection.

.10 Overvoltage/overcurrent DC bus monitor/protection.

.11 Undervoltage protection.

.12 Loss of phase and phase unbalance protection.

.13 Inverter over-temperature protection.

.14 Capable of running without motor for start-up.

.15 Maximum acceptable noise level is eighty (80) dBA at one (1) m.

.13 Operation features:

.1 Integral flush mounted display in VFD cover with keypad for programming, monitoring and operating of drive, accessible through password or other acceptable security measure only. Remote keypads, completely duplicating functions of integral keypads, shall also be provided for all VFD(s) that are not normally accessible such as located inside enclosures, fan plenums, etc. The remote keypads in these cases shall be located on the enclosure door.

.2 Fault shutdown and indication.

.3 Automatic restart following power outage.

.4 Ability to disconnect motor load for setup or trouble.

.5 Manual speed control potentiometer mounted on standalone enclosure door.

.6 Adjustable maximum and minimum speed.

.7 Acceleration and deceleration time adjustment.

.8 Controller “stop” interlock from a NC dry contact.

.9 Drive fault contact.

.10 Stop/start forward/start reverse push buttons on keypad and standalone enclosure door as indicated on the drawings.

.11 Transient voltage protection.

.12 Provide three (3) dry “C” type contacts programmable for any combination of the following:

.1 Running (output frequency being generated).

.2 Pump ready signals.

.3 High vibration lockout.

.4 Fault lockout.

.5 Stopped.

.6 At speed.

.7 Under speed.

.8 Forward/Reverse.

.9 Low reference.

.10 Manual/Auto Mode.

.11 Local/Remote Mode.

.13 Soft start sequence.

.14 Minimum of three (3) skip frequencies.

.15 Indicating lights as follows:

.1 Ready (Blue)

.2 Running Forward (Green)

.3 Running Reverse (Green)

.4 VFD Mode (Red) (VFD-M100 Only)

.5 RVMS Mode (Red) (VFD-M100 Only)

.6 VFD Fault (Amber)

.7 Bearing Vibration High Alarm (Amber)

.8 Bearing Temperature High Alarm (Amber)

.9 Motor Temperature High Alarm (Amber)

.16 Provide Hand/Off/Auto selector switch. Keypad HOA is not an acceptable replacement.

.17 Provide test plugs for the connection of monitoring CTs and PTs and configured as shown on the drawings to short CT secondaries with the plug removed.

.1 Acceptable product: GE PK2

.18 Password protection of parameter programming or some method to prevent unauthorized changes.

.19 Output speed monitoring signal to be selective between 4-20 mA or 0-10 V.

.14 Environmental Capabilities: The drive shall operate without mechanical or electrical damage under any combination of conditions as follows:

.1 Ambient temperature minus zero (-0) degrees to forty (40) degrees Celsius.

.2 Humidity zero (0) to ninety percent (90%) (non condensing).

.3 Vibration up to 0.5 g.

.4 Altitude zero (0) to one thousand two hundred fifty (1,250) metres.

.15 Diagnostic and indicating features:

.1 Power On indication;

.2 Percentage speed indicator;

.3 Overload indication;

.4 Short circuit indication;

.5 Ground fault indication;

.6 Overvoltage indication;

.7 Undervoltage indication;

.8 High temperature (controller);

.9 AC voltmeter (output);

.10 AC ammeter (output);

.11 Inverter ready;

.12 Inverter fault; and

.13 External fault

.16 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.

.17 Wiring:

.1 The sizes and colours of wires shall be in accordance with the CSA and the Canadian Electrical Code.

.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 Provide wire markers at both ends of all control wires.

.5 Control wiring shall be TEW one hundred five (105) degrees Celsius rise.

.6 Identification shall follow the supplied documents, such as wiring diagrams.

.1 Label both ends of each wire.

.2 Utilize heat shrink wire labels, black text with white background.

.3 Wherever possible wire labels shall be positioned to be read from the panel opening without removal of wire duct covers or other wiring.

.7 Individual conductors or wires exiting a cable shall be identified using non-erasable markers.

.8 All wiring too and from the VFD is to terminate on terminating strips.

.9 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.

.10 All analog signal wiring shall be 18 AWG shielded twisted pairs such as Belden No. 8760, or an approved equivalent in accordance with B7. 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.

.11 All 24 VDC or 120 VAC discrete signal panel wiring shall be 16 AWG TEW stranded conductor. Increase the size of power wiring to 12 AWG minimum.

.12 Stranded wire terminations are not acceptable. Use appropriately sized ferrules.

.13 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.

.14 Ethernet Patch Cords

.1 Requirements:

.1 CAT-6.

.2 Jacket colour: Blue.

.15 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 B7

.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.

1.11 SPARE PARTS

.1 Provide, at minimum, the following spare parts:

.1 One cooling fan

.2 Five (5) spare fuses of each type used

.3 One N.O. and N.C. contact block for control switches

.4 One form “C” relay

Part 3 Execution

3.1 TESTS

.1 VFD units are to be factory tested prior to shipment. City representative to be present for factory testing. Provide confirmation 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 Supplier to allow for two (2) working days for on-site commissioning assistance.

.2 Provide on-site start-up, fine-tuning, commissioning, operator training, and instruction.

.3 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.

.4 Ensure shaft to ground voltages do not exceed 1.5 V at any speed or load requirement.

3.2 FIELD QUALITY CONTROL

.1 Operate switches, contactors to verify correct functioning.

.2 Perform starting and stopping sequences of contactors and relays.

.3 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

END OF SECTION

1. GENERAL

1.1 SYSTEM

.1 Provide complete power transfer equipment with electronic microprocessor-based controls designed for fully automatic operation and including: surge voltage isolation, voltage and current sensors on all phases of the normal source and of the secondary source as indicated on the drawings.

.2 The transfer system shall consist of a delayed neutral position (open) transition utilizing the existing mechanical interlock and the programmed software interlock.

.3 The transfer switch shall transfer the load in delayed transition: break – delay position (no connection) - make mode. Transfer is accomplished with a user-defined interruption period in both directions adjustable from 1 second to 5 minutes in a maximum of 15 second increments. Unit is to be designed for fully automatic operation upon power failure.

1.2 ACCEPTABLE MANUFACTURERS

.1 The automatic transfer relay shall be provided by:

.1 Schweitzer Engineering Laboratories (SEL)

(i) **Contact:** Ken Hamilton

(ii) **Email:** khamilton@pro-techpower.com

(iii) **Phone:** 431-374-7266

.2 Approved alternate that meets or exceeds the requirements of the contract documents.

.2 Basis of design: SEL-700BT bus transfer relay.

1.3 SHOP DRAWINGS

.1 Provide shop drawings showing:

.1 Front and interior layout of equipment in the low voltage switching compartment of the main switchgear.

.2 Locations of all instrument transformers to be installed.

.3 Wiring of the automatic transfer system.

2. PRODUCTS

2.1 COMPONENTS

.1 Automatic transfer system: fully automatic electrically operated, mechanically held, for all load classes with normal and secondary supply as defined below. Switch to be complete with full phase relay protection to operate on normal power voltage drop to 65 per cent on any phase. Detects when all three phases are present, have the correct sequence and detects if voltage or phase angle asymmetry is below set value. Transfer to utilize the existing breakers shunt trip controls.

.2 The transfer system shall include both electrical and mechanical interlocks to prevent both sets of main contacts from being closed at the same time. The switch shall be positively locked and unaffected by momentary outages, so that contact pressure is maintained at a constant value and contact temperature rise is minimized for maximum reliability and operating life.

.3 Provide programmable time delays accessible from the transfer relay HMI, adjustable from 10 seconds to 5 minutes to delay transfer from normal to standby until standby power source has obtained 90 per cent of rated voltage.

.4 Provide programmable time delays accessible from the transfer relay HMI, adjustable from 1 to 5 minutes, to delay transfer from standby to normal source.

.5 Provide programmable time delays accessible from the transfer relay HMI, adjustable from 0 seconds to 5 minutes, to adjust time in neutral “off” position.

.6 Provide a 120V 4PDT control relay to provide redundant power to the protection relay from either feed as indicated.

.7 Source status screens shall be provided for both normal and secondary to provide digital readout of voltage on all three phases and frequency. System status screens shall display a clear description of the active operating sequence and switch position.

.8 The transfer system’s sensing and logic shall be provided by a single built-in microprocessor for maximum reliability, minimum maintenance, and the ability to communicate through an included ethernet communication module to the existing DCS. The controller shall be capable (when activated by the keypad or through the ethernet port) of sensing the phase rotation of both the normal and secondary sources. The controller shall include a user selectable algorithm to prevent repeated transfer cycling to a source on an installation which experiences primary side, single phase failures on a Grounded Wye – Grounded Wye transformer which regenerates voltage when unloaded.

.9 An HMI display and keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through the ethernet communications input port.

.10 All time delays shall be adjustable by using the HMI display and keypad or with a remote device connected to the serial communications port. The time delay value displayed on the LCD or remote device shall be the remaining time until the next event occurs.

.11 Voltage (all phases) and frequency on both the normal and emergency sources shall be continuously monitored, with the following pickup, dropout, and trip setting capabilities (values shown as % of nominal unless otherwise specified):

	Parameter	Dropout/Trip	Pickup/Reset
.1	Under voltage	65 to 90%	85 to 100%
.2	Over voltage	106 to 135%	95 to 100% of trip
.3	Under frequency	90 to 99%	80 to 95%
.4	Over frequency	101 to 115%	105 to 120%
.5	Voltage unbalance	5 to 20%	3 to 18%

.12 The automatic Transfer Switch control system shall provide alarms to the DCS as indicated on the drawings utilizing the relay discrete output card.

.13 The transfer switch shall operate in open transition mode (break before make) in a syncing configuration.

3. EXECUTION

3.1 OPERATION

.1 Refer to the automatic transfer control narrative (Document A-0103-APCN-M002) included in this bid opportunity for detailed operation requirements.

3.2 ACCESSORIES

.1 Provide two (2) spare fuses of each size.

3.3 PROGRAMMING

.1 Transfer Relay programming to be completed by SEL Engineering Services to the requirements set out in document A-0103-APCN-M002 included in this bid opportunity.

3.3 SPARE PARTS

.1 Provide one (1) spare programmed SEL-700BT relay with a matching product number to keep on site. The program installed to the spare relay shall be the final program after any changes made during commissioning.

3.4 COMMISSIONING

.1 Provide and pay for the transfer relay programmer to assist in commissioning the transfer switch.

.2 Notify the City 1 week prior to the day in which the transfer system is to be commissioned.

.3 Set and adjust all Transfer System parameters as per the City's requirements.

.4 Commission the transfer switch in the presence of the City or Contract Administrator via a live load test as follows:

.1 Turn off the main breaker.
.2 Verify the power transfer from primary to secondary power.
.3 Turn on the main breaker to the transfer switch.
.4 Turn off the secondary main breaker.
.5 Verify the power transfer from secondary to primary power.
.6 Verify and test all alarm and monitoring points to the DCS

.5 Record all data and parameter settings on a type written sheet and provide copies to be inserted into the Operation and Maintenance Manuals.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

.2 Section 40 03 12– Controls Instrumentation

1.2 DESCRIPTION OF WORK INCLUDED

.1 Work of this Section consists of supply and installation of instrumentation and control equipment as specified and as shown on the plans.

.2 The work includes, but is not necessarily limited to, the following:

.1 Wiring of all process instrumentation including those devices supplied by other divisions.

.2 Supply, Programming, and testing of the new utility transfer relay.

.3 Training for plant operators as specified herein.

.4 Commissioning.

.3 This section does not include devices or equipment for installation in the control panel as specified in Section 40 95 13 – Control Panels.

1.3 SUBMITTALS

.1 The Contractor shall provide the following instrumentation plans as a minimum:

.1 Submit product data in accordance with Contract Document.

.2 Completed instrument record sheets.

.3 Communications system interface connection diagrams.

.4 Instrument calibration records.

.5 Instrumentation installation in process line detail plans.

Part 2 Products

2.1 GENERAL INSTRUMENT REQUIREMENTS

.1 Unless otherwise specified, the Contractor shall provide instruments in accordance with the drawings and the following general requirements:

.1 Provide indicating transmitters on nearby wall in the vicinity of the instruments. Where there are multiple instruments in proximity, group indicating transmitters.

.2 Locate in a logical arrangement. For transmitter layout, mimic physical layout of process and/or process sequence.

.3 Provide CSA 4X enclosure for all instruments.

.4 Power supply is 120 VAC unless otherwise noted.

.5 For analogue instruments, provide 4 - 20 mA, linear, isolated output, capable of driving a minimum of 600 ohms.

.6 Instrumentation cable: to manufacturer's recommendations and Code requirements.

.7 Provide all necessary brackets or stands to mount instrument.

.8 Supply any spare parts or calibration instruments required to commission instruments.

.9 Instrument tags will be generally to ISA 5.1, and supplied by instrument system supplier as required.

.10 All instruments in contact with the water shall be NSF 61 certified.

.11 Provide instruments with features and options to suit good practice in all applications.

Part 3 Execution

3.1 MATERIAL CONTROL

.1 The Contractor shall provide all components (and software where required) as outlined in this Specification and shown on the Plans.

.2 The Contractor shall co-ordinate with component and software suppliers and subcontractors to allow for timely and coordinated delivery, construction, testing, installation and programming of the control system as outlined in this Specification.

.3 The Contractor shall identify all field instruments with a permanent, weatherproof label showing tag number and service. Use engraved lamacoid, or stamped stainless steel and fix with non-rusting screws or wire, or chain.

3.2 FABRICATION

.1 The plans have been prepared using the latest information available from the component

suppliers. Check these plans against the plans supplied with the components and make any necessary changes.

.2 Obtain from the component suppliers, the manufacturer's wiring diagrams to determine the equipment terminals and record these terminal numbers on the wiring diagrams.

.3 Identify jumper settings, switch settings, program entries, etc. necessary to complete the installation.

3.3 EQUIPMENT IDENTIFICATION

.1 Refer to Section 26 05 01 – Common Work Results - Electrical.

3.4 INSTALLATION

.1 Install according to supplied instructions. Follow manufactures recommendations regarding installation locations, mounting methods, connection methods, etc.

.2 Commission all field wiring before terminating.

.3 Do not energize the control system until authorized to do so by the Contract Administrator.

.4 The Contractor shall co-ordinate the components of the instrumentation and control system to achieve a complete working system to the intent of this specification.

.5 The Contractor shall provide supports or frames if not already supplied by the manufacturer of the equipment.

.6 The Contractor shall obtain written permission from the Contract Administrator before fixing supports or frames to structural members.

.7 Mount instruments in strict accordance with manufacturer's recommendations. The Contractor shall not mount any equipment on vibrating structures (eg. handrails) or below lines carrying corrosive chemicals or where condensation may occur.

.8 The Contractor shall ensure instruments and their associated sensors are easily accessible for maintenance, calibration, withdrawal or replacement.

.9 The Contractor shall install instruments as specified in accordance with plans and as required by process schematic.

.10 Instruments are shown on the plans in their approximate locations. Exact location shall consider visibility, work space, and any special installation instructions.

.11 Attach permanent tags.

3.5 INSTALLATION ACCEPTANCE FIELD TESTING, FINAL COMMISSIONING

.1 The Contractor shall provide the services of qualified instrument technicians to commission and demonstrate the operation of the control system. The technicians shall include commissioning of all equipment including but not limited to equipment supplied in the Contract, existing equipment, City of Winnipeg supplied equipment, and equipment supplied by others.

.2 Where specialized vendor assistance may be required, the Contractor shall ensure this is available during proposed commissioning period and pay for all costs associated with this assistance. This shall include assistance from the panel builder and system programmer.

.3 All the equipment in this Contract shall be supplied so that installation can be carried out in a reasonably expeditious manner. The Contractor shall cooperate with the Contract Administrator, the City of Winnipeg and other trades and shall provide off-site and on-site installation supervisory assistance during the course of the work as detailed herein.

.4 The Contractor shall complete instrument record sheets at the time of calibration and ensure all instruments meet specifications. The Contractor shall make record sheets available to the Contract Administrator during construction/installation period.

.5 The Contractor shall confirm correctness of operation of all instrumentation and end devices.

.6 The Contractor shall confirm correctness of operation of all instruments and end devices feeding into the control system.

.7 Mass balance shall be demonstrated under all operating scenarios. Flow, level, and pressure values shall be in agreement.

.8 Prior to the commencement of software commissioning, the Contractor shall ensure that all deficiencies have been corrected without undo delay to the schedule of work.

.9 The Contractor shall certify the following:

.1 That the equipment has been installed in accordance with the Contract Administrator's plans and recommended installation procedures, with any discrepancies reported to the Contract Administrator.

.2 That the equipment power and grounding requirements have been satisfied, with any discrepancies reported to the Contract Administrator.

.3 That all terminations to the equipment have been properly installed, with any discrepancies reported to the Contract Administrator.

.4 Calibration and adjustment of the equipment as required to place the equipment in trouble-free operation. Certified calibration reports for each instrument shall be provided. This calibration work shall be in addition to the factory calibration

provided with each device when shipped.

.5 That the system is ready for final commissioning and program testing.

.10 The Contractor shall prepare the various reports and certificates specified in this Section. One copy of each report and certificate shall be forwarded to the Contract Administrator and to the City of Winnipeg. Any discrepancies which require further action on the part of the Contract Administrator or the City of Winnipeg shall be clearly identified on the report or certificate.

.11 Prior to commencement of software commissioning, the Contractor shall ensure that all spare parts, expendables and test equipment pertinent to the equipment supplied by this section and being tested, are on site.

.12 Test equipment shall include all necessary multi-meters, process instrument calibrators for 4 - 20 mA, 24 VDC devices, thermocouples signal generators. Test equipment shall be provided by the Contractor and shall remain the property of the Contractor at the end of all testing.

.13 The Contractor shall provide assistance during commissioning and start-up related to any equipment supplied by the Contractor. This shall include the manual or automatic activation of field devices.

.14 The Contractor shall demonstrate the integrity and functional operation associated with the wiring and equipment supplied by the Contractor, which is required to operate with the PLC software.

.15 Refer to Section 40 95 13 – Control Panels, for testing and commissioning to be performed under that section which may require co-operation by verification personnel under this section.

.16 The Contractor shall submit details on instrument wiring to Contract Administrator on request. Include information on raceway materials and sizes, cable and wire type and numbers, manufacturer, model, markings, ratings, listings, etc. Indicate presence or absence of grounding, bonding, screening, and drain layers in cable construction. Indicate grounding arrangements on a per cable basis.

3.6 TRAINING

.1 The Contractor shall provide one (1) day training to the City of Winnipeg's operating staff on the operation and maintenance of the system.

.2 Training shall include for the use of both hardware, software and plant operations.

.3 Training shall be on site with the installed equipment.

3.7 Spares

.1 The Contractor shall provide the following spare parts:

.1 One (1) years supply of expendable parts, or parts requiring regular replacement.

.2 Two of each type of fuse on equipment supplied under this section.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 This Section covers items common to Sections of Division 26.

1.2 CODES AND STANDARDS

.1 Do complete installation in accordance with 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 Unless otherwise indicated, all references to "Canadian Electrical Code" or "CEC" shall mean the edition of the Canadian Electrical Code, Part I, CSA C22.1, and the variations made thereto by Manitoba regulation, which are in force on the date of bid closing for the Contract.

.4 All electrical products shall be tested, certified and labeled in accordance with a certification program accredited by the Standards Council of Canada (at a minimum, STANDATA Section 2 – Electrical System Equipment). Where a product is not so labeled, provide written approval by the authority having jurisdiction.

.5 Submit to The City, copy of electrical permit obtained from authority having jurisdiction.

.6 If authority having jurisdiction conducts an electrical inspection, submit copy of certificate of acceptance provided by authority having jurisdiction.

.7 All equipment supplied to have 75°C termination ratings and suitable for connection of copper or aluminum conductors.

.8 All cable ampacities in the drawings and specifications are based on equipment termination ratings of 75°C. Should equipment be provided with a different rating it is the Contractors responsibility to size cable accordingly to meet the electrical code requirements.

1.3 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 B4.

1.4 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.

1.5 PERMITS, FEES AND INSPECTION

.1 Submit to Electrical Inspection Department and Supply Authority the 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.

1.6 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Contract Document.

.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.

1.7 ELECTRICAL EQUIPMENT MODIFICATION

.1 Where electrical equipment is field modified, arrange for special inspection and pay all associated fees.

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 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 Refer to City of Winnipeg Electrical Design Guidelines section 2.3 for Identification Lamacoid Requirements.

1.10 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings on both ends of phase conductors of feeders and branch circuit wiring.

.1 Wire tags to be heat shrink type with black letters on white background.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

.1 Plexiglass holder to be designed for the purpose and allow for easy replacement of the drawing.

.2 Size: 432 x 279 mm minimum size.

.1 Single Line Diagram

.2 Process P&ID

1.14 LOCATION OF OUTLETS

.1 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

1.15 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centerline of equipment unless specified.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights.

.1 Panelboards: 1800 to top

.2 Light switches: 1420 to top

.3 Wall receptacles: 900 to top

.4 Control panels: 1800 to top

.5 Emergency lights: 2400 (minimum)

.6 Emergency stop switches: 900 to top

.7 Motor disconnect switches: 1800 to top

1.16 CONDUIT AND CABLE INSTALLATION

.1 Sleeves through concrete: schedule 40 galvanized steel pipe, sized for free passage of conduit.

.2 For wall, partitions, and ceilings the sleeve ends shall be flush with the finish on both sides but for floors they shall extend 100 mm above finished floor level.

.3 Fire stop opening with ULC approved assembly for the installation conditions.

1.17 FIELD QUALITY CONTROL

.1 All electrical work to be carried out by qualified, licensed electricians or apprentices as the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties

.2 The work of this division to be carried out by a contractor who holds a valid Master Electrical contractor license as issued by the Province of Manitoba.

1.18 TESTING

.1 All test instruments utilized are to have been calibrated within one year of the date utilized.

.2 Prior to energizing any portion of the electrical system, perform megger tests on all parts of the distribution system. Results shall meet the requirements of the CEC, authority having jurisdiction and the Contract Documents.

.3 Test results shall be consolidated into a typed report and included in the Operation and Maintenance Manuals.

1.19 SUBMITTAL

.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.

.2 Submit Shop Drawings (including Product Data) for all equipment as required in each Section of this Specification. At minimum the following should be included in each submission.

.3 Submit shop drawings, product data and samples of equipment and materials. Shop drawings to include but not be limited to the following:

.1 Complete product part numbers for each piece of equipment
.2 Corresponding equipment tag numbers with part numbers
.3 Product specification sheets indicating product features and options
.4 Dimensions in metric measurement (mm or meters)
.5 Weights in metric measurement
.6 Wiring/interconnection diagrams with manufacturer terminals numbers
.7 Any additional information requested by The City or The Citys representative

1.20 AS-BUILT MARKUPS

.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 Markups. 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 Markups to include circuiting of all devices, conduit and feeder runs (complete with conductor size and number) and locations of all electrical equipment.

.2 Provide red line as-built markups in pdf format to Contract Administrator. MPE will prepare Record Drawings based on the Contractor as-built markups.

.3 Record actual locations of all pull boxes, panelboards, luminaires, feeders, electrical equipment and electrical site services.

.4 Record any changes to circuit designations.

.5 Include on as-built markups, revisions due to engineering change orders, site alterations, additions and field ordered changes made during construction.

.6 Record any changes to control circuit wiring including but not limited to terminal numbering, wire and cable labels, interconnect wiring between equipment.

.7 Record any changes to schedules including panel, luminaire, mechanical, and conduit/cable schedules.

1.21 OPERATION AND MAINTENANCE DATA

.1 Provide O&M Manuals as per E22.

.2 Provide the following for all systems and components:

.1 Manufacturer's product data, including performance curves, schematics, and wiring diagrams for all electrical control systems.

.2 Manufacturer's installation instructions.

.3 Manufacturer's operation instructions.

.4 Manufacturer's maintenance instructions, including complete parts list for all serviceable components.

.3 Provide a comprehensive list of subcontractors and suppliers who supplied and installed systems and components.

.4 Provide copies of all inspection certification reports from authorities having jurisdiction.

.5 Reference Section 40 05 01

1.22 COMMISSIONING

.1 Commission all instruments as described in Section E19, 26 91 90, and 40 80 11.

.2 Retain the services of the equipment Manufacturers Technical Representative as required in each specification section.

.3 Upon completion of construction, all circuits are to be operational and all instruments operating within manufacturer's specifications.

.4 Prior to notifying The City’s Representatives Commissioning Team to begin commissioning activities, verify all control logic, inputs, and outputs, and complete Record Drawings as described in this section.

.5 Electrical controls, circuits and systems shall be tested by trial operation of control equipment after all wiring is completed to see that each interlock and control function operates in accordance with the contract drawings and the description of operation for the equipment. Where field conditions prevent actual equipment functioning during testing, the contractor shall simulate the intended operating condition in the associated control circuits.

.6 The contractor shall locate the cause of any malfunction and make the necessary wiring and / or equipment changes or corrections to obtain the particular systems intended operation as defined by the contract drawings. Such changes shall be included in the test report.

.7 Control Panels shall be operated through all design functions. This shall include remote operation of all equipment and actuation of alarms and indicating devices according to design requirements.

.8 Complete operation tests shall be given to all relays, and control devices to show that the equipment performs all design functions and meets design and procurement specifications.

.9 During start-up, assist Commissioning Team in debugging system operation and correct any deficiencies and omissions which appear.

1.23 AMBIENT ENVIRONMENT

.1 Unless otherwise indicated, supply equipment enclosures, boxes, electrical materials and products suitable for ambient environment of the following areas:

	Area	General Classification	Equipment Enclosure Type	Cable / Raceway
1.	Outdoor Areas	Wet	NEMA 4/NEMA 3R	Note 1
2.	Sewage Wet Well	Zone 1 (Division 1)	See CEC Section 18	PVC coated Rigid aluminum, TECK, See Note 2
3.	Dry Well	Ordinary	NEMA 12	Note 1

Note 1 Install cable or conduit type as per drawings.
Note 2 Seal all conduits with poured EYS conduit seals (or similar).

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 SECTIONS

.1 Section 26 05 01 – Common Works Results – For Electrical

.2 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

1.2 REFERENCES

.1 CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.

.2 CAN/CSA-C22.2 No. 38, Thermoset-Insulated Wires and Cables.

.3 CAN/CSA-C22.2 No. 131, Type TECK 90 Cable.

.4 CAN/CSA-C22.2 No. 239, Control and Instrumentation Cables.

.5 City of Winnipeg
- .1 Identification Standard – 510276-0000-40ER-0002.
- .2 Tag Naming Standard – 612620-0014-40ER-0001.
- .3 Electrical Design Guide – 5102786-0000-47ER-0001.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Contract Document.

Part 2 Products

2.1 BUILDING WIRES

.1 Wire: to CAN/CSA-C22.2 No. 38

.2 Conductors:

- .1 Size as indicated. Minimum size: 12 AWG.
- .2 Stranded for 10 AWG and larger.
- .3 Copper conductors.

.3 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.

.4 Colour coding to Section 26 05 01, wires sized 2 AWG and smaller to be factory-coded, taping will not be accepted.

2.2 TECK CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

.3 Insulation: chemically cross-linked thermosetting polyethylene rated type RW90, 1000V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: 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 Cable Fittings:

.1 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.

.7 (not requiring fitting disassembly) ensuring proper positioning of the cable armour during cable termination.

.8 Approved products:

.1 T&B Startech XP series or approved equal in accordance with B7.

2.3 VFD CABLE

.1 Cable to:

.1 CAN/CSA-C22.2 No. 38.

.2 CAN/CSA-C22.2 No. 174.

.3 CAN/CSA-C22.2 No. 230.

.2 Conductors:

.1 Grounding conductors: Three copper, symmetrically located in continuous contact with the copper tape shield or continuous aluminum armour.

.2 Circuit conductors: copper, size as indicated.

.3 Insulation: chemically cross-linked thermosetting polyethylene rated type RW90, 1000V.

.4 Shield: Continuous copper tape shield with 50% overlap or continuous (non-interlocked) aluminum armour.

.5 Armour: aluminum, interlocking or continuous.

.6 Overall covering: polyvinyl chloride material.

.7 Approved for six-pulse VFD use.

.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.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.9 Connectors:

.1 Watertight, approved for the cable.

2.4 600V TECK90 CONTROL CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Grounding conductor, copper.

.3 Conductors, copper, size as indicated.

.4 Insulation: chemically cross-linked thermosetting polyethylene rated type RW90, 600V.

.5 Armour: interlocking aluminum

.6 Shielding as indicated on the drawings.

.7 A higher level of shielded cable may be substituted for unshielded, or overall shielded cable, unless otherwise specified, provided that all appropriate shield grounding, as required by the Contract Administrator, is performed. All subsequent related changes, such as required conduit size, fittings, etc. are the responsibility of the Contractor.

.8 Overall covering: thermoplastic polyvinyl chloride material.

.10 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.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.11 Connectors:

.1 Watertight, approved for the cable.

2.5 300V ACIC/CIC CONTROL CABLE

.1 Cable: to CAN/CSA-C22.2 No. 239, Control and Instrumentation Cables.

.2 Conductors, copper, size as indicated. 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.

.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 A higher level of shielded cable may be substituted for unshielded, or overall shielded cable, unless otherwise specified, provided that all appropriate shield grounding, as required by the Contract Administrator, is performed. All subsequent related changes, such as required conduit size, fittings, etc. are the responsibility of the Contractor.

.9 Terminations:

.1 Use appropriately sized ferrules. Stranded wire terminations are not acceptable.

.12 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.

.13 Connectors:

.1 Watertight, approved for the cable.

2.6 WIRING IDENTIFICATION

.1 Provide wiring identification in accordance with Section 26 05 01 – Common Work Results

Part 3 Execution

3.1 GENERAL

.1 Do not splice cables. A continuous length is required for all feeds.

.2 Install in accordance with manufacturer’s recommendations, observing requirements for

minimum bending radius and pulling tensions.

3.2 INSTALLATION OF BUILDING WIRES

.1 Install in conduit as per Section 26 05 34.

3.3 INSTALLATION OF ARMOURED CABLE AND TECK CABLE 0 -1000 V

.1 Group cables wherever possible.

.2 Where surface mounted, provide clamps spaced a maximum of 1 m apart.

.3 Perform an insulation-resistance test on each conductor, prior to termination, utilizing a megohmmeter with a voltage output of 1000 volts DC. Individually test each conductor with all other conductors and shields grounded. The test duration shall be one minute.

.4 Investigate resistances less than 50 megaohms, or deviations between parallel conductors. Conductors with insulation resistance values, at one minute, less than 25 megaohms, or that deviate from other similar conductors by more than 50% will be rejected.

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

B7.

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.

3.8 TESTING

.1 Test all power conductors 10 AWG and larger in accordance with 26 08 05.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

.1 Provide submittals in accordance with Contract Document.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)

.1 ANSI/IEEE 837, Qualifying Permanent Connections Used in Substation Grounding.

.2 Canadian Standards Association, (CSA International)

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 6 AWG, complete with insulated supports, fastenings, connectors.

.5 Ground Grid: Copper galvanized rods, installed as indicated on drawings.

.6 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 EQUIPMENT GROUNDING AND BONDING

.1 Install grounding connections to transformers.

.2 Install bonding connections to all electrical equipment.

.3 Include a separate green bonding wire in all power conduits including branch circuit wiring sized according to the largest power conductor in the conduit:

.1 8 AWG green ground wire for up to 4 AWG power conductors.

.2 6 AWG green ground wire for up to 2 AWG power conductors.

3.2 GROUNDING BUS

.1 Ground to existing copper grounding bus mounted inside the service entrance compartment of the main switchgear.

.2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections as indicated on drawings.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Perform tests before energizing electrical system.

.3 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.

.4 Disconnect ground fault indicator during tests.

3.3 INSTALLATION

.1 Comply with requirements of CSA C22.2 No. 0.4-M1982 and Canadian Electrical Code.

.2 Install complete permanent grounding system for new equipment including conductors, connectors and accessories. Where EMT is used, run ground wire in conduit. **Connect to existing station grounding system.**

.3 Protect exposed ground conductors from mechanical injury.

.4 Use mechanical connectors for ground connection to equipment provided with lugs.

.5 Solder joints are not permitted.

.6 Install bonding wire in flexible metal conduit connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.7 Install separate insulated bonding conductor in conduit runs installed in concrete which is subject to moisture penetration and underground.

.8 Install a separate insulated bonding conductor in all RPVC conduit runs.

.9 Install insulated copper bonding conductor in all cable tray, mechanically fixed to the trays at a minimum of 2 meter intervals.

.10 Install connectors in accordance with manufacturer's instructions.

.11 Bond single conductor, metallic armoured cables to cabinet at supply end, and load end.

3.5 COMMUNICATION SYSTEMS

.1 Install grounding connections for telephone, sound, fire alarm, intercommunication systems as indicated. Ensure telephone grounding system is in accordance with telephone company requirements.

END OF SECTION

Part 1 General

1.1 NONE

.1 None.

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/ inside panels, 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 B7.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to solid masonry, tile and plaster surfaces with galvanized anchors.

.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 Maximum spacing between conduit supports:

.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

.6 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole aluminum straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole aluminum straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.7 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm dia. threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm dia. threaded rod hangers where direct fastening to building construction is impractical.

.8 For surface mounting of two or more conduits use channels, with maximum centre spacing as indicated above.

.9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.10 Ensure adequate support for raceways and cables dropped vertically where there is no wall support.

.11 Do not use wire lashing or perforated strap to support or secure cables.

.12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of the Contract Administrator.

.13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

.14 Touch up abraded surfaces and cut ends of galvanized members with an approved galvanizing repair compound.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and components for splitters, junction, pull boxes, and cabinets.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.76, Splitters

1.3 SUBMITTALS

.1 Provide submittals in accordance with Contract Document.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

Part 2 Products

2.1 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 except where indicated otherwise.

.3 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

.4 Install terminal blocks as indicated in Type T cabinets.

.5 All enclosures shall suit the environment where they are installed as follows:

.1 CSA/ NEMA 1 metal enclosures when installed inside panel

.2 CSA/ NEMA 3R (WP) metal enclosures when installed outdoors

.3 CSA/ NEMA 7 (XP) metal enclosures when installed in hazardous classified areas.

.6 Refer to specification 26 05 01 for further details.

3.2 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Install size 3 identification labels indicating system voltage and phase.

.3 Install a permanent label or lamacoid on the cover of all junction boxes indicating the circuit(s) contained within.

.1 Example: M73-2 (Panel M73, circuit 2)

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-21, Canadian Electrical Code, Part 1.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required.

.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 Wetwell: Metal

2.2 SURFACE MOUNTED OUTLET BOXES FOR METAL CONDUIT

.1 General Requirements:

.1 Acceptable materials:

.1 Cast Aluminum

.2 Cast ferrous alloy with corrosion resistant epoxy coating.

.2 Finish: Epoxy Enamel

.3 Suitable for threaded rigid conduit

.4 Mounting lugs as required.

.5 Wet location covers for all locations unless otherwise approved by the Contract Administrator.

.6 To CSA 22.2

.2 Specific Requirements:

.1 In Panel Outlets:

.1 Crouse Hinds VXF/VFT series

.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 B7.

.3 Device Boxes:

.1 Crouse Hinds FS/FD series with factory threaded hubs and mounting feet for surface wiring of receptacles.

.2 Single gang unless specified otherwise.

.3 Wet location covers for all locations below grade.

.4 Manufacturer / Model:

.1 Crouse Hinds FS/FD series

.2 Or approved equal in accordance with B7.

.4 Device Boxes in classified areas:

.1 Crouse Hinds 'explosion-proof' rated.

2.3 SURFACE MOUNTED OUTLET BOXES FOR PVC CONDUIT

.1 General Requirements:

.1 To CSA 22.2 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:

.1 IPEX OB series

.2 Or approved equivalent in accordance with B7.

.2 Device Boxes:

.1 IPEX FX/FD series

.2 Or approved equivalent in accordance with B7.

2.4 CONDUIT BOXES FOR PVC CONDUIT

.1 Non-metallic PVC boxes with mounting feet for surface wiring of devices.

.2 Acceptable products:

.1 Ipex

.2 Or approved equal in accordance with B7.

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 FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of devices in Panels.

2.8 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

.1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63 mm with two double clamps to take non-metallic sheathed cables.

2.9 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 35 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

.1 All boxes for outlets and devices shall suit the environment where they are installed as follows:

.1 CSA/ NEMA 1 metal enclosures when installed inside panel

.2 CSA/ NEMA 3R (WP) metal enclosures when installed outdoors

.3 CSA/ NEMA 7 (XP) metal enclosures when installed in hazardous classified areas.

.2 Support boxes independently of connecting conduits.

.3 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work. Vacuum clean interior of outlet boxes before installation of wiring devices.

.4 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.5 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.

.6 Provide permanent label or lamacoid for all device boxes indicating the circuit(s) contained within.

.1 Example: M73-2 (Panel M73, circuit 2)

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.

.2 CAN/CSA C22.2 No. 45.1, Electrical Rigid Metal Conduit – Steel.

.3 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.4 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.

.5 CAN/CSA C22.2 No. 227.3, Nonmetallic Mechanical Protection Tubing (NMPT) and Fittings (Binational Standard, with UL 1696).

1.2 SUBMITTALS

.1 Provide submittals in accordance with Contract Document.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

Part 2 Products

2.1 CONDUITS

.1 Minimum conduit size: 19 mm, unless specifically indicated on the drawings or approved by the Contract Administrator.

.2 Rigid metal conduit: to CSA C22.2 No. 45.1, aluminum, threaded,

.3 Electrical Metallic Tubing CAN/CSA C22.2 No. 83, aluminum threaded.

.4 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

.5 Rigid PVC conduit: to CSA C22.2 No. 211.2.

.6 PVC coated Rigid Aluminum: to CSA C22.2 No. 45.1

.7 PVC coated Rigid Aluminum: to CSA C22.2 No. 45.1

2.2 CONDUIT FASTENINGS

.1 One-hole steel straps to secure surface conduits 50 mm and smaller. Two-hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 1.5 m oc.

.4 Threaded rods, 6 mm dia., to support suspended channels.

2.3 CONDUIT 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.

2.4 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.

.3 Utilize insulated grounding bushings at all enclosure entries.

.4 Watertight connectors and couplings for EMT. Set-screws are not acceptable.

2.5 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.

2.6 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 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.

.4 Equipment Monorails.

.3 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 in mechanical and electrical service rooms and in unfinished areas.

.4 Use rigid aluminum threaded conduit except where specified otherwise.

.5 Minimum conduit size for lighting and power circuits: 19 mm.

.6 Mechanically bend steel conduit over 19 mm dia.

.7 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.8 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.9 Dry conduits out before installing wire.

.10 Do not include more than the equivalent of four (4) quarter bends. Provide pull boxes as required.

.11 Ensure electrical continuity in all conduit systems.

.12 All conduit shown exposed in finished areas is to be free of unnecessary labels and trade marks.

.13 Seal conduits with duct seal where conduits are run between heated and unheated areas. Where conduits, cables, or cable trays pierce fire separations, seal openings with Dow Corning 3-6548 sealant. Seal all conduits entering or leaving hazardous classified areas with approved seals.

.14 EYS seal conduits after explosion-proof boxes towards unclassified areas. Add Chico compound to stop migration of hazardous gases only after all tests and commission is successfully done.

.15 Where conduits pass through walls, group and install through openings. After all conduits shown on the Drawings are installed, close wall openings with material compatible with the wall construction.

.16 Install fish cord in empty conduits.

.17 Install ground wire in all conduits. Size ground wire as per CEC Table 17.

.18 Underground conduits: Slope conduits to provide drainage, use waterproof joints (PVC excepted) with heavy coat of bituminous paint.

3.3 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 Provide a separate ground wire within rigid conduit, bonded to motor frames and system ground.

7 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

3.4 Colour Coding

.1 Apply plastic tape or paint colour coded bands to conduits at points where conduit or cable enters wall, ceiling, or floor, and at 5 m intervals.

.2 Bands: 38 mm wide prime colour and 19 mm wide auxiliary colours.

.3 Band colours as per below, table 4-5 of the CoW Electrical Design Guide.

Table 4-5 : Conduit Colour Bands

System	Prime Band	Aux. Band
Medium Voltage (> 750 V)	Orange	
347/600 V	Yellow	
208/120/240 V Power	Black	
UPS 208/120/240 V Power	Black	Green
Control Wiring (120 V)	Black	Orange
Fire Alarm	Red	
Low Voltage Communication/General	Blue	
Low Voltage Control Wiring (< 50 V)	Blue	Orange
Intrinsically Safe	Blue	White
Grounding	Green	
Fibre Optic Cable	Purple	

3.5 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

3.6 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.

3.7 LIQUID-TIGHT AND EXPLOSION-PROOF FLEXIBLE CONDUIT

.1 Use as LT raceways at all motors, pipe-mounted control devices, and other devices subject to movement or water when located in non-classified areas.

2 Use as XP raceways at all motors, pipe-mounted control devices, and other devices subject to movement when located in classified areas.

.3 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.

.4 Provide a separate ground wire within flexible conduit, bonded to motor frames and system ground.

3.8 CONCEALED CONDUIT

.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.

3.9 CONDUIT 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.

3.10 CONDUIT 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.

3.11 INSTALLATIONS IN CATEGORY 1 AND 2 LOCATIONS

.1 As per CEC section 22.

.2 Arrange to provide drainage at frequent intervals to suitable locations.

.3 Equip with approved fittings to permit the moisture to drain out of the system.

.4 Install the conduit with a minimum of 12 mm space from the supporting surface.

.5 Install every joint to be water-tight.

.6 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 HAZARDOUS ZONE 1 AND 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 GENERAL

.1 This Section covers items common to Sections of Division 40.

1.2 CODES AND STANDARDS

.1 Do complete installation in accordance with 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.

1.3 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 B4.

1.4 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.

1.5 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.

1.6 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Contract Document.

.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.

1.7 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.

1.8 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates as follows:

.2 Nameplates:

.1 Lamicoid 3 mm thick plastic lamicoid 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

.3 Wording on nameplates to be approved by Contract Administrator prior to manufacture.

.4 Allow for average of twenty-five (25) letters per nameplate.

.5 Identification to be English.

1.9 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings on both ends of phase conductors of feeders and branch circuit wiring.

.1 Wire tags to be heat shrink type with black letters on white background.

1.10 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.

.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.

1.11 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.

1.12 O&M MANUAL

.1 Provide O&M Manuals as per E22.

.2 Operations and Maintenance Manuals:

.1 Refer to Contract Document 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.

.7 Testing documentation including:

.1 Loop Check Report

.3 Utility Transfer Relay (ATS-M7001) Software Operation and Maintenance Manual:

.1 To be provided by the Contractor.

.4 Motor Protection Relays (RLY-M1001, RLY-M2001) Software Operation and Maintenance Manual:

.1 To be provided by the VFD supplier.

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 Requirements and procedures for identification of devices, sensors, wiring tubing, conduit and equipment, the Control System Work and nameplates materials, colours and lettering sizes.

.2 Related Sections.

.1 Section 40 05 01 - Controls: General Requirements.

.2 Section 26 05 01 - Common Work Results - Electrical.

.3 Section E7 – "Shop Drawings" of this Bid Opportunity.

.4 City of Winnipeg Electrical Design Guide.

.5 City of Winnipeg Identification Standard.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA C22.1-06, The Canadian Electrical Code, Part I (20th Edition), Safety Standard for Electrical Installations.

1.3 SYSTEM DESCRIPTION

.1 Language Operating Requirements: provide identification for control items in English.

1.4 SUBMITTALS

.1 Submittals in accordance with Section E7 – "Shop Drawings" of this Bid Opportunity supplemented and modified by requirements of this Section.

.2 Submit to Contract Administrator for approval samples of nameplates, identification tags and list of proposed wording.

Part 2 - Products

2.1 NAMEPLATES FOR PANELS

.3 Provide panel identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.4 Nameplate for each panel size 4 engraved as indicated.

.5 Nameplate for each panel mounted device size 2 engraved as indicated.

2.2 NAMEPLATES FOR FIELD DEVICES

.1 Provide field device identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Nameplate for field device size 7 engraved as indicated.

.3 Nameplate shall be attached by chain.

2.3 WIRING

.1 Supply and install heat shrink labels on wiring at panels, junction boxes, splitters, cabinets and outlet boxes.

.2 Colour coding: to CSA C22.1. Use colour coded wiring in communications cables, matched throughout system.

.3 Power wiring: identify circuit breaker panel/circuit breaker number inside each control panel.

.4 Terminations: stranded wire terminations are not permitted, use ferrules for terminations.

Part 3 - Execution

3.1 NAMEPLATES AND LABELS

.1 Ensure that manufacturer's nameplates, CSA labels and identification nameplates are visible and legible at all times.

END OF SECTION

Part 1 - General

1.1 SUMMARY

.1 Section Includes:

.1 Instrumentation devices integral to the Control System: transmitters, sensors, controls, meters, switches, dampers, damper operators, valves, valve actuators, and low voltage current transformers.

.2 Related Sections:

.1 Section 40 05 01 - Controls: General Requirements.

.2 Section 40 05 54 - Controls: Identification.

.3 Section 26 05 01 - Common Work Results - Electrical.

.4 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings

.5 Section 26 27 26 - Wiring Devices.

.6 Section E7 – "Shop Drawings" of this Bid Opportunity.

1.2 REFERENCES

.1 American National Standards Institute (ANSI).

.1 ANSI C12.7-1993(R1999), Requirements for Watthour Meter Sockets.

.2 ANSI/IEEE C57.13-1993, Standard Requirements for Instrument Transformers.

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM B148-97(03), Standard Specification for Aluminum-Bronze Sand Castings.

.3 National Electrical Manufacturer's Association (NEMA).

.1 NEMA 250-03, Enclosures for Electrical Equipment (1000 Volts Maximum).

.4 Canadian Standards Association (CSA International).

.1 CSA-C22.1-06, Canadian Electrical Code, Part 1 (20th Edition), Safety Standard for Electrical Installations.

1.3 DEFINITIONS

.1 Acronyms and Definitions: refer to Section 40 05 01 - Controls: General Requirements.

1.4 SUBMITTALS

.1 Submittals in accordance with Section E7 – "Shop Drawings" of this Bid Opportunity supplemented and modified by requirements of this Section.

.2 Submit to Contract Administrator for approval samples of nameplates, identification tags and list of proposed wording.

.3 Pre-Installation Tests.

.1 Submit samples at random from equipment shipped, as requested by Contract Administrator, for testing before installation. Replace devices not meeting

specified performance and accuracy.

.4 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions for specified equipment and devices.

Part 2 - Products

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer.

.2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, shockproof, vibration-proof, heat resistant assembly.

.3 Operating conditions: -40 - 40 degrees C with 10 - 90 % RH (non-condensing) unless otherwise specified.

.4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.

.5 Transmitters and sensors to be unaffected by external transmitters including handheld transceivers.

.6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

.7 Outdoor installations: use weatherproof construction in NEMA 4 enclosures.

2.2 ELECTROMECHANICAL RELAYS

.1 Requirements:

.1 Relays as noted on drawings.
.2 Contacts: rated at 5 amps at 120 Vac.
.3 Relays to have visual status indication.

2.3 SEAL WATER FLOW SWITCH (FSL-M1005, FSL-M2005)

.1 Requirements:

.1 Type: Thermal
.2 Dry Contact: SPDT, rated for at least 0.2 Amps at 24VDC
.3 Power: 24 VDC
.4 Operating Temperature: 0°C to +35°C, minimum
.5 Enclosure Rating: NEMA 4 or NEMA 4X
.6 Approvals: CSA or cUL
.7 Mounting: Pipe

.8 Accessories: Provide mounting hardware as required

.9 Size: 12mm

.10 Process Connection: ANSI Class 125/150; B16.5

.11 Flow Range: 0 to 1.2 L/s (0.5 to 19 USGPM)

.2 Acceptable products:

.1 KOBOLD KAL-K

.2 Or approved equal in accordance with B7.

2.4 TEMPERATURE SENSOR WITH INTEGRAL TRANSMITTER (TT-M614)

.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 TF.

2.5 WIRING

.1 In accordance with Section 26 27 26 - Wiring Devices.

.2 For wiring under 70 volts use FT6 rated wiring where wiring is not run in conduit. Other cases use FT4 wiring.

.3 Wiring must be continuous without joints.

.4 Sizes:

.1 Field wiring to digital device: #14 AWG Teck 90 Cu or RW90 Cu in conduit in accordance with Section 26 05 26 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 Analog input and output: shielded #16 minimum stranded twisted pair ACICCu.

Part 3 - Execution

3.1 INSTALLATION

.1 Instrument components are not specifically located on drawings, but located on drawings in the general vicinity. The instrument components shall be field located as defined by mechanical piping and in accordance with the following:

.1 Instrument components shall not be attached to vibrating equipment, but shall be remotely mounted to a solid structure or on approved instrument mounting stands.

.2 Location of instruments, when shown on the drawings, is only approximate. The Contractor is responsible for actual location of field devices and must avoid interferences between conduit, pipes, equipment and instruments while providing maximum accessibility.

.3 Locate instruments components at eye level and in an easily accessible location.

.4 Instrument components that must be removed for servicing shall be installed with re-usable connectors, unions and flexible conduit.

.5 Electrical connections and terminations for field instruments and other field devices shall be in strict compliance with the manufacturer’s instructions and loop drawings. This will include wire, wire termination, labelling, rigid and flexible conduit, fittings, and seals where required.

.2 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

.3 Support field-mounted panels, transmitters and sensors on wall or pipe stands with approved mounting brackets or stands at a nominal height of 1.4 meters off floor.

.4 Install in a manner to allow easy removal of the transducer and cable assembly for maintenance purposes.

.5 For instruments with pre-terminated cable lengths provide a junction box as close as practical to connect with armoured cable or cable in conduit.

.6 Allow for a variation of 3 meters from locations of devices as shown on drawings without extra cost provided pertinent information is provided prior to installation. Exact location will be determined by the installation of piping and mechanical equipment.

.7 Threaded fastenings for mounting instrument components shall have either lock nuts or double nuts.

.8 Cover locally mounted instrument components, after installation, with plastic bags to protect then from dust, dirt, paint spray, insulation materials, etc. Protect from mechanical damage.

.9 Set output pressure of local air sets to pressure recommended for instrument to which it is to be connected.

.10 Independently support solenoids, regulators or similar control devices on solid, vibration free structures and not on control valves. Minimize load on pneumatic tubing.

.11 Field instruments located outdoors shall be winterized to prevent process or measurement fluids from freezing. The use of steam or electrical tracing, fill fluids, or enclosures will be shown on the Installation Detail drawings.

.12 All instrument signal wiring and 120 Vac wiring shall be run by the Contractor from the field instrument to the field device as shown on the loop drawings. This includes wiring, rigid and flexible conduit, fittings and seals where shown. Conduit penetrations are not permitted into the top of any field junction box.

.13 Electrical:

.1 Provide and route all instruments, power and control signal cabling.

.2 Complete installation in accordance with Section 26 05 01 - Common Work Results - Electrical.

.3 Refer to electrical control schematics included as part of control design schematics on drawings. Trace existing control wiring installation and provide updated wiring schematics including additions, deletions to control circuits for review by Contract Administrator before beginning Work.

.4 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.

.5 Install communication wiring in conduit.

.1 Provide complete conduit system to link Control panels, field panels and OWS(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.

.6 Install conduit systems in accordance with Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

3.2 INSTRUMENT SUPPORTS

.1 Clean and paint fabricated galvanized carbon steel mounting stands and brackets.

.2 Before a mounting stand is attached to a concrete floor the surface of the concrete to be in contact with grout shall be roughed and cleaned of all dirt, oil, grease and loose material.

3.3 TEMPERATURE AND HUMIDITY SENSORS

.1 Stabilize to ensure minimum field adjustments or calibrations.

.2 Readily accessible and adaptable to each type of application 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.

3.4 PANELS

.1 Arrange for conduit and tubing entry from bottom or either side.

.2 Wiring and tubing within panels: locate in trays or individually clipped to back of panel.

.3 Identify wiring and conduit clearly.

3.5 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.

3.6 CALIBRATION TAGGING

.1 When satisfactorily inspected and calibrated, the item shall have a tag affixed to it in an immediately visible location, which shall indicate that the device has been calibrated, by whom and the date of the calibration. Calibration procedures and records shall be available to the Contract Administrator throughout the course of the project and shall be delivered to the Contract Administrator upon the completion of work.

3.7 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.

3.8 IDENTIFICATION

.1 All field-mounted instrument items shall have an approved identification tag permanently attached by the Contractor upon completion of the initial inspection and calibration. This tag shall reflect the device's identification as shown on the appropriate drawing.

.2 The tag will be permanently attached to the instrument with screws, rivets, or stainless steel or Monel wire, as appropriate. If an instrument is inside a protective enclosure or mounted behind a panel, instrument identity tags shall be mounted twice, once on the instrument and again on the enclosure. All instruments mounted on a control panel shall have an identity tagmounted on the instrument body and again on the face of the panel below the instrument face.

.3 Identify field devices in accordance with Section 40 05 54 - Controls: Identification.

3.9 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 SUBMITTALS

.1 Submittals in accordance with Section Contract Document.

.2 Submit commissioning plans and procedures, in writing, at least 20 Working days prior to commissioning.

1.2 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 Contract Document.

.5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

1.3 COMMISSIONING FORMS

.1 Example commissioning forms have been included in this Bid Opportunity. The contractor shall develop all commissioning forms required for use in this project based on the provided examples as a minimum for required information. The Contractor shall fill out separate commissioning forms for each piece of equipment.

.2 The contractor shall develop commissioning forms as required to make a complete commissioning report package. Utilize the specifications, drawings, and Control Narrative as the basis for preparation of the additional commissioning forms.

1.4 COMMISSIONING

.1 Carry out commissioning under direction of the Contract Administrator 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.

1.5 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 EQUIPMENT

.1 Provide sufficient instrumentation to verify and commission the installed system. Provide two-way radios.

.2 Test instrumentation accuracy tolerances: higher order of magnitude than equipment or system being tested.

.3 Independent testing laboratory to certify test equipment as accurate to within approved tolerances no more than 6 months prior to tests.

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 technician to test and commission the control system.

.2 Test each I/O point from the instrument to the DCS.

.1 Coordinate with City of Winnipeg personnel to verify all addresses are mapped properly to the DCS.

.2 Tests to be performed in conjunction with City of Winnipeg personnel to verify alarm and status signals.

.3 Test both states of discrete points.

.4 Test, at minimum, two values for analog points. plus zero and full scale readings (at minimum four values total).

.5 Test each piece of equipment individually for complete functionality.

.6 Test all control and interlock functions.

.7 Test pump operation in auto mode when controlled by the DCS.

.8 Completely test the E-Stop functionality of each piece of equipment, as provided.

.9 All modifications to the software program, to bypass interlocks or sensors, shall be recorded and documented clearly in a separate document, and the software.

.1 Any software bypasses that remain, prior to leaving site, must be authorized by the Contract Administrator.

.10 All deficiencies must be corrected by the Contractor.

.11 Commission each system using procedures prescribed by the Contract Administrator.

.12 Optimize operation and performance of systems by fine-tuning control loops and PID values.

.13 Complete local HMI tests.

3.3 SYSTEM SOFTWARE

.1 Programming of protection relays by others, programming to be fully tested and approved as part of the software FAT.

.1 Any changes made to the software after the FAT must be submitted for review and approval of the Contract Administrator.

.2 Any changes made to the software after the FAT must be subject to re-commissioning to ensure proper system operation.

.2 Any issues identified on site must be communicated to the Contract Administrator. Approval is required prior to making any modifications.

.3 The Contractor is reminded that this facility is critical to the operation of the City's Wastewater pumping system.

3.4 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

3.5 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 REFERENCES

.1 NEMA 250-2003, Enclosures for Electrical Equipment (1000 Volts Maximum).

.2 Canadian Standards Association (CSA International).

.1 CSA-C22.1-2021, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

1.2 SUBMITTALS

.1 Submit product data in accordance with contract document.

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-M100-1, HSS-M200-1, HSS-M100-2, HSS-M200-2, HSS-M100-3, HSS-M200-3)

.1 Supply and install enclosed two-position maintained emergency stop operator stations for the lift pumps M100PP and M200PP 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 B7.

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 MAINTENANCE SERVICES

.1 Not required.

1.2 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 any critical system supplied by the Vendor.

.2 Critical systems include, but are not limited to:

.1 Communication networks.

.2 DCS system.

.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 Products

2.1 NOT APPLICABLE.

.1 Not applicable.

Part 3 Execution

3.1 NOT APPLICABLE.

.1 Not applicable.

END OF SECTION