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 PROCEDURES

.1 Notify appropriate agency and Contract Administrator in advance of requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.5 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.

1.6 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.

1.7 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as requested.

.2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Contract Administrator and may be authorized as recoverable.

1.8 MOCK-UPS

.1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections required to provide mock-ups.

.2 Construct in locations acceptable to the Contract Administrator.

.3 Prepare mock-ups for Contract Administrator review with reasonable promptness and in orderly sequence, to not cause delays in Work.

.4 Failure to prepare mock-ups 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.

.5 If requested, Contract Administrator will assist in preparing schedule fixing dates for preparation.

.6 Remove mock-up at conclusion of Work or when acceptable to Contract Administrator.

.7 Mock-ups may remain as part of Work.

.8 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

1.9 MILL TESTS

.1 Submit mill test certificates as required of specification Sections.

1.10 EQUIPMENT AND SYSTEMS

.1 Submit adjustment and balancing reports for mechanical and electrical systems.

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

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 Owner 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.

1.1 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling 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 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 01 33 00 – Submittal Procedures.

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

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

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

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

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

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

.2 Format

.1 Organize data as instructional manual.

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

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

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

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

.5 Arrange content by Division and Section numbers and sequence of Table of Contents.

.6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.7 Text: manufacturer's printed data or type written data.

.8 Drawings: provide with reinforced punched binder tab.

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

.3 Contents

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

.1 The title "Operation and Maintenance Instructions";

.2 Project name and date;

.3 Facilities covered in the manual;

.4 City’s Contract number;

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

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

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

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

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

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

.3 Documentation of all test results.

.4 Complete set of equipment and assembly drawings.

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

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

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

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

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

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

.9 Certificate of Inspection from the inspection authority.

.10 Testing and commissioning documentation.

.11 Warranty certificate, signed and dated.

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

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

.1 Unit

.2 Scale

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

.4 4-20 mA settings

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

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

.4 Equipment and System

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

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

.2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.

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

.2 Include summer, winter, and any special operating instructions.

.5 Maintenance Requirements: include routine procedures and guide for troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions

.6 Provide servicing and lubrication schedule, and list of lubricants required.

.7 Include manufacturer's printed operation and maintenance instructions.

.8 Include sequence of operation by controls manufacturer.

.9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.

.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.14 Additional requirements: as specified in individual Specification sections.

.5 Materials and Finishes

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

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

.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Moisture-protection and weather-exposed products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.4 Additional requirements: as specified in individual Specifications sections.

1.2 AS -BUILT / RECORD DRAWINGS

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

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

1.3 WARRANTIES AND BONDS

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

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

.3 Warranty management plan to include required actions and documents to assure that the City receives warranties to which it is entitled.

.4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.

.5 Submit warranty information, made available during construction phase, to the Contract Administrator for approval prior to each monthly pay estimate.

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

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

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

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within [ten] 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 Bid Opportunity 54-2024

.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 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: ??? Bid Opportunity D12, 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.

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 Bid Opportunity 54-2024 Section E27.

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

1.3 GENERAL

.1 Provide a fully functional pumping station:

.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 OCntract 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.

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

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

.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 Consultant and City Cx Manager for administrative and coordination purposes.

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

.1 Demonstrations.

.2 Training, except as noted below.

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

.3 Testing.

.4 Development of Cx documentation.

.5 Preparation, submission of test reports.

.6 Developing O&M Manual.

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

.1 Receiving the completed facility.

.2 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.

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

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

.1 To include performance verification.

.1 Process Pumps

.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 heating or cooling loads beyond scope of EMCS.

.3 Changes to EMCS control strategies 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 (P-G01, P-G02,)
  .2 Process valves
  .3 Wet well level gauges (LIT-G101, LSL-G101)
.2 Gate systems:
  .1 Sluice gate
  .2 Flap gate
  .3 Inclinometer (ZT-S851)

.2 Commission electrical systems and equipment:

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

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 EMCS:

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

.2 Perform point-by-point testing in parallel with start-up.

.3 Carry out point-by-point verification.

.4 Demonstrate performance of systems, to be witnessed by the Contract Administrator prior to start of thirty (30) day Final Acceptance Test period.

.5 Perform final Cx and operational tests during demonstration period and thirty (30) day test period.

.6 Only additional testing after foregoing have been successfully completed to be "Off-Season Tests".

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

.1 No pre-Cx activities.

.4 Pre-Cx activities - ELECTRICAL:

.1 Low voltage distribution systems under 750 V:

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

.2 Lighting systems:

.1 Emergency lighting systems:

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

.3 Automation systems: these include:

.1 Instrumentation calibration.

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

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

1.12 START-UP

.1 Start up components, equipment and systems.

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

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

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

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

.4 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.

.5 Integrated systems to include:

.1 Lighting and Emergency lighting systems.

.2 Automation systems.

1.15 INSTALLATION CHECK LISTS (ICL)

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

1.16 PRODUCT INFORMATION (PI) REPORT FORMS

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

1.17 PERFORMANCE VERIFICATION (PV) REPORT

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

1.18 CX SCHEDULES

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

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

.1 Cx agents' credentials: 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 Not Used

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 Bid Opportunity 54-2024

.2 Section 40 80 11 – Automation - Commissioning

1.2 INSTALLATION/START-UP CHECK LISTS

.1 Include the following data:

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

.2 Special procedures as specified in relevant technical sections.

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

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

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

.4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to 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 Contract Administrator will develop and provide to Contractor required project-specific Commissioning forms in electronic format complete with specification data. 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 Valves
  - .3 Level Gauge
- .2 Plumbing System Commissioning Forms:
  - .1 Water Meter
  - .2 Valves
  - .3 Sump Pump
- .3 HVAC System Commissioning Forms:
  - .1 Fans
  - .2 Air Conditioning Unit
  - .3 Unit Heater
  - .4 Duct Heater
  - .5 Dampers
  - .6 Filter
  - .7 HVAC controls
- .4 Fire and Life Safety Systems Commissioning Forms:
  - .1 Fire extinguishers
- .5 Low Voltage (below 750V) Commissioning Forms
  - .1 Low voltage equipment
  - .2 Low voltage distribution systems
  - .3 Motor control centres
  - .4 Motor control field devices
- .6 Emergency Power Generation Systems
  - .1 Transfer switchgear
  - .2 Uninterruptible power systems
- .7 Lighting Systems

.1 Lighting equipment.

.2 Distribution systems.

.3 Emergency lighting systems, including battery packs.

.8 Automation systems and equipment:

.1 Process instrumentation calibration sheets.

.2 Process instrumentation loop checks

.3 PLC control panels

.1 PLC Control Panel and standalone level controllers shall be commissioned by the Contract Administrator. As part of the loop check procedure, Contractor shall assist/collaborate with Contract Administrator to verify functionality of each PLC input/output to the instrumentation device in the field.

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

.3 Samples of Commissioning forms and a complete index of produced to date will be attached to this section.

1.6 CHANGES AND DEVELOPMENT OF NEW REPORT FORMS

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

.1 Additional commissioning forms to be in same format as provided by Contract Administrator.

1.7 COMMISSIONING FORMS

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

.2 Strategy for Use:

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

.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.

1.8 LANGUAGE

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 This Section specifies roles and responsibilities of Commissioning Training

.2 Related Requirements

.2 Section 40 80 11 – Automation - Commissioning

1.2 TRAINEES

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

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

1.3 INSTRUCTORS

.1 Contract Administrator will provide:

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

.2 Operator training on PLC panel selector switches

.3 Operator training on standalone level controllers

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

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

.2 Control features, reasons for, results of, implications on associated systems of, adjustment of set points of control and safety devices.

.3 Instructions on servicing, maintenance and adjustment of systems, equipment, and components.

.3 Contractor and equipment manufacturer to provide instruction on:

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

1.4 TRAINING OBJECTIVES

.1 Training to be detailed and duration to ensure:

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

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

.3 Proper preventive maintenance, diagnosis, and 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 Instructors to be responsible for content and quality.

.2 Training materials to include:

.1 "As-Built" Contract Documents.

.2 Operating Manual.

.3 Maintenance Manual.

.4 TAB and PV Reports.

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

1.6 SCHEDULING

.1 Include in Commissioning Schedule time for training.

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

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

1.7 RESPONSIBILITIES

.1 Be responsible for:

.1 Implementation of training activities,

.2 Coordination among instructors,

.3 Quality of training, training materials,

.2 City Representative will evaluate training and materials.

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

1.8 TRAINING CONTENT

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

.2 Content includes:

.1 Functional requirements.

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

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

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

.5 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.

.6 Maintenance and servicing.

.7 Trouble-shooting diagnosis.

.8 Inter-Action among systems during integrated operation.

.9 Review of O&M documentation.

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCE STANDARDS

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

.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 three (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 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).

.3 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - [current edition]

.4 Underwriters Laboratories (UL)

.1 UL 2768-[11], Architectural Surface Coatings

.5 NACE International

.1 ANSI/NACE No. 13/SSPC-ACS-1-[2016] -SG, Industrial Coating and Lining Application Specialist Qualification and Certification.

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 Qualifications

.1 Ensure that 50% of industrial coating specialists who perform concrete and steel surfaces preparation and coating applications, are certified by a recognized Applicator Certification Agency, in accordance with NACE 13/SSPC ACS-1, Applicator Certification Standard (ACS).

.2 Maintain a current and valid ACS Certification during project period.

.1 Application specialists who perform surface preparation and coating application work on this project must have a current ACS.

.3 Notify the Contract Administrator of any change in application specialist certification status.

.1 Any delays to the completion of the Project due to invalid certifications will not be considered, liquidated damages shall not be waived for any-non-performance by Contractor.

.4 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.

Part 2 Products

2.1 MATERIALS

.1 All material shall be of a type acceptable to the Contract Administrator and 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: to ASTM A307.

.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.

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.

.8 All steel welding shall conform to CSA Standard W59. Fabricator shall be fully approved by the Canadian Welding Bureau, in conformance with CSA Standard W47.1. Welding shall be done currently licensed welders only.

.9 All aluminum welding shall be in accordance with the requirements of CSA W59.2. The fabricator shall be fully certified in conformance with CSA Standard W47.2. All welding shall be done in a licensed shop, and no filed welding will be permitted unless approved in writing, in advance, by the Contract Administrator.

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

.11 Seal exterior steel fabrications to provide corrosion protection in accordance with CAN3-S16-1.

.12 Use self-tapping shake-proof flat0headed screws on items requiring assembly by screws.

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.

2.4 COATINGS

.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 To PIP STE05501

.2 Ladder to wet well is to exclude a cage and be constructed of aluminum with stainless steel anchors.

2.6 ACCESS COVERS

.1 All aluminum surfaces in contact with concrete shall be isolated using alkali-resistant bituminous paint meeting the requirement of CGSB 31-GP-3M.

.2 Aluminum plates shall have an approved raised multi-grip pattern with edges straight and true, and shall be cut as far as practical to maintain continuity of the pattern at abutting edges.

.3 Angle frames shall be of the same material as cover plates, and cover plates shall be hinged and be supplied with lifting handles, as required.

2.7 GUARDRAILS AND GATES

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

.2 Fabricate and install pipe rails to be removable as indicated on Drawings. Sleeve to be secured in concrete slab.

.3 Fully assembled gate shall be capable of swinging in either direction by inverting installation position. Gate size shall be laterally adjusted from minus 32 mm (1-1/4 inch) to plus 64 mm (2-1/2 inch).

.4 Approved Product: Guard Dog Self-Closing Safety Gate

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

.2 Width: As indicated on Drawings.

.3 Height:

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

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

.4 Hardware: Provide the following:

.1 Gate Hardware: U-Bolts.

.2 Universal Hinge Assembly: Fits railing types up to 51 mm (2 inches) O.D. or flat surface mounting.

.3 Railing adapter kit.

.4 Self-Closing Springs: Two stainless steel torsion springs.

.5 Material: Mild steel, hot-dip galvanized with powder-coated finish.

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 Provide suitable means of anchorage acceptable to Contract Administrator such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.4 Touch up rivets, bolts and burnt or scratched surfaces that are to receive paint finish, with zinc, primer after completion of erection.

.5 Repair damaged galvanized surfaces and field welds with self-fluxing, low temperature, zinc-based alloy rods in accordance with ASTM A780, Repair of Damaged Hot Dip Galvanizing Coatings. The general procedure shall be to allow a small amount of the repair alloy to flow then spread by brushing briskly with a wire brush. Brushing shall be sufficient to obtain a bright finish. Repeat process there (3) times to ensure a proper thickness is achieved. Temperatures shall be kept below 177°C (350°F) at all times. All

heating of structural steel work shall be done in the presence of the Contract Administrator.

.6 All aluminum surfaces in contact with concrete shall be isolated using alkali resistant bituminous paint meeting the requirements of CGSB 31-GP-3M.

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

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

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

.10 Deliver items over for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel.

.11 Install access hatch frames square and level at the locations show on the drawings. Embed anchors in concrete as shown on the drawings. Install covers and adjust hardware to proper function.

.12 Install 50 mm rigid insulation on the underside of all surface hatches and covers to the pump chamber.

.13 Install electromechanical isolation gaskets and sleeves to electrically isolate dissimilar metals.

.14 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 SUMMARY

.1 Provide two (2) submersible pumps (P-G01, P-G02) and related accessories including discharge connections, discharge pipes, guide bars, cable holder, and lifting chains.

1.2 SUBMITTALS

.1 Shop drawings: submit in accordance with E10 of the Tender Documents.

1. Pump: make, model, weight and horsepower.
2. Complete catalogue information, description literature, specifications, dimensions and identification of materials of construction.
3. Performance data curves showing head, capacity, horsepower demand and pump efficiency over entire operating range of pump, from shutoff to maximum capacity. Indicate separately design points, head, capacity, horsepower demand and overall efficiency at duty point.
4. Motor operating data, including motor and insulation ratings, start-up and operating current ratings, operating voltage and amperage tolerances.
5. Power and control wiring diagrams, including terminals and numbers.
6. Complete motor nameplate data, as defined by NEMA, from motor manufacturer.
7. Factory finish system.
8. Installation instructions indicating assembly and mounting requirements, alignment and assembly tolerances.
9. Start-up instructions including lubricant requirements, electrical requirements, etc.
10. List special tools, materials, and supplies furnished with equipment for use prior to and during start-up and for future maintenance, if any.

.2 Quality control submittals:

1. Factory test reports.
2. Special shipping, storage and protection, and handling instructions.
3. Suggested spare parts list to maintain equipment in service for period of one (1) year and five (5) years. Include list of special tools required for checking, testing, parts replacement, and maintenance with current price information.

Part 2 Products

2.1 SUBMERSIBLE PUMP

.1 Provide pumps individually capable of operating at a design condition point of 48 L/s at 12.3 m T.D.H.

.2 The pump shall be submersible intended for water containing solids or fibered material, clean water or surface water.

.3 The pump must be suitable to operate for continuous operation in a dry pit.

.4 The pump body, motor casing shall be cast iron, free form blow holes, sand holes and other faults, accurately machined and fitted. All passages shall be designed and finished to reduce friction and the passageways shall be balanced with the impeller to reduce vibration. The impeller shall be statically and dynamically balanced.

.5 The submersible pumps shall have a semi open multi vane self-cleaning impeller designed to transport wastewater with fibrous materials like wet wipes.

.6 Use high chrome abrasion resistant impeller. Due to the presence of sand and chlorides the impeller shall be made of high chromium cast iron with at least 24% chrome. The impeller blades shall be self-cleaning upon each rotation as they pass across a sharp relief groove in the Insert ring and shall keep the impeller blades clear of debris. The insert ring shall have a guide pin which moves fibers from the center of the impeller to the leading edges of the impeller. The impeller shall move axially upwards to allow larger debris to pass through and immediately return to normal operating position. The clearance between the insert ring and the impeller leading edges shall be adjustable.

.7 The impeller shall be mounted on the motor shaft. Couplings shall not be accepted.

.8 Furnish pump with 10hp electric motor rated at 600V, 60 hertz, 3 phase. The motors shall be capable of driving the pumps continuously through the entire range of pump operation without increasing the temperature of the windings above the insulation rating. Pump units shall be supplied with operating cable of sufficient length for connection to panel.

.9 The hydraulic efficiency in this duty point shall be not less than 71 % and approved according HI 11.6:2012 Grade 3B.

.10 The pump motor shall be induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. It shall be permanently submersible according standard IEC 60034 and protection class IP 68.

.11 The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C.

.12 Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable.

.13 It shall be possible to lift and lower the pumps on parallel guide bars and connect them to wet well mounted discharge connection. There shall be no need for personal to enter the wet well when removing or reinstalling the pumps.

.14 The pump coupling for the pump discharge shall be sourced from the pump manufacturer with a discharge elbow connection for lift station, or approved equal in accordance with B7, complete with guide pipes, upper guide pipe holder, floor mounted discharge elbow and stainless steel concrete anchor bolts.

.15 Provide leak detection sensor system.

.16 Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable.

.17 The junction chamber containing the terminal board shall be hermetically sealed from the motor by an elastomeric compression seal. Connection between the cable conductors and stator leads shall be made with threaded compression type binding posts permanently affixed to a terminal board. The motor and the pump shall be produced by the same manufacturer.

.18 The motor shall be protected by 3 thermal switches embedded in the stator set to open at 125°C and one leakage sensor floating type located in the stator chamber. The sensor and the switches shall be connected to a Mini CAS II (one per pump, complete with control panel mounting kit) monitoring relay supplied with the pump which shall stop the motor and send an alarm when the sensors are activated.

.19 The pump shall be approved according CSA CLASS 1. DIV 1

.20 The cable entry shall consist of dual cylindrical elastomer sleeves, flanked by washers, all having a close tolerance fit against the cable and the cable entry. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

.21 The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated and have a nominal L10 lifetime of 50.000 hours. The upper bearing shall be a single deep groove ball bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces. Single row lower bearings are not acceptable.

.22 The shaft shall be sealed by a tandem mechanical shaft seal system consisting of two seals, each having an independent spring system. The seals shall require neither maintenance nor adjustment and shall be capable of operating in either clockwise or counter clockwise direction of rotation without damage or loss of seal function.

.23 Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. Seal lubricant shall be non-hazardous.

.24 Where a seal cavity is present in the seal chamber, the area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action

.25 The Materials of construction shall be as follows:

i. Pump housing: ASTM A-48, Class 35B
ii. Impeller and insert ring: A 532 ALLOY III A (25% Chrome)
iii. Stator housing: ASTM A-48, Class 35B
iv. Shaft: ASTM A479 S43100-T.
v. Shaft seal: Pump side: - Corrosion resistant Tungsten carbide WCCR
vi. Shaft seal Motor side: - Carbon-Aluminum oxide (AL2O3)

.26 All castings must be blasted before coating. All wet surfaces are to be coated with two-pack oxyrane ester Duasolid 50. The total layer thickness should be at least 120 microns. Zink dust primer shall not be used.

.27 The motor shall be equipped with a screened cable suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet.

.28 Each completed and assembled pump/motor unit shall undergo the following factory tests at the manufacturer's plant prior to shipment. The Manufacturer shall provide on demand a copy of his quality control plan for these tests and an ISO 9001 factory certificate:

i. Minimum 3-point hydraulic performance test
ii. No-Leak seal integrity test
iii. Electrical integrity test

.29 For each pump the contractor shall supply and install a discharge connection made of cast iron ASTM A-48, Class 35B.

.30 The outlet flange of the discharge connection shall be 4 or 6" drilled according ANSI B16.1-89; tab.5.

.31 The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two parallel guide bars extending from the top of the station to the wet well mounted discharge connection. The material of the guide bars shall Stainless steel AISI 316.

.32 The length of the guide bars shall extend to the top of the chamber and they shall be fasten at the top of the station with a guide bar holder made of Stainless steel AISI 316.

.33 For each pump the contractor shall supply and install a cable holder made of Stainless steel AISI 316.

.34 There shall be no need for personnel to enter the wet-well.

.35 The sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be accepted. The entire weight of the pump/motor unit shall be borne by the pump discharge elbow. No portion of the pump/motor unit shall bear on the sump floor directly or on a sump floor mounted stand.

.36 Each pump shall be fitted with a suitable length of stainless steel lifting chain or lifting cable. The working load of the lifting system shall be 50% greater than the pump unit weight.

.37 Approved products include:

i. Flygt NP 3153 MT ~ 435

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product bulletins, handling, storage, installation instructions, and datasheet.

3.2 EQUIPMENT INSTALLATION

.1 Dimensions shown on the drawings for equipment bases and piping connections, etc., are approximate. Correct to suit the exact dimensions of the equipment provided.

.2 Supply and install all necessary shims, gaskets, any other items required to complete the installation.

.3 Provide all necessary lifting and loading equipment and all tools required to complete the installation.

.4 Make good all defects in the operation of the pump. Provide 1 year warranty.

3.3 TESTING

.1 Test the pump after installation. Record and document electrical data on pump performance and confirm acceptable.

.2 After installation, a pump station start-up shall be performed by the installing contractor under the supervision of the manufacture’s authorized representative. 8 hours of field service shall be provided by an authorized, factory trained representative of the pump manufacturer. Services shall include, but not be limited to, inspection of the completed pump station installation to ensure that it has been performed in accordance with the manufacturer’s instructions and recommendations, supervision of all field-testing and activation of the Pump Manufacturer’s Warranty. The test shall demonstrate to the satisfaction of the City that the equipment meets all specified performance criteria, is properly installed and anchored, and operates smoothly without exceeding the full load

amperage rating of the motor. The Contractor shall be responsible for coordinating the required field services with the Pump Manufacturer.

END OF SECTION

Part 1 General

1.1 QUALITY ASSURANCE

.1 Welding materials, fabrication standards and labour qualifications must conform to ANSI/ASME B31.1, ANSI B16.25, ASME Section IX, and the Provincial Board of Labour Regulations latest current editions.

.2 Use welders fully qualified and licensed by Provincial Authorities.

.3 Non-specified pipe joining and pipe fitting methods such as T-drill and press fit are not permitted.

1.2 SUBMITTALS

.1 Shop drawings: submit in accordance with E10 of the Tender Documents.

Part 2 Products

2.1 PIPE

.1 Pump discharge piping to be Schedule 40, 316 Stainless Steel.

2.2 FITTINGS AND JOINTS

.2 Sump pump discharge piping:

1. Flanges and Victaulic couplings where required.

.3 Sump pump to forcemain joint.

1. Smith Blair OMNI 411
2. Robar
3. Approved Equal in accordance with B7.

.4 Use appropriate radius elbows where necessary to ensure proper fitment of pipework as shown on drawings.

2.3 SWING CHECK VALVES

.1 Applicable Equipment: CHV 101, CHV 102

.1 Liquid Type:

.1 Raw Sewage / Stormwater

.2 Location:

.1 Inside Chamber: CHV G01, CHV G02

.3 Valve Type:

.1 Flanged

.4 Valve Size:

.1 150 mm

.5 Specified Equipment:

.1 Manufacturer: Val-Matic or approved equal in accordance with B7

.2 Model: Swing Flex Check Valve

.3 Pressure Class: 125 lb.
.4 Body and Cover: Ductile Iron, ASTM A536
.5 Flange: ANSI- B16.1, Class 125
.6 Disc: Buna-N
.7 Coatings:
.1 Interior: ANSI/NSF 61 Fusion Bonded Epoxy
.2 Exterior: ANSI/NSF 61 Fusion Bonded Epoxy

2.4 SOLID WEDGE GATE VALVES

.1 Applicable Equipment: GAV G01, GAV G02, GAV G03, GAV G04
.1 Liquid Type:
.1 Raw Sewage / Stormwater

.2 Location:
.1 Inside Chamber: GAV G01, GAV G02, GAV G03, GAV G04

.3 Valve Type:
.1 Flanged: GAV G01, GAV G02, GAV G03, GAV G04
.2 Threaded: N/A
.4 Valve Size:
.1 150 mm: GAV G01, GAV G02
.2 200 mm: GAV G03, GAV G04

.5 Solid wedge gate valves shall be metal-seated, single wedge NRS type comprised of ductile iron body with flanged ends designed and produced in accordance with AWWA C500.

.6 Valves to be designed for open/close service with minimal moving parts to prevent clogging or excessive build-up of foreign matter.

.7 Valve Body, Bonnet, Wedge: ductile iron ASTM A536 Gr. 65-45-12

.8 Scraper, Stem Nut, Wedge and Body Seat Rings: cast from ASTM B62 low-zinc bronze

.9 Stem: machined from ASTM A276 Type 304 or Type 316 stainless steel or materials offering equal and/or greater physical and material properties. Provide stem with an integrally cast thrust collar.

.10 Coatings: consistent with AWWA C500, Section 4

.11 Verification: tested and inspected in accordance with AWWA C500, Section 5

.12 Markings: cast on each valve in accordance with AWWA C500, Section 6

.13 Acceptable product: American R/D AWWA Solid Wedge Gate Valve, Clow 100 Series for NRS style or approved equal in accordance with B7

2.5 COMBINATION AIR VALVES

.1 Applicable Equipment:

.1 CAV G01

.2 End Detail:
.1 Threaded

.3 Valve Size:
.1 50 mm (2”)

.4 Specified Equipment:
.1 Manufacturer: ARI Flow Control Accessories or approved equal in accordance with B7.
.2 Model: D-025 “SAAR” Short Version
.3 Outlet: (1 1/2”) NPT.
.4 Orifice Area: Automatic: 12 mm^2; Kinetic: 804 mm^2
.5 Drainage Outlet: NSF 61 Certified Polypropylene
.6 Float: NSF 61 Certified Foamed Polypropylene
.7 Clamping Stem: NSF 61 Certified Reinforced Nylon
.8 Body: NSF 61 Certified Reinforced Nylon
.9 O-Ring: NSF 61 Certified Buna-N (NBR 70)
.10 Base: NSF 61 Certified Reinforced Nylon
.11 Working Pressure Range: 3-145 psi
.12 Accessories: N/A

2.5 BALL VALVES

.1 Applicable Equipment:
.1 BAV G01

.2 End Detail:
.1 Threaded

.3 Valve Size:
.1 50 mm (2”)

.4 Specified Equipment:
.1 Class 1000, cast steel body, TFE seat and seal, SS ball and stem, screwed, W-K-M Dyanseal 310; M.A.S. No. CSSDR-1 unless otherwise noted

Part 3 Execution

3.1 PREPARATION

.1 Ream pipes and tubes. Clean off scale and dirt, inside and outside, before assembly. Remove welding slag or other foreign material from piping.

.2 Protect all pipes when stored on site from external conditions.

3.2 INSTALLATION

.1 Provide dielectric type connections wherever joining dissimilar metals in open systems.

.2 Support piping with suitable hangers, supports, and anchors within 150 mm on each side of all valves.

END OF SECTION

Part 1 - General

1.1 SUMMARY

.1 Section Includes:

.1 General requirements for Control Systems.

.2 Related Sections:

.1 Section 25 05 54 - Controls: Identification.
.2 Section E10 – "Shop Drawings" of this Bid Opportunity.
.3 City of Winnipeg Electrical Design Guide.
.4 City of Winnipeg Identification Standard.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/The Instrumentation, Systems and Automation Society (ISA).

.1 ANSI/ISA 5.5-1985, Graphic Symbols for Process Displays.

.2 American National Standards Institute (ANSI)/ Institute of Electrical and Electronics Engineers (IEEE).

.1 ANSI/IEEE 260.1-1993, American National Standard Letter Symbols Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).

.3 Canadian Standards Association (CSA International).

.1 CAN/CSA-Z234.1-89(R1995), Canadian Metric Practice Guide.

.4 Electrical and Electronic Manufacturers Association (EEMAC).

.1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.

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

.1 Material Safety Data Sheets (MSDS).

1.3 SYSTEM DESCRIPTION

.1 The controls shall include but not be limited to:

.1 Level transmitters (LIT-G101)
.2 Float level switches (LSL-G101)
.3 Flap gate inclinometer (ZT-S851)
.4 RTU control panel
.5 Termination of control wiring to terminals within existing field termination section.

1.4 SCOPE OF CONTROL WORK

.1 Design and installation to be in accordance with the City of Winnipeg Electrical Design Guide and Identification Standard.

.2 The Contractor shall engage a factory trained representative to supervise the installation, setup, calibrate and operationally verify and commission the following:

.1 Ultrasonic level transmitters
.2 Float level switches
.3 Flap gate inclinometer
.4 RTU control panel

.3 The Contactor shall provide a certified instrument technician in order to operate all field devices that are wired to the RTU control panel in order for City of Winnipeg staff to verify the loop is correctly wired.

.4 The Contractor shall submit written reports identifying the commissioning work, together with any parameter settings and final adjustments.

.5 The Contractor is responsible for the supply and installation of the RTU control panel, termination of field wiring for power, controls and instrumentation to the terminals within the RTU control panel. Coordinate all remote interface and alarm points with the City of Winnipeg.

1.5 SUBMITTALS

.1 Make submittals in accordance with Section E10 – "Shop Drawings" of this Bid Opportunity.

.2 Submit for review equipment list and system manufacturers 10 days after award of contract.

Part 2 - Products

.1 **NOT USED**

Part 3 - Execution

3.1 MANUFACTURER'S RECOMMENDATIONS

.1 Installation: to manufacturer's recommendations.

3.2 PAINTING

.1 Painting: as follows:

.1 Clean and touch up marred or scratched surfaces of factory finished equipment to match original finish.
.2 Clean and prime exposed hangers, racks, fastenings, and other support components.
.3 Paint unfinished equipment interiors to EEMAC 2Y-1.

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 25 05 01 - Controls: General Requirements.

.2 Section 26 05 01 - Common Work Results - Electrical.

.3 Section E10 – "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 E10 – "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.

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 25 05 01 - Controls: General Requirements.

.2 Section 25 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 E10 – "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 25 05 01 - Controls: General Requirements.

1.4 SUBMITTALS

.1 Submittals in accordance with Section E10 – "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

.5 Control devices of each category to be of same type and manufacturer.

.6 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, shockproof, vibration-proof, heat resistant assembly.

.7 Operating conditions: -40 - 40 degrees C with 10 - 90 % RH (non-condensing) unless otherwise specified.

.8 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.

.9 Transmitters and sensors to be unaffected by external transmitters including walkie talkies.

.10 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

.11 Outdoor installations: use weatherproof construction in NEMA 4 enclosures.

2.2 LEVEL TRANSMITTER (LIT-G101)

.1 Ultrasonic Level Transmitter Requirements:

.1 Dual point level monitoring
.2 Pump on/off control
.3 Modbus communication
.4 Door mount
.5 Resolution: 0.1% of range
.6 Power requirement: 24VDC
.7 Safety Approvals: FM/CSA Class 1, Div.2 Approval
.8 4-20mA analog output

Approved Product: Siemens MultiRanger 100 Dual Point

.2 Remote Ultrasonic Transducer Requirements:

.1 Remote Ultrasonic Level Meter
.2 Measuring Range: 0.45 to 15 m
.3 Beam angle: 6º
.4 Weight: 2.0kg

.5 Frequency: 44Hz
.6 Complete with submergence shield
.7 Safety Approvals: FM/CSA Class 1 Div. 2

Approved Product: Siemens Echomax XRS-15 c/w submergence shield

2.3 ELECTROMECHANICAL RELAYS

.1 Requirements:

.1 Double voltage, DPDT, plug-in type with termination base.
.2 Coils: rated for 120 Vac or 24 Vdc. Other voltage: provide transformer.
.3 Contacts: rated at 5 amps at 120 Vac.
.4 Relay to have visual status indication

2.4 INCLINOMETER (ZT-S851)

.1 Requirements:

.1 Tilt transmitter
.2 Measuring range: -10˚ to +80˚
.3 Resolution: 0.15˚
.4 Operating range: -40 ˚C to 85 ˚C
.5 Output: 4-20mA output
.6 Bandwidth: DC – 8 Hz
.7 Enclosure: Stainless Steel NEMA Type 4X, IP68
.8 Sensor: MEMS Triaxial Accelerometer
.9 Mounting: Surface Mount
.10 Provide a stainless steel mounting bracket fabricated with type 316 stainless steel. The mounting bracket shall be fabricated to allow for the gauge to be installed in a plumb or level orientation such that the gauge reads zero degrees when the flap gate is in the closed position.
.11 Safety Approvals: FM/CSA Class 1 Div. 2

Approved Product: RST Instruments Model: ICEX360A

2.5 LEVEL SWITCH (LSL-G101)

.1 Requirements:

.1 Intent: Low Low Level Alarm (Low Level Pump Lockout)
.2 Liquid Density Measurement Range 0.95 – 1.10 g/cm3
.3 Materials: Polypropylene body, EPDM rubber bending relief
.4 Voltage: 250 VAC
.5 Cable Length: Confirm prior to ordering

Approved Product: Flygt Model ENM-10

2.6 PANELS

.1 Free-standing or wall mounted enameled steel cabinets with hinged and key-locked front door as indicated on drawings.

.2 Multiple panels as required to handle requirements with additional space to accommodate 25% additional capacity as required by Contract Administrator without adding additional cabinets.

.3 Panels to be lockable with same key.

2.7 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 #18 minimum stranded twisted pair ACIC Cu.

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 Temperature transmitters, humidity transmitters, current-to-pneumatic transducers, solenoid air valves, controllers, relays: install in NEMA 1 enclosure or as required for specific applications. Provide for electrolytic isolation in cases when dissimilar metals make contact.

.4 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.

.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 Building Controllers, 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.

3.4 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 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.

3.6 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 25 05 54 - Controls: Identification.

3.7 TESTING AND COMMISSIONING

.1 Calibrate and test field devices for accuracy and performance.

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.

.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 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 equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

1.9 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates as follows:

.2 Nameplates:

.1 Lamacoid 3 mm thick plastic lamacoid nameplates, white face, black lettering, mechanically attached with self tapping screws. Where mechanically fastened lamacoids will compromise the enclosure rating of the electrical equipment or are not practical adhesive such as 3M 467MP is allowable.

.2 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. Text on lamacoids to be as noted in the City of Winnipeg Electrical Design Guidelines section 2.3.

.4 Allow for average of twenty-five (25) letters per nameplate.

.5 Identification to be English.

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.

1.11 MANUFACTURERS AND CSA LABELS

.1 Visible and legible, after equipment is installed.

1.12 WARNING SIGNS

.1 As specified and to meet requirements of Electrical Inspection Department and the Contract Administrator.

.2 Lamacoid 3 mm thick plastic engraving sheet, red face, white core, mechanically attached with self tapping screws, 20mm text.

1.13 WALL MOUNTED DRAWINGS

.1 Provide drawings in plexiglass holder adjacent to the main electrical distribution.

.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 centreline 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 unless otherwise noted on the drawings.

.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 City’s representative

1.20 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.

.2 Provide as-built drawings in AutoCAD current format. Retain and pay MPE for this service.

.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 record drawings, 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 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.

.2 Provide a comprehensive list of subcontractors and suppliers who supplied and installed systems and components.

.3 Provide copies of all inspection certification reports from authorities having jurisdiction.

.4 Reference Section 40 05 01

1.22 COMMISSIONING

.1 Commission all instruments as described in Section 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	Note 1
2.	Waste Water Pumping Area (wet side)	Zone 1 (Division 1)	See CEC Section 18	PVC coated Rigid aluminum, TECK, See Note 2

Note 1 Install 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 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.

1.2 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 malleable iron / 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.

.8 Connectors:

.1 Watertight, approved for TECK cable.

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 malleable iron / 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 ACIC/CIC CONTROL CABLE

.1 Cable: to CAN/CSA-C22.2 No. 239, Control and Instrumentation Cables.

.2 Conductors, copper, size as indicated.

.3 Insulation: chemically cross-linked thermosetting polyethylene rated type RW90, 600V.

.4 Shielding as indicated on the drawings.

.5 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.

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 TECK CABLE 0 -1000 V

.1 Where surface mounted, provide clamps spaced a maximum of 1 m apart.

.2 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.

.3 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.

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 GROUND PLATES

.1 Material: Copper galvanized plates

.2 Dimensions: 254mm(10”) x 450mm(16”) x 6.35mm(1/4”)

.3 Cable Range: #8awg - #1/0 stranded

.4 Make / Manufacturer: Thomas and Betts 1016BTB or equal

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 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Perform tests before energizing electrical system.

3.3 INSTALLATION

.1 Comply with requirements of CSA C22.2 No. 0.4-M1982 and Canadian Electrical Code.

.2 Install complete permanent grounding system including electrodes, conductors, connectors and accessories.

.3 Protect exposed ground conductors from mechanical injury.

.4 Make buried connections, and connections to electrodes using thermite welding.

.5 Use mechanical connectors for ground connection to equipment provided with lugs.

.6 Do not solder joints.

.7 Install bonding wire in flexible metal conduit connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw.

.8 Install separate insulated bonding conductor in conduit runs installed in concrete which is subject to moisture penetration and underground.

.9 Install a separate insulated bonding conductor in all RPVC conduit runs.

.10 Install insulated copper bonding conductor in all cable tray, mechanically fixed to the trays at a minimum of 2 meter intervals.

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.

.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.

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

Part 2 Products

2.1 JUNCTION AND PULL BOXES AND CABINETS

.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.

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 Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

.4 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 4 (WP) stainless steel enclosures when installed outdoors

.3 CSA/ NEMA 7 (XP) metal enclosures when installed in hazardous classified areas.

.5 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: G72-2 (Panel G72, circuit 2)

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-18, Canadian Electrical Code, Part 1, 24th Edition.

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.

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 Suitable for threaded rigid conduit

.3 Mounting lugs as required.

.2 Specific Requirements:

.1 In Panel Outlets:

.1 Crouse Hinds VXF/VFT series

.2 Device Boxes:

.1 Crouse Hinds FS/FD series

.2 Wet location covers for all locations below grade

.3 Device Boxes in classified areas:

.1 Crouse Hinds ‘explosion-proof’ rated.

2.3 MASONRY BOXES

.1 Electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

.1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 CONDUIT BOXES

.1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of devices in Panels.

2.6 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.

2.7 FITTINGS – GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 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 4 (WP) stainless steel enclosures when installed outdoors

.3 CSA/ NEMA 7 (XP) metal enclosures when installed in hazardous classified areas.Support boxes independently of connecting conduits.

.2 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.

.3 Vacuum clean interior of outlet boxes before installation of wiring devices.

.4 Provide permanent label or lamacoid for all device boxes indicating the circuit(s) contained within.

.1 Example: L10-2 (Panel L10, 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).

Part 2 Products

2.1 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45.1, galvanized steel threaded.

.2 Electrical Metallic Tubing CAN/CSA C22.2 No. 83, aluminum threaded.

.3 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

.4 Rigid PVC conduit: to CSA C22.2 No. 211.2.

.5 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.

2.3 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Utilize insulated grounding bushings at all enclosure entries.

Part 3 Execution

3.1 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Use rigid aluminum threaded conduit and flexible metal conduit inside P&C Panel.

.3 Use rigid galvanized steel threaded conduit outside P&C Panel and in Chambers.

.4 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.5 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.6 Do not include more than the equivalent of four (4) quarter bends. Provide pull boxes as required.

.7 Ensure electrical continuity in all conduit systems.

.8 All conduit shown exposed in finished areas is to be free of unnecessary labels and trade marks.

.9 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.

.10 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.

.11 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.

.12 Install fish cord in empty conduits.

.13 Install ground wire in all conduits. Size ground wire as per CEC Table 17.

3.2 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.

3.3 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.

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 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 Pad mounted electrical enclosure including:

.1 Surge Protectors

.2 Power fail relay

.3 CTs

.4 PTs (if present)

.5 600V Power Panel PNL-G71

.6 120/240V Power Panel PNL-G73

.7 600-120/240V Transformer XFMR-G73

.8 Motor Starter P-G01 & P-G02

.9 Motors, pumps

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

.1 Power Panel PNL-G71 incoming feed.

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

.1 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

.1 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

.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 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.

.5 Clean the unit.

.6 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.

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

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

.9 Perform a rotation test to insure correct shaft direction.

.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.

.1 Where powered by a VFD with bypass, perform test with the motor powered by the VFD and by the bypass starter.

.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

.1 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 TRANSFORMERS, LOW VOLTAGE, DRY-TYPE

.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 Torque all accessible bolted power connections.

.6 Record the tap setting.

.7 Perform insulation-resistance tests winding-to-winding and each winding-to ground. Duration of the test is to be one minute. Calculate the dielectric absorption ratio.

.1 600 V windings shall be tested at 1000 Vdc.

.2 120/240 V windings shall be tested at 500 Vdc.

3.10 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.

3.11 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 P&C Panel, 200A CSTE, etc. Investigate connections with a resistance greater than 0.5 milliohms.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and components for dry type transformers up to 600 V primary, equipment identification and transformer installation.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.2 No. 47, Air-Cooled Transformers (Dry Type).

.2 CSA C9, Dry-Type Transformers.

.2 National Electrical Manufacturers Association (NEMA)

1.3 PRODUCT DATA

.1 Submit product data in accordance with Contract Document.

Part 2 Products

2.1 TRANSFORMERS

.1 Use transformers of one manufacturer throughout project and in accordance with CAN/CSA C22.2 No. 47.

.2 TFMR-G73 600V Input.

.1 Type: ANN.

.2 Single phase, 5 kVA, 600V input, 120/240 V output, 60 Hz.

.3 Voltage taps: 2.5% full capacity above and below normal.

.4 Windings: copper.

.5 Insulation: Class H, 220ºC.

.6 Temperature rise: 115ºC at continuous full load.

.7 Basic Impulse Level (BIL): 10 kV.

.8 Hipot: 4kV.

.9 Average sound level: To meet the local municipal & building codes and meet at minimum the following criteria:

45 dB max. up to 45 kVA

50 dB max. up to 150 kVA

.10 Impedance at 170 degrees C: standard

.11 Mounting: wall mounted.

.12 Nameplate to include actual transformer impedance (%Z).

.13 Encapsulated outdoor rated. NEMA 3R.

.14 Finish: in accordance with Section 26 05 01 - Common Work Results - Electrical.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Label size: 7.

.3 Indicate equipment identifier, KVA rating, primary and secondary voltage.

Part 3 Execution

3.1 INSTALLATION

.1 Mount dry type transformers up to 75 kVA. Provide brackets and bolts for wall mounted transformers. Ensure all transformers have good ventilation.

.2 Ensure adequate clearance around transformer for ventilation.

.3 Install transformers in level upright position.

.4 Install non-combustible insulating board, extending 300mm around transformer on all sides, behind transformer to meet CEC code requirements.

.5 Remove shipping supports only after transformer is installed and just before putting into service.

.6 Loosen isolation pad bolts until no compression is visible.

.7 Make primary and secondary connections in accordance with wiring diagram

.8 Mount transformers to reduce direct and transmitted noise. Mount core and coils of transformers.

.9 Make connections to transformers in flexible conduit, entering the enclosure below the coils.

.10 Energize transformers after installation is complete.

.11 Adjust tap connections to give a continuous secondary voltage of 120 volts phase to neutral, under load.

3.2 TESTING

.1 Utilize test form provided. Complete test form in full.

.2 Perform an insulation-resistance test. Individually test each winding with all other windings grounded, and test winding to winding, with both windings ungrounded. The test voltage shall be 1000 VDC, unless otherwise indicated by the manufacturer. The test duration shall be one minute.

.3 Measure and record the voltage on the primary and secondary of the transformer. Adjust the tap position as required. Record final tap position and voltage.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for standard and custom breaker type panelboards.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No. 29, Panelboards and enclosed Panelboards.

1.3 SHOP DRAWINGS

.1 Submit product data in accordance with Contract Document.

.2 For SPD units:

.1 Provide verification that the SPD complies with the required ANSI/UL 1449 3rd Edition listing by Underwriters Laboratories (UL) or other Nationally Recognized Testing Laboratory (NRTL). Compliance may be in the form of a file number that can be verified on UL's website or on any other NRTL's website, as long as the website contains the following information at a minimum: model number, SPD Type, system voltage, phases, modes of protection, Voltage Protection Rating (VPR), and Nominal Discharge Current (In).

.2 For side-mount mounting applications (SPD mounted external to electrical assembly), electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.

1.4 O&M Manual

.1 Include SPD Operation and maintenance manuals.

Part 2 General

2.1 PANELBOARDS, 240 V OR LESS

.1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.

.1 In addition to CSA requirements, manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 240 V panelboards: bus and breakers rated for 10 kA (symmetrical) interrupting capacity.

.3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers.

.5 Main Breaker:

.1 Main Breaker if required to be top mounted.

.2 Back-fed main breakers are not acceptable.

.6 Two (2) keys for each panelboard and key panelboards alike.

.7 Copper bus with neutral of same ampere rating as mains.

.8 Trim with concealed front bolts and hinges.

.9 Trim and door finish: baked grey enamel.

.10 Enclosure: 222mm (8.74") wide, 319mm (12.56") tall.

.11 Acceptable equipment:

.1 Square D (Schneider) QO816L100DSCU or approved substitute.

2.2 PANELBOARD, 600 V

.1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer

.1 In addition to CSA requirements, manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 Provide panelboard as follows:

.1 Service type: 3 phase, 4 wire

.2 Bus and breakers rated for 22 kA (symmetrical) interrupting capacity.

.3 Continuous bus rating: 125 A

.4 Main moulded case service entrance type breaker:

.5 Enclosure:

.1 Minimum 508 mm (20") wide, 660 mm (26") tall.

.6 Acceptable equipment:

.1 Square D (Schneider) NF418L1C or approved substitute.

2.3 BREAKERS

.1 Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers.

.2 Breakers with thermal and magnetic tripping in panelboards.

2.4 SURGE PROTECTIVE DEVICE

.1 Supply and install a Surge Protective Device (SPD) where shown on the drawings.

.2 Requirements:

.1 SPD units and all components shall be designed, manufactured, and tested in accordance with the latest applicable UL standard (ANSI/UL 1449 3rd Edition).

.2 Voltage: Refer to drawings.

.3 Maximum Continuous Operating Voltage (MCOV): The MCOV shall not be less than 115% of the nominal system operating voltage.

.4 The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.

.5 Protection Modes – The SPD must protect all modes of the electrical system being utilized. The required protection modes are:

.1 3Ø, 3W System: L-L, and L-G

.2 3Ø, 4W Wye System: L-L, L-N, L-G, and N-G

.3 1Ø, 3W Wye System: L-L, L-N, L-G, and N-G

.6 Nominal Discharge Current (In) – All SPDs applied to the distribution system shall have a 80kA In rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an In less than 80kA shall be rejected.

.7 Make: Schneider Electric

.8 Model: SSP08XDSE20A

.1 UL 1449 2nd Edition/UL 1449 3rd & 4th Edition Voltage Protection Ratings

.2 L-N, L-G, L-L, N-G:

.1	L-N	1500
.2	L-G	1500
.3	L-L	1500
.4	N-G	2500

.3 SPD Design

.1 Maintenance Free Design – The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

.2 Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.

.3 Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220B insertion loss test method.

.4 Internal Connections – No plug-in component modules or printed circuit boards shall be as surge current conductors. All internal components shall utilize low impedance conductors.

.5 Monitoring Diagnostics – Each SPD shall provide the following integral monitoring options:

.1 Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of each protection mode on each phase.

.6 The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.

.7 Overcurrent Protection

.1 The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.

.8 Panelboard Installation Requirements:

.1 The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and subfeed breaker options.

.2 The SPD shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.

.3 The panelboard shall be capable of re-energizing upon removal of the SPD.

.4 Utilize a breaker, appropriately rated as directed by the SPD manufacturer, to connect the SPD to the panelboard. The SPD shall be located directly adjacent to the circuit breaker.

.5 Install SPD as shown on the drawings.

.1 Lead length between the breaker and suppressor shall be kept as short as possible to ensure optimum performance. Any excess conductor length shall be trimmed in order to minimize let-through voltage. The installer shall comply with the manufacturer's recommended installation and wiring practices.

.3 Basis of Design: Total Protection Solutions Service Track ST080 or Equal

2.5 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results – Electrical.

.2 Nameplate for each panelboard size 7 engraved as follows:

.1 Line 1 is to be the panel identifier on the drawings, for example “PNL-G10”.

.2 Line 2 is to be the voltage, for example “120/240V, 1Ø”.

.3 Complete circuit directory with typewritten legend.

.4 Provide lamacoid for each breaker in 600V panelboards.

2.6 POWER FAIL RELAY (ESL-G711)

.1 Basis of Design: LITTLEFUSE DLMHBRAAA

.2 Location and mounting:

.1 Electrical Enclosure: Equipment to be installed in a hinged box with a ¼ turn latch, box to be mounted on enclosure backboard.

.3 Features:

.1 3-phase over and under voltage, phase sequence, phase loss and asymmetry monitoring.

.2 Detects when all 3 phases are present and have the correct sequence (phase angle).

.3 Detects if all the 3 phase-phase or phase-neutral voltages are within the set limits.

.4 Detects if asymmetry is below set value.

.5 Separately adjustable set points.

.6 Separately adjustable delay functions (0.1 to 30 sec).

.7 Output: 8 Amp relay SPDT.

.8 LED indication for relays, fault, and time delay status

Part 3 Execution

3.1 INSTALLATION

.1 Locate panelboards and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height of two (2) metres to top of cover, as required by Code.

.4 Connect loads to circuits.

3.2 TESTING

.1 Test in accordance with Section 26 08 05.

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 4X rated enclosure for all locations except within electrical rooms and control rooms.

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

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

.4 Door interlocks

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 CAN/CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Wiring Devices.
- .2 CAN/CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-National Standard, with UL 514D).
- .3 CSA-C22.2 No.55, Special Use Switches.
- .4 CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20).

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Contract Document.

Part 2 Products

2.1 SWITCHES

.1 15 A, 120 V, single pole switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111.

.2 Enclosure rating:

- .1 Electrical cabinet: NEMA 12
- .2 Pumping chamber: NEMA 7

.3 Manually-operated heavy-duty AC switches with following features:

- .1 Heavy-duty mounting strap.
- .2 Terminal holes approved for No. 10 AWG wire.
- .3 Silver alloy contacts.
- .4 One-piece Lexan toggle, lever, and cam.
- .5 Suitable for back and side wiring.
- .6 Green hex head grounding terminal.

.4 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.5 Switches of one manufacturer throughout project.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, heavy duty specification grade to: CSA-C22.2 No.42 with following features:

.1 Heavy-duty nylon face with steel reinforcing plate in centre.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Receptacle contacts to utilize spring steel clips to reduce contact fatigue.

.2 Receptacles of one manufacturer throughout project.

.3 Acceptable manufacturer:

.1 Hubbell 8200 or approved equal in accordance with B7.

2.3 COVER PLATES

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

.2 Cover plates from one manufacturer throughout project.

.3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 Stainless steel, 1 mm thick cover plates wiring devices mounted in flush-mounted outlet box.

.5 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.6 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles.

Part 3 Execution

3.1 INSTALLATION

.1 Switches.

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height in accordance with Section 26 05 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 duplex receptacles vertically.

.3 Mount receptacles at height in accordance with Section 26 05 01 - Common Work Results – Electrical.

.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: L10-2 (Panel L10, 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.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers, and Circuit breakers to CSA C22.2 No. 5

.2 Common-trip breakers: with single handle for multi-pole applications.

.3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.4 Circuit breakers to have minimum 10kA symmetrical rms interrupting capacity rating, or higher.

.5 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.

.6 Include:

.1 On-off locking device.

.2 Neutral and Ground bus bars, fully rated.

2.2 600V MAIN BREAKER (MCB-G70)

.1 Requirements:

.1 Frame Size: 100A.

.2 Trip Rating: as shown on drawings.

.3 Interrupting Rating: 25 KAIC.

.4 Type: as shown on drawings.

.5 Long Time PU: to be determined during commissioning.

.6 Long Time Delay: not applicable.

.7 Short Time Pickup: to be determined during commissioning.

.8 Short Time Delay: Inst – not applicable.

.9 Instantaneous Override: to be determined during commissioning.

.10 Enclosure: Schneider Electric J250SS

.11 Model: Schneider Electric HGL36100U33X

2.3 ACCESSORIES

.1 All power panels are to include three (3) permanently fixed attachment for padlocking the breakers in the OFF position.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers.

.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-L73”.

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 Consultant.

.2 Inform Consultant 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 Consultant.

3.2 INSTALLATION

.1 Contractor is responsible for installation, wiring, testing, and assisting the Owner representative in commissioning of all HMI equipment, HMI communication equipment, PC equipment and Operator interfaces.

.2 The Contractor shall supply and deliver to the Owner’s Representative any HMI or PLC products identified herein for the purpose of programming. The Owner’s Representative will advise the contractor when and which items will be required on a later date. The Contractor will pay all costs associated with handling, extended warranties, etc.

.3 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 ACTION AND INFORMATIONAL 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.

.3 Shop Drawings:

.1 Provide shop drawings: in accordance with Contract Document.

.1 Provide shop drawings for each type of starter to indicate:

.1 Mounting method and dimensions.

.2 Starter size and type.

.3 Layout and components.

.4 Enclosure type.

1.2 CLOSEOUT SUBMITTALS

.1 Provide maintenance materials in accordance with Contract Document.

.2 Submit operation and maintenance data for each type and style of motor starter for incorporation into maintenance manual.

.3 Extra Materials:

.1 Provide listed spare parts for each different size and type of starter.

.1 All control fuses.

.2 indicating lamp bulb.

Part 2 Products

2.1 REVERSING AND FULL VOLTAGE MAGNETIC STARTERS

.1 UL/CSA listed, NEMA size as shown on the drawings.

.1 Smallest size of starter: NEMA size 1.

.2 IEC rated starters are not acceptable.

.2 Magnetic of size, type, rating and enclosure type as indicated with components as follows:

.1 All coils to be epoxy coated.

.2 Contactor solenoid operated, rapid action type.

.3 Mechanical and electrically interlock to defeat simultaneous starting the 2 contactors for reversing starters.

.4 Motor overload protective device in each phase, manually reset from outside enclosure.

.5 Wiring and schematic diagram inside starter enclosure in visible location.

.6 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.3 Accessories:

.1 Selector switches and Pushbuttons: heavy-duty oil tight labelled as indicated.

.2 Indicating LED lights: heavy-duty oil tight type and color red and green.

.3 1-N/O spare auxiliary contact.

2.2 CONTROL TRANSFORMER

.1 100VA minimum single phase, dry type, control transformer with primary voltage as indicated and 120 V
secondary, complete with primary and secondary fuses, installed in with starter.

.2 Size control transformer as required.

2.3 ACCESSORIES

.1 Pushbutton: heavy duty, oil tight.

.1 Pushbuttons to have standard heads; color to be determined by the City.

.2 Emergency stop pushbutton to have large red mushroom head.

.2 Selector switches: heavy duty, oil tight.

.3 Indicating LED lights: heavy duty, oil tight, type and colour red and green.

2.4 FINISHES

.1 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 4 (WP) stainless steel enclosures when installed outdoors

.3 CSA/ NEMA 7 (XP) metal enclosures when installed in hazardous classified areas.

.2 Apply finishes to enclosure in accordance with Section 26 05 01 - Common Work Results for Electrical.

2.5 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results for Electrical.

.2 Magnetic starter designation label, white plate, black letters, size 5 engraved on lamacoid schedule.

2.6 SPARE PARTS

.1 Fuses: two of each rating.

Part 3 Execution

3.1 INSTALLATION

.1 Install starters and control devices in accordance with manufacturer's instructions.

.2 Install and wire starters and controls as indicated.

.3 Ensure correct fuses installed.

.4 Confirm motor nameplate and adjust / replace overload device to suit.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results for Electrical and manufacturer's instructions.

.2 Operate switches and contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI C82.1-97, Electric Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.

.2 ANSI C82.4-92, Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps.

.2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE C62.41-1991, Surge Voltages in Low-Voltage AC Power Circuits.

.3 American Society for Testing and Materials (ASTM)

.1 ASTM F1137-88(1993), Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.4 United States of America, Federal Communications Commission (FCC)

.1 FCC (CFR47) EM and RF Interference Suppression.

.5 Canadian Standards Association (CSA International)

.6 ICES-005, latest edition, Radio Frequency Lighting Devices.

.7 Underwriters' Laboratories of Canada (ULC)

1.2 SHOP DRAWINGS AND PRODUCT DATA

.3 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.4 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Engineer.

.5 Photometric data to include: VCP Table and spacing criterion.

Part 2 Products

2.1 LAMPS

.1 Lamps shall be as indicated on luminaire schedule on drawings.

2.2 LED DRIVER

.1 LED Driver: CSA certified, energy efficient type, IC electronic.

.1 Rating: 120 V, 60 Hz.

.2 Totally encased and designed for 40 degrees Celsius ambient temperature.

.3 Start-up ambient temperature of -20°C for indoor luminaires, and -40°C for outdoor luminaires.

.4 Power factor: minimum 95% with 95% of rated lamp lumens.

.5 Harmonics: 10 % maximum THD.

.6 Estimated lifespan equal or greater than LED lamps of respective luminaire.

.7 Sound rated: Class A.

.8 Mounting: integral with luminaire.

2.3 FINISHES

.1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

2.4 LUMINAIRES

.1 As indicated in luminaire schedule.

Part 3 Execution

3.1 INSTALLATION

.1 Locate and install luminaires as indicated.

.2 Provide adequate support to suit ceiling system.

3.2 WIRING

.1 Connect luminaires to lighting circuits:

.2 Install rigid PVC conduit or Teck 90 cable for luminaires.

3.3 LUMINAIRE SUPPORTS

.1 For suspended ceiling installations support luminaires independently of ceiling.

.2 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors (Nylon shields not acceptable) or as recommended by Anchor Construction Industrial Building Products Ltd for the specific surface & equipment being installed.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 If there is potential of Asbestos, Electrical Contractor must use a proper collection boot and HEPA vacuum whenever drilling of holes in facility.

.5 All steel channel support for wall and surface mounted luminaires to be PVC coated strut.

.6 All RGS conduit stem threaded on both sides shall be PVC coated. All hardware shall be rated for the application environment.

3.4 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.5 CLEANING

.3 Clean in accordance with Section 01 74 11 - Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.141-M1985(R1999), Unit Equipment for Emergency Lighting.

1.2 SUBMITTALS

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

.2 Data to indicate system components, mounting method, source of power and special attachments.

1.3 WARRANTY

.1 For batteries, the 12 months warranty period prescribed in subsection GC32.1 of General Conditions "C" is extended to 120 months, with no-charge replacement during the first 5 years and pro-rate charge on the second 5 years.

Part 2 Products

2.1 EQUIPMENT

.1 Battery Unit

.1 Emergency lighting equipment: to CSA C22.2 No.141.

.2 Supply voltage: 120 VAC.

.3 Output voltage: 12 VDC.

.4 Operating time: 60 min. minimum

.5 NEMA 4X rated weatherproof, fully gasketed

.6 Liquid-tight, momentary push button test switch

.7 Signal lights: solid state, for 'AC ON' and 'Charge'.

.8 Battery: sealed, maintenance free.

.9 Charger: fully automatic, current limited charger.

.10 Battery protection: a low voltage battery protection circuit to disconnect the load when the battery reaches the end of discharge.

.11 Lamp heads: remote, fully adjustable. Lamp type: LED, 6 W.

.12 Large magnum terminal screw type connectors for remote load connection.

.13 Automatic Self Testing Feature that test once a month, every 6 months and 12 months c/w visual and audible alarm and should indicate the following at a minimum:

.1 Battery Failure

.2 Battery Disconnect

.3 Charger Failure

.4 Lamp Failure

.5 Service Alarm

.6 AC on

.7 Charger on

.14 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.

.15 Finish: Grey.

.16 Options required:

.1 Automatic test self-diagnostic

.2 Ammeter and Voltmeter

.3 Line cord & plug

.4 A.C./D.C. Terminal block capable of accepting #10 AWG Cu. Wire

.5 Audible alarm, Audible emergency

.6 Six (6) circuit fused internal distribution

.7 Internal thermostatically controlled battery heater

.8 Infrared remote test

.9 Lamp disconnect (internal)

.10 Octagon box mount (line cord delete)

.11 RFI suppressors.

.12 Time delay

.13 Twist lock plug

.2 Remote Head Lamps

.1 Supply voltage: 12 V dc

.2 CSA C22.2 No.141-15 approved

.3 Explosion proof, submersible

.4 Single head

.5 Basis of design: Stanpro VC12-12-24V-6WLAWM

Part 3 Execution

3.1 INSTALLATION

.1 Install unit equipment and remote mounted fixtures.

.2 Direct heads.

3.2 WIRING OF REMOTE HEADS

.1 Conduit: in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 Conductors: in accordance with Section 26 05 21 - Wires and Cables 0-1000 V, sized in accordance with manufacturer's recommendations to minimize voltage drop.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

.2 Section 40 95 13 – Control Panels

.3 Section 25 30 02 – 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 Training for plant operators as specified herein.

.3 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 In addition to the requirements of drawings 5516047-I01-I18, the Contractor shall provide the following instrumentation plans as a minimum:

.1 Fully itemized instrument loop plans for all analog process loops, digital, and motor control, to be generally in accordance with ISA.S54 Format.

.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 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.

2.2 LEVEL SWITCHES

.1 Reference Section 25 30 02

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 PLC, HMI, or SCADA.

.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 PLC 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 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 Lamacoid 3 mm thick plastic lamacoid nameplates, white face, black lettering, mechanically attached with self tapping screws. Where mechanically fastened lamacoids will compromise the enclosure rating of the electrical equipment or are not practical adhesive such as 3M 467MP is allowable.

.1 NAMEPLATE SIZES

.1 Size 1 10 x 50 mm 1 line 3 mm high letters

.2 Size 2 12 x 70 mm 1 line 5 mm high letters

.3 Size 3 12 x 70 mm 2 lines 3 mm high letters

.4 Size 4 20 x 90 mm 1 line 8 mm high letters

.5 Size 5 20 x 90 mm 2 lines 5 mm high letters

.6 Size 6 25 x 100 mm 1 line 12 mm high letters

.7 Size 7 25 x 100 mm 2 lines 6 mm high letters

.8 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. Text on lamacoids to be as noted in the City of Winnipeg Electrical Design Guidelines section 2.3.

.4 Provide warning and caution lamacoids in conformance with the latest requirements of the CEC. Lamacoids will have white lettering on a red background.

.5 Allow for average of twenty-five (25) letters per nameplate.

.6 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 in Division

.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 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

.2 Wireless Modem Operation and Maintenance Manual:

.1 Complete step-by-step procedures for operation of the system.

.2 Operation of computer peripherals, and associated input and output formats.

.3 Emergency, alarm and failure recovery procedures.

.4 Step-by-step instructions for start-up, back-up equipment operation, execution of systems functions and operating modes, including key strokes for each command so that operator need only refer to these pages for keystroke entries required to call up display or to input command.

.5 Repair instructions for common issues.

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 REFERENCES

.1 Canadian Standards Association (CSA International).
  .1 CSA C22.2 No. 205-17, Signal Equipment.
.2 International Electrotechnical Commission (IEC).
  .1 IEC 61131, Programmable Controllers.

1.2 DEFINITIONS

.1 PLC Programmable Logic Controller.

1.3 SOURCE OF SUPPLY

.1 Should any equipment or software indicated below be no longer available it is the Contractors responsibility to provide equal or better equipment or Software. The Contractor is to confirm with The City's Representative for any part number alterations and order equipment **AFTER** signed reviewed shop drawings have been issued.

1.8 O&M MANUALS

.1 Include the following in the O&M Manuals:
  .1 Product datasheets.
  .2 Hardware and software user manuals.
  .3 Wireless Modem interface map.
  .4 PLC database listing and logic printout.
  .5 CD sleeve with CD containing PLC application program.

Part 2 Products

2.1 PROGRAMMABLE LOGIC CONTROLLERS

Item	Description	Schneider Part NO.	Qty.
1	M580 Processor Module	BMEP583020	1
2	Power Supply module	BMXCPS3020	1
3	Discrete Input Module	BMXDDI3202K	2
4	Discrete Output Module	BMXDDO1602	1
5	Analog Input Module	BMXAMI0810	1
6	Nor Card	BMXNOR0200H	1
7	40 pin terminal block	BMXFTB4000	2
8	Protective cover	BMXXEM010	4

2.2 NETWORKING EQUIPMENT

.1 Router:
- .1 Location:
  - .1 PLC Panel
- .2 Wireless modem is City supplied and will require LTE 4G sim card set up with a BellMTS account and antenna mounted externally to the electrical enclosure as shown on the drawings. Contractor is responsible for the installation of the Modem along with all associated components.

2.3 ETHERNET Module

.1 2 Port NOR Card
- .1 Manufacturer: Schneider
- .2 Model: BMXNOR0200H
- .3 Connector Type: RJ45
- .4 Data Rate: 10Base-T/100Base-TX
- .5 Supply: Internal Power Supply
- .6 Location: PLC Panel

Part 2 Execution

3.1 INSTALLATION

.1 Contractor is responsible for installation, wiring, testing, and assisting the City representative in commissioning of all PLC equipment, PLC communication equipment, PC equipment and Operator interfaces.

.2 The Contractor shall supply and deliver to the City's Representative (#202, 2211 McPhillips St., R2V 3M5 Winnipeg) any of the computer and PLC products identified herein for the purpose of programming. The City's Representative will advise the contractor when and which items will be required on a later date. The Contractor will pay all costs associated with handling, extended warranties, etc.

.3 Contractor shall supply all required cabling to connect hardware above.

3.2 PROGRAMMING

.1 The City's Representative (MPE Engineering) will be responsible for programming the PLC and the network equipment.

END OF SECTION

Part 1 General

1.1 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. 1-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standards for Electrical Installations.

1.2 GENERAL REQUIREMENTS

.1 All Control Panels shall be built by a CSA/cUL-approved manufacturer and shall bear the CSA/cUL seal with the manufacturer's file number.

.2 Control Panels shall be factory assembled and pre-wired. The Control Panel wiring shall be verified at the manufacturer's factory and completely tested before being shipped to the site.

.3 Supply, install, wire and test all components inside the Control Panels according to the specifications herein and the drawings.

1.3 SEPARATE ALTERNATE PRICE

.1 The Control Panel with RTU and related components as shown on the drawing shall be CSA 1 rated and mounted inside P&C Panel with other individually enclosed power panels, transformer, starter, etc.

.2 The bidder shall submit a separate price for alternate stainless steel CSA 4 rated Control Panel with RTU and related components to be installed besides Power Panel with only power related equipment but on a common concrete base.

1.4 SUBMITTALS

.1 Prior to construction.

.1 Submit product datasheets and wait for approval, prior to construction of the Control Panels.

.2 Submit stamped dimensioned drawings showing all exterior and interior features/ devices and wait for approval, prior to construction of the Control Panels.

.2 Prior to shipment:

.1 Submit electronic pictures of enclosure exterior and interior, including door interior.

.1 Pictures to be of sufficient resolution to read component labels.

.2 As-built drawings:

.1 Submit as-built drawings. Minor changes may be made via red-line mark-ups.

.2 Draft significant changes on AutoCAD drawings.

.3 Do not ship control panel until approval from Contract Administrator is received.

1.5 INSPECTION

.1 A factory inspection of the control panels will be performed at the discretion of the Contract Administrator based upon the pre-shipment submittals.

.2 If requested, demonstrate and test the control panel in presence of the Contract Administrator.

Part 2 Products

2.1 GENERAL

.1 Construction of the control panels is required, in accordance with the supplied drawings.

.2 Control devices of each category shall be of same type and manufacturer.

2.2 ENCLOSURES

.1 Install lamacoids as per the control panel layout drawings.

.2 All indoor control panels shall be NEMA 12.

.3 All enclosure angles and cut-outs shall be free of dents, gouges or weld marks, and shall present a clean, smooth appearance.

.4 No screws, fittings or other fastenings shall be used on external panel faces, which must be free of any marks, scratches or defaults.

.5 The door is to be a minimum fourteen (14) gauge steel plate, full height and flush with adjacent surfaces.

.6 The interior of the control panel shall be painted gloss white.

.7 Component mounting plates shall be three (3) mm thick steel and shall be painted with one (1) coat of primer and one (1) coat of white baked enamel.

.8 All Control Panel doors shall open through 180 degrees without restriction.

.9 All control panels of a depth greater than or equal to twelve (12) inches shall be equipped with a LED tube type lighting located in the cabinet’s upper portion with a motion sensor lighting system. Whenever the door is opened, the lighting system shall automatically be activated.

.10 Enclosure brand shall be Hoffman CSD603616 c/w back panels or equivalent.

2.3 POWER SOURCE

.1 Each power source must be protected by a CSA approved circuit breaker.

.2 The location of each power source must be clearly shown.

.3 Panels powered by more than 1 electrical source shall display on their door; "Caution: This panel is electrically powered by more than one source".

2.4 COMPONENTS

.1 Rails (DIN Rails):

.1 Rails used must be DIN Rail style TS 35mm, slotted.

.2 When used to mount terminals, rails shall be mounted on straight raisers (Rail support / Mounting feet) so as to raise them to the same height as the highest adjacent wiring duct.

.3 Raisers (Rail support / Mounting feet) shall not be used when rail hosts heavy components.

.2 Terminals:

.1 Requirements:

.1 TS-35 DIN Rail mounting.

.2 Voltage rating:

.1 600V for general control circuits.

.2 600V for power circuits.

.3 Manufacturer: Phoenix Contact or approved equal.

.2 Terminal blocks shall be designed for the size of the wires to be connected to them. Terminal blocks used for analog, digital, and power cables shall be identified and physically separated from each other.

.3 Each terminal shall bear an identification number on both sides.

.4 Drawings and templates supplied may not detail all hardware components such as labels, stoppers, rail lifters, end plates, separators, etc. The supplier must supply and install such components when required.

.3 Ground Bus Bar:

.1 Supply a ground bus bar in each control panel.

.2 Requirements:

.1 Tapped holes with screws.

.2 Bar to have sufficient connection points for all cables entering the control panel, plus 25% spare.

.3 Maximum one wire termination per screw.

.4 Pushbutton, Switch and Indicator Light:

.1 When required, all control panel pushbuttons, switches and indicator lights shall be at least NEMA 12 (or better)-type devices.

.2 Manufacturer to be Schneider Electric or approved equivalent.

.5 Programmable Logic Controllers:

.1 As per section 40 94 43.

.6 Wireless Modem:

.1 As per Contract Document.

.7 General Purpose Relays:

.1 Type: DPDT or as shown on drawings.

.2 Indication: LED.

.3 Coil Voltage: As per drawings.

.4 Contact Rating: 5A (120 VAC), 5A (24 VDC).

.5 Approvals: CSA.

.6 Manufacturer: Omron or approved equal.

.8 24 VDC Power Supplies:

.1 Size: As shown on the drawings.

.2 Supply Voltage: 120 VAC, 1ph.

.3 Approvals: CSA.

.4 Manufacturer: Phoenix Contact or approved equal.

.9 Uninterruptible Power Supply:

.1 Size: 216 VA.

.2 Type: Offline.

.3 Input Voltage: 24 V DC

.4 Output Voltage: 24 V DC.

.5 Manufacturer: QUINT-UPS by Phoenix Contact in combination with a QUINT-BAT/24DC 12Ah

.10 Grounding:

.1 All control panel components shall be adequately grounded in accordance with the component manufacturer, especially control system components.

.2 Firmly bond all panel mounted devices on or within the panels to ground. Provide supplementary bonding conductors for back panels and doors. Attach a separate bonding conductor to all devices that are not firmly fastened to the panels with screws for such devices as case mounted instruments, meters, etc.

.11 Wiring:

.1 All conductors shall be securely fastened to terminals at both ends; no splices are allowed inside the panel.

.2 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.

.3 All wires and cables inside the control panels shall be identified on both ends with non-erasable markers from.

.4 Identification shall follow the supplied documents, such as wiring diagrams.

.1 Label both ends of each wire.

.2 Utilize machine printed non-slip labels.

.3 Wherever possible wire labels shall be positioned to be read from the panel opening without removal of wire duct covers or other wiring.

.4 Individual conductors or wires exiting a cable shall be identified using non-erasable markers.

.5 The routing of all analog, digital, and power cable wiring inside control panels shall be segregated as much as possible, in distinct wiring ducts, by the type of signal they are carrying. 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.

.6 All analog signal wiring shall be 18 AWG shielded twisted pairs such as Belden No. 8760, or an approved equivalent. Shield wires exiting the jacket must be covered with a black heat shrink, and the overall cable at the jacket end must also be covered with a heat shrink.

.7 All 24 VDC or 120 VAC discrete signal panel wiring shall be 16 AWG TEW stranded conductor unless otherwise noted.

.1 Increase the size of power wiring, 12 AWG minimum.

.8 The sizes and colours of wires shall be in accordance with the CSA and the Canadian Electrical Code.

.9 The panel builder shall group and form wiring into a loop when going from a fixed part of the panel to a door. Each end of the loop shall be properly supported.

.10 Wiring Duct:

.1 All wires shall be run in narrow slot wiring duct such as such as Panduit or an approved equivalent.

.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 4-20mA wires, but can cross their path.

Part 3 Execution

3.1 COMPONENT INSTALLATION

.1 Components on the front of the panel shall be identified with an individual permanent nameplate installed in an organized manner. The nameplate must identify the component's function.

.2 Each component inside the control panel shall be identified with a nameplate corresponding to the drawings.

.3 All non-DIN rail mountable devices in the control panel shall be mechanically affixed to the back panel with either tapped or self-tapping screws.

.4 All control devices shall be mounted so that any component can be replaced without removing the sub-panel.

.5 Components and/or auxiliary instruments mounted at the rear of the panel shall be readily accessible and their installation shall not be affected by, or interfere with the removal of any panel instrument.

.6 Nameplates shall be made of lamacoid material with a white background and engraved black letters for internal and external components. Nameplates must resist harsh industrial conditions.

.7 Supply and install all required fuses.

.8 Control devices must be spaced adequately to allow for cooling, replacement, servicing, and wiring access.

.9 Control devices shall be grouped according to voltage and function to reduce electrical noise.

3.2 IDENTIFICATION

.1 Perform terminal identification using a computerized device. Handwriting is not acceptable.

.2 Label terminals as shown on drawings.

.3 Install label above each terminal block with terminal block name.

3.3 TESTING

.1 Send invitation to the City with 5 days advanced notice and submit agenda with list of all tests and procedures. If the City declines the invitation then submit test results for their review and approval prior to shipment.

.2 Testing of the control panels shall be fully completed prior to the FAT, and shall include at minimum:

.1 Provide a signed and dated inspection sheet with all tests performed listed on it.

.2 The list of the various test procedures described hereunder is not restrictive, and does not relieve the control panel manufacturer of his responsibility to perform any other work that is not mentioned but requested to verify the good operation of the control panels.

.3 Isolate all instruments and components of the control panels as required to protect them from any damage during tests.

.4 Provide the services of qualified personnel as well as tools and equipment required to perform all tests and inspection of the control panels.

.5 Tests to include:

.1 Power supply functionality.

.2 PLC component functionality.

.3 Point to point tests of all inputs and outputs.

.4 Power terminal voltage verification.

.5 Relays and switches functionality.

.6 E-stop system component functionality.

.7 Receptacle and lighting functionality.

.8 Wireless Modem transceiver functionality

3.4 SPARE COMPONENTS

.1 Supply two spares of each fuse type and rating. Place in a clear plastic bag and attach to the panel door interior.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

.1 Submit training proposal complete with hour-by-hour schedule including brief overview of content of each segment to the Contract Administrator, 30 working days prior to anticipated date of beginning of training.

.1 List name of trainers, and type of visual and audio aids to be used.

1.2 QUALITY ASSURANCE

.1 Provide competent instructors thoroughly familiar with all aspects of the instrumentation system installed in the facility.

.2 Contract Administrator reserves right to approve instructors.

1.3 INSTRUCTION

.1 Provide instruction to designated personnel in adjustment, operation, maintenance and pertinent safety requirements of the system installed.

1.4 TRAINING MATERIALS

.1 Provide equipment, visual and audio aids, and materials for classroom training at City's site.

.2 Supply manual for each trainee, describing in detail data included in each training program.

.1 Review contents of manual in detail to explain aspects of operation and maintenance (O&M).

1.5 TRAINING PROGRAM

.1 Operations Training:

.1 Location: At a facility provided by the City.

.2 Duration: Four hours.

.3 Number of trainees: Coordinate with Contract Administrator prior to training.

.4 Audience: Operations and maintenance personnel.

.1 Content:

.1 General system overview.

.2 Description of system components.

.3 Presentation of control panel and system operation.

1. Use of the system.
2. Navigation.
3. Alarm system use.

.4 Presentation of the pump starters and system operation.

1.6 MONITORING OF TRAINING

.1 Contract Administrator to monitor training program and may modify schedule and content.

Part 2 Products

2.1 GENERAL

.1 Not Applicable.

Part 3 Execution

3.1 TRAINING

.1 Provide on-site training to City personnel.

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 of any critical system supplied by the Vendor.

.2 Critical systems include, but are not limited to:

.1 Communication networks.

.2 PLC 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

Part 1 General

1.1 SUBMITTALS

.1 Submittals in accordance with Section Contract Document.

.2 Submit commissioning plans and procedures, in writing, at least 10 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 The Contract Administrator will provide the required commissioning forms.

.2 Supplement the provided forms as required to make a complete commissioning report package.

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.

3.2 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 PLC.

.1 Test both states of discrete points.

.2 Test, at minimum, two values for analog points.

.3 Test each piece of equipment individually for complete functionality.

.4 Completely test the E-Stop functionality of each piece of equipment, as provided.

.5 All 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.

.6 All deficiencies must be corrected by the Contractor.

.7 Commission each system using procedures prescribed by the Contract Administrator.

.8 Optimize operation and performance of systems by fine-tuning control loops and PID values.

3.3 SYSTEM SOFTWARE

.1 Load PLC system with appropriate program, 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 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 operation of the City's Wastewater pumping station.

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

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