Part 1 General

1.1 ADMINISTRATIVE

.1 Coordinate with the Contract Administrator to schedule project meetings throughout the progress of the work at the call of the Contract Administrator.

.2 Support the preparation of an agenda for meetings.

.3 Location:

.1 At the North End Sewage Treatment Plant (NEWPCC).

1.2 PRECONSTRUCTION MEETING

.1 Agenda to include, but not be limited to:

.1 Designation of personnel representing the parties.

.2 Schedule of Work.

.3 Schedule of submittals.

.4 Permits.

.5 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00- Construction Facilities.

.6 As-Built drawings.

.7 Monthly progress claims.

.8 Work hours.

.9 Emergency contacts.

.10 City of Winnipeg templates to be utilized.

1.3 PROGRESS MEETINGS

.1 Contract Administrator will schedule regular progress meetings at Site during course of Work.

.2 Contractor, major Subcontractors involved in Work are to be in attendance.

.3 Agenda to include the following:

.1 Review, approval of minutes of previous meeting.

.2 Review of Work progress since previous meeting.

.3 Field observations, problems, conflicts.

.4 Problems which impede construction schedule.

.5 Review of off-site fabrication delivery schedules.

.6 Corrective measures and procedures to regain projected schedule.

.7 Revision to construction schedule.

.8 Progress schedule, during succeeding work period.

.9 Review submittal schedules: expedite as required.

.10 Maintenance of quality standards.

.11 Review proposed changes for effect on construction schedule and on completion date.

.12 Other business.

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 ADMINISTRATIVE

.1 Submit to the Contract Administrator submittals listed for review.

.2 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.

.3 Allow ten (10) Working Days for review of submittals by the Contract Administrator.

.4 Do not proceed with Work affected by submittal until review is complete.

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

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

.7 Review submittals prior to submission to the Contract Administrator. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project may be returned without being examined and considered rejected.

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

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

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

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

.12 Make any corrections required by the Contract Administrator and resubmit the required Submittals.

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

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "shop drawings" 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 Where specified, submit drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada.

.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 the Section

under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.4 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 Contract Administrator prior to proceeding with Work.

.5 Make changes in shop drawings as Contract Administrator may require, consistent with Contract Documents. When resubmitting, notify Contract Administrator in writing of revisions other than those requested.

.6 Accompany submissions with transmittal letter, 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.

.7 Submissions include:

- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.
  - .3 Manufacturer.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 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.

.8 Submit in the following format:

- .1 One electronic PDF copy; and
- .2 As elsewhere required in the Specifications.

.9 Delete information not applicable to project.

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

.11 If upon review by the Contract Administrator , no errors or omissions are discovered or if only minor corrections are made, an electronic 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.

.12 The review of shop drawings by the Contract Administrator is for sole purpose of ascertaining conformance with the general concept.

.1 This review shall not mean that Contract Administrator or the City approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

.2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 INSPECTION

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

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

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

.4 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.

1.2 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies may be engaged by the City for purpose of inspecting and/or testing portions of Work. The cost of such services will be borne by the City.

.2 Engagement of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.

.3 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by the Contract Administrator at no cost to City. Pay costs for retesting and re-inspection.

1.3 ACCESS TO WORK

.1 Allow inspection/testing agencies access to Work.

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

1.4 PROCEDURES

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

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 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 Contract Documents, amount of which will be determined by the Contract Administrator.

.4 Where requested by the Contract Administrator, provide digital photographs to the Contract Administrator of corrected Work in a timely manner.

1.6 REPORTS

.1 Submit digital copies of commissioning, inspection and test reports to the Contract Administrator.

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

1.2 INSTALLATION AND REMOVAL

.1 Provide temporary utilities controls in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.3 TEMPORARY HEATING AND VENTILATION

.1 If required, provide temporary heating required during construction period, including attendance, maintenance and fuel.

.2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.

.1 All heaters for hazardous locations shall be approved for the location.

.3 Provide temporary heat and ventilation in enclosed areas as required to:

.1 Facilitate progress of Work.

.2 Protect Work and products against dampness and cold.

.3 Prevent moisture condensation on surfaces.

.4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.

.5 Provide adequate ventilation to meet health regulations for safe working environment.

.4 Maintain temperatures of minimum 10 °C in areas where construction is in progress or affects existing areas.

.5 Ventilating:

.1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.

.2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.

.3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.

.4 Ventilate storage spaces containing hazardous or volatile materials.

.5 Ventilate temporary sanitary facilities.

.6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.

.6 Permanent heating system of building, to be used when available. Be responsible for damage to heating system if use is permitted.

.7 Maintain strict supervision of operation of temporary heating and ventilating equipment to:

.1 Conform with applicable codes and standards.

.2 Enforce safe practices.

.3 Prevent abuse of services.

.4 Prevent damage to finishes.

.5 Vent direct-fired combustion units to outside.

.8 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.4 TEMPORARY POWER AND LIGHT

.1 City will provide electric power for construction purposes, provided such electric power is not utilized for heating purposes.

.1 The Contractor is responsible for locating an appropriate source of electrical power and providing all breakers, cables, and other temporary facilities for the temporary power.

.2 Connect to existing power supply in accordance with Canadian Electrical Code

.3 Submit plans for temporary power connection in accordance with 01 33 00 – Submittal Procedures.

.4 Upon completion of the Work, disconnect temporary power and make good all connections.

.2 Provide and maintain temporary lighting throughout project.

1.5 TEMPORARY COMMUNICATION FACILITIES

.1 Provide all require temporary communication facilities, and do not interconnect with the City's systems.

1.6 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction governing codes, regulations and bylaws.

.2 Do not burning rubbish and construction waste materials on site.

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 CSA Group (CSA)

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

1.2 INSTALLATION AND REMOVAL

.1 Prepare 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.

.2 Indicate use of supplemental or other staging area.

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

.4 Remove from site all such work after use.

1.3 SCAFFOLDING

.1 Scaffolding in accordance with CAN/CSA-S269.2.

.2 Provide and maintain ramps, platforms, ladders, scaffolding, and temporary stairs as required.

1.4 HOISTING

.1 Provide, operate and maintain hoists and cranes required for moving of materials and equipment.

.2 Hoists and cranes to be operated by qualified operator.

1.5 CONSTRUCTION PARKING

.1 Parking will be permitted on site at designated location, provided it does not disrupt City operations.

.2 Provide and maintain adequate access to project site.

1.6 SECURITY

.1 All security is the responsibility of the Contractor. Do not rely on any City security personnel , system or facility.

1.7 OFFICES

.1 The Contractor may bring a trailer to site.

1.8 SANITARY FACILITIES

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

.2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.9 PROTECTION AND MAINTENANCE OF TRAFFIC

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

.2 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

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

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

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

1.10 CLEAN-UP

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

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

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

Part 2 Products

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 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

1.2 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.

1.3 PROTECTION OF BUILDING FINISHES

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

.2 Provide necessary screens, covers, and hoardings.

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

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 Conform to these reference standards, in whole or in part as specifically requested in specifications.

.2 If there is question as to whether products or systems are in conformance with applicable standards, the Contract Administrator reserves right to have such products or systems tested to prove or disprove conformance.

.1 Cost for such testing will be born by City in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.2 QUALITY

.1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

.2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.3 Should disputes arise as to quality or fitness of products, decision rests strictly with Contract Administrator based upon requirements of Contract Documents.

.4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

1.3 AVAILABILITY

.1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Contract Administrator of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

1.4 STORAGE, HANDLING AND PROTECTION

.1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.

.2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.

.3 Store products subject to damage from weather in weatherproof enclosures.

.4 Store cementitious products clear of earth or concrete floors, and away from walls.

.5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

.6 Touch-up damaged factory finished surfaces to Contract Administrator's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.5 TRANSPORTATION

.1 Pay costs of transportation of products required in performance of Work.

1.6 MANUFACTURER'S INSTRUCTIONS

.1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.

.2 Notify the Contract Administrator in writing, of conflicts between specifications and manufacturer's instructions, so that the Contract Administrator will establish course of action.

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes the Contract Administrator to require removal and re-installation at no increase in Contract Price or Contract Time.

1.7 QUALITY OF WORK

.1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify the Contract Administrator if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. The Contract Administrator reserves right to require dismissal from site, workers deemed incompetent or careless.

.3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Contract Administrator, whose decision is final.

1.8 CO-ORDINATION

.1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.9 REMEDIAL WORK

.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.

.2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.10 LOCATION OF FIXTURES

.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

.2 Inform the Contract Administrator of conflicting installation. Install as directed.

1.11 FASTENINGS

.1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.

.2 Prevent electrolytic action between dissimilar metals and materials.

.3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.

.4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.

.5 Keep exposed fastenings to a minimum, space evenly and install neatly.

.6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.12 PROTECTION OF WORK IN PROGRESS

.1 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of Contract Administrator.

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 City or separate contractor.

.3 Include in request:

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

1.2 MATERIALS

.1 Required for original installation.

.2 Change in Materials:

- .1 Submit request for change in materials in accordance with B7.
- .2 The City and Contract Administrator may reject all change in materials after bid submittal. If change in materials is required to deliver the Work, submit request for substitution in accordance with Section 01 33 00- Submittal Procedures, along with a complete rationale for the substitution.
  - .1 Price is not a valid rationale for substitution after bid submission.

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.

1.4 EXECUTION

.1 Execute cutting, fitting, and patching to complete Work.

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

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

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

.5 Pneumatic or impact tools not allowed on masonry work without prior approval.

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

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

.8 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material in accordance with Section 07 84 00- Firestopping , full thickness of the construction element.

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

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by the City or other Contractors.

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

.4 Provide and use marked separate bins for recycling.

.5 Dispose of waste materials and debris off site.

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

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

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

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

.10 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 Substantially Performance is achieved, 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 other than that caused by City or other contractors.

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

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

.7 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.

.8 Remove dirt and other disfiguration from exterior surfaces.

1.3 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 DEFINITIONS

.1 Hazardous: Exhibiting the characteristics of hazardous substances including properties such as ignitability, corrosiveness, toxicity or reactivity.

.2 Recyclable: The 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.

.3 Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

.4 Reuse: To reuse a construction waste material in some manner on the project site.

.5 Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

.6 Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Storage Requirements: Implement a recycling/reuse program that includes separate collection of waste materials as appropriate to the project waste and the available recycling and reuse programs in the project area.

.2 Handling Requirements: Clean materials that are contaminated before placing in collection containers and ensure that waste destined for landfill does not get mixed in with recycled materials:

.1 Deliver materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to recycling process.

.2 Arrange for collection by or delivery to the appropriate recycling or reuse facility.

.3 Hazardous Waste and Hazardous Materials: Handle in accordance with applicable regulations.

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

.2 Operation and Maintenance Manuals

.1 Prior to Substantial Performance of the Work, submit to the Contract Administrator a digital PDF copy of the Operation and Maintenance Manuals for review.

.2 Submit one (1) digital PDF copy of the final Operation and Maintenance Manuals.

.3 Submit four (4) hardcopy copies of the final Operation and Maintenance Manuals.

.3 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.

1.2 AS -BUILT DOCUMENTS

.1 Maintain on site, one as-built markup copy, of:

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Change Orders and other modifications to Contract.

.5 Reviewed shop drawings, product data, and samples.

.6 Field test records.

.7 Inspection certificates.

.8 Manufacturer's certificates.

.2 As-built markup copy of documents may be physical or digital, provided continuous access is provided to required personnel.

.3 Maintain as-built documents in legible condition.

.4 Keep as-built markup documents available for inspection by the Contract Administrator.

.5 Record information on as-built markup concurrently with construction progress .

.1 Do not conceal Work until required information is recorded.

.6 Contract Drawings and shop drawings: mark each item to record actual construction, including:

.1 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.2 Field changes of dimension and detail.

.3 Changes made by change orders.

.4 Details not on original Contract Drawings.

.5 Referenced Standards to related shop drawings and modifications.

.7 Specifications: mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Addenda and change orders.

.8 Other Documents: maintain inspection certifications, manufacturer's certifications, field test records, required by individual specifications sections.

1.3 Operation and Maintenance Manuals

.1 Prepare Operation and Maintenance (O&M) Manuals.

.1 Provide the services of qualified and experienced personnel to prepare manuals.

.2 Prepare sets of manuals for various divisions using identical bindings, and the same indexing system and format for all manuals (e.g. if there are X number of binder for the entire project they are to be labelled Vol. 1 of Y, Vol. 2 of Y, Vol. 3 of Y, etc.)

.2 Format

.1 Organize data as instructional manual.

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.

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

.1 Identify contents of each binder on spine.

.4 Cover:

.1 City of Winnipeg

.2 Project title (NEWPCC Rehabilitation of Digester No. 11 and Sludge Holding Tanks No. 5 and 7)

.3 Tender No. (630-2019)

.4 Binder Title (e.g. Electrical Operation and Maintenance Manual)

.5 Volume No. (e.g. Vol. X of Y)

.6 Contractor Name.

.5 Arrange each individual binder as follows:

.1 Title Page (first page on inside of binder)

.1 Project title

.2 City of Winnipeg

.3 Tender No

.4 Name, address, telephone number for:

.1 Contractor

.2 Subcontractors (list all applicable to binder contents)

.6 Index (follows Title Page)

.1 Project title

.2 Volume No.

.3 Table of Contents broken out into three columns as follows:

.1 Item No.

.2 Specification reference No.

.3 Description of item

.7 Tabs

.1 Tab Title Page

.1 Item description

.2 Manufacturer

.3 Agent name

.4 Agent address

.5 Agent telephone number

.6 Agent e-mail address

.7 Item No.

.8 Specification reference No.

.9 General description

.2 Permit and Inspection Certificate(s).

.3 Contents of each product / system tab

.1 Part number specific to the item provided

.2 Product information specific to the item provided

.3 Operating procedures and instructions specific to the item provided

.4 Preventive maintenance program specific to the item provided

.5 Servicing schedules specific to the item provided

.6 Spare parts list specific to the item provided

.7 Start-up documentation and check sheets (if applicable)

.8 Warranty information

.9 Shop Drawings: provide with reinforced punched binder tab.

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

.4 Pre-commissioning and Commissioning Forms and reports

.1 Typed

.5 Other data as specified and applicable.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

.3 Store components subject to damage from weather in weatherproof enclosures.

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 performance verification of components, equipment, sub-systems, systems, and integrated systems.

.2 Acronyms:

.1 O&M - Operation and Maintenance.

1.2 DEFINITIONS

.1 Pre-Commissioning – Checking and testing of the equipment and construction to confirm that the equipment is in accordance with the drawings and specifications.

.2 Cold Commissioning – Commissioning processes that are executed prior to introducing process fluids. This may include dry commissioning (without any process fluids), or wet commissioning, which includes more inert fluids, such as water.

.3 Hot Commissioning – Commissioning processes that are executed with the design process fluid.

.4 Start-Up – The commissioning phase when the entire plant, including all systems and sub-systems) are brought into full operation with process fluids, with the intent of complete process operation. Start-up may overlap hot commissioning.

1.3 GENERAL

.1 Commissioning is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project.

.2 Objectives:

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

.2 Ensure appropriate documentation is compiled.

.3 Effectively train O& M staff.

1.4 SCOPE OF COMMISSIONING

.1 The scope of commissioning indicated here does not limit any requirements elsewhere in the Specifications.

.2 The Contractor’s scope of Pre-Commissioning includes:

.1 All power cables installed or modified as part of the Work:

.1 Test in accordance with 26 08 05 - Electrical Acceptance Testing.

.2 All instrumentation and control cables installed or modified as part of the Work:

.1 Inspect and test in accordance with 40 80 11 - Automation Commissioning.

.3 All network cables installed or modified as part of the Work:

.1 Inspect and test in accordance with 40 66 33 – Network Cabling.

.4 D130-LIT

.1 Inspect and test instrument in accordance with 40 80 11 – Automation Commissioning.

.5 D142-FIT

.1 Inspect and test instrument in accordance with 40 80 11 – Automation Commissioning.

.6 D375-P and D376-P

.1 Inspect and test the motors in accordance with 26 08 05 - Electrical Acceptance Testing.

.7 D379-XV and D380-XV

.1 Inspect and test valves in accordance with 40 80 11 – Automation Commissioning.

.8 D384-XV-1 and D384-XV-2

.1 Inspect and test valves in accordance with 40 80 11 – Automation Commissioning.

.9 D386-PE/PIT

.1 Inspect and test instrument in accordance with 40 80 11 – Automation Commissioning.

.10 D939-GDC Gas Detection and Alarming System

.1 Inspect and test in accordance with 40 80 11 – Automation Commissioning.

.11 D1112-HTR Dome Heater

.1 Inspect and test in accordance with 26 08 05 - Electrical Acceptance Testing.

.12 D1113-HTC-1 and D1113-HTC-1

.1 Inspect and test in accordance with 26 08 05 - Electrical Acceptance Testing.

.3 The Contractor's scope of Cold Commissioning includes:

.1 D375-P and D376-P:

.1 Uncouple the motor from the pump, and perform complete commissioning of the motor and VFD, including local and remote control, speed tests and interlock tests.

.2 Test and document motor thermistor connection to the VFD and appropriate interlock action. Test appropriate control system alarm (programmed by the City).

.3 Test and document emergency stop operation and reset. Test appropriate control system alarm(s) (programmed by the City).

.4 Commissioning is limited to proper operation of the equipment. Process interlocks (in the PLC) are not required as part of the commissioning process.

.2 D379-XV and D380-XV:

.1 Commission dry in accordance with 40 80 11 – Automation Commissioning.

.2 Process interlocks (in the PLC) are not required as part of the commissioning process.

.3 D384-XV-1 and D384-XV-2:

.1 Commission dry in accordance with 40 80 11 – Automation Commissioning.

.4 D939-GDC Gas Detection and Alarming System

.1 Commission in accordance with 40 80 11 – Automation Commissioning.

.5 D1112-HTR Dome Heater

.1 Inspect and test and document heater and temperature switch operation.

.2 Measure and document voltage and current at the heater.

.6 D1113-HTC-1 and D1113-HTC-2 heat trace systems.

.1 Inspect and test and document heat trace and heat-trace controller operation.

.2 Measure and document voltage and current at the heater.

.4 The Contractor's scope of Hot Commissioning & Start-up includes:

.1 D939-GDC and associated gas detection system and equipment interlocks in accordance with 40 80 11 – Automation Commissioning;

1.5 CONFLICTS

.1 Report conflicts between requirements of this section and other sections to the Contract Administrator before commissioning and obtain clarification.

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

1.6 FAILURE OF SYSTEMS NOT SUPPLIED UNDER THE CONTRACT

.1 Investigate, at no additional cost to the Contract, failures of components and systems that are part of the scope of the commissioning process, but not supplied in the scope of this Contract.

.1 Investigation is to be sufficient to understand the issue, identify the scope of work, and estimate the cost of repair required. Provide associated documentation.

.2 If the repair work is within the Contractor's typical scope of practice, provide a formal quotation to perform the repair in accordance with E17.

.3 Provide associated investigation documentation and quotation to the Contract Administrator in writing.

.4 Include all relevant information within the Commissioning Documentation.

1.7 COMMISSIONING DOCUMENTATION

.1 Contract Administrator to review and approve Commissioning Documentation.

.2 Provide completed and approved Commissioning Documentation to the Contract Administrator.

1.8 COMMISSIONING SCHEDULE

.1 Provide detailed Commissioning schedule as part of construction schedule.

1.9 COMMISSIONING MEETINGS

.1 Convene commissioning meetings following project meetings.

.2 Purpose:

.1 To resolve issues, monitor progress, identify deficiencies, relating to Commissioning.

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

1.10 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.

1.11 WITNESSING OF TESTING

.1 Provide ten (10) Working Days' notice prior to commencement.

.2 Provide access to Contract Administrator to witness testing.

1.12 TEST RESULTS

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

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

1.13 START OF COMMISSIONING

.1 Notify Contract Administrator at least 21 Calendar Days prior to start of commissioning activities.

1.14 CITY'S PERFORMANCE TESTING

.1 Performance testing of equipment or system by the City or Contract Administrator will not relieve Contractor from compliance with specified 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 REFERENCE STANDARDS

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

.1 Material Safety Data Sheets (MSDS).

.2 Underwriter's Laboratories of Canada (ULC)

.1 CAN-ULC-S115-2018, Fire Tests of Firestop Systems.

1.2 PERFORMANCE REQUIREMENT

.1 Provide firestop systems with materials and installation that achieve a fire rating of not less than the surrounding assembly, the Manitoba Building Code, or as required by the drawings or specification, whichever is greater.

.2 Provide fire stopping systems to provide closures to fire and smoke at openings around all openings and penetrations, including joints, within fire separations and assemblies having a fire-resistance rating.

1.3 QUALITY ASSURANCE

.1 Utilize installers experienced and specialized in the installation of fire stopping systems.

.2 Utilize a quality control program for all fire stopping installation.

1.4 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS - Material Safety Data Sheets.

.3 Test reports:

.1 Submit test reports in accordance with CAN-ULC-S101 for fire endurance and CAN-ULC-S102 for surface burning characteristics.

.4 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

Part 2 Products

2.1 MATERIALS

.1 Fire stopping and smoke seal systems: in accordance with CAN-ULC-S115.

.1 Asbestos-free materials and systems

.2 Fire-resistance rating of installed fire stopping assembly to meet the requirements of the Manitoba Building Code, match existing wall or floor rating, or as required in the drawings or specification, whichever is greater.

.3 Utilize fire stopping materials around cables to allow for re-entry and future modifications.

.4 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

Part 3 Execution

3.1 GENERAL

.1 Follow manufacturer’s instructions and specifications.

3.2 INSTALLATION

.1 Provide a smooth, neat and clean finish to all fire stopping installations.

.2 Remove excess compound promptly as work progresses and upon completion.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group

.1 CSA C22.1-2018, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.

.2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE 100-2013, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.2 DEFINITIONS

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE 100.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 CLOSEOUT SUBMITTALS

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

.2 Certificates:

.1 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to the Contract Administrator and include in the O&M Manuals.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

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

.3 Storage and Handling Requirements:

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

.2 Replace defective or damaged materials with new.

1.6 DRAWINGS AND SPECIFICATIONS

.1 The intent of the Drawings and Specifications is to include all labour, products, and services necessary for complete Work, tested and ready for operation.

.2 These Specifications and the Drawings and Specifications of all other divisions shall be considered as an integral part of the accompanying Drawings. Any item or subject omitted from either the Specifications or the Drawings but which is mentioned or reasonably specified in and by the others, shall be considered as properly and sufficiently specified and shall be provided.

.3 Provide all minor items and Work not shown or specified but which are reasonably necessary to complete the Work.

.4 If discrepancies or omissions in the Drawings or Specifications are found, or if the intent or meaning is not clear, advise the Contract Administrator for clarification before submitting Bid, in accordance with B4.

1.7 FIELD QUALITY CONTROL

.1 The electrical contractor shall:

.1 Hold an A Licence in accordance with the Winnipeg Electrical Bylaw.

.2 The electrical work shall be supervised by an electrician with a current Master Electrician's Licence issued by the Province of Manitoba.

.3 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification.

.1 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.

1.8 PERMITS, FEES AND INSPECTION

.1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Notify the 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.

Part 2 Products

2.1 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates for control items in English.

2.2 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.

.2 Equipment and Material to be CSA certified. Where CSA certified equipment or material is not available, obtain and pay for special approval from the authority having jurisdiction and the Contract Administrator.

.3 Factory assemble control panels and component assemblies.

2.3 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of this Contract and the authority having jurisdiction.

2.4 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates as follows:

.1 Nameplates: lamacoid 3 mm thick plastic engraving sheet, matt white finish, white core, lettering accurately aligned and engraved into core.

.2 Nameplates to be mechanically attached with self-tapping screws, except where this would void or render ineffective the enclosure rating.

.3 Sizes as follows:

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters
Size 8	35 x 100 mm	3 lines	5 mm high letters

.2 Wording on nameplates to be approved by the Contract Administrator prior to manufacture, except for those identified on a provided Lamacoid Schedule.

.3 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.4 Terminal cabinets and pull boxes: indicate system and voltage.

2.5 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 coding: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

2.6 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 5 m intervals.

.3 Colours: 35 mm wide prime colour and 19 mm wide auxiliary colour.

System	Prime Band	Auxiliary Band
600/347V	Yellow	
208/120V and 240V Power	Black	
UPS 208/120V and 240V Power	Black	Green
Control Wiring (120 V)	Black	Orange
Low Voltage Communication / General	Blue	
Low Voltage Control Wiring (<50V)	Blue	Orange

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 the construction of the Work.

.1 Inform the Contract Administrator of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 AS-BUILT DRAWINGS

.1 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 preparing As-Built Drawing markups . As the Work on-site proceeds, clearly record in red all as-built conditions, which deviate from the original Contract Documents.

.1 Alternately, a digital as-built markup system, continuously networked and backed-up to a centralized location is also acceptable, provided it will provide

equivalent results and is acceptable to appropriate Contractor staff members who will be performing the work.

.2 As-Built markups to include:

.1 Circuiting of all devices, conduit and feeder runs (complete with conductor size and number); and

.2 Dimensioned locations of all electrical equipment.

.3 On completion of the Work, two (2) weeks prior to final inspection, submit As-Built Drawings to Contract Administrator for review.

.1 Certify, in writing, that the As-Built Drawings are complete and that they accurately indicate all electrical services, including exposed as well as concealed items.

3.3 ANCHORS

.1 Exercise care where installing anchors into existing concrete elements so as not to damage existing reinforcing.

.1 Locate and mark the existing reinforcing prior to drilling.

.2 Utilize carbide tip drill bits for all anchor installation.

.3 In the event reinforcement is encountered while drilling, terminate the hole and reposition to clear the reinforcement.

.4 Do not use core bits that can easily intercept and damage/cut the reinforcing during drilling.

3.4 DRILLING, CUTTING AND PATCHING

.1 When cutting or drilling holes in existing concrete elements, ensure that existing reinforcing is not cut or damaged:

.1 Locate existing reinforcing utilizing a reinforcing bar locator and mark out on the surface of the concrete.

.2 Firestop and seal all penetrations, regardless of whether the penetration requires a fire rating.

.2 Return exposed surfaces to an as-found condition.

3.5 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.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.

3.6 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

.2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.1 except where specified otherwise.

3.7 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.8 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

3.9 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.10 SYSTEM INSTRUCTION

.1 Instruct City personnel in operation, care and maintenance of systems, system equipment and components.

3.11 CLEANING

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

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

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

3.12 WARNING SIGNS

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

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes requirements for selective demolition and removal of electrical components including removal of conduit, junction boxes, and panels to source (home run removal) and incidentals required to complete work described in this Section.

1.2 DEFINITIONS

.1 Demolish: Detach items from existing construction and legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.

.2 Remove: Planned deconstruction and disassembly of electrical items from existing construction including removal of conduit, junction boxes , cabling and wiring from electrical component to panel taking care not to damage adjacent assemblies designated to remain; legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.

.3 Remove and Salvage: Detach items from existing construction and deliver them to City ready for reuse. Dispose of items that the City decides not to take / reuse.

.4 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

.5 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed and salvaged, or removed and reinstalled.

.6 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by Federal Hazardous Products Act (RSC 1985) including latest amendments.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate work of this Section to avoid interference with work by other Sections.

Part 2 Products

2.1 GENERAL

.1 Supply and install the necessary temporary bracing, supporting structures, guards, warning signs, etc. necessary to complete the project safely and in accordance with all regulations and/or codes.

2.2 REPAIR MATERIALS

.1 Electrical Repair Materials: Use only new materials, CSA or ULC labelled as appropriate and matching components remaining after work associated with components identified for removal or demolition are completed.

.2 Firestopping Repair Materials: Use firestopping materials compatible with existing firestopping systems where removal or demolition work affects rated assemblies, restore to match existing fire rated performance.

2.3 SALVAGE AND DEBRIS MATERIALS

.1 Material Ownership: Demolished materials become Contractor's property and will be removed from Site; except for items indicated as being reused, salvaged, reinstalled, or otherwise indicated to remain the City's property.

.2 Salvaged Materials: Carefully remove materials designated for salvage and store in a manner to prevent damage or devaluation of materials.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Existing Conditions: Visit site, thoroughly examine and become familiar with conditions that may affect work of this Section before tendering Bid; The City will not consider claims for extras for work or materials necessary for proper execution and completion of contract that could have been determined by a site visit.

3.2 COORDINATION

.1 Coordinate work with the City and the Contract Administrator as required to ensure that operational impact is minimized.

3.3 PREPARATION

.1 Protection of Existing Systems to Remain: Protect systems and components indicated to remain in place during selective demolition operations and as follows:

.1 Prevent movement and install bracing to prevent settlement or damage of adjacent services and parts of existing buildings scheduled to remain.

.2 Notify the Contract Administrator and cease operations where safety of buildings being demolished, adjacent structures or services appears to be endangered and await additional instructions before resuming demolition work specified in this Section.

.3 Prevent debris from blocking drainage inlets.

.4 Protect mechanical systems that will remain in operation.

.2 Protection of Building Occupants: Sequence demolition work so that interference with use of the building by the City is minimized and as follows:

.1 Prevent debris from endangering safe access to and egress from occupied buildings.

.2 Notify the Contract Administrator and cease operations where safety of occupants appears to be endangered and await additional instructions before resuming demolition work specified in this Section.

3.4 DEMOLITION

.1 Disconnect electrical circuits and panel feeders; maintain electrical service and main distribution panel as is, ready for subsequent Work.

.2 Remove existing luminaires, electrical devices and equipment including associated conduits, boxes, wiring, and similar items unless specifically noted otherwise.

.3 Perform demolition work in a neat and workmanlike manner:

.1 Remove tools or equipment after completion of work, and leave site clean and ready for subsequent renovation work.

.2 Repair and restore damages caused as a result of work of this Section to match existing materials and finishes.

.4 Remove existing conduits, boxes, cabling and wiring associated with removed luminaires, electrical devices, automation systems and equipment.

.5 Grind off conduits and make flush with surface of concrete where conduits are cast into concrete; seal open ends of conduit with approved fire stopping material and leave in place.

.6 Seal open ends of empty conduit with silicone sealant and leave in place where they are inaccessible or cannot be removed without damaging adjacent construction.

.7 Leave all systems modified by the demolition process in a state that is code compliant.

3.5 SALVAGE

.1 Remove and handle salvageable items on site to minimize damage and to ensure that usability is maintained.

.2 Clean all salvaged items.

.3 Place materials on palettes or wrap in protective film to ensure that loose pieces and projections do not cause injury to personnel, and that salvaged items remain as complete units.

3.6 DISPOSAL

.1 Take all reasonable steps to ensure that equipment removed from site is recycled.

3.7 CLOSEOUT ACTIVITIES

.1 Demolition Waste Disposal: Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle centre) except where explicitly noted otherwise for materials being salvaged for re use or turn-over to the City.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group

- .1 C22.2 No. 0.3, Test Methods for Electrical Wires and Cables.
- .2 CSA-C22.2 No. 38, Thermoset-Insulated Wires and Cables.
- .3 CSA-C22.2 No. 131, Type TECK 90 Cable.
- .4 CSA-C22.2 No. 174, Cables and Cable Glands for Use in Hazardous Locations.
- .5 CSA-C22.2 No. 239, Control and Instrumentation Cables.

1.2 PRODUCT DATA

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

Part 2 Products

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG unless otherwise specified.

.2 Copper conductors: size as indicated, insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE.

.3 Voltage rating:

- .1 Circuits 480 V and less: 600 V; and
- .2 Circuits greater than 480V and up to 600V: 1000V.

.4 Wires 2 AWG and smaller to be factory colour coded. Taping of colour coding is not accepted.

2.2 TECK 90 CABLE

.1 Cable and connectors to:

- .1 CSA 22.2 No. 131.
- .2 CSA 22.2 No. 174 for hazardous locations.

.2 Cable marking:

- .1 TECK90 HL

.3 Conductors:

- .1 Grounding conductor: copper.
- .2 Circuit conductors: copper, size as indicated.

.4 Insulation:

- .1 Cross-linked polyethylene XLPE.

.2 Voltage Rating:

.1 Circuits 480 V and less: 600 V; and

.2 Circuits greater than 480V and up to 600V: 1000V.

.5 Inner jacket: polyvinyl chloride material.

.6 Armour: interlocking aluminum.

.7 Overall covering:

.1 Thermoplastic polyvinyl chloride.

.2 FT4 rated.

.8 Fastenings:

.1 One hole aluminum straps to secure surface cables 50 mm and smaller. Two hole aluminum or stainless steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables.

.3 Threaded rods: stainless steel 6 mm diameter to support suspended channels.

.9 Connectors:

.1 Non-Hazardous Locations:

.1 Watertight, approved for TECK cable.

.2 Hazardous Locations:

.1 CSA approved for the indicated hazardous rating.

.2 Watertight type with:

.1 an elastomeric bevelled bushing.

.2 a funnel entry, splined gland nut.

.3 a non-magnetic, stainless steel grounding device with dual grounding action.

.4 a taper threaded hub.

.5 a hexagonal body and gland nut

.3 Integral seal type with metal-to-metal contact construction.

.4 Sealing of multi-conductor cable shall be accomplished with a liquid type polyurethane compound.

.5 The fitting must:

.1 Provide an environmental seal around the outer jacket of the cable and electrically bond the fitting to the cable armour prior to potting the explosion-proof seal.

.2 Allow the possibility of disconnection without disturbing the environmental seal, the electrical bonding or the explosion proof seal.

.6 All metal-clad cable fittings, for jacketed and non-jacketed interlocked armour cable, shall incorporate an easily-removable armour stop (not requiring fitting disassembly) ensuring proper positioning of the cable armour during cable termination.

.7 Approved products:

.1 T&B Startech XP series; or

.2 Approved equal in accordance with B7.

2.3 VFD CABLE

.1 Cable to:

.1 CSA 22.2 No. 131.

.2 CSA 22.2 No. 174 for hazardous locations.

.2 Cable marking:

.1 Cable shall indicated HL marking for approval in hazardous locations.

.3 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.

.4 Insulation: chemically cross-linked thermosetting polyethylene rated type RW90, 1000 V.

.5 Armour: aluminum, interlocking or continuous.

.6 Overall covering: polyvinyl chloride material.

.7 Approved for six-pulse VFD use.

.8 Fastenings:

.1 One hole aluminum straps to secure surface cables 50 mm and smaller. Two hole aluminum or stainless steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables.

.3 Threaded rods: stainless steel 6 mm diameter to support suspended channels.

.9 Connectors:

.1 In accordance with Teck 90 cable requirements.

2.4 CIC CONTROL CABLE

.1 Cable to:

.1 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.

.1 Shielding as indicated on the drawings.

2.5 ACIC CONTROL CABLE

.1 Cable to:

.1 CSA-C22.2 No. 239, Control and Instrumentation Cables.

.2 CSA 22.2 No. 174 for hazardous locations.

.2 Cable to be specifically marked as “HL” indicating approval for hazardous locations along with the applicable group, group “D”. For example, cables marked as “HLABCD” are acceptable.

.3 Conductors, copper, size as indicated.

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

.5 Shielding as indicated on the drawings.

Part 3 Execution

3.1 GENERAL CABLE INSTALLATION

.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 Lay cable in cable trays in accordance with Section 26 05 36- Cable Trays for Electrical Systems.

.4 Cable Colour Coding:

.1 To Section 26 05 00 - Common Work Results for Electrical.

.5 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.6 Installations in Category 1 Locations

.1 Install the cable with a minimum of 12 mm space from the supporting surface.

.2 Install every joint and cable connectors to be water-tight.

.3 Install grounding and bonding conductors to be protected from corrosion.

.7 Installations in Category 2 Wet Locations:

.1 Comply with all requirements of Category 1 locations.

.8 Installations in Hazardous Class I, Zone 1 Locations:

.1 Explosion-proof cable sealing fittings:

.1 Install sealing fittings as indicated and on all new cable installations to meet Canadian Electrical Code requirements.

.2 Install sealing compound following manufacturer’s instructions.

.9 Installations in Hazardous Class I, Zone 2 Locations:

.1 Explosion-proof cable sealing fittings:

.1 Install sealing fittings as indicated and on all new cable installations to meet Canadian Electrical Code requirements.

.2 Add sealing compound following manufacturer’s instructions.

3.2 INSTALLATION OF TECK90 CABLE (0 -1000 V)

.1 Group cables wherever possible on channels and cable tray. Unless otherwise specified on the drawings, more than two conductors in parallel shall be installed in cable tray.

.2 Install cable exposed, securely supported by straps, hangers, and cable tray.

.3 Where surface mounted, provide clamps spaced a maximum of 1 m apart, unless otherwise indicated.

3.3 INSTALLATION OF VFD CABLE

.1 Install as per Section 3.2.

.2 Space VFD cable a minimum of:

.1 Other 600V motor cables: 150 mm

.2 120/208V wiring: 300 mm

.3 24 VDC instrumentation and control wiring: 450 mm

.4 Instrumentation sensor wiring: 1000 mm

3.4 INSTALLATION OF CIC CONTROL CABLE

.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.

3.5 INSTALLATION OF ACIC CONTROL CABLE

.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.

.4 Sealing of ACIC Control Cable in Hazardous Locations

.1 Ensure cables are marked with the appropriate “HL” and group rating. Appropriately rated cables do not require separation of the individual sub-assemblies such as the shield and individual pairs/triads, unless required by the Inspection Authority.

3.6 TERMINATIONS AND SPLICES

.1 Wire nuts are permitted only in the following circuits:

.1 Lighting circuits.

.2 Receptacle circuits.

.3 Power circuits rated less than 30A.

.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 and Model:

.1 Thomas and Betts Sta-Kon; or

.2 Approved equal in accordance with B7.

3.7 INDENTIFICATION

.1 Install cable tags on all cables.

.2 Install wire tags on all switched and control wiring, or on any wiring where the cable tag together with the wire phase color does not simply identify the wires.

3.8 TESTING

.1 Test all power conductors 10 AWG and larger, as well as all gas detection annunciation wiring (regardless of size), in accordance with 26 08 05 – Electrical Commissioning.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group

.1 CSA C22.1-18, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 CSA C22.2 No.41 (R2017), Grounding and Bonding Equipment (Tri-National Standard, with NMX-J-590ANCE and UL 467).

.3 CSA C22.2 No.65-18, Wire connectors (Tri-National Standard, with UL 486A-486B NMX-J-543-ANCE).

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 connectors and terminations and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

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

.2 Operation and Maintenance Data: submit operation and maintenance data for connectors and terminations for incorporation into manual.

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

.1 Connectors and terminations to CSA C22.2 No. 65.

.2 Configuration:

.1 Long-barrel

.2 Compression type.

.3 2-hole lugs for 2/0 AWG and larger conductors. Smaller conductors may use 1-hole lugs.

.3 Material: of same material as conductor metal. Copper connectors to be tin-plated.

.4 Connectors suitable for 75°C termination.

.5 Hardware for bolting shall be Grade 5, chrome-plated.

.6 Contact aid for aluminum cables where applicable.

.7 Acceptable manufacturers:

.1 Burndy;

.2 Thomas & Betts; or

.3 Approved equal in accordance with B7.

Part 3 Execution

3.1 INSTALLATION

.1 Install connectors and terminations in accordance with manufacturer's instructions.

.2 Bond and ground as required to CSA C22.2 No. 41.

.3 Splices shall not be utilized, except where shown on the drawings or with the written permission of the Contract Administrator.

END OF SECTION

Part 1 General

1.1 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 grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

Part 2 Products

2.1 EQUIPMENT

.1 Bare grounding conductors: bare stranded copper, tinned, soft annealed, size as indicated.

.2 Insulated grounding conductors: green, copper conductors, RW90, size as indicated .

.3 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.

.2 Protective type clamps.

.3 Bolted type conductor connectors.

.4 Thermit welded type conductor connectors.

.5 Bonding jumpers, straps.

.6 Pressure wire connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

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

.2 Protect exposed grounding conductors from mechanical injury.

.3 Use mechanical connectors for grounding connections to equipment provided with lugs.

.4 Soldered joints not permitted.

.5 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

3.2 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems,

frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting, cable trays.

3.3 AUTOMATION SYSTEMS

.1 Install grounding connections for automation systems. Where detailed on the drawings, provide grounding as shown. Where not shown on the drawings, ground in a radial manner from a centralized automation point, avoiding ground loops.

END OF SECTION

Part 1 General

1.1 NONE

.1 None.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 Configuration:

.1 U shape, sized as required for the application.

.2 Employ a complete system from a single manufacturer, complete with all connecting components.

.2 Materials:

.1 Channels & components: Aluminum.

.2 Nuts, bolts, machine screws: stainless steel.

2.2 CONCRETE AND MASONRY ANCHORS

.1 Materials:

.1 Hardened steel inserts, zinc plated for corrosion resistance.

.2 Components:

.1 Non-drilling anchors for use in predrilled holes, sized to safely support the applied load with a minimum safety factor of four.

.3 Manufacturers:

.1 Hilti (Canada) Limited; or

.2 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 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.

.6 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm diameter stainless steel threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.

.7 For surface mounting of two or more conduits or cables, use channels, spaced as required.

.8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.10 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of the Contract Administrator.

.12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

.13 Touch up abraded surfaces and cut ends of galvanized members with an approved galvanizing repair compound.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.1-18, Canadian Electrical Code, Part 1.

.2 CSA 22.2 No. 30 – M1986 (R2016), Explosion-Proof Enclosures for Use in Class I Hazardous Locations

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Provide shop drawings for:

.1 D375-JB and D376-JB.

1.3 DESIGN REQUIREMENTS

.1 Where shown, junction box arrangements shown on the Drawings are indicative of general arrangement only and do not constitute a complete design. Design all junction boxes to meet all applicable code requirements and good industry design practice, including appropriate spacing, conductor bending radius allowances, and wireway fill allowances.

.2 Terminals shall be provided for all:

.1 Other electrical connections, where specified; and

.2 Automation, instrumentation and control wiring.

Part 2 Products

2.1 GENERAL REQUIREMENTS

.1 All enclosures to be CSA approved.

.2 All junction boxes with terminals to be designed and constructed by a CSA approved panel shop.

.3 Provide hinged doors for enclosures with any dimension larger than 150 mm, unless otherwise specified. Provide screw fastened cover for small enclosures.

2.2 JUNCTION AND PULL BOXES IN NON-PROCESS AREAS

.1 Non-process areas are limited to electrical and control rooms and similar locations.

.2 NEMA 1 or 12 type enclosures.

.3 Material: Aluminum or painted mild steel.

2.3 JUNCTION AND PULL BOXES IN NON-HAZARDOUS RATED PROCESS AREAS AND OUTDOOR LOCATIONS

.1 NEMA 4X type enclosures.

.2 Material: Aluminum or stainless steel.

2.4 JUNCTION AND PULL BOXES IN CLASS I, ZONE 2 AREAS

.1 NEMA 4X type enclosures, provided no sparking components and consistent with Canadian Electrical Code requirements. Boxes shall be suitable for the classification shown on the drawings.

.2 Material: Aluminum or stainless steel.

2.5 JUNCTION AND PULL BOXES IN CLASS I, ZONE 1 AREAS

.1 All junction and pull boxes in Class I, Zone 1 locations shall be explosion-proof. Boxes shall be suitable for the classification shown on the drawings.

.2 To CSA C22.2 No. 30.

.3 Provide NEMA 4 and NEMA 7 ratings. This may require the installation of additional seals or other components.

.4 Material: cast aluminum.

2.6 SPECIFIC JUNCTION BOX REQUIREMENTS

.1 D375-JB and D376-JB

.1 Purpose:

.1 Connect two 2/0 AWG VFD-rated TECK90 cables

.2 Enclosure:

.1 NEMA 4X, Screw or hinge cover.

.2 Minimize Size: Designed to accommodate acceptable cable bending radius for the installation configuration proposed by the Contractor.

.3 Provide baseplate.

.3 Power Terminals:

.1 Type: Double ended (power connection on both ends).

.2 Qty: 3 minimum.

.3 200A rated.

.4 Suitable for 2/0 AWG copper wire.

.4 Bonding Terminal:

.1 Suitable for bonding of enclosure and a minimum of three 4 AWG grounding conductors for each of the two cables.

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 Not all junction and pull boxes required for complete installation are shown on the drawings. Install additional pull boxes as required by CSA C22.1. For conduit runs, install pull boxes so as not to exceed 30 m of conduit runs between pull boxes.

3.2 IDENTIFICATION

.1 Equipment Identification: to Section 26 05 00 - Common Work Results for Electrical.

.2 Install size 3 identification labels indicating system voltage and phase, or loop number for control wiring.

.3 Install a permanent label or lamacoid on the cover of all power junction boxes indicating the circuit(s) contained within. Example: CCT L5 (sourced from PNL-L, circuit 5)

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.1-18, Canadian Electrical Code, Part 1.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

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 Provide outlet and conduit boxes rated for the hazardous location.

2.2 CONDUIT BOXES

.1 Cast aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

.2 Provide conduit bodies rated for the hazardous location.

2.3 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.

.3 Provide fittings rated for the hazardous location.

Part 3 Execution

3.1 INSTALLATION

.1 Provide boxes sized as required by the Canadian Electrical Code.

.2 Support boxes independently of connecting cables and conduits.

.3 Provide correct size of openings in boxes for conduit and cable connections. Do not install reducing washers.

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

.5 Install a permanent label or lamacoid on the cover of all power junction boxes indicating the circuit(s) contained within. Example: CCT L5 (sourced from PNL-L, circuit 5)

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 C22.2 No. 18.3-12 (R2017) - Conduit, tubing, and cable fittings (Tri-national standard, with ANCE NMX-J-017 and UL 514B)

.2 CSA C22.2 No. 45-M1981(R2008), Rigid Metal Conduit.

.3 CSA C22.2 No. 56-17, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.4 CSA C22.2 No. 83-M1985(R2003), Electrical Metallic Tubing.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product data: submit manufacturer's printed product literature, specifications and datasheets.

1.3 DESIGN REQUIREMENTS

.1 The Drawings do not show every specific conduit run. Supply and install conduit as required for a complete installation.

.1 Note that armoured cable is acceptable.

.2 The conduit must meet the environmental requirements of each area.

.3 Design conduit support anchorage and support systems for vertical and lateral loading in accordance with the Manitoba Building Code.

.4 Size conduits in accordance with Canadian Electrical Code requirements for wire counts installed. Conductors shall be de-rated according to code requirements.

.5 Minimum conduit size: 21 mm, unless specifically indicated otherwise on the Drawings or approved in writing by the Contract Administrator.

Part 2 Products

2.1 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, threaded.

.1 Material: type 6063, copper-free aluminum alloy.

.2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83.

.1 Acceptable within the Electrical and Control Rooms only.

2.2 CONDUIT FASTENINGS

.1 One-hole aluminum straps to secure surface conduits 50 mm and smaller.

.2 Two hole aluminum straps for conduits larger than 50 mm.

.3 Channel type supports for two or more conduits or as shown on the drawings.

.4 Threaded rods, stainless-steel, 6 mm diameter, to support suspended channels.

2.3 CONDUIT SPACERS

.1 PVC coated malleable iron spacers, CSA approved for the purpose.

.2 Aluminum channel may be utilized where conduits are grouped, however a non-metallic spacer must be provided between the aluminum channel and concrete.

2.4 CONDUIT FITTINGS

.1 Fittings: to CAN/CSA C22.2 No. 18.3, manufactured for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.

.3 Watertight connectors and couplings for EMT.

.1 Set-screws are not acceptable.

.4 Explosion proof conduit sealing fittings:

.1 CSA Certified suitable for Hazardous Locations – Class I, Zone 1, Group IIA.

.2 Material: Cast aluminum.

.5 Sealing Compound. As recommended by manufacturer.

2.5 FISH CORD

.1 Polypropylene.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 ROUTING

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

.2 Avoid routes that would interfere with any potential maintenance activities, including removal and replacement of equipment.

3.3 INSTALLATION

.1 Surface mount conduits.

.2 If using conduit installation to connection to explosion-proof motors, use explosion proof flexible connection.

.3 Install conduit sealing fittings in hazardous areas.

.1 Fill with compound.

.4 Bend conduit cold:

.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.5 Mechanically bend steel conduit over 19 mm diameter.

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

.7 Install fish cord in empty conduits.

.8 Install ground bonding wire in all conduits. Size ground wire as per Canadian Electrical Code Table 16.

.10 Remove and replace blocked conduit sections.

.1 Do not use liquids to clean out conduits.

.11 Dry conduits out before installing wire.

.12 Installations in Category 1 Locations:

.1 Arrange to provide drainage at frequent intervals to suitable locations.

.2 Equip with approved fittings to permit the moisture to drain out of the system.

.3 Install the conduit with a minimum of 12 mm space from the supporting surface.

.4 Install every joint to be water-tight.

.5 Where conduit leaves a warm room and enters a cooler atmosphere, seal the conduit and arrange the conduit in a manner to avoid condensation accumulation at the seal.

.13 Installations in Category 2 Locations:

.1 Comply with all requirements of Category 1 locations.

.14 Installations in Category 2 Wet Locations:

.1 Comply with all requirements of Category 1 locations.

.15 Installations In Hazardous Class I, Zone 1 Locations:

.1 Explosion proof conduit sealing fittings:

.1 Install sealing fittings as indicated and on all new conduit installations to meet Canadian Electrical Code requirements.

.2 Install sealing compound following manufacturer’s instructions.

.16 Installations In Hazardous Class I, Zone 2 Locations:

.1 Explosion proof conduit sealing fittings:

.1 Install sealing fittings as indicated and on all new conduit installations to meet CEC requirements.

.2 Add sealing compound following manufacturer’s instructions.

3.4 SUPPORTS

.1 Maximum spacing for supports:

.1 Rigid Aluminum Conduit

.2	16mm conduit:	1.0 m
.3	21mm conduit:	1.5 m
.4	27mm conduit	1.5 m
.5	35mm conduit	2.0 m
.6	≥ 41mm conduit	2.5 m

3.5 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Group conduits wherever possible on surface and suspended channels.

.3 Provide a minimum space of 12 mm between conduits.

.4 Do not pass conduits through structural members except as indicated.

.5 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

.6 Install spacers as required to provide a space between the conduits and the supporting surface, with a minimum space as follows:

.1 Above grade spaces not classified as CEC Category 1 or 2:

.1 Masonry / concrete surfaces: 6 mm

3.6 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.7 FIRE STOP ASSEMBLIES

.1 Seal and firestop penetration around conduit with ULC approved fire stop assembly for the installation conditions.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CAN/CSA C22.1 No.126-M91(R2002) , Cable Tray Systems.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA VE 2, Cable Tray Installation Guidelines.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data: submit manufacturer's product data sheets for cable tray indicating dimensions, materials, and finishes, including classifications and certifications.

1.3 DESIGN REQUIREMENTS

.1 Design, supply and install cable tray as required for a complete installation.

Part 2 Products

2.1 CABLE TRAY

.1 Ladder type, Class D1 to CAN/CSA C22.2 No. 126.1.

.2 Material: aluminum.

.3 Width: as required.

.4 Depth : 125 mm.

.5 Fittings: horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion joints and reducers where required, manufactured accessories for cable tray supplied.

.6 Barriers where different voltage systems are in same cable tray.

.7 Ground cable trays with #2 AWG bare copper conductor attached to each tray section in accordance with CEC requirements.

2.2 SUPPORTS

.1 Provide splices, supports for a continuously grounded system as required.

2.3 FIRESTOPPING

.1 Provide ULC approved fire stop system at all wall and floor penetrations.

.1 Fire stop system to be one-hour fire rated, or to the required rating of the fire separation, whichever is greater.

.2 Ensure provided system is configured to allow for re-entry as part of future work, without excessive work.

Part 3 Execution

3.1 ROUTING

.1 Route cable tray systems to avoid interference with personnel walkways.

.2 Avoid interference with both routine and infrequent maintenance activities, including repair, removal, and replacement of equipment.

.3 Coordinate with the Contract Administrator regarding routing and make adjustments as determined by the Contract Administrator.

3.2 INSTALLATION

.1 Install complete cable tray system in accordance with NEMA VE 2.

.2 Install cable tray in accordance with the manufacturer's recommendations.

.3 Install cable tray parallel to structure walls, straight and plumb.

.4 Support cable tray on both sides.

.5 Size support system for the maximum allowable load, based upon the CSA Class of the cable tray.

.6 The drawings may not show all details required for mounting or installation. Supply and install any additional items required to complete the installation.

.7 Minimum cable and channel tray fitting radius shall meet or exceed the minimum bending radius of the cables installed.

.8 Install cable tray supports at every 4000mm interval or less as required.

.9 Support cable tray fittings, including expansion joints, within 600mm of both sides of the connection.

.10 Locate splice plates within 600mm of a support.

.11 Expansion joints:

.1 Install expansion joints complete with ground bond as indicated on the drawings.

.2 Install expansion joints at intervals not exceeding 30 m.

.12 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

.13 Install a barrier between 600V power cables and lower voltage instrumentation cables.

.14 Provide a cover for vertical cable trays that are accessible to personnel.

3.3 BONDING

.1 Bond all cable trays in accordance with Canadian Electrical Code requirements.

.2 Install a copper grounding conductor in each cable tray.

.3 Bond the conductor to the cable tray at intervals not exceeding 6000 mm and at all separate joints, fittings, tray sections.

.4 Utilize 2/0 AWG copper bonding conductors, unless otherwise indicated on the drawings.

.5 Conductor type:

.1 Bare in general locations; and

.2 Insulated RW90 in corrosive locations.

3.4 CABLES IN CABLE TRAY

.1 Install cables individually.

.2 Lay cables into cable tray. Use rollers when necessary to pull cables.

.3 Secure cables in horizontal cable tray at 4.5 m centres, with nylon ties, or as shown on the drawings.

.4 Secure cables in vertical cable tray at intervals not exceeding 1.2 m using approved cable clamps.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No.26-13(R2018), Construction and Test of Wireways, Auxiliary Gutters and Associated Fittings.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit data sheets for wireways and auxiliary gutters and include product characteristics, performance criteria, physical size, finish and limitations.

Part 2 Products

2.1 WIREWAYS

.1 Wireways and fittings: to CSA C22.2 No.26.

.2 Control and Electrical Room Locations:

.1 Sheet steel with bolted or hinged cover to give uninterrupted access.

.2 Finish: baked grey enamel in accordance with Section 26 05 00- Common Work Results for Electrical.

.3 Elbows, tees, couplings and hanger fittings manufactured as accessories to wireway supplied.

Part 3 Execution

3.1 INSTALLATION

.1 Install wireways and auxiliary gutters in accordance with manufacturer's written recommendations.

.2 Keep number of elbows, offsets, connections to minimum.

.3 Install supports, elbows, tees, connectors, fittings.

.4 Install barriers where required.

.5 Install gutter to full length of equipment.

.6 Ground metallic wireways and gutters as required.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

- .1 CSA C22.2 No. 100-2014, Motors and Generators.
- .2 CSA C22.2 No. 145-11(R2015), Motors and Generators for Use in Hazardous Locations.
- .3 CSA C390, Test Methods, Marking Requirements, and Energy Efficiency Levels for Three-phase Induction Motors.

.2 American Bearing Manufacturers Association (ABMA):

- .1 ABMA 9, Load Ratings and Fatigue Life for Ball Bearings.
- .2 ABMA 11, Load Ratings and Fatigue Life for Roller Bearings.

.3 American National Standards Institute (ANSI):

- .1 C50.41, Polyphase Induction Motors for Power Generating Stations.

.4 Institute of Electrical and Electronics Engineers, Inc. (IEEE):

- .1 IEEE 85, Test Procedure for Airborne Sound Measurements on Rotating Electric Machinery.
- .2 IEEE 112, Standard Test Procedures for Polyphase Induction Motors and Generators.
- .3 IEEE 620, Guide for the Presentation of Thermal Limit Curves for Squirrel Cage Induction Motors.
- .4 IEEE 841, Standard for Petroleum and Chemical Industry – Severe Duty Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors – up to and Including 500 hp.

.5 National Electrical Manufacturers Association (NEMA):

- .1 NEMA MG 1, Motors and Generators.
- .2 NEMA MG 13, Frame Assignments for Alternating Current Integral Horsepower Induction Motors.
- .3 NEMA 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).

.6 Underwriters Laboratories (UL):

- .1 UL 674, Standard for Safety Electric Motors and Generators for use in Division 1 Hazardous (Classified) Locations.
- .2 UL 2111, Overheating Protection for Motors.

.7 Manitoba Energy Code for Buildings (MECB).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Include: product characteristics, performance criteria, physical size, horsepower, watt rating, limitations and finish.

.3 Shop drawings:

.1 Indicate:

.1 Nameplate data.

.2 Overall dimensions of motor.

.3 Shaft centreline to base dimension.

.4 Shaft extension diameter and keyway, coupling dimensions and details.

.5 Fixing support dimensions.

.6 Dimensioned position of ventilation openings. Details of ventilation duct attachments.

.7 Conduit box (termination) dimensions and usable volume as defined in NEMA MG 1.

.8 Terminal box location and size of terminals.

.9 Arrangement and dimensions of accessories.

.10 Diagram of connections.

.11 Starting current and relative data necessary for use in design of motor starting equipment.

.12 Speed/torque characteristic.

.13 Bearings:

.1 Type, lubrication and life.

.14 Sound level, in accordance with NEMA MG 1.

.15 Weight.

.16 Installation data.

.4 Closeout Submittals:

.1 Provide maintenance data for motors for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Data necessary for maintenance of motors.

.3 Manufacturer's recommended list of spare parts.

.4 Include all Product Data and Shop Drawings.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.

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

.3 Handle motors with suitable lifting equipment.

Part 2 Products

2.1 GENERAL REQUIREMENTS

.1 Motors:

.1 Hazardous locations: to CSA C22.2 No. 145.

.2 Efficiency:

.1 Comply with CSA C390.

.3 Lead markings: to EEMAC M2-1.

.4 City of Winnipeg Requirements:

.1 Motors shall be in compliance and marked in accordance with the City of Winnipeg Electrical By-laws, and information bulletin (2014-013-E/M).

.5 Manufacturer

.1 The manufacturer shall be reputable, normally operating within North America, and have suitable service facilities within two days land travel of the site.

.6 For multiple units of the same type of equipment, furnish identical motors and accessories of a single manufacturer.

.7 Lifting lugs on all motors weighing 45 kg or more.

2.2 CORROSION PREVENTION AND FINISH PAINTING

.1 Provide equipment resistant to corrosion from severe moisture conditions.

.2 All motors in corrosive locations shall use a uniform material for the motor and motor connection box(es).

2.3 ENCLOSURE

.1 Totally enclosed explosion proof for use in: Class I, Zone 1 Group IIA hazardous location.

.2 Suitable for in a corrosive location as per CSA 22.1 Section 22.

.3 Provide the motor frames bonding via a bonding/grounding terminal located in the main power terminal box.

2.4 TERMINAL BOXES

.1 Oversize main terminal boxes for all motors a minimum of 50% larger by volume than required by the NEMA MG 1 standard.

.2 Provide terminal for connection of equipment bonding wire in each terminal box, which effectively bonds the entire motor frame.

2.5 NAMEPLATES

.1 Raised or stamped letters on stainless steel or aluminum.

.2 Display motor data required by NEMA MG 1, paragraphs 10.39 and 10.40 in addition to bearing numbers for both bearings.

.3 Premium efficiency motor nameplates to also display NEMA nominal efficiency, guaranteed minimum efficiency, full load power factor, and maximum allowable kVAR for power factor correction capacitors.

.4 Include CSA or cUL certifications.

.5 Include requirements as per City of Winnipeg Electrical Bylaw and information bulletin (2014-013-E/M).

2.6 APPLICATION

.1 Motor suitable for driving specific pump detailed on the provided shop drawings.

2.7 BEARINGS

.1 Antifriction type bearings, fitted with readily accessible facilities for lubrication while motor running or stationary.

.2 Minimum 100,000 L-10 bearing life as defined in ABMA 9 and 11.

.3 Electrically isolated (insulated) bearings on the non-driven end to prevent circuiting electrical currents.

.4 Bearing isolator mechanical shaft seals to prevent motor contamination from bearing grease.

2.8 THERMAL PROTECTION

.1 Factory installed thermistors, one in each phase, wired in series, wired to identified terminals in motor terminal box.

2.9 STARTING METHOD

.1 Terminate winding connection necessary for appropriate starting method and identify in motor terminal box.

2.10 BALANCE AND VIBRATION CONTROL

.1 In accordance with NEMA MG 1.

2.11 NOISE

.1 Measured in accordance with IEEE 85 and NEMA MG 1.

.2 In accordance with NEMA MG 1.

2.12 FACTORY TESTING

.1 In accordance with CSA C390 for polyphase motors and for single-phase motors.

.2 Routine (production) tests on all motors in accordance with NEMA MG 1, plus no load power at rated voltage and polyphase, rated voltage measurement of locked rotor current. Test multispeed motors at all speeds.

.3 For energy efficient motors, test efficiency at 50, 75, and 100 percent of rated horsepower:

.1 In accordance with CSA C390 or IEEE 112, Test Method B, and NEMA MG 1, paragraphs 12.59. and 12.60.

.4 Power Factor.

.5 Speed.

.6 Current at rated horsepower.

.7 kW input at rated horsepower.

.8 Vibration (balance).

2.13 SPECIFIC D375-P AND D376-P MOTOR REQUIREMENTS

.1 Severe-Duty Explosion-Proof

.2 Frame: 444T

.3 HP: 125

.4 Voltage: 575V

.5 Phase: 3

.6 Design: B

.7 RPM: 1785

.8 Hz: 60

.9 Amb: 40°C

.10 SF: 1.00 (1.15 on sinewave power)

.11 Duty: Continuous

.12 Insul. Class: F

.13 Encl. TEXP (Explosion-proof)

.14 Code: G

.15 Suitable for PWM inverter.

.1 Minimum turndown ratio 5:1.

.16 Weight: 1045 kg (2300 lbs) or less.

.17 Accessories:

.1 Thermister

.1 Terminate thermister leads in terminal box separate from main terminal box.

.18 Bearings:

.1 Insulated on non-drive end;

.2 Non-Insulated on drive end.

.19 Accessories: suitable for use in same hazardous location as that specified for motor.

.20 Include anchor devices and setting templates.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Dry out motor if dampness present in accordance with manufacturer's instructions.

.2 Install motor on baseplate rigid plumb and square, using only lifting facilities provided. Secure with appropriate stainless steel bolts.

.3 Make wiring connections.

.4 Check for correct direction of rotation, with motor uncoupled from driven equipment.

.5 Align and couple motor to driven machinery to manufacturer's instructions, using only correct parts.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 08 05 – Electrical Commissioning.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ANSI/NETA

.1 ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems - 2017 Edition

1.2 ACTION AND INFORMATIONAL SUBMITALS

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

.2 Qualifications

.1 Submit qualifications of technicians performing testing and commissioning.

.3 Testing Report

.1 Provide a draft report a minimum of two weeks after the completion of the testing.

.2 Provide the following in accordance with 01 78 00 - Closeout Submittals:

.1 Five (5) paper copies;

.2 Digital PDF of the report.

.1 Summary PDF of the entire report and all tests; and

.2 A separate PDF for each equipment tested.

.3 Microsoft Word version of the all completed test forms.

1.3 CLOSEOUT SUBMITTALS

.1 Final Report:

.1 Include measurements, final settings and certified test results.

.2 Include completed commissioning forms.

.3 Bear signature of commissioning technician and independent supervisor / technician responsible for checking the work.

.4 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments and modifications as set during commissioning and submit to the Contract Administrator in accordance with Section 01 78 00 - Closeout Submittals.

1.4 INSPECTION AND COMMISSIONING FORMS

.1 The Contract Administrator will provide a base set of standard inspection and commissioning forms. They may be included in the tender package in PDF format.

.2 Supplement the provided forms as required to make a complete commissioning report package. Utilize all Contract Documents together with all submittals, shop drawings and manufacturer’s data as the basis for preparation of the additional commissioning forms.

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

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

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

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

.4 Submit electronic PDF copies of the inspection forms.

.5 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.

Part 2 Products

2.1 Not Used

.1 Not Used

Part 3 Execution

3.1 GENERAL

.1 Perform all testing in accordance with manufacturer's recommendations, which shall supersede the requirements of this specification. If manufacturer's recommendations contradict or limit the application of the specified tests, notify the Contract Administrator and include any modified tests in the report.

3.2 TESTING EQUIPMENT

.1 Equipment function:

.1 Utilize test equipment appropriate for the test being performed.

.2 Equipment condition and calibration:

.1 Ensure all test equipment is in good mechanical and electrical condition.

.2 Utilize a testing organization with a calibration program which assures that all applicable test instruments are maintained within rated accuracy for each test instrument calibrated. The calibration program will include the following:

.1 Maintain up-to-date instrument calibration instructions and procedures for each test instrument calibrated.

.2 Calibrated in within the prior 12 months.

.3 Ensure calibration labels are visible on all test equipment.

.4 Keep and provide access to records showing the date and results of instruments calibrated or tested.

.3 Insulation resistance meters.

.1 Utilize specialized digital units, designed for the intended purpose.

.4 Low-resistance meters:

.1 Utilize specialized digital units, designed for the intended purpose

.2 Resistance range from 1 μΩ to 1000 Ω minimum.

.3 Standard electrician multimeters will not be accepted.

3.3 TESTING REPORT

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

.2 Include the following:

.1 Summary of project.

.2 Testing equipment utilized

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

.3 List of equipment tested.

.4 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. Include all measurements and readings taken Where repairs are made, include measurements and readings before and after the repair.

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

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

.5 Deficiency list:

.1 Itemized list of all repaired deficiencies.

.2 Itemized list of all unrepaired deficiencies, including a detailed description of the deficiency.

3.4 SCOPE OF TESTING

.1 The scope of testing is to include, but not be limited to:

.1 D375-MTR;

.2 D376-MTR;

.3 D375-P2 / D375-P3 (old and new cables as an assembly);

.4 D376-P2 / D376-P3 (old and new cables as an assembly);

.5 D1112-HTR;

.6 D1113-HTC-1 Heat Trace System; and

.7 D1113-HTC-2 Heat Trace System.

3.5 TESTING IN HAZARDOUS LOCATIONS

.1 Perform all tests in accordance with the applicable hazardous location requirements. Refer to E12.

3.6 INPECTION, TESTING AND MAINTENANCE PROCEDURES

.1 General

.1 All tests are based on NETA (InterNational Electrical Testing Association) standard ATS-2017. Where manufacturer's specifications, tolerances, and/or published data are not available, refer to the appropriate tables in ATS-2017.

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

.3 Utilize the existing 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 Specific Requirements:

.1 Perform insulation resistance temperature correction calculations utilizing the correction tables in ATS-2017.

.2 Perform winding resistance temperature correction calculations in accordance with ATS-2017.

3.7 CABLES, < 1000 V (ALSO WIRES IN CONDUIT)

.1 Inspection and testing shall include the following:

.1 Test bolted electrical connections using a low-resistance ohmmeter for:

.1 Cables and wires 4/0 AWG or larger; or

.2 Cables and wires 10 AWG or larger in a hazardous location

.3 Compare bolted connection resistance values to values of similar connections.

.4 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 bonding.

.5 Inspect cable/conduit support.

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

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

.8 Perform an insulation-resistance test on each conductor.

.1 Individually test each conductor with all other conductors and shields grounded.

.2 Test voltage:

.1 300 V rated cables: 500 VDC; and

.2 600 V or 1000 V rated cables. 1000 VDC.

.3 Test duration: one minute.

.4 Investigate resistances less than 1000 megaohms.

.9 Measure and record the length of each cable. Cable jacket length markings may be utilized.

3.8 HEATER, ELECTRIC, AC, <1000 V

.1 Include the following:

.1 Visual inspection.

.1 Visually inspect the Heater, insulation, and connections to the cable for physical damage. Check that no moisture is present. Confirm electrical connections are tight and grounded, and control and monitoring systems are operational and properly set.

.2 Insulation Resistance Test

.3 Heater Power Test

.1 Record ambient temperature.

.2 Record voltage.

.3 Record current.

.4 Calculate power.

3.9 HEAT TRACE SYSTEM, AC, 120 V

.1 Include the following:

.1 Visual inspection.

.1 Visually inspect the pipe, insulation, and connections to the heating cable for physical damage. Check that no moisture is present. Confirm electrical connections are tight and grounded, insulation is dry and sealed, and control and monitoring systems are operational and properly set.

.2 Insulation Resistance Test

.1 Utilize voltage in accordance with manufacturer's recommendations.

.3 Heating Cable Power Test

.1 Record ambient temperature;

.2 Record total current;

.3 Record heating cable length; and

.4 Calculate power per meter (W/m).

.4 Ground Fault Test

.1 Test ground fault breaker in accordance with manufacturer's instructions.

3.10 MOTORS, INDUCTION, AC, 600 V

.1 Include the following:

.1 Record the nameplate data for inclusion in the report.

.2 Inspect physical and mechanical condition.

.3 Inspect anchorage and alignment.

.4 Confirm appropriate bonding connections.

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

.6 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 NETA ATS and ANSI/IEEE Standard 43.

.1 For motors <= 150 kW (200 HP), utilize a test duration of one (1) minute. Calculate the dielectric absorption ratio.

.2 Correct test results to 40 °C.

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

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

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

.13 Test and record resistance of motor thermistors. Note any abnormal values.

.2 Clean the motor.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No. 5-16, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2010).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit load balance reports.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers and ground-fault circuit-interrupters: to CSA C22.2 No. 5.

.2 Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation.

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

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

.1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.5 Circuit breakers to have minimum symmetrical rms interrupting capacity in accordance with the existing panelboard breaker ratings.

Part 3 Execution

3.1 LOAD BALANCE – EXISTING PANELBOARDS

.1 For all panelboards where loads are being added or removed, measure phase voltages and currents, including neutral current, while under normal operating conditions, prior to and after the construction work.

.2 Locate and adjust breakers to balance loads on the panelboard. Coordinate with the Contract Administrator prior to re-locating breakers not being modified as part of this work.

.3 Submit, at completion of work, a report listing phase and neutral currents on panelboards, operating under normal load. Indicate the date and time of the measurements.

3.2 INSTALLATION

.1 Install circuit breakers as indicated.

3.3 IDENTIFICATION

.1 In accordance with Section 26 05 01 – Common Work Results – Electrical

.2 Update all panel schedules.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group

.1 CSA C22.1-2018, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.

1.2 DEFINITIONS

.1 Automation: Includes all instrumentation and control systems to monitor and control process and mechanical systems.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 CLOSEOUT SUBMITTALS

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

.2 Certificates:

.1 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to the Contract Administrator.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

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

.3 Storage and Handling Requirements:

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

.2 Replace defective or damaged materials with new.

1.6 DRAWINGS AND SPECIFICATIONS

.1 The intent of the Drawings and Specifications is to include all labour, products, and services necessary for complete Work, tested and ready for operation.

.2 These Specifications and the Drawings and Specifications of all other divisions shall be considered as an integral part of the accompanying Drawings. Any item or subject omitted from either the Specifications or the Drawings but which is mentioned or reasonably specified in and by the others, shall be considered as properly and sufficiently specified and shall be provided.

.3 Provide all minor items and Work not shown or specified but which are reasonably necessary to complete the Work.

.4 If discrepancies or omissions in the Drawings or Specifications are found, or if the intent or meaning is not clear, advise the Contract Administrator for clarification before submitting Bid, in accordance with B4.

1.7 FIELD QUALITY CONTROL

.1 The automation contractor shall:

.1 Hold an appropriate licence in accordance with the Winnipeg Electrical Bylaw.

.2 The electrical work shall be supervised by an electrician with a current Master Electrician's Licence issued by the Province of Manitoba.

.3 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification.

.1 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.

1.8 PERMITS, FEES AND INSPECTION

.1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Notify the 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.

Part 2 Products

2.1 DESIGN REQUIREMENTS

.1 Language operating requirements: provide identification nameplates for control items in English.

2.2 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.

.2 Equipment and Material to be CSA certified. Where CSA certified equipment or material is not available, obtain and pay for special approval from the authority having jurisdiction and the Contract Administrator.

.3 Factory assemble control panels and component assemblies.

2.3 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates as follows:

.1 Nameplates: lamacoid 3 mm thick plastic engraving sheet, matt white finish, white core, lettering accurately aligned and engraved into core.

.2 Nameplates to be mechanically attached with self-tapping screws, except where this would void or render ineffective the enclosure rating.

.3 Sizes as follows:

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters
Size 8	35 x 100 mm	3 lines	5 mm high letters

.2 Wording on nameplates to be approved by the Contract Administrator prior to manufacture, except for those identified on a provided Lamacoid Schedule.

.3 Nameplates for terminal cabinets and junction boxes to indicate the loop / system.

.4 Terminal cabinets and pull boxes: indicate loop / system.

2.4 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings on both ends of phase conductors.

.1 Wire tags to be heat shrink type with black letters on white background.

.2 Use colour coded wires in communication cables, matched throughout system.

2.5 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 5 m intervals.

.3 Colours: 35 mm wide prime colour and 19 mm wide auxiliary colour.

System	Prime Band	Auxiliary Band
Low Voltage Communication / General	Blue	
Low Voltage Control Wiring (<50V)	Blue	Orange

Part 3 Execution

3.1 AS-BUILT DRAWINGS

.1 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 preparing As-Built Drawing markups . As the Work on-site proceeds, clearly record in red all as-built conditions, which deviate from the original Contract Documents.

.1 Alternately, a digital as-built markup system, continuously networked and backed-up to a centralized location is also acceptable, provided it will provide equivalent results and is acceptable to appropriate Contractor staff members who will be performing the work.

.2 As-Built markups to include:

.1 All wire tags, terminal numbers, and other identification to match the actual installation; and

.2 Dimensioned locations of all automation equipment.

.3 On completion of the Work, two (2) weeks prior to final inspection, submit As-Built Drawings to Contract Administrator for review.

.1 Certify, in writing, that the As-Built Drawings are complete and that they accurately indicate all electrical services, including exposed as well as concealed items.

3.2 ANCHORS

.1 Exercise care where installing anchors into existing concrete elements so as not to damage existing reinforcing.

.1 Locate and mark the existing reinforcing prior to drilling.

.2 Utilize carbide tip drill bits for all anchor installation.

.3 In the event reinforcement is encountered while drilling, terminate the hole and reposition to clear the reinforcement.

.4 Do not use core bits that can easily intercept and damage/cut the reinforcing during drilling.

3.3 DRILLING, CUTTING AND PATCHING

.1 When cutting or drilling holes in existing concrete elements, ensure that existing reinforcing is not cut or damaged:

.1 Locate existing reinforcing utilizing a reinforcing bar locator and mark out on the surface of the concrete.

.2 Firestop and seal all penetrations, regardless of whether the penetration requires a fire rating.

.2 Return exposed surfaces to an as-found condition.

3.4 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.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.

3.5 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

3.6 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, labels and identification nameplates are visible and legible after equipment is installed.

3.7 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

3.8 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.9 SYSTEM INSTRUCTION

.1 Instruct City personnel in operation, care and maintenance of systems, system equipment and components.

3.10 CLEANING

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

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

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA-C22.2 No. 214-17, Communications Cables (Bi-National standard with UL 444).

.2 Telecommunications Industry Association (TIA)/Electronic Industries Alliance (EIA)

.1 TIA/EIA-568.0 (Rev D), Generic Telecommunications Cabling for Customer Premises.

.2 TIA/EIA-568.1 (Rev D), Commercial Building Telecommunications Infrastructure Standard.

.3 TIA/EIA-568.2 (Rev D), Balanced Twisted-Pair Telecommunications Cabling and Components Standard.

.4 TIA/EIA-606 (Rev C), Administration Standard for Telecommunications Infrastructure.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

Part 2 Products

2.1 ETHERNET CABLE, CAT-6, PLENUM RATED

.1 Industrial Grade Cat 6 Ethernet Cable, 100 ohm

.2 to: TIA/EIA-568 and CSA-C22.2 No. 214.

.3 FT6 / CMP rated.

.4 Conductors: 23 AWG copper, solid

.5 Shielding: none

2.2 WORK AREA UTP 4-PAIR MODULAR JACK

.1 Eight-position modular jack ("RJ-45"), Category 6 to: TIA/EIA-568:

.1 In self-contained surface-mount box.

.2 Mounted in compatible double faceplate

2.3 UTP PATCH CORDS

.1 Pre-manufactured and with factory-installed male plug at other end, to mate with "RJ-45" jack

.2 To: TIA/EIA-568

.3 Category 6, 4 pairs.

Part 3 Execution

3.1 GENERAL CABLE INSTALLATION

.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 Lay cable in cable trays in accordance with Section 26 05 36- Cable Trays for Electrical Systems.

.4 Cable Colour Coding:

.1 To Section 26 05 00 - Common Work Results for Electrical.

3.2 INSTALLATION OF HORIZONTAL DISTRIBUTION CABLES

.1 Install horizontal cables as indicated in conduits and cable trays. Identify and label as indicated to: TIA/EIA-606.

.2 Support horizontal cables at intervals not exceeding 2 metres.

3.3 INSTALLATION OF EQUIPMENT CABLES

.1 Install equipment cables from equipment as indicated.

3.4 INDENTIFICATION

.1 Install cable tags on all cables in accordance with the Drawings.

3.5 FIELD QUALITY CONTROL

.1 Test horizontal UTP cables as specified below and correct deficiencies provide record of results in PDF format.

.1 Perform tests for Permanent Link on installed cables, including spares:

.1 Category 6 using certified level III tester to: TIA/EIA-568.

.2 Perform tests for Channel on 100% of cross-connected data horizontal cabling installed.

.1 Category 6 using certified level III tester to: TIA/EIA-568.

.3 Correct deficiencies.

.4 Provide record of results.

.2 Provide record of results in report format as PDF and hardcopy in the O&M manuals.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Refer to Section 01 91 13 – General Commissioning Requirements.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Qualifications

.1 Submit qualifications of technicians performing acceptance testing.

.3 Testing Report

.1 Provide a draft report a minimum of two weeks after the completion of the testing.

.2 Provide the following in accordance with 01 78 00 - Closeout Submittals:

.1 Five (5) paper copies;

.2 Digital PDF of the report.

.1 Summary PDF of the entire report and all tests; and

.2 A separate PDF for each equipment tested.

.3 Microsoft Word version of the all completed test forms.

1.3 CLOSEOUT SUBMITTALS

.1 Final Report:

.1 Include measurements, final settings and certified test results.

.2 Include completed commissioning forms

.3 Bear signature of commissioning technician and independent supervisor / technician responsible for checking the work.

.4 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments and modifications as set during commissioning and submit to the Contract Administrator in accordance with Section 01 78 00 - Closeout Submittals.

1.4 INSPECTION AND COMMISSIONING FORMS

.1 The Contract Administrator will provide a base set of standard inspection and commissioning forms. They may be included in the tender package in PDF format.

.2 Supplement the provided forms as required to make a complete commissioning report package. Utilize all Contract Documents together with all submittals, shop drawings and manufacturer’s data as the basis for preparation of the additional commissioning forms.

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

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

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

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

.4 Submit electronic PDF copies of the inspection forms.

.5 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.

1.5 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.

.4 Correct deficiencies and re-test until satisfactory performance is obtained.

.5 Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.

.6 Perform tests as required.

1.6 COMPLETION OF COMMISSIONING

.1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by the Contract Administrator.

Part 2 Products

2.1 None

.1 None.

Part 3 Execution

3.1 GENERAL

.1 Perform all testing in accordance with manufacturer's recommendations, which shall supersede the requirements of this specification. If manufacturer's recommendations contradict or limit the application of the specified tests, notify the Contract Administrator and include any modified tests in the report.

3.2 TEST EQUIPMENT

.1 Provide sufficient instrumentation to verify and commission the installed system. Provide two-way radios.

.2 Equipment function:

.1 Utilize test equipment appropriate for the test being performed.

.3 Test instrumentation accuracy tolerances: higher order of magnitude than equipment or system being tested.

.4 Equipment condition and calibration:

.1 Ensure all test equipment is in good mechanical and electrical condition.

.2 Utilize a testing organization with a calibration program which assures that all applicable test instruments are maintained within rated accuracy for each test instrument calibrated. The calibration program will include the following:

.1 Maintain up-to-date instrument calibration instructions and procedures for each test instrument calibrated.

.2 Calibrated in within the prior 12 months.

.3 Ensure calibration labels are visible on all test equipment.

.4 Keep and provide access to records showing the date and results of instruments calibrated or tested.

.5 Insulation resistance meters.

.1 Utilize specialized digital units, designed for the intended purpose.

.6 Continuity resistance test:

.1 Digital multimeters are acceptable.

3.3 TESTING REPORT

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

.2 Include the following:

.1 Summary of project.

.2 Testing equipment utilized

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

.3 List of equipment tested.

.4 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. Include all measurements and readings taken Where repairs are made, include measurements and readings before and after the repair.

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

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

.5 Deficiency list:

.1 Itemized list of all repaired deficiencies.

.2 Itemized list of all unrepaired deficiencies, including a detailed description of the deficiency.

3.4 TESTING IN HAZARDOUS LOCATIONS

.1 Perform all tests in accordance with the applicable hazardous location requirements. Refer to E12.

3.5 PROCEDURES

.1 Provide an appropriate number of qualified technicians to test and commission the control system. Some tests may require a minimum of two technicians.

.2 Specific testing requirements:

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

.2 Perform insulation resistance temperature correction calculations utilizing the correction tables in ATS-2017.

3.6 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.

3.7 CONTROL AND INSTRUMENTATION CABLES

.1 Inspection and testing shall include the following:

.1 Torque all accessible terminations.

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

.3 Inspect bonding.

.4 Inspect for proper shield grounding and/or isolation as appropriate.

.5 Inspect cable support.

.6 Perform an insulation-resistance test on each conductor.

.1 Individually test each conductor to all other conductors and shield, and shield to ground.

.2 Test voltage:

.1 500 VDC unless otherwise recommended by manufacturer.

.3 Investigate resistances less than 1000 megaohms.

.7 Perform a continuity resistance test on each conductor.

3.8 GAS DETECTION CONTROLLER

.1 Inspection and testing shall include the following:

.1 Calibrate all gas detection sensors and transmitters in accordance with 3.9.

.2 Configure gas detection controller.

.3 Confirm and document display of alarm levels from each gas detector.

.4 Confirm and document actuation of appropriate alarms from each gas detector.

.5 Confirm and document visibility of the gas alarm strobes from within the entire space.

.6 Confirm and document audibility of the gas alarm sirens within the entire space. Measure with calibrated meter in dBA.

.7 Confirm and document actuation of the interlocked equipment with the gas detection alarms.

.8 Confirm and document appropriate operation of all DCS/PLC alarms (to be programmed by the City).

.9 Demonstrate operation of the system to the Contract Administrator and the City.

3.9 INSTRUMENTATION TRANSMITTERS

.1 Inspection and testing shall include the following:

.1 Confirm the instrument type and class matches the P&ID and other Contract documentation.

.2 Confirm an identification lamacoid is installed.

.3 Confirm installation of sensor complete and correct.

.4 Confirm installation of block and drain valves, as appropriate.

.5 Visually inspect pneumatic / hydraulic tubing.

.6 Leak test pneumatic / hydraulic tubing (not required for Tender 630-2019).

.7 Inspect heat tracing, insulation, and instrument housing as applicable.

.8 Inspect wiring and ensure it matches the Drawings, and As-Built markups are made.

.9 Inspect HMI graphics for correctness (not required for Tender 630-2019).

.10 Test signal loop cable in accordance with 3.7.

.2 Calibrate entire instrument loop. Reference manufacturer's recommendations.

.1 Calibration to include all gas detection transmitters.

.2 Calibration of existing instrument transmitters not required for Tender 630-2019.

3.10 ON-OFF VALVES

.1 Inspection and testing shall include the following:

.1 Torque all accessible terminations.

.2 Inspect cable support.

.3 Inspect for correct anchorage, proper grounding, alignment, clearances and overall mechanical condition.

.4 Test operation of *Local/Remote* switch and status indication to the PLC/DCS.

.5 With the *Local/Remote* switch in the *Local* position, test the operation of the valve with the local *Open/Close* switch.

.6 With the *Local/Remote* switch in the *Remote* position, test the operation of the valve from the PLC/DCS.

.7 Test the operation of the Open and Closed limit switches and indication to the PLC/DCS.

.8 Adjust the limit switches, as applicable, in accordance with manufacturer recommendations.

END OF SECTION

Part 1 General

1.1 QUALIFICATIONS

.1 Assembly of all field control stations with pushbuttons, switches and indicators to be performed by the manufacturer or a CSA approved panelshop.

1.2 REFERENCES

.1 NEMA

.1 NEMA 250-2003, Enclosures for Electrical Equipment (1000 Volts Maximum).

.2 CSA Group (CSA)

.1 CSA-C22.1-18, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit:

.1 Product datasheets.

.2 Shop drawings.

Part 2 Products

2.1 GENERAL

.1 Ensure device of each type is of identical manufacturer and model.

.2 Provide components with CSA or cUL approval.

.3 Operating conditions: -20 – 55 °C with 5 - 95% RH (non-condensing) unless otherwise specified.

2.2 EMERGENCY STOP PUSHBUTTON STATION – CLASS I, ZONE 1 LOCATION

.1 Configuration:

.1 Oversized red mushroom, Push – Pull/Twist to release.

.2 Complete with enclosure

.2 Approved for Class I, Zone 1, Group IIA location.

.3 Rating: NEMA TYPE 7 + NEMA 4.

.1 Provide additional sealing flange and sealing nuts as required to achieve the NEMA 4 rating.

.4 Pushbutton:

.1 Size: 30 mm

.2 Mechanical Life: 250,000 cycles

.5 Contacts:

.1 AC 600 Rating (600 V, 10 A)

.2 Contact Configuration:

.1 As shown on the Drawings

.2 Minimum 2 N.C. contacts

.3 Contact Life: 1,000,000 cycles

.6 Illumination:

.1 Not required unless otherwise indicated.

.7 Acceptable Products:

.1 Allen-Bradley 800H series; or

.2 Approved equal in accordance with B7.

2.3 VALVE LOCAL CONTROL STATION – CLASS I, ZONE 1 LOCATION

.1 Configuration:

.1 Top switch:

.1 Local-Remote switch, 2-position, maintained.

.2 Bottom switch:

.1 Open-Close, 2-position, maintained

.3 Complete with enclosure.

.2 Approved for Class I, Zone 1, Group IIA location.

.3 Rating: NEMA TYPE 7 + NEMA 4.

.1 Provide additional sealing flange and sealing nuts as required to achieve the NEMA 4 rating.

.4 Selector switches:

.1 Size: 30 mm

.2 Mechanical Life: 250,000 cycles

.5 Contacts:

.1 AC 600 Rating (600 V, 10 A)

.2 Contact Configuration:

.1 As shown on the Drawings

.3 Contact Life: 1,000,000 cycles

.6 Illumination: Not required unless otherwise indicated.

.7 Acceptable Products:

.1 Allen-Bradley 800H series; or

.2 Approved equal in accordance with B7.

Part 3 Execution

3.1 GENERAL

3.2 INSTALLATION

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

.2 Locate devices to be unobstructed and readily accessible to operations personnel.

.3 Securely mount the control devices to a secure structural attachment, such as a wall or a strut framing system.

.4 Mount field pushbuttons, switches, and control stations at a height of 1200 mm unless otherwise indicated or approved by the Contract Administrator.

3.3 COMMISSIONING

.1 Pre-commission and commission all pushbuttons, switches and indicators in accordance with 40 80 11 – Automation Commissioning.

3.4 IDENTIFICATION

.1 Identify field devices with lamacoids.

.1 Top of control station to indicate the equipment controlled and device function;

.2 Bottom of control station to indicate the specific device identification.

.2 All identification to be mechanically generated. Handwriting is not acceptable.

.3 Clearly label all selector switch positions.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group

.1 CSA C22.1-2018, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.

.2 CSA 22.2 No. 152-M1984(R2016) Combustible Gas Detection Instruments

.3 CSA 22.2 No 60079-29-1:17 Explosive atmospheres - Part 29-1: Gas detectors - Performance requirements of detectors for flammable gases (Adopted IEC 60079-29-1:2016, second edition, 2016-07, with Canadian deviations)

.4 CSA C22.2 (as applicable)

1.2 STANDARDIZED PRODUCT

.1 The City of Winnipeg has Standardized on Mine Safety Appliance (MSA) Company for all gas detection equipment via Request For Proposal 123-2014.

.2 See E18 and E19.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit product data sheets.

Part 2 Products

2.1 GENERAL

.1 All products to have CSA or cUL approval.

2.2 GAS DETECTION CONTROLLER

.1 Number of channels: 8 or as noted on Drawings.

.2 Channel relay cards: none.

.3 Battery Backup: Not required.

.4 Communication Interface: Modbus TCP

.5 Approved manufacturer and model:

.1 MSA GasGard XL

.2 No alternates or substitutes will be accepted, as this product was selected by the City via RFP 123-2014.

2.3 INFRARED COMBUSTIBLE GAS DETECTOR (SENSOR + TRANSMITTER)

.1 Sensor:

.1 Methane combustible gas, 0 – 100 percent LEL

.2 Type: infrared.

.3 Mounting: Remote housing with mounting bracket.

.2 Approvals

.1 CSA

.3 Enclosure:

.1 Explosion-proof.

.2 Suitable for Class I, Zone 1, Group IIA, Temperature Code T1.

.4 Power Supply

.1 Not required.

.5 Transmitter Display:

.1 Required.

.6 Transmitter Output:

.1 3-wire, 4-20 mA with HART

.7 Maintenance Port:

.1 Integrated explosion-proof / intrinsically-safe HART port.

.8 Relays:

.1 None, unless otherwise noted.

.9 Language

.1 English

.10 Mounting brackets:

.1 As required.

.11 Integrated accessories

.1 Integrated explosion-proof HART port

.12 Approved manufacturer and model:

.1 MSA Ultima XIR

.2 No alternates or substitutes will be accepted, as this product was selected by the City via RFP 123-2014.

2.4 SIREN, HAZARDOUS CLASS I, ZONE 1 RATED

.1 Function: Audible Alarm

.2 General

.1 Approvals: CSA or cUL

.2 Hazardous Rating: Class I, Zone 1, Group IIA, Temperature Code T1.

.3 Performance:

.1 Sound Output Level: >100 dB nominal at 3m.

.4 Environmental:

.1 Operating Temperature: -4°C to 40°C.

.2 Suitable for corrosive locations.

.5 Features:

.1 Projector: required.

.6 Enclosure:

.1 Type: NEMA 4X

.2 Mounting: Surface Mount

.7 Power:

.1 Voltage: 120 VAC, 60 Hz.

.2 Current: 0.25A or less.

.8 Manufacturer and Model:

.1 Federal Signal SSTX3-MV; or

.2 Approved equal in accordance with B7.

2.5 STROBE, HAZARDOUS CLASS I, ZONE 1 RATED

.1 Function: Visual Alarm

.2 General

.1 Approvals: CSA or cUL

.2 Hazardous Rating: Class I, Zone 1, Group IIA, Temperature Code T1.

.3 Lamp Type: LED.

.4 Dome Colour: Red.

.5 Type: Rotating Reflector or flashing bulb.

.3 Performance:

.1 Light Intensity: 2,000,000 candela peak, 850 cd ECP.

.2 Flash Rate: 60 - 80 per minute

.3 Lamp Life: 10,000 hours

.4 Environmental:

.1 Operating Temperature: -20°C to 40°C.

.2 Suitable for corrosive locations.

.5 Enclosure:

.1 Type: Explosion-proof, NEMA 4X

.2 Mounting: Surface Mount, wall mount, or ceiling pendant mount as required.

.6 Power:

.1 Voltage: 120 VAC, 60 Hz.

.2 Current: 1.25A or less.

.7 Manufacturer and Model:

.1 Federal Signal 27XST; or

.2 Approved equal in accordance with B7.

2.6 ACCESSORIES

.1 Provide the latest version of the GasGard XL Configuration Software.

.2 Provide one intrinsically safe handheld IR Ultima Controller/Calibrator for Calibration and Configuration of gas detectors.

.3 Provide one MSA Hart Port cable, for use with the integrated explosion-proof HART port.

.4 Provide a calibration kit with sufficient number of gas cylinders to calibrate supplied gas detectors.

Part 3 Execution

3.1 INSTALLATION

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

.2 Mount equipment in Category 1 and Category 2 wet locations a minimum of 12 mm from supporting surface as per the Canadian Electrical Code Section 22.

3.2 SENSORS

.1 Mount methane combustible gas sensors on the ceiling.

.2 The location indicated on the drawing is approximate. Locate to avoid mechanical or airflow interferences that would prevent the sensor from rapidly detecting a gas leakage. Notify the Contract Administrator of any location concerns or questions and install as directed.

3.3 TRANSMITTERS

.1 Mount transmitters in an accessible location.

.2 Mount at a height of 1500 mm AFF, unless otherwise noted.

3.4 SIRENS

.1 Mount sirens such as to provide maximum audibility.

.2 Select siren tone unless otherwise directed by the Contract Administrator.

3.5 STROBES

.1 Mount strobes such as to provide maximum visibility.

.1 Avoid obstructions that would impair visibility, including equipment, structural beams and columns.

.2 Provide pendants and other accessories as required to locate strobes appropriately.

3.6 CONFIGURATION

.1 Configure the gas detectors as required.

.2 Configure the gas detection controller(s) in accordance with the Drawings.

.3 Provide technical services to configure the complete gas detection system.

3.7 COMMISSIONING

.1 Calibrate all gas detection sensors.

.2 Measure and map the sound levels of the sirens within the entire room(s) covered by the horns with a calibrated sound meter. Provide a report indicating the ambient sound level, and the average, maximum, and minimum horn sound levels in dBA with and without the sirens in operation.

.3 Commission in accordance with 40 80 11 – Automation Commissioning.

3.8 TRAINING

.1 Provide training in accordance with E19.5.

END OF SECTION

Part 1 General

1.1 QUALIFICATIONS

.1 All control panel modifications shall be constructed by a CSA/cUL-approved manufacturer.

1.2 DESIGN REQUIREMENTS

.1 Drawings provided may not detail all hardware components such as labels, stoppers, rail lifters, end plates, separators, etc.

.2 Design, supply and install all components required for a complete installation.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit:

.1 Product datasheets.

.2 Shop drawings, including panel modifications for CP-D91.

1.4 CLOSEOUT SUBMITTALS

.1 As-Built Drawings

.1 Provide as-built drawings for all shop drawings.

Part 2 Products

2.1 GENERAL

.1 Ensure device of each type is of identical manufacturer and model.

.2 Provide components with CSA or cUL approval.

2.2 DIN RAILS

.1 Utilize DIN Rail style TS 35mm, slotted.

.2 When used to hold terminals, Attach rails to mounting feet to raise them to the same height as the highest adjacent wiring duct.

.1 Do not use mounting feet when the rail holds heavy components.

2.3 TERMINALS

.1 Configuration

.1 Screw clamp terminal.

.2 Voltage rating:

.1 300V for general control circuits.

.2 600V for power circuits.

.3 Select terminal blocks:

.1 For the size of the wires to be connected to them.

.2 To match the configuration as required by the drawings.

.3 To exceed the current rating requirements of the circuit.

.4 Manufacturer:

.1 Weidmuller;

.2 Phoenix Contact; or

.3 Approved equal in accordance with B7.

2.4 TERMINALS – FUSED

.1 Configuration:

.1 Screw clamp terminal.

.2 Fuse plug insert into terminal.

.3 LED blown-fuse indication.

.2 Voltage rating:

.1 300V for general control circuits.

.2 600V for power circuits.

.3 Select fused terminal blocks:

.1 For the size of the wires to be connected to them.

.2 To match the configuration as required by the drawings.

.3 To exceed the current rating requirements of the circuit.

.4 Manufacturer:

.1 Weidmuller;

.2 Phoenix Contact; or

.3 Approved equal in accordance with B7.

2.5 SOLID STATE RELAYS

.1 Type: Solid state, transistor-based.

.2 Enclosure style: 35 mm DIN-Rail mounted terminal-style

.3 Input:

.1 24 VDC, or as required by the Drawings.

.4 Output:

.1 Contact configuration as required by the Drawings.

.2 48 VDC rated.

.3 Minimum current rating: 100 mA continuous.

.4 Voltage drop at max load: ≤ 1 V.

.5 Switching Frequency: 300 Hz.

.6 Insulation rating: 300V.

.7 Approvals: CSA and/or cULus;

.8 Terminal type: Screw clamp

.9 Status indicator: LED

.10 Manufacturer:

.1 Omron;

.2 Weidmuller;

.3 Phoenix Contact; or

.4 Approved equal in accordance with B7

2.6 CONTROL RELAYS

.1 Contact rating:

.1 NEMA A600 contact rating (10A @ 600VAC)

.2 Approvals: CSA

.3 Coil voltage as required by the circuits on the Drawings.

.4 Contact configuration as required by the Drawings.

.5 Terminal type: Screw clamp

.6 Manufacturer:

.1 Omron;

.2 Schneider Electric; or

.3 Approved equal in accordance with B7.

2.7 NAMEPLATES

.1 Lamacoid material with a white background and engraved black letters for internal and external components.

.2 Suitable to resist harsh industrial conditions.

2.8 WIRING

.1 Power wiring

.1 Sized in accordance with Drawings, CSA 22.1, CSA 22.2, or 12 AWG; whichever is larger.

.2 Analog signal wiring

.1 All analog signal wiring shall be 18 AWG shielded twisted-pair or triad, as applicable.

.2 Approved Products:

.1 Belden No. 8760,

.2 Or approved equal in accordance with B7.

.3 Discrete signal wiring

.1 Type TEW stranded conductor.

.2 Size: 16 AWG or larger as required.

.4 Colors:

120 VAC Power / Line:	Black
120 VAC Control:	Red
120 VAC Neutral:	White
24 VDC Power / Line:	Black
24 VDC Control:	Blue
24 VDC Common:	White/Blue
120 VAC Supplied from an external power source:	Orange
120 VAC Neutral from an external power source:	White/Orange
4-20mA	White (+), Black (-)
Ground	Green or Green/Yellow

2.9 ETHERNET PATCH CORDS

.1 Requirements:

.1 Cat-6.

.2 Jacket colour: Blue.

2.10 WIRING DUCT

.1 Narrow slot wiring duct.

.2 Color:

.1 General purpose: gray

.3 Approved Manufacturer:

.1 Panduit

.2 Or approved equal in accordance with B7.

Part 3 Execution

3.1 GENERAL

.1 Mount all non-DIN rail mountable devices in the control panel shall to the back panel with either tapped or self-tapping screws.

.2 Provide spacing for appropriate device thermal management, with manufacturer's recommended spacing as a minimum requirement.

.3 Mount all components such that they are accessible for testing and maintenance purposes, including wiring or component replacement.

.4 Mount all components so that any component can be replaced without removing the sub-panel or other components.

.5 Supply and install all required fuses.

.6 Locate and group components to minimalize electrical noise interference on other components.

.7 Ensure panel areas designated for future equipment remain clear without any interference for future component installation, including field wiring.

.8 Ensure appropriate space is provided for the entrance, routing and termination of field cables into the panel.

.9 Ensure the rating of the enclosure is maintained, considering all panel cut-outs and penetrations.

3.2 IDENTIFICATION

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

.2 Identify components on the front of the panel with an individual permanent nameplate installed in an organized manner. The nameplate must identify the component's function.

.3 Identify each component inside the control panel shall be identified with a nameplate corresponding to the drawings.

.4 Label terminals as shown on drawings, with labels on both sides of the terminals.

.5 Install a group label above each terminal block with terminal block group name.

.6 Base identification on the Drawings and other supplied documents. Request clarification from the Contract Administrator if an inconsistency in identification is found.

3.3 TERMINAL BLOCKS

.1 Unless specifically indicated on the drawings, separate power, digital and analog terminals from each other.

.2 Use machine-printed labelling to label both sides of the terminal blocks with appropriate identification consistent with the Drawings.

.3 Use terminal bus connectors to connect terminals with equal potential, where indicated on the Drawings and where otherwise possible to minimize daisy-chaining of wiring.

3.4 BONDING / GROUNDING

.1 Bond / ground all control panel components in accordance with code requirements and component manufacturer instructions.

.2 Bond all panel mounted devices on or within the panels to ground.

.3 Provide supplementary bonding conductors for back panels and doors.

.4 Attach a separate bonding conductor to all devices that are not firmly fastened to the panels with screws. This includes case mounted instruments, meters, etc.

3.5 WIRING

.1 Install all panel wiring in a near and orderly manner.

.2 Install wire ferrules on all wiring 16 AWG and smaller.

.3 Wiring splices are not permitted within the panel.

.4 Power Wiring

.1 Do not terminate more than one conductor on each terminal.

.5 Control Wiring

.1 Do not terminate more than two (2) conductors on each terminal.

.6 Where possible, connect all internal panel conductors shall be connected to the same side of a terminal block, and allocate space for field/external conductors to the other side.

.7 Label both ends of each wire.

.8 Utilize machine printed non-slip labels. Wrap-around or self-adhesive markers shall not be permitted.

.9 Position wire labels to be readily visible and readable. This includes, but is not limited to ensuring that:

.1 Wire labels do not need to be rotated to be read;

.2 Wiring duct covers do not need to be removed; and

.3 Other wires do not need to be relocated to allow wire labels to be read.

.10 Twisted-pair / triad wiring:

.1 Insulate shield with heat shrink where prone to potential contact with other wiring, shields, or ground.

.2 Provide heat shrink over cable at the end of the jacket.

.11 Group and form wiring into a loop when going from a fixed part of the panel to a door such that there is sufficient slack to minimize strand fatigue and breaking. Support each end of the loop.

3.6 WIRING DUCT

.1 Unless shown otherwise on the Drawings, provide separate wire ducts for power and 120 VAC wiring from 24 VDC and analog circuits. 120 VAC wires may cross other circuits perpendicularly.

.2 Utilize wiring duct to enclose all wiring. The maximum distance that a wire of cable, should not be within a wiring duct is 5 cm within the panel interior and 10 cm on the outside edge of the panel interior.

.3 Size wire ducts such that they are filled to a maximum of 50% of their area, at any point in the wiring duct.

.4 Provide covers for all wiring ducts.

3.7 TESTING

.1 Provide comprehensive control panel testing.

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

.3 The various test procedures described herein is not exhaustive, and does not relieve the Contractor's responsibility to provide comprehensive testing to demonstrate appropriate panel operation.

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

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

.6 Testing to include:

.1 Power supply.

.2 PLC components.

.3 Point to point tests of all inputs, outputs and control wiring.

.4 Relays.

.5 Selector switches, pushbuttons and indicator lights.

.6 E-stop system component functionality.

.7 Repeat tests where the panel is modified after tests have been performed.

3.8 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 QUALIFICATIONS

.1 All automation junction boxes with more than three (3) terminals shall be constructed by a CSA/cUL-approved manufacturer.

1.2 DESIGN REQUIREMENTS

.1 Where design drawings are provided, they are indicative only.

.2 Drawings provided may not detail all hardware components such as labels, stoppers, rail lifters, end plates, separators, etc. Design, supply and install all components required for a complete installation.

.3 Design junction boxes for the required terminals and space required for all wiring. Junction box enclosures shown on the drawings are indicative and may require a larger size based upon the design.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit:

.1 Product datasheets.

.2 Shop drawings.

1.4 CLOSEOUT SUBMITTALS

.1 As-Built Drawings

.1 Provide as-built drawings for all shop drawings.

Part 2 Products

2.1 GENERAL

.1 Ensure device of each type is of identical manufacturer and model.

.2 Provide components with CSA or cUL approval.

2.2 ENCLOSURES

.1 Enclosure rating:

.1 Hazardous Class I, Zone 1, Group IIA location:

.1 Explosion-proof.

.2 Cast- aluminum.

.2 Hazardous Class I, Zone 2, Group IIA location:

.1 NEMA 4X unless otherwise indicated on the drawings.

.3 Unclassified outdoor or process area location:

.1 Category 1, Category 2, Category 2 Wet locations:

.1 Aluminum or Stainless Steel NEMA 4X unless otherwise indicated on the drawings.

.2 Other dry, non-corrosive locations:

.1 NEMA 4 unless otherwise indicated on the drawings.

.4 Electrical or control room location:

.1 NEMA 12.

.2 Exterior finish: ANSI 61 Grey.

.3 Continuous hinge.

.4 Door clamps for closing.

.5 Provide back-panel for mounting of components.

.6 Ensure enclosure is suitable for carrying the weight of the equipment mounted inside the panel and on the doors without any warpage.

.7 Manufacturer:

.1 Hammond Manufacturing;

.2 nVent Hoffman; or

.3 Approved equal in accordance with B7.

2.3 DIN RAILS

.1 Utilize DIN Rail style TS 35mm, slotted.

2.4 TERMINALS

.1 Configuration

.1 Screw clamp terminal.

.2 Voltage rating:

.1 300V for general control circuits.

.2 600V for power circuits.

.3 Select terminal blocks:

.1 For the size of the wires to be connected to them.

.2 To match the configuration as required by the drawings.

.3 To exceed the current rating requirements of the circuit.

.4 Manufacturer:

.1 Weidmuller;

.2 Phoenix Contact; or

.3 Approved equal in accordance with B7.

2.5 TERMINALS – FUSED

.1 Configuration:

.1 Screw clamp terminal.

.2 Fuse plug insert into terminal.

.3 LED blown-fuse indication

.2 Voltage rating:

.1 300V for general control circuits.

.2 600V for power circuits.

.3 Select fused terminal blocks:

.1 For the size of the wires to be connected to them.

.2 To match the configuration as required by the drawings.

.3 To exceed the current rating requirements of the circuit.

.4 Manufacturer:

.1 Weidmuller;

.2 Phoenix Contact; or

.3 Approved equal in accordance with B7.

2.6 NAMEPLATES

.1 Lamacoid material with a white background and engraved black letters for internal and external components.

.2 Suitable to resist harsh industrial conditions.

2.7 WIRING

.1 Power wiring

.1 Sized in accordance with Drawings, CSA 22.1, CSA 22.2, or 12 AWG; whichever is larger.

.2 Analog signal wiring

.1 All analog signal wiring shall be 18 AWG shielded twisted-pair or triad, as applicable.

.2 Approved Products:

.1 Belden No. 8760,

.2 Or approved equal in accordance with B7.

.3 Discrete signal wiring

.1 Type TEW stranded conductor.

.2 Size: 16 AWG or larger as required.

.4 Colors:

120 VAC Power / Line:	Black
120 VAC Control:	Red

120 VAC Neutral:	White
24 VDC Power / Line:	Black
24 VDC Control:	Blue
24 VDC Common:	White/Blue
120 VAC Supplied from an external power source:	Orange
120 VAC Neutral from an external power source:	White/Orange
4-20mA	White (+), Black (-)
Ground	Green or Green/Yellow

2.8 WIRING DUCT

.1 Narrow slot wiring duct.

.2 Color:

.1 General purpose: gray

.3 Approved Manufacturer:

.1 Panduit

.2 Or approved equal in accordance with B7.

Part 3 Execution

3.1 GENERAL

.1 Mount all non-DIN rail mountable devices in the control panel shall to the back panel with either tapped or self-tapping screws.

.2 Provide spacing for appropriate device thermal management, with manufacturer's recommended spacing as a minimum requirement.

.3 Mount all components such that they are accessible for testing and maintenance purposes, including wiring or component replacement.

.4 Mount all components so that any component can be replaced without removing the sub-panel or other components.

.5 Supply and install all required fuses.

.6 Locate and group components to minimalize electrical noise interference on other components.

.7 Ensure panel areas designated for future equipment remain clear without any interference for future component installation, including field wiring.

.8 Ensure appropriate space is provided for the entrance, routing and termination of field cables into the panel.

.9 Ensure the rating of the enclosure is maintained, considering all panel cut-outs and penetrations.

3.2 IDENTIFICATION

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

.2 Identify components on the front of the panel with an individual permanent nameplate installed in an organized manner. The nameplate must identify the component's function.

.3 Identify each component inside the control panel shall be identified with a nameplate corresponding to the drawings.

.4 Label terminals as shown on drawings, with labels on both sides of the terminals.

.5 Install a group label above each terminal block with terminal block group name.

.6 Base identification on the Drawings and other supplied documents. Request clarification from the Contract Administrator if an inconsistency in identification is found.

3.3 TERMINAL BLOCKS

.1 Unless specifically indicated on the drawings, separate power, digital and analog terminals from each other.

.2 Use machine-printed labelling to label both sides of the terminal blocks with appropriate identification consistent with the Drawings.

.3 Use terminal bus connectors to connect terminals with equal potential, where indicated on the Drawings and where otherwise possible to minimize daisy-chaining of wiring.

3.4 BONDING / GROUNDING

.1 Bond / ground all control panel components in accordance with code requirements and component manufacturer instructions.

.2 Bond all panel mounted devices on or within the panels to ground.

.3 Provide supplementary bonding conductors for back panels and doors.

.4 Attach a separate bonding conductor to all devices that are not firmly fastened to the panels with screws. This includes case mounted instruments, meters, etc.

3.5 WIRING

.1 Install all panel wiring in a near and orderly manner.

.2 Install wire ferrules on all wiring 16 AWG and smaller.

.3 Wiring splices are not permitted within the panel.

.4 Power Wiring

.1 Do not terminate more than one conductor on each terminal.

.5 Control Wiring

.1 Do not terminate more than two (2) conductors on each terminal.

.6 Where possible, connect all internal panel conductors shall be connected to the same side of a terminal block, and allocate space for field/external conductors to the other side.

.7 Label both ends of each wire.

.8 Utilize machine printed non-slip labels. Wrap-around or self-adhesive markers shall not be permitted.

.9 Position wire labels to be readily visible and readable. This includes, but is not limited to ensuring that:

.1 Wire labels do not need to be rotated to be read;

.2 Wiring duct covers do not need to be removed; and

.3 Other wires do not need to be relocated to allow wire labels to be read.

.10 Twisted-pair / triad wiring

.1 Insulate shield with heat shrink where prone to potential contact with other wiring, shields, or ground.

.2 Provide heat shrink over cable at the end of the jacket.

.11 Group and form wiring into a loop when going from a fixed part of the panel to a door such that there is sufficient slack to minimize strand fatigue and breaking. Support each end of the loop.

3.6 WIRING DUCT

.1 Unless shown otherwise on the Drawings, provide separate wire ducts for power and 120 VAC wiring from 24 VDC and analog circuits. 120 VAC wires may cross other circuits perpendicularly.

.2 Utilize wiring duct to enclose all wiring. The maximum distance that a wire of cable, should not be within a wiring duct is 5 cm within the panel interior and 10 cm on the outside edge of the panel interior.

.3 Size wire ducts such that they are filled to a maximum of 50% of their area, at any point in the wiring duct.

.4 Provide covers for all wiring ducts.

3.7 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