Part 1 General

1.1 ADMINISTRATIVE

.1 Submit to Contract Administrator submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

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

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

.4 Where items or information is not produced in SI Metric units converted values are acceptable. Review submittals prior to submission to Contract Administrator. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

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

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

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

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

.9 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 The Contractor shall arrange for the preparation of clearly identified Shop Drawings as specified or as the Contract Administrator may reasonably request. Shop Drawings are to clearly indicate materials, weights, dimensions, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of the Work. Where articles or equipment attach or connect to other articles or equipment, clearly indicate that all such attachments and connections have been properly coordinated, regardless of the trade under which the adjacent articles or equipment will be supplied and installed. Shop Drawings are to indicate their relationship to design Drawings and Specifications. Notify the Contract Administrator in writing of any deviations in Shop Drawings from the requirements of the Contract Documents.

.3 The Contractor shall examine all Shop Drawings prior to submission to the Contract Administrator to ensure that all necessary requirements have been determined and verified and that each Shop Drawing has been checked and coordinated with the requirements of the Work and the Contract Documents. Examination of each Shop Drawing shall be indicated by stamp, date and signature of a responsible person of the sub-contractor for supplied items and of the General Contractor for fabricated items.

Shop Drawings not stamped, signed and dated will be returned without being reviewed and stamped "Re-submit".

.4 The Contractor shall submit a Shop Drawings delivery schedule and provide Shop Drawings in an orderly sequence so as to cause no delay in the Work. Failure to submit Shop Drawings in ample time is not to be considered sufficient reason for an extension of Contract time and no claim for extension by reason of such default will be allowed. Jointly prepare a schedule fixing the dates for submission and return of Shop Drawings.

.5 The Contract Administrator will review and return Shop Drawings in accordance with the schedule agreed upon or otherwise with reasonable promptness so as to cause no delay in the Work.

.6 Submit three (3) paper copies of all submittals or one (1) PDF copy.

.1 PDF submittals are to be in a high quality format. If scanned, utilize sufficient resolution to ensure that all details of the document are easily readable.

.7 Delete information not applicable to project.

.8 Shop Drawing reviews by the Contract Administrator is solely to ascertain conformance with the general design concept. Responsibility for approval of detail design inherent in Shop Drawings rests with the Contractor and review by the Contract Administrator shall not imply such approval.

.9 Shop Drawings will be returned to the Contractor with one of the following notations:

.1 When stamped "REVIEWED" or "NO EXCEPTIONS TAKEN", distribute additional copies as required for execution of the Work.

.2 When stamped "REVIEWED AS MODIFIED" or "MAKE NOTED CORRECTIONS", ensure that all copies for use are modified and distributed, same as specified for "REVIEWED".

.3 When stamped "REVISE AND RESUBMIT", make the necessary revisions, as indicated, consistent with the Contract Documents and submit again for review.

.4 When stamped "NOT REVIEWED" or "REJECTED", submit other Drawings, brochures, etc., for review consistent with the Contract Documents.

.5 Only Shop Drawings bearing "REVIEWED", "NO EXCEPTIONS TAKEN", "MAKE NOTED CORRECTIONS", or "REVIEWED AS MODIFIED" shall be used on the Work unless otherwise authorized by the Contract Administrator.

.6 After submittals are stamped "REVIEWED", "NO EXCEPTIONS TAKEN", "MAKE NOTED CORRECTIONS" or "REVIEWED AS MODIFIED", no further revisions are permitted unless re-submitted to the Contract Administrator for further review.

.10 Any adjustments made on Shop Drawings by the Contract Administrator are not intended to change the Contract Price. If it is deemed that such adjustments affect the Contract Price, clearly state as such in writing prior to proceeding with fabrication and installation of Work.

.11 Make changes in Shop Drawings, which the Contract Administrator may require, consistent with Contract Documents. When re-submitting, notify the Contract Administrator in writing of any revisions other than those requested by the Contract Administrator.

.12 Shop Drawings indicating design requirements not included in the Contract Documents require the seal of a qualified Professional Engineer, registered in the Province of

Manitoba. Calculations shall be submitted for review, if requested, and sealed by a qualified Professional Engineer.

.13 Only two (2) reviews of Shop Drawings will be made by the Contract Administrator at no cost. Each additional review will be charged to the Contractor at the Contract Administrator's scheduled rates. The Contract Administrator's charges for the additional Work will be deducted from the Contractor's Progress Certificates.

.14 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.
- .6 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .7 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.

1.3 PROCEDURES

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

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

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 Within the text of the specifications, reference may be made to the following standards:

.1 ANSI American National Standards Institute
.2 CEC Canadian Electrical Code (published by CSA)
.3 CEMA Canadian Electrical Manufacturer's Association
.4 CSA Canadian Standards Association
.5 IEEE Institute of Electrical and Electronic Engineers
.6 NBC National Building Code
.7 NEMA National Electrical Manufacturers Association
.8 NFPA – National Fire Protection Association
.9 ULC Underwriters' Laboratories of Canada

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

.2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Contract Administrator instructions, 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. If such Work is found in accordance with Contract Documents, the City shall pay cost of examination and replacement.

1.2 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies may be engaged by the City for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by the City. Costs of additional tests required due to defective Work shall be paid by the Contractor.

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

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

.4 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 the City. Pay costs for retesting and reinspection.

1.3 ACCESS TO WORK

.1 The City, the Contract Administrator, and other authorities having jurisdiction shall have access to the work.

1.4 REJECTED WORK

.1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by the Contract Administrator as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents, at no cost to the City.

.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 Contract Administrator.

1.5 REPORTS

.1 Submit 4 copies of inspection and test reports to 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 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA-S269.2-M1987(R2003), Access Scaffolding for Construction Purposes.

1.2 CONTRACTOR'S OFFICE

.1 Accommodation for the Contractor's office, plant, tools, equipment, and materials (including fuel) shall be the responsibility of the Contractor. Such accommodation at the Site shall be located after consultation with the Contract Administrator. The Contractor shall be responsible for the protection of its plant, tools, equipment, and materials stored on-site. Materials stored on the City's premises shall be neatly stacked and protected from the weather.

.2 The Contractor shall confine their activities to the minimum area necessary for undertaking and completing the Work. Material and equipment storage areas shall be at locations acceptable to the Contract Administrator.

.3 The Contractor's construction activities shall not encroach or enter onto private property without written consent from the owner of the property concerned. The Contractor shall provide the Contract Administrator with a copy of the written agreement with the property owner.

1.3 LAYDOWN AND STORAGE

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

.2 Designated areas shall be used for storage of flammable and combustible liquids and gases. Spills shall be contained as required by Provincial Regulations.

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

.1 Flammable liquids are stored or handled.

.2 Welding or flame cutting is performed.

1.4 TEMPORARY CONSTRUCTION MATERIALS

.1 Tarpaulins and plastic coverings shall consist of fire retardant materials, which are UL or FM listed or approved, or which have passed the Large Scale Test specified in NFPA-701.

1.5 TOILETS AND WASHROOMS

.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.

1.6 DISPOSAL OF WASTE MATERIALS

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

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

.3 When working anywhere within the Works the Contractor shall at the end of each working day remove the rubbish and leave the Site in a clean and tidy state, to the satisfaction of the Contract Administrator. If this is not done, the City will clean the Site and charge the Contractor.

1.7 PARKING

.1 The Contractor parking shall be as designated by the Contract Administrator. The parking shall be arranged and maintained so that is does not disrupt the plant's operation and access for the City's operations and maintenance staff.

1.8 USE OF PERMANENT WATER SUPPLY, HEAT, POWER LIGHT, AND TELEPHONE

.1 The Contractor shall not make use of permanent water supply, heat, power, or telephone inside the SEWPCC without permission from the Contract Administrator.

1.9 SITE SECURITY

.1 The City does not normally provide security forces to the plant Site. Contractor is responsible for all material and equipment stored on the site.

1.10 SCAFFOLDING

.1 Provide and maintain adequate scaffolding as required. Scaffolding is to be rigid, secure, and constructed to ensure adequate safety for workers. Erect without damage to the building or finishes.

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

1.11 FACILITY ELECTRICAL SUPPLY AND DISTRIBUTION

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

1.12 HOISTING

.1 Provide, operate and maintain hoists and cranes required for moving of workers, materials and equipment. Hoists and cranes to be operated by qualified operator.

1.13 WORK SCHEDULING AND PLANT OPERATIONS

.1 Plan and schedule work to minimize outages on the plant operations.

.2 Provide Work Plan for approval to Contract Administrator a minimum of 7 days prior to start of planned work. Detail work date, start/stop times, duration and required equipment or system shutdowns.

.3 Do not start work until approval is provided from the Contract Administrator.

1.14 WARNINGS AND TRAFFIC SIGNS

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

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

Part 2 Products

.1 Not Used.

Part 3 Execution

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Conform to 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 the right to have such products or systems tested to prove or disprove conformance.

.3 Cost for such testing will be born by the City in event of conformance with Contract Documents or by the 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. Should disputes arise as to quality or fitness of products, decision rests strictly with the Contract Administrator based upon requirements of Contract Documents.

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

.4 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.3 METRIC PROJECT

.1 Unless otherwise noted, this project has been designed and is to be constructed in the International System (SI) of Units metric system of measurements.

.2 During construction, when specified metric elements are unattainable at the time they are required to meet the construction schedule, the Contractor shall notify the Contract Administrator in writing and suggest alternative substitutions. Costs due to these substitutions shall be borne by the Contractor.

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 Remove and replace damaged products at own expense and to satisfaction of the Contract Administrator.

.5 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 the 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 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.

1.8 CONCEALMENT

.1 In finished areas conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

.2 Before installation inform the Contract Administrator if there is interference. Install as directed by the Contract Administrator.

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 existing and new mechanical and electrical items as approximate. Coordinate location with the Contract Administrator if not clear.

.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 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.

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

.5 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 the Contract Administrator.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 WORKMANSHIP

.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 the 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 the Contract Administrator, whose decision is final.

END OF SECTION

Part 1 General

1.1 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 Owner or separate contractor.

.3 Include in request:

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

1.2 MATERIALS

.1 Required for original installation.

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

1.3 PREPARATION

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

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

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

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

1.4 EXECUTION

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

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

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

.4 Provide openings in non-structural elements of Work for penetrations of electrical Work.

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

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

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

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

.9 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material, full thickness of the construction element.

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

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

.4 Dispose of waste materials and debris off site.

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

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

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

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

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

.2 Prepare instructions and data using personnel experienced in maintenance and operation of described products.

.3 Copy will be returned after final inspection, with Contract Administrator's comments.

.4 Revise content of documents as required prior to final submittal.

.5 Furnish evidence, if requested, for type, source and quality of products provided.

.6 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

.7 Pay costs of transportation.

1.2 OPERATING AND MAINTENANCE MANUALS

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

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

.3 For the guidance of the City's operating and maintenance personnel, the Contractor shall prepare O&M Manuals for the Work, describing in detail the construction of each part of the Work and the recommended procedure for operation, servicing and maintenance.

.4 One (1) advance copies of the manuals shall be submitted prior to Substantial Performance of the Work for review and comments. After review, four (4) copies of the final manuals shall be submitted.

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

.6 In addition to information called for in the Specifications, include the following:

.1 Overall Title sheet, labelled "Operation and Maintenance Instructions", and containing project name and date, facility's covered in the manual, City's Contract number, the name and address of the Contractor, and the issue date.

.2 Overall list of contents, indicating the facilities upgraded by the project.

.3 Title sheet for each section, labelled "Operation and Maintenance Instructions", the applicable facility, and containing project name and date.

.4 List of contents for each section.

.5 Include:

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

.2 Documentation of all test results.

.3 Complete set of equipment and assembly drawings

.4 Installation, start-up, O&M Manuals

.5 Any specific requirements from the Specifications

.6 Reviewed Shop Drawings of all equipment.

.7 Names, addresses, and telephone numbers of all major sub-contractors and suppliers.

.7 Modify and supplement the manual as required by the Contract Administrator.

.8 Format to be as follows:

.1 Organize data as instructional manual.

.2 Binders: vinyl, hard covered, 3 'D' ring, with spine and face pockets.

.3 When multiple binders are used correlate data into related consistent groupings. Identify contents of each binder on spine.

.4 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

1.3 AS-BUILT DRAWINGS

.1 After award of Contract, the Contract Administrator will provide a complete set of Drawings for the purpose of maintaining Project As-Built Drawings. Accurately record significant deviations from Contract Documents caused by Site conditions and changes ordered by the Contract Administrator. Update daily.

.2 Record locations of concealed elements of mechanical and electrical services.

.3 Identify Drawings as "Project As-Built Copy". Maintain in good condition and make available for inspection on-site by Contract Administrator at all times.

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

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 DESCRIPTION

.1 Demonstrate operation and maintenance of equipment and systems to City personnel as equipment is replaced and upgraded.

.2 City will provide list of personnel to receive instructions, and will co-ordinate their attendance at agreed-upon times.

1.2 QUALITY CONTROL

.1 When specified in individual Sections require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Owner's personnel, and provide written report that demonstration and instructions have been completed.

1.3 SUBMITTALS

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

.2 Submit schedule of time and date for demonstration of fire alarm system two weeks prior to designated dates, for Contract Administrator’s approval. Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.

.3 Give time and date of each demonstration, with list of persons present.

1.4 CONDITIONS FOR DEMONSTRATIONS

.1 Equipment has been inspected and put into operation in accordance with Section 01 45 00.

.2 Testing, adjusting, and balancing has been performed and equipment and systems are fully operational.

1.5 PREPARATION

.1 Verify that conditions for demonstration and instructions comply with requirements.

.2 Verify that designated personnel are present.

1.6 DEMONSTRATION AND INSTRUCTIONS

.1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled times, at the equipment location.

.2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.

.3 Review contents of manual in detail to explain aspects of operation and maintenance.

.4 Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instructions.

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 Product Data:

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

.3 Pre-shipment photos

.1 Provide pre-shipment photos of the operator control enclosure. Resolution to be of sufficient quality to be able to read individual wire tags on wires.

.4 Shop Drawings:

.1 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.

.1 Provide shop drawings including but not limited to:

.1 Wiring diagrams.

.2 Schematics.

.3 Installation details.

.4 Layout and parts list.

1.2 CLOSEOUT SUBMITTALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Submit operation and maintenance data for incorporation into maintenance manual.

.3 Provide recommended spare parts list.

Part 2 Products

2.1 GENERAL

.1 Provide complete Hazardous Area Class I, Zone 2 rated door operator for existing truck bay door including motor, operator, pushbutton station, safety edge switch and miscellaneous fittings.

.2 Approvals: CSA or cUL

2.2 BREAKERS

.1 See Section 26 28 21.

2.3 MOTOR

.1 Size: 0.56 kW (0.75 HP) – This is the existing motor size. Confirm this is acceptable with the manufacturer for the size and weight of door.

.2 Voltage: 575 V, 3 ph, 60 Hz

.3 Hazardous Locations: to CSA C22.2 No. 145

.1 Rating: Class I, Zone 2, Group IIA

.2 Temperature Code: T2A

.4 Type: TEFC or Explosionproof

2.4 FULL VOLTAGE MAGNETIC STARTERS

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

.1 Smallest size of starter: NEMA size 1, unless otherwise indicated

.2 IEC rated starters are not acceptable.

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

.1 All coils to be epoxy coated.

.2 Contactor solenoid operated, rapid action type.

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

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

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

2.5 OVERLOADS

.1 Provide a thermally protected motor.

.2 The overload shall have 1 N.C. isolated auxiliary contact.

2.6 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120 VAC secondary, complete with primary and secondary fuses, installed with starter as indicated.

.2 Size control transformer as indicated.

2.7 ENCLOSURES

.1 Suitable for Class I, Zone 2 Hazardous locations

.2 Enclosures shall be NEMA 4X rated unless located in electrical or control rooms.

2.8 WIRING AND ACCESSORIES

.1 Provide wiring inside the panels according to the following Specifications:

.1 Control wiring to be a minimum of 16 AWG tinned stranded copper; insulation rated at 600 V.

.2 Wiring for power distribution shall be a minimum of 14 AWG tinned stranded copper; insulation rated at 600 V.

.3 Install cables in accordance with the requirements of Division 26.

.2 Tag each wire at both ends with a heat shrink sleeve that is machine printed. Allow approximately 20 mm of wire insulation between the tag and the bare wire.

.3 Wiring systems with different voltage levels or types shall be suitably segregated within the panel, according to relevant electrical codes.

.4 Run all wiring in enclosed plastic wireways such as Panduit. Size all wireways so that the total cross sectional area of the insulated wire and cable does not exceed 40 percent of the cross sectional area of the wire way.

.5 Provide a minimum clearance of 50 mm between wire ways and any point of wire termination.

.6 Terminate all wiring, incoming and outgoing, at terminal strips mounted inside the panels. Identify each terminal strip with a terminal strip number, as per the drawings.

.7 Provide sufficient terminals so that not more than two wires are connected under the same terminal.

.8 Provide nameplates for each device on or within the enclosure.

2.9 LIMIT SWITCHES

.1 As required for equipment protection and safety. Including but not limited to open limit, advanced open limit, closed limit, advanced closed limit

2.10 ACCESSORIES

.1 Pushbutton station:

.1	Area Classification:	Class I, Zone 2
.2	Pushbuttons:	Heavy duty, oil tight as required.
.3	Functions:	Open, Close, Stop

.2 Pneumatic safety edge switch

.1	Area Classification:	Class I, Zone 2
.2	Hardwire interlocked to control circuit.	

2.11 FINISHES

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

2.12 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Magnetic starter designation label, white plate, black letters, as indicated on lamacoid schedule.

2.13 SPARE PARTS

.1 Fuses: two of each rating.

2.14 ACCEPTABLE MANUFACTURERS

.1 Manaras

.2 Or approved equal in accordance with B6.

Part 3 Execution

3.1 INSTALLATION

.1 Install motor and operator to replace existing motor and operator. Existing door operator is a Manaras MGH4X.

.2 Install in accordance with manufacturer's instructions.

.3 Install and wire controls as indicated.

.4 Ensure correct fuses are installed.

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

3.2 FIELD QUALITY CONTROL

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

.2 Operate switches and contactors to verify correct functioning.

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

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Air Conditioning and Mechanical Contractors (AMCA)

.1 AMCA Publication 99-2003, Standards Handbook.

.2 AMCA 300-2008, Reverberant Room Method for Sound Testing of Fans.

.3 AMCA 301-2006, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.2 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)

.1 ANSI/AMCA 210-2007, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.4 Canadian Standards Association (CSA International)

.1 CSA C22.2 No. 145-2011, Motors and Generators for Use in Hazardous Locations.

1.2 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.

.2 Capacity: flow rate, total static pressure, kW, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.

.3 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.

.4 Sound ratings: comply with AMCA 301, tested to AMCA 300.

.5 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210. Supply unit with AMCA certified rating seal.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Shop Drawings:

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

.3 Provide :

.1 Fan performance curves showing point of operation, kW and efficiency.

.2 Sound rating data at point of operation.

.4 Indicate:

.1 Motors, sheaves, bearings, shaft details.

.2 Minimum performance achievable with variable speed controllers.

.5 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.1 Contract Administrator will make available 1 copy of systems supplier's installation instructions.

.6 Closeout Submittals:

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

1.4 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.1 Spare parts to include:

.1 Matched sets of belts.

.2 Furnish list of individual manufacturer's recommended spare parts for equipment, include:

.1 Bearings and seals.

.2 Addresses of suppliers.

.3 List of specialized tools necessary for adjusting, repairing or replacing.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

Part 2 Products

2.1 VANE-AXIAL FLOW FANS

.1 Acceptable manufacturers:

.1 Chicago Blower.

.2 Northern Blower.

.3 Twin City Fan & Blower.

.2 Spark Resistance Construction: Type A.

.3 Casings: welded steel with welded motor support, factory primed before assembly in colour standard to manufacturer.

.4 Blade material: aluminum. Hub material: aluminum.

.5 Motors:

.1 Sizes as specified.

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

.1 Rating: Class I, Zone 2, Group IIA.

.2 Type: TEFC.

.3 Duty: Continuous.

.3 Motor with inherent overheating protectors.

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

.6 Supports:

.1 Ceiling suspended units: support brackets welded to side of casing. Extend grease lubrication facilities to outside of casing.

.7 Bearings: ball or roller with extension tubes to outside of casing.

.8 Belt drive:

.1 Drive fixed blades by externally mounted motors through V-belt drive. Provide internal belt fairing, external belt guards and adjustable motor mounts.

.9 Accessories and hardware: matched sets of V-belt drives, adjustable motor bases, belt guards.

.10 Vibration isolation: spring hangers.

.11 Flexible connections: Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m^2, 150 mm wide with 75 mm galvanized sheet metal for the connections.

.12 Performance: 944 l/s @ 73 Pa, 0.37 kW motor (115V, 1Ph, 60 Hz, 1800 rpm).

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 FAN INSTALLATION

.1 Install fans as indicated, complete with resilient mountings as specified, flexible electrical leads and flexible connections.

.2 Provide sheaves and belts required for final air balance.

.3 Bearings and extension tubes to be easily accessible.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No. 145-2011, Motors and Generators for Use in Hazardous Locations.

1.2 PRODUCT DATA

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

.2 Submit product data sheets for unit heaters. Include:

.1 Product characteristics.

.2 Performance criteria.

.3 Mounting methods.

.4 Physical size.

.5 kW rating, voltage, phase.

.6 Cabinet material thicknesses.

.7 Limitations.

.8 Colour and finish.

.3 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence and cleaning procedures.

1.3 SHOP DRAWINGS

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

.2 Indicate:

.1 Equipment, capacity and piping connections.

.2 Dimensions, internal and external construction details, recommended method of installation with proposed support, sizes and location of mounting bolt holes.

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for unit heaters for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 HORIZONTAL UNIT HEATERS

.1 Acceptable manufacturers:

.1 Engineered Air.

.2 McQuay.

.3 Sterling.

.2 Casing: 1.6 mm thick cold rolled steel, gloss enamel finish, with threaded connections for hanger rods.

.3 Coils: seamless copper tubing, silver brazed to steel headers with evenly spaced aluminum fins mechanically bonded to tubing. Hydrostatically test to 1 MPa.

.4 Fan: direct drive aluminum propeller type, factory balanced, with fan guard.

.5 Motors:

.1 Sizes as specified.

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

.1 Rating: Class I, Zone 2, Group IIA.

.2 Type: TEFC.

.3 Duty: Continuous.

.3 Motor with inherent overheating protectors.

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

.6 Air outlet: two-way adjustable louvres.

.7 Capacity: 16 kW, base hot water heating capacity on 93 ^{o}C E.W.T. and 11 ^{o}C temperature drop, 0.075 kW (115V, 1 ph, 60 Hz, 1550 rpm).

2.2 VERTICAL UNIT HEATERS

.1 Acceptable manufacturers:

.1 Engineered Air.

.2 McQuay.

.3 Sterling.

.2 Casing: 1.6 mm thick cold rolled steel, glossed enamel finish, with threaded connections for hanger rods.

.3 Coils: seamless copper tubing, silver brazed to steel headers and with evenly spaced aluminum fins mechanically bonded to tubing. Hydrostatically test to 1 Mpa.

.4 Fan: direct drive aluminum propeller type, factory balanced.

.5 Motors:

.1 Sizes as specified.

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

.1 Rating: Class I, Zone 2, Group IIA.

.2 Type: TEFC.

.3 Duty: Continuous.

.3 Motor with inherent overheating protectors.

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

.6 Air outlet: adjustable multi-vane diffuser with finish to match casing.

.7 Capacity: 19kW, base hot water heating capacity on 93 ^{o}C E.W.T. and 11 ^{o}C temperature drop, 0.124 kW (115V, 1 ph, 60 Hz, 1550 rpm).

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Provide double swing pipe joints as indicated.

.3 Check final location with Contract Administrator if different from that indicated prior to installation.

.1 Should deviations beyond allowable clearances arise, request and follow Contract Administrator’s directive.

.4 Hot water units: for each unit, install ball valve on inlet and calibrated balancing valve on outlet of each unit. Install drain valve at low point.

.1 Install manual air vent at high point.

.5 Clean finned tubes and comb straight.

.6 Provide supplementary suspension steel as required.

.7 Connect to new line voltage thermostat.

.8 Before acceptance, set discharge patterns and fan speeds to suit requirements.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 This Section covers items common to Sections of Division 26. This section supplements requirements of Division 1.

1.2 CODES AND STANDARDS

.1 Complete installation in accordance with CSA C22.1-2009 except where specified otherwise.

.2 Comply with all laws, ordinances, rules, regulations, codes, and orders of all authorities having jurisdiction relating to this Work.

1.3 DRAWINGS AND SPECIFICATIONS

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

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

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

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

1.4 CARE, OPERATION AND START-UP

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

.2 Where services of a manufacturer's factory service engineer is required, arrange and pay for services to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.5 PERMITS, FEES AND INSPECTION

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

.2 Pay associated fees.

.3 Notify Contract Administrator of changes required by Electrical Inspection Department prior to making changes.

.4 Furnish a Certificate of Final Inspection and approvals from inspection authority to the Contract Administrator.

1.6 MATERIALS AND EQUIPMENT

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

.2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.

.3 Factory assemble control panels and component assemblies.

1.7 FINISHES

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

.1 Paint indoor switchgear and distribution enclosures light grey to ANSI 61 grey enamel, unless otherwise specified.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

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

1.8 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates as follows:

.2 Nameplates:

.1 Lamicoid 3 mm thick plastic lamicoid nameplates, white face, black core, mechanically attached with self tapping screws.

NAMEPLATE SIZES

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

.3 Wording on nameplates to be approved by Contract Administrator prior to manufacture.

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

.5 Identification to be English.

1.9 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1.

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

1.10 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: 38 mm wide prime colour and 19 mm wide auxiliary colours.

System	Prime Band	Aux. Band
Medium Voltage (>750 V)	Orange	
347/600 V	Yellow	
120/208/240 V Power	Black	
UPS 120/208/240 V Power	Black	Green
Control Wiring (120 V)	Black	Orange
Fire Alarm	Red	
Low Voltage Communication/General	Blue	
Low Voltage Control Wiring (<50 V)	Blue	Orange
Intrinsically Safe	Blue	White

.4 Cable Identification: Supply and install lamacoid type cable identification tags for all cables. Install identification tag at both ends.

1.11 MANUFACTURERS AND CSA LABELS

.1 Visible and legible after equipment is installed.

1.12 WARNING SIGNS

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

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

1.13 MOUNTING HEIGHTS

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

.2 Unless otherwise noted, mount equipment replacing existing equipment at the same height.

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

.4 Install electrical equipment at following heights unless indicated otherwise.

.1 Panelboards: as required by Code or as indicated.

1.14 CONDUIT AND CABLE INSTALLATION

.1 Sleeves through concrete: schedule 40 galvanized steel pipe, sized for free passage of conduit.

.2 For wall, partitions, and ceilings the sleeve ends shall be flush with the finish on both sides but for floors they shall extend 25 mm above finished floor level.

.3 Fire stop opening with ULC approved assembly for the installation conditions.

.4 Provide a detailed proposed conduit routing plan to the Contract Administrator prior to proceeding with the installation of conduit.

.5 If possible, avoid routing conduits through hazardous area.

1.15 FIELD QUALITY CONTROL

.1 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. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.

.2 The work of this division to be carried out by a contractor who holds a valid Master Electrical contractor license as issued by the Province of Manitoba.

.3 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

1.16 TESTING

.1 All test instruments utilized are to have been calibrated within one year of the date utilized.

.2 Carry out tests in presence of the Contract Administrator or delegated representative.

.3 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.4 Submit test results for Contract Administrator's review.

1.17 SUBMITTALS

.1 Within 15 days of award of Contract, the Contractor shall submit a completed equipment procurement schedule, which lists the Manufacturer and model of equipment, indicating the projected ordering, Shop Drawing submittal date and delivery dates of all Products to meet the required construction schedule.

.2 Prior to delivery of any Products to job Site and sufficiently in advance of requirements to allow ample time for checking, submit Shop Drawings for review as specified in Division 01.

.3 Submit Shop Drawings (including Product Data) for all equipment as required in each Section of this Specification.

.4 Prior to submitting the Shop Drawings to the Contract Administrator, the Contractor shall review the Shop Drawings to determine that the equipment complies with the requirements of the Specifications and Drawings.

.5 The term “Shop Drawing” means drawings, diagrams, illustrations, schedules, performance characteristics, brochures and other data, which are to be provided by the Contractor to illustrate details of a portion of the Work. Indicate materials, methods of construction and attachment of support wiring, diagrams, connections, recommended

installation details, explanatory notes and other information necessary for completion of Work. Where equipment is connected to other equipment, indicate that such items have been coordinated, regardless of the section under which the adjacent items will be supplied and installed. Indicate cross-references to Design Drawings and Specifications. Adjustments made on Shop Drawings by the Contract Administrator are not intended to change the contract price. If adjustments affect the value of the Work state such in writing to the Contract Administrator prior to proceeding with the Work.

.6 Manufacture of Products shall conform to revised Shop Drawings.

.7 Keep one (1) complete set of Shop Drawings at job Site during construction.

.8 Prior to shipping pre-fabricated panels, photos of completed panels shall be sent to the Contract Administrator of final review. The resolution of the photos should be such that individual wire tags can be read.

1.18 AS-BUILT DRAWINGS

.1 The Contractor shall keep one (1) complete set of white prints at the Site during work, including all addenda, change orders, Site instructions, clarifications, and revisions for the purpose of As-Built Drawings. As the Work on-site proceeds, the Contractor shall clearly record in Red Pencil all as-built conditions, which deviate from the original Contract Documents. As-Built Drawings to include circuiting of all devices, conduit and feeder runs (complete with conductor size and number) and locations of all electrical equipment.

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.

.2 CAN/CSA-C22.2 No. 38, Thermoset-Insulated Wires and Cables.

.3 CAN/CSA-C22.2 No. 131, Type TECK 90 Cable.

.4 CAN/CSA-C22.2 No. 239, Control and Instrumentation Cables.

1.2 PRODUCT DATA

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

Part 2 Products

2.1 BUILDING WIRES

.1 Wire: to CAN/CSA-C22.2 No. 38

.2 Conductors:

.1 Size as indicated. Minimum size: 12 AWG.

.2 Stranded for 10 AWG and larger.

.3 Copper conductors.

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

.1 Insulation Voltage Rating:

.1	Circuits 480 V and less:	600 V
.2	Circuits > 480 V:	1000 V

.4 Colour coding to Section 26 05 01, wires sized 2 AWG and smaller to be factory-coded, taping will not be accepted.

2.2 TECK CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

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

.1 Insulation Voltage Rating:

.1	Circuits 480 V and less:	600 V
.2	Circuits > 480 V:	1000 V

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: polyvinyl chloride material.

.7 Fastenings:

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

.2 Channel type supports for two (2) or more cables at 1000 mm centers.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.8 Cable Fittings:

.1 Minimum requirement: Watertight, approved for TECK cable.

.2 Hazardous Locations:

.1 CSA approved.

.2 Watertight type with:

.1 an elastomeric bevelled bushing.

.2 a funnel entry, splined gland nut.

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

.4 a taper threaded hub.

.5 a hexagonal body and gland nut

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

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

.5 The fitting must:

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

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

.6 All metal-clad cable fittings, for jacketed and non-jacketed interlocked armour cable, shall incorporate an easily-removable armour stop

.7 (not requiring fitting disassembly) ensuring proper positioning of the cable armour during cable termination.

.8 Approved products:

.1 T&B Startech XP series.

2.3 ACIC/CIC CONTROL CABLE

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

.2 Conductors: copper, size as indicated.

.3 Insulation: chemically cross-linked thermosetting polyethylene rated type RW90, 300V.

.4 Shielding as indicated on the drawings.

.5 A higher level of shielded cable may be substituted for unshielded, or overall shielded cable, unless otherwise specified, provided that all appropriate shield grounding, as required by the Contract Administrator, is performed. All subsequent related changes, such as required conduit size, fittings, etc are the responsibility of the Contractor.

Part 3 Execution

3.1 GENERAL

.1 Do not splice cables. A continuous length is required for all feeds.

.2 Install in accordance with manufacturer's recommendations, observing requirements for minimum bending radius and pulling tensions.

.3 Exercise care in stripping insulation from wire. Do not nick conductors.

3.2 INSTALLATION OF BUILDING WIRES

.1 Install in conduit as per Section 26 05 34.

.2 Ensure conduit is dry and clean prior to pulling wire. If moisture is present, thoroughly dry conduits. Vacuum as required.

.3 Utilize wire-pulling lubricant.

3.3 INSTALLATION OF TECK CABLE 0 -1000 V

.1 Maximum spacing between supports for surface mounted TECK cable:

.1 1.0 m unless otherwise approved by the Contract Administrator.

3.4 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit.

.2 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.

.3 Shield drain wires, at the ungrounded end, are to be taped back to the cable. Do not cut the shield drain wire off.

.4 CIC cable may not be installed in cable tray. Protection in conduit is required over the entire length.

.5 ACIC cable may be installed in cable tray, provided that:

.1 The cable tray does not contain power cables, unless specifically authorized by the Contract Administrator in writing.

.2 The ACIC cable voltage rating is equal or greater than the highest voltage contained in the cable tray.

3.5 TERMINATIONS AND SPLICES

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

.1 Lighting circuits.

.2 Receptacle circuits.

.2 Exercise care in stripping insulation from wire. Do not nick conductors.

.3 Strictly follow manufacturer's instructions with regards to tool size and application methods of terminations and compounds.

.4 Where screw-type terminals are provided on equipment and instrumentation, terminate field wiring with insulated fork tongue terminals.

.1 Manufacturer: Thomas and Betts, Sta-Kon, or approved equal in accordance with B6.

3.6 RE-USE OF EXISTING WIRING

.1 Re-use of existing wiring will generally be accepted where the work is limited to the replacement of the field device, and the wires meet the requirements of the drawings.

.2 Wire nuts are not permitted to extend existing wiring except for lighting and receptacle circuits.

.3 Ensure all existing wiring is tagged prior to disconnection of equipment.

.4 Tag spare wires as “Spare” and indicate the location of the other end of the wire.

3.7 TESTING

.1 Perform an insulation resistance test on all new and existing power conductors that are being re-terminated as part of the work.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

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

.1 ANSI/IEEE 837, Qualifying Permanent Connections Used in Substation Grounding.

.2 Canadian Standards Association, (CSA International)

Part 2 Products

2.1 EQUIPMENT

.1 Grounding conductors: bare stranded copper, soft annealed, size as indicated.

.2 Insulated grounding conductors: green, type RW90.

.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 Use Burndy compression connectors for all grounding splices and terminations, unless otherwise indicated.

.5 Soldered joints are not permitted.

3.2 EQUIPMENT GROUNDING AND BONDING

.1 Install grounding connections to transformers.

.2 Install bonding connections to all electrical equipment.

.3 Include a separate green bonding wire in all power conduits including branch circuit wiring sized according to the drawings, or the Canadian Electrical Code, whichever is larger.

3.3 FIELD QUALITY CONTROL

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

END OF SECTION

Part 1 General

Part 2 Products

2.1 FRAMING AND SUPPORT SYSTEM

.1 Materials:

.1 Conduit support structures shall employ an aluminum strut framing system together with the manufacturer's connecting components and fasteners for a complete system.

.2 Finishes:

.1 Wet locations: Aluminum.

.2 Indoors, dry locations: Aluminum.

.3 Nuts, bolts, machine screws: Stainless Steel.

.3 Unistrut

.1 As required for load and span, with mounting screws.

.2 Acceptable products:

.1 Unistrut P1000 or approved equal in accordance with B6.

2.2 CONCRETE AND MASONRY ANCHORS

.1 Materials: hardened steel inserts, zinc plated for corrosion resistance.

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

.3 Manufacturer: Hilti (Canada) Limited.

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 Do not drill through steel reinforcement encased in concrete.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Suspended support systems.

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

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

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

.8 Ensure adequate support for raceways and cables dropped vertically where there is no wall support.

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

.10 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.

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

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and components for splitters, junction, pull boxes, and cabinets.

1.2 SUBMITTALS

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

Part 2 Products

2.1 JUNCTION AND PULL BOXES – HAZARDOUS, CATEGORY 2, AND CATEGORY 2 WET LOCATIONS

.1 NEMA 4X rated

.2 Stainless Steel Construction.

.3 Refer to 40 95 74 for custom automation junction boxes.

2.2 JUNCTION AND PULL BOXES – UNCLASSIFIED INDOOR, DRY LOCATIONS

.1 NEMA 12 or NEMA 4 rated

.2 Sheet steel, welded construction, phosphatised and factory point finish.

.3 Surface boxes to have rolled edges.

.4 Refer to 40 95 74 for custom automation junction boxes.

Part 3 Execution

3.1 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

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

3.2 IDENTIFICATION

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

.2 Install size 3 identification labels indicating system voltage, phase, and source of feed.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA C22.1-2009, Canadian Electrical Code, Part 1.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit product data 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 outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 OUTLET BOXES FOR METAL CONDUIT – NON-EXPLOSIONPROOF

.1 General Requirements:

- .1 Acceptable materials:
  - .1 Cast Aluminum (preferred)
  - .2 Cast ferrous alloy with corrosion resistant epoxy coating.
- .2 Suitable for threaded rigid conduit
- .3 Mounting lugs as required.
- .4 Wet location covers for all locations unless otherwise approved by the Contract Administrator.
- .5 To CSA 22.2

.2 Round Boxes:

- .1 100mm (4”) round.
- .2 Tapped conduit openings and plugs.
- .3 Gasketed cover
- .4 Manufacturer / Model:
  - .1 Crouse Hinds VXF series

.3 Device Boxes

- .1 FS or FD cast aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of receptacles.
- .2 Single gang unless specified otherwise.
- .3 Manufacturer / Model:
  - .1 Crouse Hinds FS/FD series

2.3 OUTLET BOXES FOR METAL CONDUIT –EXPLOSIONPROOF

.1 General Requirements:

.1 Rated for Hazardous Class I, Zone 2 Locations

.2 Acceptable materials:

.1 Cast Aluminum (preferred)

.2 Cast ferrous alloy with corrosion resistant epoxy coating.

.3 Suitable for threaded rigid conduit

.4 Mounting lugs as required.

.5 Wet location covers for all locations unless otherwise approved by the Contract Administrator.

.6 To CSA 22.2

.2 Device Boxes

.1 EDS or EDSCM cast aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of receptacles.

.2 Single gang unless specified otherwise.

.3 Manufacturer / Model:

.1 Crouse Hinds EDS or EDSCM series

2.4 CONDUIT BOXES

.1 FS or FD cast aluminum boxes with factory-threaded hubs and mounting feet for surface wiring.

2.5 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

.4 Install all outlets surface mounted as required for the installation.

.5 Provide lamacoid for all device boxes indicating the circuit(s) contained within.

.1 Example: G10-5 (Panel G10, circuit 5).

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.

.2 CSA C22.2 No. 45, Rigid Metal Conduit.

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

1.2 CONDUIT REQUIREMENTS

.1 The drawings do not show every specific conduit run. Supply and install conduit as required to provide a complete system.

.2 All conduits shall be surface mounted unless otherwise indicated in the specifications and/or shown on the drawings.

Part 2 Products

2.1 CONDUITS

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

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

.3 Minimum conduit size: 19 mm, unless specifically indicated on the drawings or approved by the Contract Administrator.

2.2 CONDUIT FASTENINGS

.1 One hole aluminum straps to secure surface conduits 50 mm and smaller. Two hole aluminum straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits.

.4 Threaded rods, 6 mm dia., to support suspended channels.

2.3 CONDUIT SPACERS

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

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

2.4 CONDUIT FITTINGS

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

.2 Utilize insulated grounding bushings at all enclosure entries.

.3 Elbows:

.1 Utilize factory elbows for 27mm and larger conduits.

.4 Threaded Hubs for Metal Conduit

.1 liquid and dust tight with insulated throat

.2 Approved products

.1 Thomas & Betts "Bullet Hub" 370 Series.

.5 Fittings for Metal Conduit

.1 Cast metal

.2 Gasketted covers.

.3 Approved products

.1 Crouse-Hinds Canada Ltd. "Condulet" series.

.6 Explosion proof conduit sealing fittings:

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

.2 Material: Cast aluminum.

.3 Sealing Compound: As recommended by manufacturer.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 All conduits entering outlet boxes and devices that are located in walls subject to movement shall be terminated by means of liquid-tight flexible conduit, approximately 450 mm in length between the conduit and the outlet box or device which is being supplied. All conduits, bus duct, wireways, etc., passing through or across expansion joints of the building shall be installed with the use of approved expansion fittings.

2.6 FISH CORD

.1 Polypropylene.

Part 3 Execution

3.1 ROUTING

.1 Locate conduits containing communication and low voltage conductors away from conduits containing power wiring.

.2 Route conduits on existing or new pipe rack or suspended channels where possible.

.3 Avoid routes that would interfere with any potential maintenance activities.

.4 Where not specifically shown in detail on the drawings, review proposed conduit routing with Contract Administrator prior to installation. Comply with all routing changes requested by the Contract Administrator.

3.2 INSTALLATION - GENERAL

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

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

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

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

.5 Ensure electrical continuity in all conduit systems.

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

.7 Seal conduits with duct seal where conduits are run between heated and unheated areas. Where conduits, cables, or cable trays pierce fire separations, seal openings with Dow Corning 3-6548 sealant. Seal all conduits entering or leaving hazardous classified areas with approved seals.

.8 Where conduits pass through walls, group and install through openings. After all conduits shown on the Drawings are installed, close wall openings with material compatible with the wall construction.

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

.10 Mechanically bend conduits over 19 mm in diameter.

.11 Dry conduits out before installing wire.

.12 Surface Conduits

- .1 Run parallel or perpendicular to building lines.
- .2 Group conduits wherever possible on suspended or surface channels.
- .3 Provide a minimum space of 12mm between conduits.
- .4 Do not pass conduits through structural members except as indicated.
- .5 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.
- .6 Install spacers as required to provide a space between the conduits and the supporting surface, with a minimum space as follows:
  - .1 Above grade spaces not classified as CEC Category 1 or 2:
    - .1 Drywall / Wood surfaces: no space required
    - .2 Masonry / concrete surfaces: 6 mm
    - .3 Below grade spaces: 12 mm
  - .2 CEC Category 1 or 2: 12 mm

.13 Underground Conduits

- .1 Slope conduits to provide drainage.

.14 Floor Penetrations

- .1 Mark out intended location for openings and confirm acceptability with Contract Administrator prior to drilling.
- .2 Provide galvanized steel pipe sleeve
- .3 Provide 102 mm curb to floor penetrations in areas that are subject to regular clean up and wash down.

.15 Colour Coding

- .1 Apply plastic tape or paint colour coded bands to conduits at points where conduit or cable enters wall, ceiling, or floor, and at 5 m intervals.
- .2 Bands: 38 mm wide prime colour and 19 mm wide auxillary colours
- .3 Band colours as per the following table.

System	Prime Band	Aux. Band
Medium Voltage (>750 V)	Orange	
347/600 V	Yellow	
120/208/240 V Power	Black	
UPS 120/208/240 V Power	Black	Green
Control Wiring (120 V)	Black	Orange
Fire Alarm	Red	
Low Voltage Communication/General	Blue	
Low Voltage Control Wiring (<50 V)	Blue	Orange
Intrinsically Safe	Blue	White

3.3 METAL CONDUIT

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

.2 Mechanically bend conduits over 19 mm in diameter.

.3 Concrete Penetrations:

.1 Sleeves for Aluminum Conduit

.1 Install schedule 40 galvanized steel pipe, sized for free passage of conduit.

.2 Seal and firestop penetration around conduit with ULC approved assembly for the installation conditions.

.3 For wall, partitions, and ceilings the sleeve ends shall be flush with the finish on both sides but for floors they shall extend 50 mm above finished floor level or housekeeping pad level.

.4 Maximum spacing between supports for rigid metallic conduit:

.1	16mm conduit:	1.0 m
.2	21mm conduit:	1.5 m
.3	27mm conduit	1.5 m
.4	35mm conduit	2.0 m
.5	41mm conduit and larger	2.5 m

3.4 INSTALLATIONS IN CATEGORY 1 LOCATIONS

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

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

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

.4 Install every joint to be water-tight.

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

3.5 INSTALLATIONS IN CATEGORY 2 LOCATIONS

.1 Comply with all requirements of Category 1 locations.

3.6 INSTALLATIONS IN CATEGORY 2 WET LOCATIONS

.1 Comply with all requirements of Category 1 locations.

3.7 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 CEC requirements.

.2 Percent fill through fitting not to exceed 25%.

.3 Add sealing compound following manufacturer's instructions.

3.8 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 Percent fill through fitting not to exceed 25%.

.3 Add sealing compound following manufacturer's instructions.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

- .1 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.
- .2 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
- .3 CSA-C22.2 No. 159 Attachement Plugs, Receptacles, and Similar Wiring Devices for Use in Hazardous Locations
- .4 CSA-C22.2 No.55, Special Use Switches.
- .5 CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.2 SHOP DRAWINGS AND PRODUCT DATA

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

Part 2 Products

2.1 RECEPTACLES

.1 120V Receptacle Requirements:

- .1 Type: Dead Front Interlocked Circuit Breaking
  CSA Type 5-15R, Single Gang
  Rotate plug to engage power
- .2 Rating: 125 V, 15 A
- .3 Electrical Classification: Class I, Zone 2
- .4 Enclosure: NEMA 4 rated
- .5 Material:
  - .1 Housing: Die cast Copper Free Aluminum
  - .2 Interior: Fiberglass reinforced polyester
  - .3 Contacts: Receptacle blade – brass
    Receptacle Switch - silver
  - .4 Receptacle gasket: neoprene
- .6 Approvals: CSA
- .7 Features:
  - .1 Factory Sealed chamber enclosing the potential arcing components between two explosionproof threaded joints.
  - .2 Lockable in the closed position
  - .3 One piece molded gasket seals cover plate and ENP plug when plug is inserted, to allow for full environmental protection at the receptacle face.
  - .4 Top-hinged cover design with 45° downward angle.
- .8 Acceptable Products:

.1 Crouse Hinds ENR M4 Series

.2 600V Receptacle Requirements:

.1	Type:	Dead Front Interlocked Circuit Breaking
.2	Rating:	600 V, 60 A
.3	Electrical Classification:	Class I, Zone 2
.4	Enclosure:	NEMA 12 rated
.5	Material:	
.1	Housing:	Copper Free Aluminum
.2	Insulator:	Krydon
.3	Contacts:	brass
.6	Approvals:	CSA
.7	Features:	
.1	Lockable in the closed position.	
.2	Spring door.	
.3	Through Feed hubs – 35 mm	
.8	Compatible with Crouse Hinds Arktite APJ and NPJ plugs.	
.9	Acceptable Products:	
.1	Crouse Hinds FSQC Series	

.3 Use receptacles of one manufacturer throughout project.

2.2 PLUGS

.1 Plugs to be of matching configuration and manufacturer as receptacles.

2.3 SWITCHES

.1 347V Switch Requirements:

.1	Rating:	600 V, 30 A
.2	Electrical Classification:	Class I, Zone 2
.3	Poles:	As Indicated on drawings
.4	Housing Material:	Copper Free Aluminum
.5	Approvals:	CSA
.6	Acceptable Products:	
.1	Crouse Hinds DSD-SR Series	
.2	Or approved equal in accordance with B6.	

2.4 COVER PLATES

.1 Unless otherwise indicated, devices shall come as complete enclosures rated for the hazardous area in which they are installed.

.2 For unclassified areas:

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

.2 Cover plates from one manufacturer throughout project.

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

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

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

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

Part 3 Execution

3.1 INSTALLATION - GENERAL

.1 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount duplex receptacles vertically.

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

.2 Cover plates:

.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

.3 Install a permanent lamacoid for all light switches indicating the lights switched.

.1 Example: Wet Well Main Lighting

.2 Mount lamacoid above switch.

.4 Install a permanent lamacoid for all wiring devices indicating the circuit(s) contained within.

.1 Example: 8G-2 (PNL-8G, circuit 2)

.2 Mount circuit lamacoid on side of or below switch.

3.2 INSTALLATIONS IN HAZARDOUS CLASS I, ZONE 2 LOCATIONS

.1 Install conduit seals for devices that are not factory sealed.

3.3 INSTALLATIONS IN CATEGORY 1, CATEGORY 2, AND CATEGORY 2 WET LOCATIONS

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials for moulded-case circuit breakers and circuit breakers.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No. 5, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.3 SUBMITTALS

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

Part 2 Products

2.1 BREAKERS GENERAL

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

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

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

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

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

.5 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

.6 Include:

.1 On-off locking device.

2.2 PANELBOARD BREAKERS

.1 Breakers in Cutler-Hammer CBL, NQB, and PRL1 panelboards are to be BAB bolt-on breakers.

2.3 BREAKERS MOUNTED IN ENCLOSURES

.1 Standalone breaker enclosures:

.1 Requirements:

.1 Explosionproof, Type 4 surface mounted, front mounted external operating handle, lockable in the “off” position with a padlock.

.2 Provide neutral bar, with ampere rating equal or greater than the breaker rating.

.3 Provide ground bar with two (2) terminals.

.2 Breakers fed from MCC-1G and MCC-2G are to have an interrupting rating of 25 kA.

.3 Acceptable Products:

.1 Cutler-Hammer HFD series breakers

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

.2 Identification:

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

.2 For all individually mounted breakers and breakers in MCCs, CDPs and switchboards:

.1 Provide lamacoid plate on or adjacent to each breaker showing load being fed.

.2 Format:

.1 Line 1: The breaker identifier. Example: “CB-MTS-G1”.

.1 Where the breaker identifier is not specified, utilize “CB-“ followed by the immediate device being fed.

.2 Line 2: The ultimate load being fed, or a description of the breaker functionality. Example: “Load: UPS-G1” or “MCC-1G/MCC-2G Transfer Switch”.

.3 For panelboards:

.1 Ensure panelboard directory is updated.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.14 - 2010, Industrial Control Equipment.

.2 National Electrical Manufacturer's Association (NEMA)

.1 NEMA Standards Publication ICS 2-2000: Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.

1.2 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 Shop Drawings:

.1 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.

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

.1 Mounting method and dimensions.

.2 Starter size and type.

.3 Layout and components.

.4 Enclosure type.

.5 Wiring Diagram

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

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

.3 Extra Materials:

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

.1 All control fuses.

.2 One indicating lamp bulb.

Part 2 Products

2.1 COMBINATION CONTACTOR – HAZARDOUS CLASS 1, ZONE 2 RATED

.1 Contactors: to CSA C22.2 No.14 and NEMA ICS 2-2000.

.2 Enclosure

.1 Requirements:

.1 Explosionproof

.2 NEMA 4X

.3 Corrosion Resistant

.4 Copper-free aluminum

.3 Short Circuit Current Rating: 22 kA

.4 Breakers

.1 See Section 26 28 21.

.5 Full Voltage Magnetic Starters

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

.1 Rated for type of load controlled.

.2 Smallest size of starter: NEMA size 1, unless otherwise indicated

.3 IEC rated starters are not acceptable.

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

.1 All coils to be epoxy coated.

.2 Contactor solenoid operated, rapid action type.

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

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

.6 Control Transformer

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with primary and secondary fuses, installed with starter as indicated.

.2 Size control transformer as indicated.

.7 Accessories

.1 Pushbutton: heavy duty, oil tight as required.

.2 Indicating lights: heavy duty, oil tight, type and colour as indicated.

.3 Two normally open and two normally closed auxiliary contacts unless indicated otherwise.

.4 Surge Suppression Device: 25 kA SCCR

.8 Finishes

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

.9 Equipment Identification

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

.2 Magnetic starter designation label: white plate, black letters.

.10 Spare Parts

.1 Fuses: two of each rating.

.11 Acceptable Products

.1 Crouse Hinds

.2 O-Z/Gedney

.3 or approved equal in accordance with B6.

2.2 COMBINATION CONTACTOR – UNCLASSIFIED

.1 Contactors: to CSA C22.2 No.14 and NEMA ICS 2-2000.

.2 Enclosure

.1 Requirements:

.1 NEMA 1

.2 Gasketed Sheet Steel

.3 Short Circuit Current Rating: 22 kA

.4 Breakers

.1 See Section 26 28 21.

.5 Full Voltage Magnetic Starters

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

.1 Rated for type of load controlled.

.2 Smallest size of starter: NEMA size 1, unless otherwise indicated

.3 IEC rated starters are not acceptable.

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

.1 All coils to be epoxy coated.

.2 Contactor solenoid operated, rapid action type.

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

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

.6 Control Transformer

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with primary and secondary fuses, installed with starter as indicated.

.2 Size control transformer as indicated.

.7 Accessories

.1 Pushbuttons: heavy duty, oil tight as required.

.2 Indicating lights: heavy duty, oil tight, type and colour as indicated.

.3 Two normally open and two normally closed auxiliary contacts unless indicated otherwise.

.4 Surge Suppression Device: 25 kA SCCR

.8 Finishes

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

.9 Equipment Identification

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

.2 Magnetic starter designation label: white plate, black letters

.10 Spare Parts

.1 Fuses: two of each rating.

.11 Acceptable Products (For Components)

.1 Cutler Hammer

.2 or approved equal in accordance with B6.

Part 3 Execution

3.1 INSTALLATION

.1 Install starters as shown on drawings.

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

.3 Install and wire starters and controls as indicated.

.4 Ensure correct fuses installed.

3.2 FIELD QUALITY CONTROL

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

.2 Operate switches and contactors to verify correct functioning.

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

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 National Electrical Manufacturers Association (NEMA)

.1 NEMA Standards Publication ICS 2-2000: Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts

1.2 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 Shop Drawings:

.1 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.

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

.1 Mounting method and dimensions.

.2 Starter size and type.

.3 Layout and components.

.4 Enclosure type.

.5 Wiring Diagram

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

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

.3 Extra Materials:

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

.1 All control fuses.

.2 One indicating lamp bulb.

Part 2 Products

2.1 GENERAL

.1 Motor starters to be installed in the MCC are to be completely compatible with the existing MCC.

2.2 MCC BUCKET STARTER

.1 Full Voltage Magnetic Safety Contactors

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

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

.1 All coils to be epoxy coated.

.2 Contactor solenoid operated, rapid action type.

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

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

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

.6 IEC 60947 compliant Mechanically linked N.C. auxiliary contacts

.7 One N.O auxiliary contact

.8 SUVA third party certified

.3 Acceptable Products:

.1 Allen Bradley 100S Series

.2 Or approved equivalent

.2 Overload Relays

.1 Provide a solid-state overload relay for the protection of motors.

.2 The electronic overload relay shall be designed for compliance to the following standards:

.1 EN 60947-4-1

.2 EN 60947-5-1

.3 UL508

.4 CSA C22.2 No. 14

.3 The electronic overload relay shall be self-powered with no external power connections to ensure overload protection.

.4 The electronic overload relay shall provide current measurement-based protection.

.5 Motor current shall be monitored through three integral current transformers that power the overload protection circuitry.

.6 The electronic overload relay shall operate on 150mW or less of power.

.7 The electronic overload relay shall provide 1 N.O. and 1 N.C. isolated auxiliary contacts.

.8 All relay contacts shall be rated AC15 / B600.

.9 A trip indicator flag shall be provided at the overload relay face for visual trip status indication.

.10 A reset button shall be provided at the overload relay face for the purpose of trip resetting.

.11 A mechanical trip cam shall be provided at the overload relay face for the purpose of mechanically operating both sets of contacts.

.12 Wiring terminals shall provide IP20 finger protection.

.13 The electronic overload relay and accessories shall be rated for an operating environment of -20°C to +60 C (-4 to +140 F).

.14 The electronic overload relay shall be capable of operating in an environment with a relative humidity range of 0 to 95%, non-condensing.

.15 The electronic overload relay shall incorporate the following protection function capabilities:

.1 Thermal Overload

.1 The thermal overload algorithm shall employ a time-current integration model based on the composite average phase current as compared to the threshold setting.

.2 The electronic overload relay shall provide ambient temperature compensated thermal protection.

.3 The electronic overload relay shall offer a FLA setting range of 5:1 or greater.

.4 The electronic overload relay shall provide DIP switch selectable trip classes (10 or 20).

.5 The electronic overload relay shall incorporate a thermal memory circuit to ensure accurate protection for both hot and cold motors.

.6 The electronic overload relay shall provide manual-only trip resetting capability with an option for DIP switch selectable reset mode (manual / automatic-manual).

.7 The electronic overload relay shall provide trip-free operation.

.2 Phase Loss

.1 The electronic overload relay shall incorporate a phase loss detection circuit for responsive phase loss tripping performance.

.2 The typical reaction time for phase loss tripping shall be 3 seconds or less.

.16 Acceptable Products

.1 Cutler Hammer C440

.2 Allen-Bradley E1 Plus Electronic Overload Relay,

.3 Or approved equal in accordance with B6.

.3 Control Transformer

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with primary and secondary fuses, installed with starter as indicated.

.2 Size control transformer as indicated.

.4 Power Supply

.1 Requirements

.1	Power Supply Voltage:	120 VAC
.2	Output Voltage:	24 VDC
.3	Output Rating:	60 W
.4	Approvals:	CSA or cUL
.5	Mounting:	DIN Rail

.2 Acceptable Products:

.1 SolaHD SDN Series

.2 Or approved equal in accordance with B6.

.5 Safety Relay

.1 Requirements:

.1	Power Supply:	24 VDC
.2	Classification:	Category 4, ISO 1384901 SIL CL3, EN IEC 62061
.3	Certification:	CSA or cUL
.4	Number of Inputs:	Two
.5	Type of Inputs:	2 N.C.
.6	Safety Contact Outputs:	2 N.O.
.7	Aux. Contact Outputs	1 N.C., 2 PNP
.8	Features:	Pulsed Input Monitoring External Device Monitoring Monitored Manual Reset

.2 Acceptable Products:

.1 Allen Bradley MSR210P Series

.2 Or approved equal in accordance with B6.

.6 Wire duct

.1 Narrow slot wiring duct

.2 Manufacturer:

.1 Panduit

.2 Or approved equal in accordance with B6.

.7 Accessories

.1 Pushbutton: heavy duty, oil tight as required.

.2 Indicating lights: heavy duty, oil tight, type and colour as indicated.

.8 Finishes

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

.9 Equipment Identification

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Magnetic starter designation label: white plate, black letters.

.3 Provide lamacoids for all devices on the front panel with clear identification of purpose.

.10 Spare Parts

.1 Fuses: two of each rating.

2.3 MANUAL MOTOR STARTERS – SINGLE PHASE

.1 Requirements:

.1	Electrical Classification:	Class I, Zone 2
.2	Rating:	120 VAC
.3	Poles:	One

.4 Acceptable Products:

.1 Crouse Hinds EFD Series

.2 Or approved equal in accordance with B6.

Part 3 Execution

3.1 INSTALLATION

.1 Install starters as shown on drawings.

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

.3 Install and wire starters and controls as indicated.

.4 Ensure correct fuses installed.

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

3.2 FIELD QUALITY CONTROL

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

.2 Operate switches and contactors to verify correct functioning.

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

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA C22.2 No. 9.0 -1996 (R2011), General Requirements for Luminaires.

.2 CSA C22.2 No. 137 –M1981 (R2009) Electric Luminaires for Use in Hazardous Locations

1.2 SHOP DRAWINGS AND PRODUCT DATA

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

Part 2 Products

2.1 LAMPS

.1 Fluorescent cool white, 32 Watt, T8, rapid start, minimum rated life 20,000 hours

.2 High Pressure Sodium

.3 Metal Halide

2.2 WALL PACK LUMINAIRES - HID

.1 Ballast: CBM and CSA certified, energy efficient type, IC electronic, integral

.2 Rating: 347 V, 60 Hz for use with one 100W High Pressure Sodium lamp.

.3 Electrical Classification: Class I, Zone 2

.4 Temperature Code: T2A

.5 Power factor: minimum 90% with 95% of rated lamp lumens

.6 Operating frequency of electronic ballast: 21 kHz minimum.

.7 Accessories: Wire guard

.8 Approved Product:

.1 Crouse Hinds CPMV Series

.2 or approved equal in accordance with B6.

2.3 HIGH BAY – HID

.1 Ballast: CBM and CSA certified, energy efficient type, IC electronic, integral

.2 Rating: 347 V, 60 Hz for use with one 250W Pulse Start Metal Halide lamp.

.3 Electrical Classification: Class I, Zone 2

.4 Temperature Code: T2A

.5 Power factor: minimum 90% with 95% of rated lamp lumens

.6 Harmonics: 20% maximum THD, including 49^{th}

.7 Operating frequency of electronic ballast: 21 kHz minimum.

.8 Seal: Factory Sealed

.9 Accessories: Dome Reflector

.10 Approved Product:

.1 Crouse Hinds DMV Series

.2 or approved equal in accordance with B6.

2.4 HIGH BAY LUMINAIRES - FLUORESCENT

.1 Ballast: CBM and CSA certified, energy efficient type, IC electronic, integral

.2 Rating: 347 V, 60 Hz for use with four 32W lamps.

.3 Electrical Classification: Class I, Zone 2

.4 Temperature Code: T2A

.5 Mounting: Ceiling

.6 Approved Product:

.1 Crouse Hinds HazMax Apex HBA44164

.2 or approved equal in accordance with B6.

2.5 LOW BAY LUMINAIRES - FLUORESCENT

.1 Ballast: CBM and CSA certified, energy efficient type, IC electronic, integral

.2 Rating: 347 V, 60 Hz for use with two or three 32W lamps.

.3 Electrical Classification: Class I, Zone 2

.4 Temperature Code: T2A

.5 Lamp Type: As per the drawings

.6 Approved Product:

.1 Crouse Hinds HazMax Intrepid SPA42160 and SPA43160

.2 or approved equal in accordance with B6.

Part 3 Execution

3.1 INSTALLATION

.1 Locate and install luminaires as indicated.

.2 For re-wiring of existing fixtures, use closest available tie-in point.

.3 All lighting circuits shall be wired using RW90 run in rigid aluminum conduit.

.4 Lighting fixtures are indicated in the Lighting Fixture Schedule by means of type letters that correspond to similar letters on the plans.

.5 Lighting fixtures shall be installed in accordance with fixture manufacturer's recommendations, and the requirements of the drawings and specifications. Each luminaire shall be solidly and rigidly installed in a manner so that the fixture does not move or swing.

.6 Verify locations and spacing of lighting fixtures with the plans and notify the Contract Administrator of any variance or conflicts between the plans and field conditions. Do not proceed until conflict has been resolved.

.7 All fixtures shall be supported directly from the building structural members or from ridging attached to the structural members by rod hangers and inserts. Provide all necessary hardware and blocking to ensure that fixtures hang true.

.8 Effectively bond all fluorescent fixtures to ground. Fixtures with poor grounds will be rejected and shall be re-installed by the Contractor without extra charge.

.9 Install a lamacoid with circuit identifier on all luminaires.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

- .1 CSA C22.2 No.141- Unit Equipment for Emergency Lighting.
- .2 CSA C860- Performance of Internally-Lighted Exit Signs.
- .3 CSA C22.2 No. 137 – M1981(R2009)- Electric Luminaires for Use in Hazardous Locations

.2 National Fire Protection Association (NFPA) requirements

.3 National Building Code of Canada 3.4.5 – Exit Signs

1.2 PRODUCT DATA

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

Part 2 Products

2.1 HAZARDOUS AREA EXIT LIGHTS – CLASS I, Div/Zone 2

.1 Exit lights: to CSA C22.2 No.141 and CSA C860, packaged in accordance with the Canadian Code for Preferred Packaging guidelines.

.2 Rated for Hazardous Class I, Division/Zone 2 Area as per CSA C22.2 No. 137 – M1981

.3 Housing: moulded high impact thermoplastic.

.4 Power supply: Universal 120-347V.

.5 Face and back plates: moulded high impact thermoplastic.

.6 Lamps: LED, 5W Maximum.

.7 Letters: 150 mm high x 19 mm, with 13 mm thick stroke, red, reading EXIT.

.8 Face plate to remain captive for relamping.

.9 Universal (Wall, end, ceiling) mounting.

.10 Knockouts available for directional arrows.

.11 Manufacturers and Model:

- .1 Emergi-Lite LPEXHZ
- .2 Lumacell LER-HZ series
- .3 Ready-Lite TUFHZ series

2.2 ADDITIONAL EXIT SIGNAGE

.1 To CAN/ULC S572-10.

.2 “NOT AN EXIT” signs

- .1 Black lettering on white background.
- .2 Minimum size: 178 x 254 mm (7”x10”).

□

.3 Aluminum

.3 Supplier:

.1 www.safetysupplywarehouse.com

.2 or approved equal in accordance with B6.

Part 3 Execution

3.1 EXIT LIGHTS

.1 Install exit lights as per drawings.

.1 Mount above door, or if not above door, at a height that matches the nearest exit sign above a door.

.2 Connect exit lights to circuits listed on drawings using closest available tie in point.

3.2 ADDITIONAL EXIT SIGNAGE

.1 Install signs as per drawings, at a height of 1200 to 1600 mm above the finished floor.

.1 Install “Not an Exit” signs on doors that lead to dead ends or away from the closest exit.

.2 Install signs with screws and appropriate wall anchors, where required.

END OF SECTION

□

Part 1 General

1.1 REFERENCES

.1 Underwriters Laboratories of Canada (ULC)

.1 ULC-S317-1996, Installation and Classification of Closed Circuit Video Equipment (CCVC) Systems for Institutional and Commercial Security Systems.

1.2 SUBMITTALS

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

Part 2 Products

2.1 CHARACTERISTICS

.1 Video Camera Requirements:

.1	Enclosure:	Explosionproof
.2	Type:	Colour
.3	Sensitivity:	0.15 lux for useable video image.
.4	Resolution:	540 lines of horizontal resolution
.5	Environment:	indoor.
.6	Mounting:	wall mount.
.7	Lens functions:	2.8 - 12 mm, Auto-iris
.8	Additional features:	day/night image sensor, backlight compensation.
.9	Operational voltage:	standard 24 VAC.
.10	Operation temperature:	5 to 30 degrees C.
.11	Trasmission method:	Coax
.12	Power Supply:	Mounted in separate enclosure

.13 Acceptable Product:

.1 Bosch VEN-650V05 Series

.2 or approved equal in accordance with B6.

.2 Coax Cable Requirements:

.1 Industrial Grade RG-6

.2 Acceptable for CCTV use.

.3 Acceptable Product:

.1 Belden 7503A

.2 or approved equal in accordance with B6.

□

Part 3 Execution

3.1 INSTALLATION

.1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheet.

.2 Install video surveillance equipment and components in accordance with ULC-S317.

.3 Install cable, boxes, mounting hardware, brackets, video cameras and system components in accordance with manufacturer's written installation instructions.

.4 Install components secure, properly aligned and in locations shown on reviewed shop drawings.

.5 Connect cameras to cabling in accordance with installation instructions.

.6 Install ULC labels where required.

END OF SECTION

□

Part 1 General

1.1 GENERAL

.1 This Section covers items common to Sections of Division 40. This section supplements requirements of Division 1.

1.2 CODES AND STANDARDS

.1 Do complete installation in accordance with CSA C22.1-2009 except where specified otherwise.

.2 Comply with all laws, ordinances, rules, regulations, codes, and orders of all authorities having jurisdiction relating to this Work.

1.3 DRAWINGS AND SPECIFICATIONS

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

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

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

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

1.4 CARE, OPERATION AND START-UP

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

.2 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.5 PERMITS, FEES AND INSPECTION

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

.2 Pay associated fees.

.3 Notify Contract Administrator of changes required by Electrical Inspection Department prior to making changes.

.4 Furnish a Certificate of Final Inspection and approvals from inspection authority to the Contract Administrator.

1.6 MATERIALS AND EQUIPMENT

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

.2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.

.3 Factory assemble control panels and component assemblies.

.4 Minimum enclosure type to be used is NEMA 12 unless otherwise specified.

1.7 FINISHES

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

.1 Paint indoor switchgear and distribution enclosures light grey to ANSI 61 grey enamel, unless otherwise specified.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

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

1.8 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates as follows:

.2 Nameplates:

.1 Lamicoid 3 mm thick plastic lamicoid nameplates, white face, black lettering, mechanically attached with self tapping screws.

NAMEPLATE SIZES

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

.3 Wording on nameplates to be approved by Contract Administrator prior to manufacture.

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

.5 Identification to be English.

1.9 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings on both ends of phase conductors of feeders and branch circuit wiring.

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

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

1.10 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.

1.11 JUNCTION BOXES

.1 Wherever existing instrumentation wiring is not long enough to connect to new hazardous rated equipment, install a 254x203mm junction box to extend wiring to device.

.1 Confirm all junction box identifiers with the Contract Adminstrator prior to fabrication.

1.12 SUBMITTALS

.1 Prior to delivery of any Products to job Site and sufficiently in advance of requirements to allow ample time for checking, submit Shop Drawings for review as specified in Division

.2 Submit Shop Drawings (including Product Data) for all equipment as required in each Section of this Specification.

.3 Prior to submitting the Shop Drawings to the Contract Administrator, the Contractor shall review the Shop Drawings to determine that the equipment complies with the requirements of the Specifications and Drawings.

.4 The term “Shop Drawing” means drawings, diagrams, illustrations, schedules, performance characteristics, brochures and other data, which are to be provided by the Contractor to illustrate details of a portion of the Work. Indicate materials, methods of construction and attachment of support wiring, diagrams, connections, recommended installation details, explanatory notes and other information necessary for completion of Work. Where equipment is connected to other equipment, indicate that such items have been coordinated, regardless of the section under which the adjacent items will be supplied and installed. Indicate cross-references to Design Drawings and Specifications. Adjustments made on Shop Drawings by the Contract Administrator are not intended to change the contract price. If adjustments affect the value of the Work state such in writing to the Contract Administrator prior to proceeding with the Work.

.5 Manufacture of Products shall conform to revised Shop Drawings.

1.13 AS-BUILT DRAWINGS

.1 The Contractor shall keep one (1) complete set of white prints at the Site during work, including all addenda, change orders, Site instructions, clarifications, and revisions for the purpose of As-Built Drawings. As the Work on-site proceeds, the Contractor shall clearly record in Red Pencil all as-built conditions, which deviate from the original Contract Documents. As-Built Drawings to include circuiting of all devices, conduit and feeder runs (complete with conductor size and number) and locations of all electrical equipment.

1.14 O&M MANUAL

.1 Operations and Maintenance Manuals

.1 Refer to Section 01 78 00 for general O&M Manual requirements.

.2 In addition to the general requirements, provide the following information:

.1 Table of Contents – Arrange contents sequentially by systems under Section numbers. Label tabs of dividers between each to match section numbers in the Table of Contents.

.2 Systems Descriptions – A brief synopsis of each system typed and inserted at the beginning of each section. Include sketches and diagrams where appropriate.

.3 Manuals containing all pertinent information, drawings and documents of the Contractor's supply and/or documentation included with the instruments supplied by others, such as:

- .1 Mechanical drawings of the equipment.
- .2 Installation drawings and procedures.
- .3 Instrument model numbers.
- .4 Equipment specifications.
- .5 Detailed utility requirements.
- .6 Replacement parts list with model numbers.
- .7 Recommended preventative maintenance frequency.
- .8 Troubleshooting procedures.
- .9 Procedures for dismantling.
- .10 Procedure to operate the equipment/instruments.
- .11 Recommended cleaning procedure.
- .12 Recommended list of supplies to be used in conjunction with the operation and maintenance of the equipment.
- .13 Recommended spare parts list

.4 A copy of all wiring diagrams complete with wire coding.

.5 Include type and accuracy of instruments used.

.6 Set of final reviewed Shop Drawings.

.7 Testing documentation including commissioning checklists.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

.2 Submit commissioning plans and procedures, in writing, at least 10 Working days prior to commissioning.

1.2 CLOSEOUT SUBMITTALS

.1 Final Report:

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

.2 Include completed commissioning forms

.3 Bear signature of commissioning technician and supervisor

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

.5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

1.3 COMMISSIONING FORMS

.1 The Contract Administrator will provide the required commissioning forms.

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

1.4 COMMISSIONING

.1 Carry out commissioning under direction of the Contract Administrator and in the presence of representatives of the Contract Administrator and the City.

.2 Inform, and obtain approval from the Contract Administrator in writing at least 14 days prior to commissioning or each test. Indicate:

.1 Location and part of system to be tested or commissioned.

.2 Testing/commissioning procedures, anticipated results.

.3 Names of testing/commissioning personnel.

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

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

.5 Perform tests as required.

1.5 COMPLETION OF COMMISSIONING

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

Part 2 Products

2.1 EQUIPMENT

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

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

.3 Independent testing laboratory to certify test equipment as accurate to within approved tolerances no more than 6 months prior to tests.

Part 3 Execution

3.1 GENERAL REQUIREMENTS

.1 Commission all instruments, switches, actuators, and other devices that have in any way been affected by the work. Modification of the device wiring conduit system requires commissioning of the device.

3.2 STATUS PRIOR TO COMMISIONING

.1 Prior to commissioning, ensure that the following is completed:

.1 Installation of all panels and completion of all wiring connections.

.2 Testing wiring for continuity from the field device to the control panel.

3.3 PROCEDURES

.1 Provide a minimum of one qualified technician to test and commission the automation devices. The devices will be commissioned as the work progresses. Commissioning of all devices at the end of the project will not be accepted.

.2 Test each I/O point from the instrument to the DCS or Field Device Panel.

.1 Test both states of discrete points.

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

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

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

.5 All modifications to the software program, to bypass interlocks or sensors, shall be recorded and documented clearly in a separate document, and the software.

.1 Any software bypasses that remain, prior to leaving site, must be authorized by the Contract Administrator or designated representative.

.6 All deficiencies must be corrected by the Contractor.

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

3.4 SYSTEM SOFTWARE

.1 Changes to the control system software are to be carried out by City Personnel only.

3.5 CHECKLISTS, FORMS, AND REPORTS

.1 Complete checklists, forms, and reports for each instrument, loop, and control device.

.1 Instrument Switch Checklist

.2 Instrument Transmitter Loop Checklist.

.3 Modulating Control Device Checklist

.4 Discrete Control Device Checklist

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.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 NEMA 250-2003, Enclosures for Electrical Equipment (1000 Volts Maximum).

.2 Canadian Standards Association (CSA International).

.1 CSA-C22.1-2009, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

1.2 SUBMITTALS

.1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 01 33 00 – Submittal Procedures.

.2 Manufacturer's Instructions:

.1 Include manufacturer's installation instructions for specified equipment and devices in O&M Manuals.

1.3 STORAGE

.1 Store instruments in their original shipping containers in a dry location that is free of fumes and vapors. Never store an instrument in an area where desensitizing agents (such as paint or silicone) may be present.

Part 2 Products

2.1 GENERAL

.1 Provide products and materials that are new and free from all defects.

.2 Products and materials called for on the Drawings or in the Specifications by trade names, manufacturer's name and catalogue reference are those which are to be used as the basis for the Bid.

.3 The design has been based on the use of the first named product, where applicable equivalent products are listed.

.4 Quality of Products

.1 All products provided to be CSA Approved, and Underwriters' Laboratories of Canada listed where applicable.

.2 If products specified are not CSA approved, obtain approval. Pay all applicable charges levied and make all modifications required for approval.

.5 Products to be manufacturers’ standard finish.

.6 Instruments are to be suitable for the environmental conditions in which they are to be installed.

.7 Determine where injurious conditions may be expected to occur and make proper provision to protect the instruments to ensure their proper and reliable operation.

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

2.2 PRESSURE SWITCHES

.1 Requirements:

.1	Type:	Electro-mechanical
.2	Seal:	Factory Sealed
.3	Voltage:	120 VAC
.4	Connection	2 wire single switch
.5	Contact Type:	SPDT or DPDT as shown on the drawings
.6	Contact Rating:	10 A @ 120 VAC
.7	Operating Temperature:	10°C to 30°C
.8	Measurement Pressure:	2.0 mbar to 17.4 mbar (0.8” to 7” W.C.)
.9	Mounting:	Wall.
.10	Enclosure Rating:	NEMA 4X
.11	Approvals:	CSA
.12	Electrical Classification:	Class I, Zone 2
.13	Temperature Code:	T2A

.14 Acceptable Products:

.1 United Electric 117 Series

.2 or approved equal in accordance with B6.

2.3 CONVEYOR PULL SWITCHES AND PULL CORD

.1 Pull Switch Requirements:

.1	Type:	Pull Cord Switch.
.2	Seal:	External hazardous seal
.3	Voltage:	120 VAC
.4	Contact Type:	Two N.C. contacts
.5	Contact Rating:	10 A @ 120 VAC
.6	Operating Temperature:	10 to 30°C
.7	Approvals:	CSA
.8	Electrical Classification:	Class I, Zone 2
.9	Temperature Code:	T2A
.10	Finish:	Corrosion Resistant

.11 Acceptable Products:

.1 Crouse Hinds AFUX

.2 or approved equal in accordance with B6.

.2 Pull Cord requirements:

.1	Type:	Stainless steel aircraft cable, 7x7 stranded
.2	Diameter:	3.2 mm (1/8”)
.3	Coating:	Vinyl
.4	Colour:	Red
.5	Tensioner Spring:	Stainless steel

2.4 EMERGENCY STOP SWITCHES

.1 Requirements:

.1	Type:	Red Mushroom Head, Maintained Contact
.2	Seal:	Integral Sealing Well or External Hazardous Seal
.3	Electrical Classification:	Class I, Zone 2
.4	Temperature Code:	T2A
.5	Contact Type:	Two N.C. contacts
.6	Contact Rating:	10 A @ 120 VAC
.7	Operating Temperature	10°C to 30°C
.8	Enclosure Rating:	NEMA 4
.9	Approvals:	CSA
.10	Acceptable Products:	

.1 Allen Bradley 800H with Type 4 Sealing Kit

.2 or approved equal in accordance with B6.

2.5 LIMIT SWITCHES

.1 Conveyor Limit Switch Requirements:

.1	Type:	Metal Adjustable Lever
.2	Seal:	Factory Sealed
.3	Voltage:	120 VAC
.4	Contact Rating:	5 A
.5	Operating Temperature	10°C to 30°C
.6	Enclosure Rating:	NEMA 4X
.7	Approvals:	CSA
.8	Electrical Classification:	Class I, Zone 2
.9	Temperature Code:	T2A
.10	Acceptable Products:	

.1 Allen Bradley 802XR

.2 or approved equal in accordance with B6.

.2 Fan Room Limit Switch Requirements:

.1	Type:	Metal Adjustable Lever
.2	Seal:	External hazardous seal
.3	Voltage:	120 VAC
.4	Contact Rating:	10 A
.5	Operating Temperature	10°C to 30°C
.6	Enclosure Rating:	NEMA 4X
.7	Approvals:	CSA
.8	Electrical Classification:	Class I, Zone 2
.9	Temperature Code:	T2A
.10	Acceptable Products:	

.1 Allen Bradley 802X

.2 or approved equal in accordance with B6.

2.6 DOOR PROXIMITY SWITCHES

.1 Requirements:

.1	Type:	Leverless Limit Switch – Ferrous Sensing
.2	Seal:	External hazardous seal
.3	Sensing Distance:	6.3 mm (1/4”)
.4	Voltage:	120 VAC
.5	Contact Type:	SPDT
.6	Contact Rating:	6 A @ 120 VAC
.7	Connection	914 mm (36”) lead wires
.8	Temperature	-40°C to 40°C
.9	Enclosure Rating:	NEMA 4X
.10	Material:	Stainless Steel
.11	Approvals:	CSA
.12	Electrical Classification:	Class I, Zone 2
.13	Temperature Code:	T2A

.14 Acceptable Products:

.1 Topworx GO Switch Model 31-17526-A2

.2 or approved equal in accordance with B6.

2.7 SPEED SWITCHES

.1 Requirements

.1	Type:	Non-contact
.2	Seal:	External hazardous seal
.3	Sensing Distance:	6.3 mm (1/4”)
.4	Voltage:	120 VAC
.5	Contact Type:	SPDT
.6	Contact Rating:	3A @ 120 VAC
.7	Relay Type:	Non-latching
.8	RPM Setpoint:	20 RPM
.9	Enclosure Rating:	NEMA 4 c/w epoxy coating
.10	Approvals:	CSA
.11	Electrical Classification:	Class I, Zone 2
.12	Temperature Code:	T2A

.13 Acceptable Products:

.1 K-Tek A22

.2 or approved equal in accordance with B6.

2.8 SUBMERSIBLE LEVEL SWITCH

.1 Replace all level switches associated with this project with new level switches.

.2 Requirements:

.1	Type:	Mechanical switch in plastic casing.
.2	Seal:	None required. Intrinsically Safe method of protection.
.3	Fluid:	Wastewater
.4	Temperature Range:	0 to 50°C
.5	Ingress Protection:	IP68
.6	Output:	Form C dry contact
.7	Electrical Connection:	Leads in submersible cable assembly.
.8	Approvals:	CSA
.9	Acceptable Products:	
	.1 Flygt ENM-10	

2.9 STROBE

.1 Requirements:

.1	Electrical Classification:	Class I, Zone 2
.2	Temperature Code:	T2A
.3	Seal:	External hazardous seal
.4	Lens:	Amber Polycarbonate
.5	Voltage:	120 VAC
.6	Operating Temperature	10°C to 30°C
.7	Enclosure Rating:	NEMA 4X
.8	Flash Rate:	120 FPM
.9	Approvals:	CSA
.10	Acceptable Products:	
	.1 Crouse Hinds XB16UL Series	
	.2 or approved equal in accordance with B6.	

2.10 HORN

.1 Requirements:

.1	Electrical Classification:	Class I, Zone 2
.2	Temperature Code:	T2A
.3	Seal:	External hazardous seal
.4	Sound Level:	108 dbA at 3.05 m
.5	Voltage:	120 VAC
.6	Operating Temperature	10°C to 30°C
.7	Enclosure Rating:	NEMA 4X
.8	Approvals:	CSA
.9	Tone:	Selectable
.10	Acceptable Products:	
	.1 Crouse Hinds DB1 Series	
	.2 or approved equal in accordance with B6.	

2.11 SPEAKER

.1 Requirements:

.1	Electrical Classification:	Class I, Zone 2
.2	Temperature Code:	T2A
.3	Seal:	External hazardous seal
.4	Output:	30 W
.5	Operating Temperature	10°C to 30°C
.6	Enclosure Rating:	NEMA 4X
.7	Colour:	Black
.8	Approvals:	CSA

.9 Acceptable Products:

.1 Crouse Hinds DB16UC Series

.2 or approved equal in accordance with B6.

2.12 PRESSURE WASHER PUSHBUTTON STATION

.1 Requirements:

.1	Electrical Classification:	Class I, Zone 2
.2	Temperature Code:	T2A
.3	Seal:	Integral Sealing Well or External Hazardous Seal

.4 Enclosure:

.1	Type:	2 Gang Vertical
.2	Covers:	
.1	Upper box:	One hole
.2	Lower box:	Two hole
.3	Rating:	NEMA 4

.5 Pushbuttons:

.1	Type:	Momentary Contact, Extended Head
.2	Contact Type:	1 N.O. and 1 N.C
.3	Contact Rating:	10 A @ 120 VAC
.4	Colour, Legend plate:	
.1	Top:	Black, “SOAP”
.2	Middle:	Green, “START”
.3	Bottom:	Red, “STOP”

.6	Approvals:	CSA

.7 Acceptable Products:

.1 Allen Bradley 800H with Type 4 Sealing Kit

.2 or approved equal in accordance with B6.

2.13 THERMOSTATS

.1 Requirements:

.1	Type:	Line Voltage Thermostat

.2	Seal:	External hazardous seal
.3	Electrical Classification:	Class I, Zone 2
.4	Temperature Code:	T2A
.5	Voltage:	120 VAC
.6	Contact Rating:	10 A
.7	Temperature Range:	2 to 28 °C (36 to 82 °F)
.8	Switch:	Bimetallic

.9 Acceptable Products:

.1 Crouse Hinds HRC1 Series

.2 Or approved equal in accordance with B6.

Part 3 Execution

3.1 INSTALLATION

.1 Install conduit drain fitting on instruments where conduit connects to instrument from above.

.2 Install equipment and components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

.3 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.

.4 Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.

.5 Electrical:

.1 Complete installation in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Install communication wiring in conduit or utilizing ACIC cabling if shown on the drawings.

.1 Provide complete conduit /cable system to link instrumentation and the control panel(s).

.2 Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems.

.3 Maximum conduit fill not to exceed 40% or 25% if passing through a hazardous seal.

.4 Design drawings do not show conduit layout.

.3 Equipment installed in Category 2 wet locations shall be mounted a minimum of 12 mm from supporting surface as per the Canadian Electrical Code Section 22.

.6 Locations of all field instruments are subject to modification by the Contract Administrator who reserves the right to move any item up to 3 meters from the position shown, without change to the contract price, provided notice is given before the related work has commenced.

.7 Exact locations of all field instruments shall be site determined by the Contractor to the satisfaction of the Contract Administrator to ensure proper operation of the device.

3.2 IDENTIFICATION

.1 Identify field devices with lamacoids. Install in a conspicuous location.

3.3 TESTING AND COMMISSIONING

.1 Calibrate and test field devices for accuracy and performance in accordance with Section 40 80 11 - Automation Commissioning.

END OF SECTION

Part 1 General

1.1 REFERENCES

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

Part 2 Products

2.1 COMPONENTS

.1 Terminals

.1 Terminals in existing control panels shall be Weidmuller SAK 4, TS-32 type.

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

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

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

.2 Switches and Pilot Lights

.1 Switches and pilot lights shall be the same make and model as switches and pilot lights on the existing control panel.

.3 General Purpose Relays

.1	Type:	DPDT or as shown on drawings
.2	Indication:	LED
.3	Coil Voltage:	As per drawings
.4	Contact Rating:	5A (120 VAC), 5A (24 VDC)
.5	Approvals:	CSA
.6	Manufacturer:	Omron or approved equal in accordance with B6.

.4 Wiring

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

.2 No more than two (2) conductors may be terminated under each terminal screw. All internal panel conductors shall be connected to the same side of a terminal block, and external conductors to the other side. The only exception is for fused terminals which require connection to the field side for internal wiring.

.3 Run all wiring in wire duct. Size all wireways so that the total cross sectional area of the insulated wire and cable does not exceed 40 percent of the cross sectional area of the wire way.

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

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

.1 Label both ends of each wire.

.2 Utilize machine printed non-slip labels.

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

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

.7 The routing of all analog, digital, and power cable wiring inside control panels shall be segregated as much as possible, in distinct wiring ducts, by the type of signal they are carrying. All wires shall be physically protected by wiring ducts with covers. The wiring ducts shall be of sufficient size to be filled to a maximum of 50% when all wires are inside.

.8 All analog signal wiring shall be 18 AWG shielded twisted pairs. Shield wires exiting the jacket must be covered with a black heat shrink, and the overall cable at the jacket end must also be covered with a heat shrink.

.9 All 24 VDC or 120 VAC discrete signal panel wiring shall be 16 AWG TEW stranded conductor.

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

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

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

Part 3 Execution

3.1 COMPONENT INSTALLATION

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

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

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

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

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

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

.7 Supply and install all required fuses.

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

□

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

3.2 IDENTIFICATION

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

.2 Label terminals as shown on drawings.

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

END OF SECTION

□

Part 1 General

Part 2 Products

2.1 GENERAL

.1 Unless otherwise specified, provide outside finishes on all enclosures in ANSI 61 Grey.

.2 The enclosures must be suitable for carrying the weight of the equipment mounted inside the panel and on the doors without any warpage.

.3 Provide a lamacoid for the junction box with identifier.

.4 Provide a lamacoid for the junction box with power panel and circuit number, if applicable.

2.2 ENCLOSURES

.1 Enclosures shall be NEMA 4X rated unless located in electrical or control rooms.

.2 Enclosures in Category 2 or Category 2 Wet locations shall be stainless steel.

.3 Enclosures shall have a continuous hinge with clamps for closing.

.4 Manufacturer: Hoffman or approved equal in accordance with B6.

2.3 WIRING AND ACCESSORIES

.1 Provide wiring inside the panels according to the following Specifications:

.1 Control wiring to be a minimum of 16 AWG tinned stranded copper; insulation rated at 600 V.

.2 Wiring for power distribution shall be a minimum of 14 AWG tinned stranded copper; insulation rated at 600 V.

.3 Install cables in accordance with the requirements of Division 26.

.2 Tag each wire at both ends with a heat shrink sleeve that is machine printed. Allow approximately 20 mm of wire insulation between the tag and the bare wire.

.3 Wiring systems with different voltage levels or types shall be suitably segregated within the panel, according to relevant electrical codes.

.4 Run all wiring in enclosed plastic wireways such as Panduit. Size all wireways so that the total cross sectional area of the insulated wire and cable does not exceed 40 percent of the cross sectional area of the wire way.

.5 Provide a minimum clearance of 50 mm between wire ways and any point of wire termination.

.6 Terminate all wiring, incoming and outgoing, at terminal strips mounted inside the panels. Identify each terminal strip with a terminal strip number, as per the drawings.

.7 Provide sufficient terminals so that not more than two wires are connected under the same terminal.

.8 Provide nameplates for each device on or within the enclosure.

□

2.4 INTRINSICALLY SAFE BARRIERS

.1 Requirements:

.1	Isolation Method:	Galvanic Isolation
.2	Channels:	Two
.3	Voltage Supply:	120 VAC
.4	Aprrovals:	CSA or cUL
.5	Acceptable Products:	
.1	Phoenix Contact	PI-EX-ME-2NAM/COC-120VAC
.2	Or approved equal in accordance with B6.	

2.5 PANEL GROUNDING

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

Part 3 Execution

3.1 MOUNTING HEIGHTS

.1 Unless otherwise specified or a conflict exists, mount all panels, starters and disconnects 2000 mm to top of cover.

END OF SECTION

□

Part 1 General

1.1 REFERENCES

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

.2 ANSI/AWWA C540, AWWA Standard for Power-Actuating Devices for Valves and Slide Gates

1.2 SUBMITTALS

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

.1 Submit shop drawings and product data for actuators specified in this section.

.2 Closeout submittals:

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

Part 2 Products

2.1 ACTUATORS

.1 General Requirements

.1 The actuators shall be suitable for use on a nominal 600 volt, 3 phase, 60 Hz power supply and are to incorporate motor, integral reversing starter, local control facilities and terminals for remote control and indication connections housed within a self contained, sealed enclosure.

.2 In order to maintain the integrity of the enclosure, setting of the torque levels, position limits and configuration of the indication contacts etc shall be carried out without the removal of any actuator covers over an Infra red interface. Sufficient commissioning tools shall be provided with the actuators and must meet the enclosure protection and certification levels of the actuators. Commissioning tools shall not form an integral part of the actuator and must be removable for secure storage/authorised release. In addition, provision shall be made for the protection of configured actuator settings by a means independent of access to the commissioning tool.

.3 The actuator shall include a device to ensure that the motor runs with the correct rotation for the required direction of valve travel irrespective of the connection sequence of the power supply. No failsafe position is required.

.2 Actuator sizing

.1 The safety margin of motor power available for seating and unseating the valve shall be sufficient to ensure torque switch trip at maximum valve torque with the supply voltage 10% below nominal.

.2 A minimum 25% safety factor should be applied to the most demanding valve operating criteria.

.3 Requirements:

.1 Area Classification: Class I, Zone 2

.2 Rising stem design.

.3 Multi-turn, 29RPM

.4 400 Nm Maximum Torque

.5 Side Handwheel

.6 Machining of drive bushing to fit valve

.3 Environmental

.1 Actuators located indoors shall be capable of functioning in an ambient temperature ranging from 0°C (32°F) to 120°C (248°F), up to 100% relative humidity.

.2 Actuators for hazardous area applications shall meet the area classification, gas group and surface temperature requirements specified on the drawings.

.3 All components of the actuator drive train shall be designed with adequate heat capacity for the actuator being operated at the specified motor duty cycle, travel times and torque requirements.

.4 Enclosure.

.1 Rated for Class I, Zone 2, Group IIA Hazardous Locations.

.2 Actuators shall be O-ring sealed, watertight to IP68 7m for 72hrs, NEMA 4X and 6.

.3 The motor and all other internal electrical elements of the actuator shall be protected from ingress of moisture and dust when the terminal cover is removed at site for cabling, the terminal compartment having the same ingress protection rating as the actuator with the terminal cover removed.

.4 Enclosure must allow for temporary site storage without the need for electrical supply connection.

.5 All external fasteners shall be zinc plated stainless steel. The use of unplated stainless steel or steel fasteners is not permitted.

.5 Motor.

.1 The motor shall be an integral part of the actuator, designed specifically for valve actuator applications. It shall be a low inertia high torque design, class F insulated with a class B temperature rise giving a time rating of 15 minutes at 40°C(104°F) at an average load of at least 33% of maximum valve torque. Temperature shall be limited by thermostats embedded in the motor end windings and integrated into its control.

.2 Electrical and mechanical disconnection of the motor should be possible without draining the lubricant from the actuator gearcase.

.6 Motor Heaters

.1 Motor heaters are to be provided at the discretion of the vendor based on the environmental requirements. Heaters are to be rated 120V AC and are to be supplied by the integral control transformer.

.7 Motor Protection

.1 Protection shall be provided for the motor as follows:

.1 Stall - the motor shall be de-energized within 8 seconds in the event of a stall when attempting to unseat a jammed valve.

.2 Over temperature - thermostat will cause tripping of the motor. Auto-reset on cooling

.3 Single phasing - lost phase protection.

.4 Direction – phase rotation correction.

.8 Gearing.

.1 The actuator gearing shall be totally enclosed in an oil-filled gearcase suitable for operation at any angle. Grease lubrication is not permissible.

.2 If the the actuator is shipped without lubricant then each actuator shall be tagged to this effect.

.3 All drive gearing and components must be of metal construction and incorporate a lost-motion hammerblow feature.

.4 For rising spindle valves the output shaft shall be hollow to accept a rising stem, and incorporate thrust bearings of the ball or roller type at the base of the actuator.

.5 The design should be such as to permit the opening of the gearcase for inspection or disassembled without releasing the stem thrust or taking the valve out of service.

.9 Hand Operation.

.1 A handwheel shall be provided for emergency operation, engaged when the motor is declutched by a lever or similar means, the drive being restored to power automatically by starting the motor. This lever shall be padlockable in either the handwheel or motor operation mode.

.2 The handwheel or selection lever shall not move on restoration of motor drive.

.3 Provision shall be made for the hand/auto selection lever to be locked in both hand and auto positions. It should be possible to select hand operation while the actuator is running or start the actuator motor while the hand/auto selection lever is locked in hand without damage to the drive train.

.4 Clockwise operation of the handwheel shall give closing movement of the valve. An arrow indicating the direction of rotation to close the valve shall be permanently engraved on the handwheel.

.5 For linear valve types the actuator handwheel drive must be mechanically independent of the motor drive and should be such as to permit valve operation in a reasonable time with a manual force not exceeding 200N through stroke and 400N for seating/unseating of the valve.

.10 Drive Bushing

.1 The actuator shall be furnished with a drive bushing easily detachable for machining to suit the valve stem or gearbox input shaft. Normally the drive bushing shall be positioned in a detachable base of the actuator. Thrust bearings, when housed in a separate thrust base should be of the sealed for life type.

.11 Torque and turns limitation

.1 Torque and turns limitation to be adjustable as follows:

.1 Position setting range – multi-turn: 2.5 to 100,000 turns, with resolution to 15 deg. of actuator output.

.2 Torque setting: 40% to 100% rated torque.

.2 Measurement of torque shall be from direct measurement of force at the output of the actuator. Methods of determining torque-using data derived from the motor such as motor speed, current, flux etc are not acceptable.

.3 A means for automatic "torque switch bypass" to inhibit torque off during valve unseating and "latching" to prevent torque switch hammer under maintained or repeated control signals shall be provided.

.4 The electrical circuit diagram of the actuator should not vary with valve type, remaining identical regardless of whether the valve is to open or close on torque or position limit.

.12 Remote valve position/actuator status indication

.1 Four contacts shall be provided which can be selected to indicate any position of the valve. Provision shall be made for the selection of a normally closed or open contact form. Contacts shall maintain and update position indication during handwheel operation when all external power to the actuator is isolated.

.2 The contacts shall be rated at 5A, 250V AC, 30V DC.

.3 As an alternative to providing valve position any of the four above contacts shall be selectable to signal one of the following:

.1 Valve opening, closing or moving

.2 Thermostat tripped, lost phase

.3 Motor tripped on torque in mid travel, motor stalled

.4 Remote selected

.5 Actuator being operated by handwheel

.13 Local Position Indication

.1 The actuator display shall include a dedicated numeric/symbol digital position indicator displaying valve position from fully open to fully closed in 1% increments. Valve closed and open positions shall be indicated by symbols showing valve position in relation to the pipework to ensure that valve status is clearly interpreted. With main power on the display shall be backlit to enhance contrast at low light levels and shall be legible from a distance of at least 6 feet (2m).

.2 Red, green, and yellow lights corresponding to open, closed, and intermediate valve positions shall be included on the actuator display when power is switched on. The digital display shall be maintained and updated during handwheel operation when all power to the actuator is isolated.

.3 In addition, the actuator display shall include a separate text display element with a minimum of 32 characters to display operational, alarm and configuration status. The text display shall be English. Provision shall be made to upload a different language without removal of any covers or using specialized tools not provided as standard with the actuator.

.14 Local Torque Indication

.1 The digital display shall be capable of indicating real time torque and valve position simultaneously, both being displayed in 1% increments of valve position and actuator rated torque. In addition torque shall also be displayed in horizontal bar graph form.

.15 Integral starter and transformer

.1 The reversing starter, control transformer and local controls shall be integral with the valve actuator suitably housed to prevent breathing and condensation. The starter shall be suitable for 60 starts per hour and of rating appropriate to motor size. The controls supply transformer shall be fed from two of the incoming three

phases and incorporate overload protection. It shall have the necessary tappings and be adequately rated to provide power for the following functions:

.1 Energization of the contactor coils.

.2 24V DC output for remote controls.

.3 Supply for all the internal electrical circuits.

.16 Local controls

.1 The actuator shall incorporate local controls for Open, Close and Stop and a Local/Stop/Remote mode selector switch lockable in any one of the following three positions: local control only, stop (no electrical operation), remote control plus local stop only. It shall be possible to select maintained or non-maintained local control.

.2 The local controls shall be arranged so that the direction of valve travel can be reversed without the necessity of stopping the actuator.

.3 Provision shall be made to orientate the local controls through increments of 90º.

.17 Control facilities

.1 The necessary control, wiring and terminals shall be provided in the actuator for the following functions:

.2 Open and close external interlocks to inhibit local and remote valve opening and/or closing control. It shall be possible to configure the interlocks to be active in remote control only.

.3 It shall be possible to reverse valve travel without the necessity of stopping the actuator. The motor starter shall be protected from excessive current surges during rapid travel reversal.

.4 The internal circuits associated with the remote control and monitoring functions are to be designed to withstand simulated lightning impulses of up to 2kV.

.18 Monitoring facilities

Facilities shall be provided for monitoring actuator operation and availability as follows:

.1 Monitor (availability) relay, having one change-over contact, the relay being energized from the control transformer will de-energise under any one or more the following conditions:

.1 Loss of main or customer 24V DC power supply

.2 Actuator control selected to local or stop

.3 Motor thermostat tripped

.4 Actuator internal fault

.2 Where specified, provision shall be made for contacts to provide discreet indication of one or more of the following:

.1 Remote selected

.2 Thermostat trip

.3 Actuator fault

.3 Actuator text display indication of the following status/alarms:

.1 Closed Limit, open limit, moving open, moving closed, stopped

.2 Torque trip closing, torque trip opening, stalled

.3 ESD active, interlock active

.4 Thermostat trip, phase lost, 24V supply lost, Local control failure

.5 Configuration error, Position sensor failure, Torque sensor failure

.6 Battery low, power loss inhibit

.4 Integral datalogger to record and store the following operational data:

.1 Opening last /average torque against position

.2 Closing last /average torque against position

.3 Opening motor starts against position

.4 Closing motor starts against position

.5 Total open/closed operations

.6 Maximum recorded opening and closing torque values

.7 Event recorder logging operational conditions (valve, control and actuator)

.5 The datalogger shall record relevant time and date information for stored data.

.6 Datalogger data is to be accessed via non-intrusive IrDA communication. Sufficient standard intrinsically safe tools shall be provided for downloading datalogger and actuator configuration files from the actuators and subsequent uploading to a PC. The actuator manufacturer shall supply PC software to enable datalogger files to be viewed and analysed.

.19 Wiring and terminals

.1 Internal wiring shall be tropical grade PVC insulated stranded cable of appropriate size for the control and 3-phase power. Each wire shall be clearly identified at each end.

.2 The terminals shall be embedded in a terminal block of high tracking resistance compound.

.3 The terminal compartment shall be separated from the inner electrical components of the actuator by means of a watertight seal and shall be provided with a minimum of 2 threaded cable entries with provision for a maximum of 4.

.4 All wiring supplied as part of the actuator to be contained within the main enclosure for physical and environmental protection. External conduit connections between components are not acceptable.

.5 A durable terminal identification card showing plan of terminals shall be provided attached to the inside of the terminal box cover indicating:

.1 Serial number

.2 External voltage values

.3 Wiring diagram number

.4 Terminal layout

.6 The code card shall be suitable for the contractor to inscribe cable core identification alongside terminal numbers.

.20 Start-up kit

.1 Each actuator shall be supplied with a start-up kit comprising installation instruction manual, electrical wiring diagram and cover seals to make good any site losses during the commissioning period. In addition, sufficient actuator

commissioning tools shall be supplied to enable actuator set up and adjustment during valve/actuator testing and site installation commissioning.

.21 Performance test certificate

.1 Each actuator must be performance tested and individual test certificates shall be supplied free of charge. The test equipment should simulate a typical valve load, and the following parameters should be recorded.

.1 Current at maximum torque setting

.2 Torque at max. torque setting

.3 Flash test voltage

.4 Actuator output speed or operating time.

.2 In addition, the test certificate should record details of specification such as gear ratios for both manual and automatic and second stage gearing if provided, drive closing direction, wiring diagram number.

.3 All actuators to be labelled with stainless steel tags with their identification number as indicated on the drawings.

.4 Actuator nameplate to be permanently affixed to equipment and stamped or marked with weather resistant markings; and removable tag with lubrication types and quantities on each actuator.

.22 Manufacturer and Model:

.1 Rotork IQ25Z – 29 RPM/400 Nm torque

.2 Alternates will not be accepted due to existing use of Rotork actuators at the facility.

2.2 SHIPPING

.1 The actuators, gearboxes and any other components shall be set on pallets for ease in shipping and handling and the shall be tagged or marked with:

a) purchase order number;

b) shipping tag number; and

c) weight.

These markings are for use in material shipping and handling and so must be readily visible.

.2 The actuator shall be shipped with sufficient protection and packaging to prevent handling damage.

.3 Handwheels shall be removed from the shaft and securely fastened to the actuator. Bolts, nuts, indicator rod, indicator rod cover and any other loose components shall be attached to each actuator.

Part 3 Execution

3.1 INSTALLATION

.1 If the actuator cannot be installed immediately store it in a dry place until it can be connected to incoming cables.

.2 If the actuator has to be installed but cannot be cabled it is recommended that the plastic transit cable entry plugs are replaced with metal plugs which are sealed with PTFE tape.

.3 Complete installation in accordance with manufacturer's written instructions unless otherwise indicated.

.4 Do not lift the actuator by the handwheel. Do not lift the actuator and valve combination via the actuator.

.5 The actuator should be fully supported until full valve stem engagement is achieved and the actuator is secured to the valve flange.

.6 Perform commissioning procedure as indicated in manufacturer written documentation.

3.2 PRE-START-UP INSPECTIONS

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

3.3 START-UP

.1 Provide continuous supervision during start-up.

.2 Start-up procedures:

.1 Perform commissioning procedure as indicated in manufacturer written documentation.

.3 Rectify start-up deficiencies.

3.4 PERFORMANCE VERIFICATION

.1 Procedures:

.1 The actuator shall be tested at the specified application torque and output rpm.

.2 Each actuator shall be performance tested to verify conformity to specified operating conditions including:

.1 voltage, phase, and Hertz;

.2 stroke time (seconds);

.3 unseating (or maximum dynamic) torque;

.4 closing torque;

.5 cracking load and seating load amperes; and

.6 torque-switch and limit-switch function.

.3 Each actuator shall be cycled through at least two strokes (open-close and close-open). Specified seating (or maximum dynamic) torque shall be applied during 10% of actuator travel in both directions. Actual stroke time shall be within ±10% of specified stroke time. Limit-switch and torque-switch functions shall be verified in both directions. Torque switches shall be demonstrated to limit torque output to 110% of required torque. Amperes at running and seating loads are to be monitored and shall not exceed motor ratings.

.2 Reports:

.1 Provide Start-up and Commissioning Reports for each actuator.

.2 Each report shall include the following at a minimum:

.1 Actuator-unit housing or frame size and model number;

.2 Actuator serial number;

.3 Power, voltage, phase, hertz;

.4 Stroke time, seating/unseating (or dynamic) torque, and seating/unseating (or dynamic) amps;

.5 Limit switch functional check;

.6 Torque switch functional check; and

.7 Switch and indicating lights functional checks.

.8 List of all programmable settings configured.

END OF SECTION