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 Two (2) 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. Each copy shall be clearly titled to show all of the information required by the Specifications as well as operational information including: the item of Work concerned, a City's Contract number, the name and address of the Contractor, the issue date, and operational information on equipment.

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

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

.8 Pay costs of transportation.

1.2 OPERATING AND MAINTENANCE MANUALS

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

.2 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.

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

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

- .1 Title sheet, labeled "Operation and Maintenance Instructions", and containing project name and date, City's Contract number, the name and address of the Contractor, and the issue date..
- .2 List of contents.
  - .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 product or maintenance manual requirements from the Specifications

.6 Reviewed Shop Drawings and product data sheet of all equipment.

.7 Include sections for the as-built drawings of all installations. Drafted as-built drawings of size 432x279mm (11 x 17") will be inserted by others, based on the as-built drawings marked up by the Contractor.

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

.5 The Contractor shall modify and supplement the manual as required by the Contract Administrator.

.6 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 two weeks prior to date of substantial performance.

.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.

.3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

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 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.

.6 Lamacoid schedule 112577-0106-47EL-0004 identifies required nameplates. The list in the schedule is not necessarily exhaustive. Provide nameplates for all items in 112577-0106-47EL-0004, as well as any other applicable equipment not specifically identified in the schedule.

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 15 m intervals.

.3 Colours: 25 mm wide prime colour and 25 mm wide auxiliary colour.

SYSTEM	Prime Band	Auxiliary Band
347/600V	Dk. Blue	
120/208/240V	Lt. Blue	
UPS System (After UPS)	Lt. Blue	White
Fire Alarm	Red	

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

.3 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.

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 Engineer'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.

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.

.5 CAN/CSA-C22.2 No. 208-03, Fire Alarm and Signal Cable.

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: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.3 Copper conductors: size as indicated, with insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

.1 Insulation Voltage Rating:

.1 Conductors carrying 120/208V: 600V

.2 Conductors carrying 600V: 1000V

.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 FIRE ALARM WIRING

.1 See Section 28 31 02.

2.3 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 Conductors carrying 120/208V: 600V
.2 Conductors carrying 600V: 1000V

.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 Connectors:

.1 Watertight, approved for TECK cable.

2.4 ACIC/CIC CONTROL CABLE

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

.2 Conductors: copper, size as indicated.

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

2.5 INDUSTRIAL DATA CABLE – RS-485

.1 Requirements:

.1 Conductors: 22 AWG, copper, stranded.
.2 Shielded Twisted Pair.
.3 Nominal Capacitance
.1 Between conductors: 36.1 pF/m.
.2 Between one conductor and other conductors connected to shield: 68.6 pF/m.
.4 Shielding: overall foil shield and TC braid with drain wire.

.2 Use Belden 3105A or approved equal in accordance with B6.

2.6 ETHERNET CABLE

.1 Requirements for wiring between panels in cable tray:

.1 Industrial Grade Cat 5e Ethernet cable.

.2 Shielding: none.

.3 Conductors: 24 AWG, copper, solid.

.4 Armoured.

.5 Use Belden 121700A or approved equal in accordance with B6.

.2 Requirements for inner panel patch cables:

.1 Commercial Grade Cat 5e Ethernet cable.

.2 Shielding: none.

.3 Conductors: 24 AWG, copper, solid.

.4 Use Belden DataTwist 1200 Series or approved equal in accordance with B6.

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 FIRE ALARM SYSTEM WIRING

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

.2 Install conductors to be entirely independent of all other wiring. Do not enter raceway, boxes or enclosures occupied by other wiring except where necessary to connect to power supply, communication circuit, or ancillary devices.

.3 For DCLA fire alarm circuits, install primary wiring circuit and alternate wiring circuit in separate conduit having a minimum separation of

.1 300mm when installed vertically

.2 1200mm when installed horizontally

.4 For DCLA fire alarm circuits, the primary wiring circuit and alternate wiring circuit may share the same conduit

.1 For a distance of less than 3000m where the primary and return conductors enter or exit field devices, control unit or transponder enclosures.

.2 For single conduit drops to individual field devices

.3 For single conduit drops to multiple field devices installed in a single room not exceeding $100m^2$.

3.4 INSTALLATION OF TECK CABLE 0 -1000 V

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

3.5 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.

.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.

3.6 INSTALLATION OF ETHERNET CABLES

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

3.7 TERMINATIONS AND SPLICES

.1 Wire nuts are only permitted on wiring associated with lighting and exits.

.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.

3.8 RE-USE OF EXISTING WIRING

.1 Except where specifically identified or approved, reuse of existing wiring is not permitted.

.2 Ensure all existing wiring is tagged prior to disconnection equipment.

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

3.9 TESTING

.1 Test all power conductors 10 AWG and larger in accordance with 26 08 05.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for connectors and terminations.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.65.

1.3 PRODUCT DATA

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

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

.1 Copper long barrel compression connectors to CSA C22.2 No.65 as required sized for conductors.

.2 Contact aid for aluminum cables where applicable.

.3 Belleville washers to be utilized.

Part 3 Execution

3.1 INSTALLATION

.1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.

.2 Bond and ground as required.

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: Cadmium plated.

.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 Fasten conduit to building construction or support system at intervals of 2.5m or less, unless otherwise noted.

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.76, Splitters

Part 2 Products

2.1 SPLITTERS

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Three sets of lugs, minimum.

.3 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.4 Main lugs rated a minimum of 225A, branch lugs rated a minimum of 150A.

.5 Provide ground bar, with a minimum of three terminals.

2.2 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

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

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Install splitters and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

3.3 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.

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

.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 Weatherproof dust tight covers to match boxes as required.

.4 UPS receptacles to have orange faces with white face plates.

2.3 CONDUIT BOXES

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

2.4 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 Affix computer printed label to each outlet box with panel and circuit number (eg. G10-5)

.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 Watertight connectors and couplings for EMT, where not in electrical or control room spaces. Set-screws are not acceptable.

.4 Elbows:

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

.5 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 Do not pass conduits through structural members except as indicated.
- .4 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.
- .5 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

.13 Underground Conduits

- .1 Slope conduits to provide drainage.

3.3 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.

3.4 INSTALLATIONS IN CATEGORY 2 LOCATIONS

.1 Comply with all requirements of Category 1 locations.

3.5 INSTALLATIONS IN CATEGORY 2 WET LOCATIONS

.1 Comply with all requirements of Category 1 locations.

3.6 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 Add sealing compound following manufacturer's instructions.

3.7 INSTALLATIONS IN HAZARDOUS CLASS I, ZONE 2 LOCATIONS

.1 Explosion proof conduit sealing fittings:

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

.2 Add sealing compound following manufacturer's instructions.

3.8 REPAIR OF CONDUITS TO UV BUILDING

.1 Locate damaged sections of conduit running from the Secondary Clarifiers Building to the UV Building.

.2 Hydrovac around damaged sections of conduit and replace sections necessary to make them structurally sound and water tight.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association, (CSA International)

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

Part 2 Products

2.1 CABLE PROTECTION

.1 38 x 140 mm planks pressure treated with coloured, copper napthenate or 5% pentachlorophenol solution, water repellent preservative.

2.2 MARKERS

.1 Cedar post type markers: 89 x 89 mm, 1.5 m long, pressure treated with coloured, copper napthenate or 5% pentachlorophenol solution, water repellent preservative, with nameplate fastened near post top, on side facing cable or conduit to indicate depth and direction of duct and cable runs.

.1 Nameplate: aluminum anodized 89 x 125 mm, 1.5 mm thick mounted on cedar post with mylar label 0.125 mm thick with words Cable, Joint or Conduit with arrows to indicate change in direction.

.2

Part 3 Execution

3.1 CABLE INSTALLATION IN DUCTS

.1 Inspect & clean ducts prior to installing cables.

.2 Install cables as indicated in ducts.

.1 Do not pull spliced cables inside ducts.

.3 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.4 Before pulling cable into ducts and until cables are properly terminated, seal ends of non-leaded cables with moisture seal tape.

.5 After installation of cables, seal duct ends with duct sealing compound.

3.2 FIELD QUALITY CONTROL

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

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.3 Check each conductor for continuity, short circuits and grounds.

.4 Provide Contract Administrator with list of test results.

.5 Remove and replace entire length of cable if cable fails to meet any of test criteria.

3.3 MARKERS

.1 Install cedar post type markers.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 NETA Acceptance Testing Specifications, 2003 (ATS-2003)

1.2 TESTING REPORT

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

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

- .1 The electronic copies of the report, including the test forms, shall be provided in PDF format.
- .2 The Microsoft Word version of the all completed test forms provided to the Contractor shall also be included on the CDs.

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

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

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

.6 The report shall include the following:

- .1 Summary of project.
- .2 Testing Equipment.
- .3 Detail the type, manufacturer, model, and last calibration date of all testing equipment.
- .4 Description of equipment tested.
- .5 Description of all tests.
- .6 Typed inspection forms including:
  - .1 Identification of the testing organization.
  - .2 Equipment identification.
  - .3 Humidity, temperature, and other conditions that may affect the results of the tests/calibrations.
  - .4 Date of inspections, tests, maintenance, and/or calibrations.
  - .5 Identification of the testing technician.
  - .6 Indication of inspections, tests, maintenance, and/or calibrations performed and recorded, along with charts, and graphs as applicable. All measurements and readings taken shall be noted for inclusion in the report. Where repairs are made, measurements and readings before and after the repair shall be included.
  - .7 Indication of expected results, when calibrations are to be performed.

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

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

.1 Detailed description of the deficiency.

.2 The cost associated with the deficiency repair.

Part 2 Products

2.1 NOT USED

.1 Not Used

Part 3 Execution

3.1 SCOPE OF TESTING

.1 Admin Building (M)

.1 C-MTS-M1
.2 C-PNL-2X
.3 MTS-M1
.4 UPS-M1

.2 Grit Building (G)

.1 CB-PNL-G10
.2 CB-PNL-6P
.3 C-MTS-G1
.4 C-XFMR-G9
.5 SPL-G1 (Along with associated C-SPL-G1, C-CB-PNL-G10, C-CB-PNL-6P)
.6 MTS-G1
.7 PNL-G10
.8 UPS-G1

.3 Service Building (B)

.1 CB-MTS-M1
.2 CB-MTS-G1

.4 Primary Clarifiers (P)

.1 C-PNL-6P

.5 Secondary Clarifiers (S)

.1 CB-XFMR-7S
.2 CB-MTS-S1
.3 C-MTS-S1
.4 C-PNL-6S
.5 C-PNL-7S
.6 C-XFMR-7S

.7 MTS-S1

.8 UPS-S1

3.2 INSPECTION, TESTING AND MAINTENANCE PROCEDURES

.1 General

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

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

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

.4 Drafting of drawings is not required.

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

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

.2 Inspection Forms

.1 The inspection forms to be completed by the Contractor are provided for reference in PDF format.

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

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

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

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

.6 Submit electronic PDF copies of the inspection forms.

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

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

.9 Perform insulation resistance temperature correction calculations utilizing the following:

.1 To correct to 20°C, utilize Table 260805-1.

.2 To correct to 40°C, utilize Table 260805-2.

Table 260805-1

Insulation Resistance Correction Factors (20 °C)

Measured Temperature (°C)	Oil Immersed Insulation	Solid Insulation
-10	0.125	0.25
-5	0.18	0.32
0	0.25	0.40
5	0.36	0.50
10	0.50	0.63
15	0.75	0.81
16	0.80	0.85
17	0.85	0.89
18	0.90	0.92
19	0.95	0.96
20	1.00	1.00
21	1.08	1.05
22	1.16	1.10
23	1.24	1.15
24	1.32	1.20
25	1.40	1.25
30	1.98	1.58
35	2.80	2.00
40	3.95	2.50
45	5.60	3.15
50	7.85	3.98
55	11.20	5.00
60	15.85	6.30

Table 260805-2

Insulation Resistance Correction Factors (40 °C)

Measured Temperature (°C)	Oil Immersed Insulation	Solid Insulation
-10	0.03	0.10
-5	0.04	0.13
0	0.06	0.16
5	0.09	0.20
10	0.13	0.25
15	0.18	0.31
16	0.19	0.33
17	0.21	0.34
18	0.22	0.36
19	0.24	0.38
20	0.25	0.40
21	0.27	0.42
22	0.29	0.44
23	0.31	0.46
24	0.33	0.48
25	0.35	0.50
30	0.50	0.63
35	0.71	0.79
40	1.00	1.00
45	1.41	1.26
50	2.00	1.59
55	2.83	2.00
60	4.00	2.52

.3 Perform winding resistance temperature correction calculations utilizing the following:

.1 $$R_C = R_M \frac{T_C + T_K}{T_M + T_K}$$

.2 Where, RC = Resistance at corrected temperature.

RM = Resistance at measured temperature.
TC = Temperature to correct to in °C.
TM = Measured temperature in °C.
TK = Temperature Resistance Constant
(234.5 °C for copper, 226.0 °C for aluminum)

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

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

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

.2 Torque all accessible bolted electrical connections.

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

.4 Inspect grounding and cable/conduit support.

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

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

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

.8 Perform an insulation-resistance test on each conductor. Individually test each conductor with all other conductors and shields grounded. The test duration shall be one minute. Investigate resistances less than 1000 megaohms. The voltage applied shall be 500 Vdc for 300 V rated cables, and 1000 Vdc for 600 V or 1000 V rated cables.

3.4 CIRCUIT BREAKERS, INSULATED-CASE/MOLDED CASE, 600 V

.1 Inspection and testing shall include the following:

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

.2 Record all adjustable settings.

.3 Inspect physical and mechanical condition.

.4 Inspect anchorage and alignment.

.5 Clean the unit.

.6 Torque all accessible bolted power connections.

.7 Operate the circuit breaker to insure smooth operation.

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

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

.3 Restore breaker position to original position.

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

3.5 MANUAL TRANSFER SWITCH

.1 Test circuit breakers in accordance with 3.4.

.2 Test transformers in accordance with 3.7.

3.6 PANELBOARDS

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

- .1 Note the equipment nameplate data for inclusion in the form.
- .2 Inspect physical and mechanical condition.
- .3 Inspect anchorage, alignment, and grounding.
- .4 Clean the unit.
- .5 Inspect breakers and verify mechanical operation by exercising all circuit breakers.
- .6 Record breaker data on the inspection form.
- .7 Test all breakers utilizing the “Push-To-Trip” button, if equipped.
- .8 Move operating handle to the off and on position.
- .9 Restore breaker position to original position.
- .10 Torque all accessible bolted power connections including incoming, load neutral and ground connections.
- .11 Perform insulation-resistance tests on each bus phase with all other phases grounded.
  - .1 The main breaker, if present, is to be open for the test. If no main breaker is present, disconnect the supply conductors.
  - .2 Open all load breakers.
  - .3 Test voltage for all 600/347 V panelboards to be 1000 Vdc.
  - .4 Test voltage for all 120/208 V panelboards to be 500 Vdc.

3.7 TRANSFORMERS, LOW VOLTAGE, DRY-TYPE

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

- .1 Note the equipment nameplate data for inclusion in the report.
- .2 Inspect physical and mechanical condition.
- .3 Inspect anchorage, alignment, and grounding.
- .4 Clean the unit.
- .5 Torque all accessible bolted power connections.
- .6 Record the tap setting.
- .7 Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Duration of the test is to be one minute. Calculate the dielectric absorption ratio.
  - .1 600 V windings shall be tested at 1000 Vdc.
  - .2 120/208 V windings shall be tested at 500 Vdc.

3.8 UNNINTERRUPTIBLE POWER SUPPLIES (UPS)

.1 Inspection and testing shall be in accordance with 26 33 53.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

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

1.3 SHOP DRAWINGS

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

Part 2 Products

2.1 PANELBOARDS

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

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

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

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

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

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

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

.7 Trim with concealed front bolts and hinges.

.8 Trim and door finish: baked grey enamel.

.9 Panelboards to be Cutler-Hammer PRL1a series to match the existing panelboards at the facility.

2.2 BREAKERS

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

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

2.3 EQUIPMENT IDENTIFICATION

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

.2 Nameplate for each panelboard size 8 engraved as follows:

.1 Line 1 is to be the panel identifier as indicated on the drawings, for example "PNL-G10".

.2 Line 2 is to be the voltage, for example "120/208V, 3Ø".

.3 Line 3 is to be the feeder equipment, for example "Source: MTS-G1".

Part 3 Execution

3.1 INSTALLATION

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

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

.3 Replace circuit directory with new updated directory.

.4 Connect loads to circuits.

.1 Affix arc flash warning label to the front of the panel. Label to be provided by the Contract Administrator.

3.2 TESTING

.1 Test the panelboard in accordance with 26 08 05.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International).

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

1.2 SUBMITTALS

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

Part 2 Products

2.1 METERS

.1 Where indicated on the drawings, provide a microprocessor based multifunction, power meter.

.2 Requirements:

.1 Multifunction electrical measurement on 3 phase power systems.

.2 User programmable for voltage range to any PT ratio.

.3 Accept a direct voltage input range of up to 347 Volts Line to Neutral, and a range of up to 600 Volts Line to Line.

.4 Accept a current input of up to 15 amps continuous.

.5 Fault Current Withstand:

.1 50 Amps for 10 seconds per hour, 500 Amps for 1 second per hour.

.6 Programmable for current to any CT ratio. The use of DIP switches for selecting fixed ratios shall not be acceptable

.7 Load: <0.15 VA

.8 All inputs and outputs shall be galvanically isolated to 1350 Volts AC.

.9 The meter shall accept current inputs of class 10: (0 to 11A), 5 Amp Nominal, and class 2 (0 to 2A), 1A Nominal Secondary.

.10 The meter shall have an accuracy of +/- 0.5% or better for volts and amps, and 0.2% for power and energy functions. The meter shall meet the accuracy requirements of IEC62053-22 (class 0.5%) and ANSI C12.20 (Class 0.2%).

.11 The meter shall provide true RMS measurements of voltage, phase to neutral and phase to phase; current, per phase and neutral.

.12 Function Requirements:

.1 Volts, Amps, kW, kVAR, PF, kVA (per phase)

.2 Frequency, kWh, kVAh, kVARh

.3 Total % THD (Total Harmonic Distortion) Monitoring for voltage and current per phase,

.4 Min / Max recording capability

.3 Communication ports:

.1 One port with RS-485

.1 Modbus RTU, 9600 baud minimum.

.2 Provide communication modules with Ethernet port and RS-485 Modbus Master port as specified on drawings

.3 One Ethernet port

.1 Fully IEEE 802.3 compliant.

.2 Fully compliant with Modbus TCP.

.3 10/100BaseTX RJ-45

.4 Remote Display:

.1 Provide means for display to be remote mounted on door of MCC meter display compartment sized 285x190x130mm (HxWxD).

.5 Relay output:

.1 Equipped with, at minimum, one Form C dry contact output for power monitoring. Relay contact to be closed during normal operation and open upon loss of 600 V power on any phase.

.6 Manufacturer and Model:

.1 Schneider Electric

.1 Meter: PM820RDMG

.2 Communication module: PM8ECC

.2 Or approved equal in accordance with B6.

Part 3 Execution

3.1 INSTALLATION

.1 Remove existing power meters installed on door of meter display compartment and turn over to City personnel. Remove existing 600 V wiring to meter display compartment.

.2 Install mounting plate on door of meter display compartment to cover existing hole in order to mount new power meters. The finish of the mounting plate is to be the same as that of the existing MCC door.

.3 Install power meters as per the drawings.

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.

Part 3 PANELBOARD BREAKERS

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

.2 Panelboard CDP-E1:

.1 Breakers are to be Cutler Hammer HFD series bolt-on breakers, 25 kAIC rated.

.3 Panelboard CDP-E2:

.1 Breakers are to be Cutler Hammer FDC series bolt-on breakers, 35 kAIC rated. Note that the purpose of the higher interrupting rating is to allow for a future reconfiguration , where the available fault current would increase.

3.2 MOUNTED BREAKERS

.1 Enclosures are to be Type 1 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.

.4 Individual breakers not in panelboards are to be Cutler-Hammer FDB series in SFDN100 enclosures.

Part 4 Execution

4.1 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 SUBMITTALS

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

.2 Submittals to include:

- .1 System configuration with single-line diagrams.
- .2 Functional relationship of equipment including weights, dimensions, and heat dissipation.
- .3 Descriptions of equipment to be furnished.
- .4 Size and weight of shipping units to be handled by installing contractor.
- .5 Detailed installation drawings including all terminal locations.

1.2 CLOSEOUT SUBMITTALS

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

.2 Operation and Maintenance Manual to include:

- .1 Operation and maintenance instructions concerning design elements, construction features, component functions and maintenance requirements to permit effective operations maintenance and repair.
- .2 Technical data:
  - .1 Approved shop drawings.
  - .2 Project data.
  - .3 Technical description of components.
  - .4 Parts lists with names and addresses of suppliers.
  - .5 Functional description of the equipment with block diagrams
  - .6 Safety precautions
  - .7 Instructions and step-by-step operating procedures
  - .8 Routine maintenance guidelines, including illustrations.

1.3 SYSTEM START-UP

.1 Provide factory authorized service personnel to supervise start-up of system, checking, adjusting and testing on site.

1.4 TRAINING

.1 Provide one training session for City electrical maintenance personnel, at the Site.

.2 Instruct City personnel on theory, construction, installation, operation and maintenance of the UPS installations.

Part 2 Products

2.1 UNINTERRUPTIBLE POWER SYSTEM

.1 Provide as per Schedule 263353-1.

.2 Manufacturer and Model: Liebert NX Series.

.1 Alternative manufacturers will not be accepted due to this product having been selected as the plant standard.

.3 Conformance with CSA C22.2, No. 107.3.

.4 CSA/ cUL approved.

.5 Technology:

.1 Online, double-conversion, split-phase topology with static bypass switch.

.2 Frequency independent operation.

.6 Design Requirements - UPS Module

.1 Voltage. Input/output voltage specifications of the UPS shall be:

.1 Rectifier Input: 208 volts, three-phase.

.2 Output: 208 volts, three-phase, 4-wire-plus-ground.

.2 Output Load Capacity. Specified output load capacity of the UPS shall be as shown in Schedule 263353-1 at 0.8 lagging power factor.

.7 Design Requirements - Battery

.1 Battery Cells: Sealed, lead-acid, valve-regulated.

.2 Recharge Time: to 95% capacity within ten (10) times discharge time.

.3 Provide means (circuit breaker or switch) to isolate the battery from the UPS.

.4 Runtime:

.1 For units going to the SEWPCC: minimum 40 minutes at design load.

.2 For units going to the NEWPCC: minimum 120 minutes at design load.

.8 Modes of Operation

.1 The UPS shall be designed to operate as an on-line, double-conversion, reverse-transfer system in the following modes:

.1 Normal - The critical AC load is continuously supplied by the UPS inverter. The rectifier/charger derives power from a utility AC source and supplies DC power to the inverter while simultaneously float-charging the reserve battery.

.2 Emergency - Upon failure of utility AC power, the critical AC load is supplied by the inverter, which, without any switching, obtains power from the battery. There shall be no interruption in power to the critical load upon failure or restoration of the utility AC source.

.3 Recharge - Upon restoration of utility AC power, after a utility AC power outage, the rectifier/charger shall automatically restart, walk-in, and gradually assume the inverter and battery recharge loads.

.4 Bypass - If the UPS must be taken out of service for maintenance or repair, or should the inverter overload capacity be exceeded, the static transfer switch shall perform a reverse transfer of the load from the inverter to the bypass source with no interruption in power to the critical AC load.

.9 Performance Requirements

.1 AC Input to UPS

.1 Voltage Configuration for Standard Units: three-phase, 3-wire plus ground.

.2 Voltage Range: +10%, -20% of nominal.

.3 Frequency: Nominal frequency ±5%.

.4 Power Factor: Up to 0.99 lagging at nominal input voltage and full rated UPS output load.

.5 Inrush Current: 800% of full load current maximum.

.6 Current Limit: 125% of nominal AC input current maximum.

.7 Input Current Walk-In: 20 seconds to full rated input current maximum. Field selectable 5 through 20 seconds.

.8 Current Distortion: 4% reflected THD maximum at full load.

.9 Surge Protection: Sustains input surges without damage per criteria listed in IEC 1000-4-5.

.2 AC Output, UPS Inverter

.1 Voltage Configuration: three-phase, 4-wire plus ground

.2 Voltage Regulation:

.1 ±1% three-phase RMS average for a balanced three-phase load for the combined variation effects of input voltage, connected load, battery voltage, ambient temperature, and load power factor.

.2 ±2% three-phase RMS average for a 100% unbalanced load for the combined variation effects of input voltage, connected load, battery voltage, ambient temperature, and load power factor.

.3 Frequency: Nominal frequency ±0.1%.

.4 Frequency Slew Rate: 1.0 Hertz per second maximum. Field selectable from 0.1 to 1.0 Hz per second.

.5 Phase Displacement:

.1 ±0.5 degree for balanced load,

.2 ±1.0 degrees for 100% unbalanced load.

.6 Bypass Line Sync Range:

.1 0.5 Hertz,

.2 Field selectable ±0.5 to 5.0 Hz.

.7 Voltage Distortion:

.1 1% total harmonic distortion (THD) for linear loads.

.2 <4% THD for 100% nonlinear loads (3:1 crest factor) without kVA/kW derating.

.8 Load Power Factor Range: 0.7 lagging to 0.95 leading without derating.

.9 Output Power Rating: Rated kVA at 0.8 lagging power factor.

.10 Overload Capability:
.1 125% for ten minutes (without bypass source).
.2 150% for one minute (without bypass source).
.11 Inverter Output Voltage Adjustment: ±5% manual adjustment.
.12 Voltage Transient Response:
.1 100% load step ±4.0%.
.2 Loss or return of AC input power ±1.0%.
.3 Manual transfer of 100% load ±3.0%.
.13 Transient Recovery Time: to within 1% of output voltage within one cycle.
.14 Voltage Unbalance: 100% unbalanced load ±1%.

.10 Environmental Conditions

.1 The UPS shall be able to withstand the following environmental conditions without damage or degradation of operating characteristics:
.1 Operating Ambient Temperature
.1 UPS Module: 0°C to 40°C.
.2 Battery: 25°C ±5°C.
.2 Storage/Transport Ambient Temperature
.1 UPS Module: -20°C to 70°C.
.2 Battery: 20°C to 33°C.
.3 Relative Humidity
.1 0 to 95%, non-condensing.
.4 Altitude
.1 Operating: to 1000 meters above Mean Sea Level. Derated for higher altitude applications.

.11 Audible Noise

.1 Noise generated by the UPS under any condition of normal operation shall not exceed 54 dBA measured 1 meter from surface of the UPS.

.12 The UPS shall have provision for battery status monitoring, which shall include automatic battery tests on a scheduled basis, and be able to report on battery life remaining (estimate), total number of discharges, total time in discharge. The power to the load of the unit shall be completely protected from unanticipated battery failure during these tests.

.13 The UPS shall have controls mounted in panel front.

.14 Factory Testing:

.1 Before shipment, the manufacturer shall fully and completely test the system to assure compliance with the specification.

.15 Relay Card

.1 Provide status contacts for:
.1 UPS Fault
.2 Summary Alarm

.3 Low battery
.4 On Battery / ON UPS status
.5 On Bypass Status

2.2 MAINTENANCE BYPASS CABINET

.1 Provide as per Schedule 263353-1.

.2 Transformers in accordance with CAN/CSA-C22.2 No. 47

.3 Include:

.1 Input and output breakers.
.2 Internal 600:120/208 V input transformer.
.3 Make-before-break switch with UPS, Line, Service, and Off Positions.

2.3 EQUIPMENT IDENTIFICATION

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

Part 3 Execution

3.1 INSTALLATION

.1 Locate UPS and Maintenance Bypass Cabinets as indicated on the drawings.

.2 Support and anchor the UPS as per manufacturer's instructions.

.3 Connect and configure UPS and Maintenance Bypass Cabinets as per manufacturer's Installation Manual.

.1 Wire input, output, and ground bus bars.
.2 Connect control cables.
.3 Connect ac mains to main input terminal.
.4 Connect UPS output to load.
.5 Connection of internal batteries to be performed ONLY by factory authorized service personnel.

.4 Start-up UPS and make preliminary tests to ensure satisfactory performance. Do not power UPS without factory authorized service personnel present.

3.2 TESTING

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

.2 Testing configuration shall not interfere with the supply of power to the load ultimately supplied by the UPS.

.3 Provide a complete UPS testing report.

.4 Test equipment:

.1 Instruments used during testing are to have been calibrated within one year prior to the test date.

.2 Load bank for testing, adjustable to 110 % of system rated output power.

.1 Load bank to be CSA approved or equivalent.

.5 Provide:

.1 Competent field personnel to perform test, adjustments and instruction on UPS equipment.

.6 Perform a visual inspection and identify deficiencies. Inspection to include:

.1 Materials, workmanship, and assembly conform with design requirements.
.2 Parts are new and free of defects.
.3 Accessories are present.
.4 Inspect equipment for signs of damage.
.5 Verify installation per drawings.
.6 Inspect cabinets for foreign objects.
.7 Verify neutral and ground conductors are properly sized and configured.
.8 Battery and components are not damaged.
.9 Battery cells are of identical construction.
.10 Inspect battery for proper polarity.
.11 Confirm polarity of connections to inverter are correct.
.12 Verify all printed circuit boards are configured properly.

.7 Mechanical Inspection

.1 Check all control wiring connections for tightness.
.2 Check all power wiring connections for tightness.
.3 Check all terminal screws, nuts, and/or spade lugs for tightness.

.8 Electrical Inspection

.1 Check all fuses for continuity.
.2 Confirm input voltage and phase rotation is correct.
.3 Verify control transformer connections are correct for voltages being used.
.4 Assure connection and voltage of the battery string(s).

.9 Demonstrate System Operation:

.1 System start-up and shut down.
.2 System switchover to and from internal and external bypass.
.3 Adjustable settings.

.10 UPS Measurement Test:

.1 Test and record all UPS internal measurements against calibrated test instruments for 50% and 100% output load. The tests shall include:

.1 Output voltage, current, frequency, and power.
.2 Battery voltage and current.
.3 Input voltage, current, and power.

.4 Bypass voltage and frequency.

.11 Steady Load Test:

.1 Switch system onto ac mains, start UPS and connect load bank at UPS rated load.

.2 Operate system at full rated load for one (1) hour.

.3 Record data, utilizing UPS display, at start of test and every 10 minutes thereafter. including:

.1 Output voltage phase to phase, phase to neutral.

.2 Output current each phase.

.3 Output frequency.

.4 Output kW.

.5 Battery voltage and current

.12 Battery Testing:

.1 Charge battery to ensure cells are fully charged. When voltage reaches steady value at end of charge, record:

.1 Ambient temperature.

.2 Temperature of each cell.

.3 Voltage of each cell.

.4 Voltage of overall battery string.

.5 Charger output voltage and current.

.6 AC ripple current and voltage imposed on the battery.

.7 Internal ohmic values of each cell and battery.

.8 Measure intercell connection resistances for all cells.

.13 Battery Load Test

.1 Charge battery to ensure cells are fully charged.

.2 Connect the load bank to the UPS output, configured for the UPS rated output power.

.3 Record data, utilizing UPS display, at start of test and every 5 minutes thereafter. including:

.1 Output voltage phase to phase, phase to neutral.

.2 Output current each phase.

.3 Output frequency.

.4 Output kW.

.5 Battery voltage and current

.4 Upon the Battery Low Alarm, record:

.1 The test time expired.

.2 Battery voltage and current.

.5 Allow the UPS to automatically shutdown on low battery. Record the time of automatic shutdown.

.14 DCS Alarms

.1 With the assistance of City of Winnipeg personnel, test the UPS alarms transmitted to the DCS system.

3.3 FAILURE OF INSPECTION AND TESTING

.1 Any deficiencies discovered during testing, where the UPS or associated components do not meet the specification shall be addressed as follows:

.1 If the problem can be resolved:

.1 Modify adjust, or replace components as required

.2 Retest all tests that were deficient, as well as any other tests that could be affected by the modifications made.

.3 All costs to be borne by the Contractor or the manufacturer.

.2 If the problem can not be resolved:

.1 If in the opinion of the Contract Administrator, the deficiency is relatively minor from a functional operation perspective, the price of the UPS unit may be adjusted by the percentage of the deficiency.

.1 Example, if the UPS having a specified runtime of 14 minutes only has a tested runtime of 12 minutes, only 86% of the UPS price would be paid.

.2 No additional price will be paid for UPS units having tests that exceed the UPS specifications.

.2 If in the opinion of the Contract Administrator, the deficiency is significant, the UPS unit will not be accepted. The Contractor is responsible for removing the UPS unit from the premises, and no payment will be made.

3.4 DEMONSTRATION AND TRAINING

.1 Provide demonstration by factory trained representative in use and maintenance of UPS system.

.1 Allocate a minimum of two hours for training.

Schedule 263353-1 : UPS Device List

Qty	Description	Model
UPS-M1 / MTS-M1 Administration Building Computer Room		
1	Three-phase UPS, 15 kVA Runtime at 3.5 kW: 73 minutes	Liebert NX (FX internal battery)
1	Maintenance Bypass Cabinet, c/w 600:120/208 V transformer	Liebert NX Type D
1	SNMP/HTTP Network Interface Card	
1	Alarm Interface Card	
UPS-G1 / MTS-G1 Grit Electrical Room		
1	Three-phase UPS, 15 kVA Runtime at 3.0 kW: 92 minutes	Liebert NX (FX internal battery)
1	Maintenance Bypass Cabinet, c/w 600:120/208 V transformer	Liebert NX Type D

Qty	Description	Model
1	SNMP/HTTP Network Interface Card	
1	Alarm Interface Card	
UPS-S1 / MTS-S1 Secondary Clarifiers Electrical Room		
1	Three-phase UPS, 15 kVA Runtime at 3.9 kW: 67 minutes	Liebert NX (FX internal battery)
1	Maintenance Bypass Cabinet, c/w 600:120/208 V transformer	Liebert NX Type D
1	SNMP/HTTP Network Interface Card	
1	Alarm Interface Card	
NEWPCC UPS-D1 (SUPPLY AND DELIVERY ONLY – NO INSTALLATION)		
1	Three-phase UPS, 15 kVA	Liebert NX (FX internal battery)
1	External Battery Cabinet Runtime at 3.42 kW: 150 minutes	Liebert (FX external battery)
1	SNMP/HTTP Network Interface Card	
1	Alarm Interface Card	
NEWPCC UPS-G1 (SUPPLY AND DELIVERY ONLY – NO INSTALLATION)		
1	Three-phase UPS, 15 kVA,	Liebert NX (FX internal battery)
1	External Battery Cabinet Runtime at 3.78 kW: 138 minutes	Liebert (FX external battery)
1	Maintenance Bypass Cabinet, c/w 600:120/208 V transformer	Liebert NX Type D
1	SNMP/HTTP Network Interface Card	
1	Alarm Interface Card	
NEWPCC UPS-S1 (SUPPLY AND DELIVERY ONLY – NO INSTALLATION)		
1	Three-phase UPS, 15 kVA,	Liebert NX (HX internal battery)
1	External Battery Cabinet Runtime at 5.76 kW: 162 minutes	Liebert (HX external battery)
1	SNMP/HTTP Network Interface Card	
1	Alarm Interface Card	
NEWPCC UPS-W1 (SUPPLY AND DELIVERY ONLY – NO INSTALLATION)		
1	Three-phase UPS, 20 kVA	Liebert NX (HX internal battery)
1	External Battery Cabinet Runtime at 7.02 kW: 133 minutes	Liebert (MX external battery)
1	Maintenance Bypass Cabinet, c/w 600:120/208 V transformer	Liebert NX Type D

Qty	Description	Model
1	SNMP/HTTP Network Interface Card	
1	Alarm Interface Card	

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA C22.2 No .9.0, General Requirements for Luminaires.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.3 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 Metal Halide Clear

2.2 FLUORESCENT FIXTURES

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

.2 Rating: 347 V, 60 Hz for use with 2-32W tubes.

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

.4 Harmonics: 10% maximum THD, including 49^{th}

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

.6 Approved Manufacturer and Model: Cooper VT2-232DR-347V-EB8-WL 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- 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 STANDARD EXIT LIGHTS

.1 Utilize in office type, non-process areas.

.2 Exit lights: to CSA C22.2 No.141 and CSA C860.

.3 Housing: moulded high impact thermoplastic.

.4 Power supply: Universal 120-347V.

.5 Face and back plates: extruded aluminum.

.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 Acceptable Manufacturer and Model:

- .1 Lumacell LER450/460
- .2 Emergi-Lite LPEX50 series
- .3 Ready-Lite CX5000 series

2.2 NEMA 4X EXIT LIGHTS

.1 Utilize in all process areas.

.2 Exit lights: to CSA C22.2 No.141 and CSA C860.

.3 Housing: moulded high impact thermoplastic.

.4 NEMA-4X certified.

.5 Power supply: Universal 120-347V.

.6 Face and back plates: sealed heavy-duty polycarbonate.

.7 Lamps: LED, 5W Maximum.

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

.9 Face plate to remain captive for relamping.

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

.11 Knockouts available for directional arrows

.12 Acceptable Manufacturer and Model:

.1 Emergi-Lite Survive-All LPEX600
.2 Lumacell “3000” series
.3 Ready-Lite TUF series

2.3 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

2.4 ADDITIONAL EXIT SIGNAGE

.1 To CAN/ULC S572-10.

.2 "Running Person" exit signs with directional arrow

.1 Photo luminescent.
.2 Colour: Safety green.
.3 Minimum size: 130 x 220 mm.
.4 Arrow direction as per drawings.
.5 Material: Plastic or aluminum.

.3 "NOT AN EXIT" signs

.1 Black lettering on white background.
.2 Minimum size: 130 x 220 mm.
.3 Material: Plastic or aluminum

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 "Running Person – down arrow" exit signs at the top of the first two sets of stairs going up past the exit from the stairwell.
.2 Install "Running Person – up arrow" exit signs at the bottom of the first two sets of stairs going down past the exit from the stairwell.
.3 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 Canadian Standards Association, (CSA International)

.1 CSA-T529 Latest Edition, Telecommunications Cabling Systems in Commercial Buildings (Adopted ANSI/EIA TIA 568a with modifications).

.2 CSA-C22.2 No. 214 Latest Edition, Communications Cables (Bi-national Standard, with UL 444).

.3 CAN/CSA-C22.2 No. 182.4 Latest Edition, Plugs, Receptacles, and Connectors for Communication Systems.

.4 EIA/TIA – 56B (latest) – Commercial Building Telecommunications Wiring Standards.

1.2 SYSTEM DESCRIPTION

.1 DCLA communication channel providing reliable communication between Central Control Unit, Secondary Central Control Unit, and Remote Annunciator for fire alarm system. Communications cable may be either shielded twisted pair or optical fibre cable, to match network communications modules installed in fire alarm system.

Part 2 Products

2.1 SHIELDED TWISTED PAIR (STP) CABLE

.1 1 pair 90 ohm cable: to CSA-T529. Minimum 18 AWG.

2.2 OPTICAL FIBRE CABLE (OFC)

.1 1 pair 62.5/125 micrometre multi-mode graded index fibre: to CSA-T529.

Part 3 Execution

3.1 INSTALLATION OF CABLES

.1 Install STP/OFC cables, as indicated in conduits between Central Control Units and Remote Annunciator panel of fire alarm system.

.2 Terminate STP cable in accordance with CSA-T529.

.3 Terminate OFC cables with ST connectors.

3.2 FIELD QUALITY CONTROL

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

.2 Test optical fibre cables for:

.1 End-to-end loss at 820 nm.

.3 Test STP cables for:

.1 Continuity.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Government of Canada

.1 NBC-2005, National Building Code of Canada.

.2 ISO 8201, Acoustics – Audible emergency Evaluation Signal

.3 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC-S524-06, Installation of Fire Alarm Systems.
.2 ULC-S525-07, Audible Signal Appliances for Fire Alarm.
.3 CAN/ULC-S526-07, Visual Signal Appliances, Fire Alarm.
.4 CAN/ULC-S527-99, Control Units.
.5 CAN/ULC-S528-05, Manual Pull Stations.
.6 CAN/ULC-S529-02, Smoke Detectors.
.7 CAN/ULC-S530-91 (R99), Heat Actuated Fire Detectors.
.8 CAN/ULC-S536-04, Inspection and Testing of Fire Alarm Systems.
.9 CAN/ULC-S537-04, Verification of Fire Alarm Systems.

.4 CSA C22.1 Canadian Electrical Code

.5 Local Building Code

1.2 ACRONYMS AND ABBREVIATIONS

.1 Acronyms used in Mulitplex Fire Alarm System

.1 BPS – Booster Power Supply
.2 DCLA – Data Communication Link style A
.3 DCLB – Data Communication Link style B
.4 DGP – Data Gethering Panels
.5 FACP – Fire Alarm Control Panel
.6 IDC – Initiating Device Circuit
.7 NAC – Notification Appliance Circuit
.8 N/O – Normally Open
.9 SLC – Signalling Line Circuit

1.3 SYSTEM DESCRIPTION

.1 Fully supervised, microprocessor-based, fire alarm system, utilizing digital techniques for data control and digital multiplexing techniques for data transmission.

.2 System to carry out fire alarm and protection functions; including receiving alarm signals; initiating general alarm; supervising components and wiring; actuating annunciators and auxiliary functions; and initiating trouble signals.

.3 Zoned, non-coded single stage.

.4 Modular in design to allow for future expansion.

.5 System to be operable by personnel not requiring special computer skills.

.6 System to include:

.1 Central Control Unit in separate enclosure with power supply, stand-by batteries, central processor with microprocessor and logic interface, main system memory, input-output interfaces for alarm receiving, local annunciation/display, and program control/signalling.

.2 Secondary Central Control Unit in separate enclosure with power supply, stand-by batteries, central processor with microprocessor and logic interface, main system memory, input-output interfaces for alarm receiving, local annunciation/display, and program control/signalling.

.3 Remote Annunciator in separate enclosure with input-output interfaces for alarm receiving, and annunciation/display.

.4 Power supplies.

.5 Initiating/input circuits.

.6 Output circuits.

.7 Auxiliary circuits.

.8 Wiring.

.9 Manual and automatic initiating devices.

.10 Audible and visual signalling devices.

.11 End-of-line resistors.

.12 Event log memory chip capable of storing up to 1000 events.

.13 Smoke door hold-open devices.

.14 Ethernet communications bridge providing Modbus TCP interface to allow for future connection to the DCS.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

.1 System components: listed by ULC and comply with applicable provisions of National Building Code and Local/Provincial Building Code, and meet requirements of local authority having jurisdiction.

1.5 DESIGN REQUIREMENTS

.1 Design conduit layout and wiring interconnection of devices specified.

.2 Perform voltage drop calculations as required.

1.6 SHOP DRAWINGS AND SUBMITTALS

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

.2 Include:

.1 Descriptive product information for each individual system component including manufacturer’s name, model number, ratings, and power requirements.

.2 Dimensional drawings of panels and associated equipment.

.3 Itemized bill of material.

.4 Operating and programming instructions.

.5 Complete point-to-point wiring diagrams of the system and device interconnection.

.6 Supervisory power requirement calculations.

.7 Alarm power requirement calculations.

.8 Battery sizing calculations.

.9 Voltage drop calculations for wiring runs.

.10 Conduit fill calculations.

.11 Detail assembly and internal wiring diagrams for control panels, annunciator panel, and booster power supply units.

.12 Overall system riser diagram identifying control equipment, initiating zones, and signalling circuits; identifying terminations, terminal numbers, conductors and raceways.

.13 Details and performance specifications for control, annunciation and peripherals with item by item cross reference to specification for compliance.

.14 Recommended types and quantities of spare parts.

.15 Written schedule of active and spare addresses on each addressable circuit.

.3 Provide informational submittals including:

.1 Service technician certifications.

.2 Code-enforcement authority approval letter.

1.7 CLOSEOUT SUBMITTALS

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

.2 Include:

.1 Instructions for complete fire alarm system to permit effective operation and maintenance.

.2 Written documentation for logic modules as programmed.

.3 System program hard copy and CD-ROM.

.4 Documentation of system voltage, current, and resistance readings taken during system installation and testing.

.5 NFPA 72, Record of Completion: Submit to Contract Administrator and AHJ.

.6 NFPA 72, Inspection and Testing Form: Submit to Contract Administrator and AHJ.

.7 Technical data - illustrated parts lists with parts catalogue numbers.

.8 Copy of approved shop drawings with corrections completed and marks removed except review stamps.

.9 List of recommended spare parts for system.

1.8 QUALITY ASSURANCE

.1 Qualifications

.1 Technician with minimum of Engineering Technologist Certification for fire alarm systems or professional engineer registered in Province of Manitoba shall be available on-site.

.2 Service technician shall be formally trained by the fire alarm manufacturer.

.2 Regulatory Requirements

.1 Submit shop drawings and system design calculations for approval to the AHJ.

1.9 EXTRA MATERIALS

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

.2 Include:

.1 Extra keys for FACP, FAAP, and resetting/opening manual pull stations.

1.10 TRAINING

.1 Provide on-site training sessions by the fire alarm equipment manufacturer to train operational and maintenance personnel in the use and maintenance of the system. See Section 3.5.

1.11 MAINTENANCE

.1 Provide one year of maintenance with two (2) inspections by the manufacturer during the warranty period. Inspection to conform to CAN/ULC-S536. Submit inspection report to the Contract Administrator.

.1 No additional payment for the inspections will be made. Include all costs in the base price for the fire alarm system.

Part 2 Products

2.1 GENERAL

.1 Acceptable Manufacturers:

.1 Siemens Building Technologies

.2 Simplex/Grinnell

.3 Notifier Fire Systems

.4 Edwards System Technology

.2 ULC Compliance

.1 Products manufactured within the scope of ULC shall conform to ULC standards and have a ULC listing mark.

.3 CSA Approval

.1 All electrical equipment shall be CSA approved.

2.2 MATERIALS

.1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.

.2 Power supply: to CAN/ULC-S524.

.3 Audible signal devices: to ULC-S524.

.4 Visual signal devices: to CAN/ULC-S526.

.5 Control unit: to CAN/ULC-S527.

.6 Manual pull stations: to CAN/ULC-S528.

.7 Thermal detectors: to CAN/ULC-S530.

.8 Smoke detectors: to CAN/ULC-S529.

.9 Smoke alarms: to CAN/ULC-S531.

2.3 SYSTEM OPERATION: SINGLE STAGE - SIGNALS ONLY

.1 Actuation of any alarm initiating device to:

.1 Indicate zone of alarm at central control units and remote annunciator.

.2 Cause audible signalling devices to sound continuously throughout facility and at central control unit.

.3 Cause indicated air conditioning and ventilation fans to shut down to provide required control of smoke movement.

.4 Cause fire doors and smoke control doors, if normally held open, to close automatically.

.5 Indicate zone(s) in alarm to DCS via communications link. While this feature will not be connected to the DCS as part of this project, this feature must be demonstrated.

.2 Acknowledging alarm: indicated at central control units and remote annunciator.

.3 Possible to silence signals by "alarm silence" switch at control unit, after 60s period of operation.

.4 Subsequent alarm, received after previous alarm has been silenced, to re-activate signals.

.5 Actuation of supervisory devices to:

.1 Indicate respective supervisory zone at central control unit and at remote annunciator.

.2 Cause audible signal at central control unit to sound.

.3 Activate common supervisory sequence.

.6 Resetting alarm device not to return system indications/functions back to normal until control unit has been reset.

.7 Trouble on system to:

.1 Indicate circuit in trouble at central control unit.

.2 Activate "system trouble" indication, buzzer and common trouble sequence. Acknowledging trouble condition to silence audible indication; whereas visual indication to remain until trouble is cleared and system is back to normal.

.8 Trouble on system: suppressed during course of alarm.

.9 Trouble condition on any circuit in system not to initiate alarm conditions.

2.4 CONTROL PANELS

.1 Requirements:

.1 Suitable for DCLB and DCLA communication style: to CAN/ULC-S524.

.2 Features specified are minimum requirements for microprocessor-based system with digital data control and digital multiplexing techniques for data transmission.

.3 Minimum capacity of 500 addressable monitoring and 500 addressable control/signal points. Points may be divided between 2 communication channels in distributed system, each channel operating independently of other. Faults on one communication channel not to affect operation of other channel.

.4 System to provide for priority reporting levels, with fire alarm points assigned highest priority, supervisory and monitoring lower priority, and third priority for troubles. Possible to assign control priorities to control points in system to guarantee operation or allow emergency override as required.

.5 Integral power supply, battery charger and standby batteries.

.6 Circuitry to continuously monitor communications and data processing cycles of microprocessor. Upon failure, audible and visual trouble indication to activate.

.7 Communication between control panels, and remote annunciator panel to be supervised, DCLA. Should communications fail between the FACP and remote units, audible and visual trouble to be indicated at the FACP. Data communication to be binary DC, baseband, time-division multiplex, half-duplex. Each data channel: capable of communicating up to distance of 1500 m between nodes.

.1 Communication between nodes in networked system to be supervised, DCLA. Should communications fail between any 2 nodes, other nodes on loop to continue to communicate with each other and programmed functions on communicating nodes to continue operating.

.8 Wiring used for the multiplex communication loop will be installed in conduit. The system shall permit use of wiring associated with IDC, NAC, and communication between FACPs wiring in the same conduit.

.9 Equipped with software routines to provide Event-Initiated-Programs (EIP); change in status of one or more monitor points, may be programmed to operate any or all of system's control points.

.10 Software and hardware to maintain time of day, day of week, day of month, month and year.

.11 Capacity requirements to be based upon the drawings.

.12 Provide expansion space in panel for all modules, power supplies, batteries, and ancillary device required to allow for a future 100% increase in system capacity (FACP-P1) and 50% increase in system capacity (FACP-S1).

.13 Provide main annunciator located on exterior of cabinet door or visible through cabinet door.

.14 Restrict operation of local controls to authorized personnel only

Enclosure:

.1 NEMA Type 1, red, with lockable door, full viewing window, flush lock, and two (2) keys. Enclosure to be suitable for surface wall mounting.

.15 Supervised modular design with plug-in modules.

.16 Required indications:

.1 Power On.

.2 Power trouble.

.3 System trouble

.4 Supervisory alarm.

.5 Ground trouble

.6 Alarm for each zone

.7 Trouble for each zone

.8 Alarm signalling circuit trouble

.9 Annunciator circuit trouble.

.10 Remote annunciator trouble

.11 Signals silenced

.17 Required controls:

.1 System trouble buzzer and silence switch

.2 System reset switch

.3 Alarm silence switch

.4 Manual evacuation drill.

.18 Piezo-electric tone device for alarm and trouble indication.

.19 Power Supply:

.1 120 VAC, 60 Hz.

.2 Transient Voltage Surge Suppression

.20 Auxiliary Relays:

.1 Plug-in type, supervised against unauthorized removal by common trouble circuit. Terminals capable of accepting 12-22 AWG wire.

.21 Battery Backup:

.1 Complete with automatic battery charger.

.2 Batteries to be sized for 24 hours of standby followed by 5 minutes of alarm.

.3 Provide battery capacity for spare circuits.

.4 Complete with voltmeter and charging meter.

2.5 REMOTE BOOSTER POWER SUPPLIES

.1 Located throughout facility in separately enclosed units.

.2 Provide up to four independent 2 Amp Class B NACs.

.1 Provide signal synchronization for visible signal devices on each NAC.

.3 Interconnected to the control panel via NAC OR SLC circuit.

.1 Upon fault or failure of booster power supply unit or BPS NACs, BPS to open the control panel NAC, indicating fault condition to the control panel.

.4 Each BPS: self contained unit, with integral power supply, battery charger and standby batteries. Short circuit, over voltage, and brown out monitoring to protect powered components by automatically switching to standby batteries whenever trouble condition exists in power supply.

.1 Batteries to be sized for 24 hours of standby followed by 5 minutes of alarm.

.2 Provide battery capacity for spare circuits.

.3 Power provided by essential power circuit.

2.6 ADDRESSABLE CONTROL MODULES

.1 Distributed throughout facility in suitable electrical boxes, and interconnected to the control panel utilizing multiplex data transmission techniques.

.1 Mounted in rooms with suitable environmental conditions, or else installed in mounting box providing sufficient environmental protection.

.2 Control and monitor conventional notification appliance circuit.via interface to addressable, intelligent device loop

.1 Control and activate one Class B NAC, as commanded by the control panel.

.2 Relay trouble status of NAC to the control panel.

.3 Provide external 2 A power supply to power devices on the NAC circuit.

.3 Module address to be set on module in the field, or electronically by loop controller.

2.7 ADDRESSABLE RELAY MODULES

.1 Distributed throughout facility in suitable electrical boxes, and interconnected to the control panel utilizing multiplex data transmission techniques.

.1 Mounted in rooms with suitable environmental conditions, or else installed in mounting box providing sufficient environmental protection.

.2 Close one Form C dry contact as commanded by the control panel

.1 Suitable for smoke door release service.

.3 Module address to be set on module in the field, or electronically by loop controller.

2.8 ADDRESSABLE MONITOR MODULES

.1 Distributed throughout facility in suitable electrical boxes, and interconnected to CCU utilizing multiplex data transmission techniques.

.1 Mounted in rooms with suitable environmental conditions, or else installed in mounting box providing sufficient environmental protection.

.2 Provide interface between standard alarm input devices and FACP.

.1 Each addressable monitor module to monitor one conventional Class B IDC and relay alarm and trouble condition of detectors on the circuit back to FACP.

.3 Module address to be set on the module in the field, or electronically by loop controller.

2.9 POWER SUPPLIES

.1 120 V, 60 Hz as primary source of power for system.

.2 Voltage regulated, current limited distributed system power.

.3 Primary power failure or power loss will activate common trouble sequence.

.4 Interface with battery charger and battery to provide uninterruptible transfer of power to standby source during primary power failure or loss.

.5 During normal operating conditions fault in battery charging circuit, short or open in battery leads to activate common trouble sequence and standby power trouble indicator.

.6 Standby batteries: sealed, maintenance free.

.7 Continuous supervision of wiring for external initiating and alarm circuits to be maintained during power failure.

2.10 INITIATING/ INPUT CIRCUITS

.1 Receiving circuits for alarm initiating devices such as manual pull stations, smoke detectors and heat detectors, wired in DCLA or DCLB configuration to control panels as shown.

.2 Alarm receiving circuits (active and spare): compatible with smoke detectors and open contact devices.

.3 Actuation of alarm initiating device: cause system to operate as specified in "System Operation".

.4 Receiving circuits for supervisory, N/O devices. Devices: wired in DCLA configuration to FACPs as shown.

.5 Actuation of supervisory initiating device: cause system to operate as specified in "System Operation".

2.11 ALARM OUTPUT CIRCUITS

.1 Alarm output circuit: connected to signals, wired in class B configuration to control panels as shown.

.1 Signal circuits' operation to follow system programming; capable of sounding horns. Each signal circuit: rated at 2 A, 24 VDC; fuse-protected from overloading/overcurrent.

.2 Manual alarm silence, automatic alarm silence and alarm silence inhibit to be provided by system's common control.

2.12 AUXILIARY CIRCUITS

.1 Auxiliary contacts for control functions.

.2 Alarm on system to cause operation of programmed auxiliary output circuits.

.3 Upon resetting system, auxiliary contacts to return to normal or to operate as pre-programmed.

.4 Fans: stagger-started upon system reset; timing circuit to separate starting of each fan or set of fans connected to auxiliary contact on system. Timing circuit: controlled by FACP.

.5 Auxiliary circuits: rated at 2 A, 24 Vdc, fuse-protected.

2.13 WIRING

.1 Fire Alarm Cable (FAS)

.1 Use:

.1 Initiating Device Circuits (IDC)

.2 Notification Appliance Circuits (NAC)

.3 Data Communication Link Circuits (DCL)

.2 Cable: to CAN/CSA-C22.2 No. 208-03.

.1 Rated FAS 105.

.3 Conductors:

.1 Twisted, stranded copper.

.2 Notification circuit conductors: stranded copper, minimum 12 AWG.

.3 Initiating Device Circuit conductors: stranded copper, minimum 18 AWG.

.4 Data Communication Link circuit conductors: stranded copper, minimum 18 AWG.

.4 Shielding:

.1 As per manufacturer’s recommendations.

.5 Insulation:

.1 PVC.

.2 Voltage Rating: 300

.3 Fire Rating: FT4

.2 Building Wires

.1 Use:

.1 Control circuits:

.2 Requirements:

.1 As per Section 26 05 21.

.2 Minimum size: 14 AWG minimum, and in accordance with manufacturer's requirements.

.3 Raceway

.1 Rigid aluminum conduit, as per Section 26 05 34.

2.14 MANUAL ALARM STATIONS

.1 Provide station manufacturer's approved back box for each manual alarm station.

.2 Station colour: red.

.3 Conventional manual alarm stations: pull lever, wall mounted surface type, non-coded, single pole normally open contact for single stage. English signage.

.1 Restoration to require use of key.

.1 Keys: identical throughout system for stations and control panels.

.2 Where weatherproof stations are required, provide stations with weatherproof housings with hinged access doors.

.4 Addressable manual pull station.

.1 Pull lever, surface wall mounted type, single action, single stage, electronics to communicate station's status to addressable module/transponder over 2 wires and to supply power to station. Station address to be set on station in field, or electronically by loop controller.

.2 Restoration to require use of key.

.1 Keys: identical throughout system for stations and control panels.

.5 Additional requirements for classified areas:

.1 Class I, Zone 1, Group IIA

.2 Pull ring, wall mounted surface type, double action, non-coded single pole normally open contact for single stage. English signage.

2.15 AUTOMATIC ALARM INITIATING DEVICES

.1 Addressable heat detectors, fixed temperature

.1 Non-restorable, rated 57°C unless indicated otherwise.

.2 Electronics to communicate detector's status to addressable module/transponder.

.3 Detector address to be set on detector in field, or electronically by loop controller.

.4 Plug-in type with fixed base.

.5 Wire-in base assembly with integral red alarm LED.

.6 Spot type: ULC rated for 15.2m spacing or greater.

.2 Addressable heat detectors, rate of rise

.1 Self-restoring, rated 8.3°C per minute.

.2 Electronics to communicate detector's status to addressable module/transponder.

.3 Detector address to be set on detector in field, or electronically by loop controller.

.4 Plug-in type with fixed base.

.5 Wire-in base assembly with integral red alarm LED.

.6 Spot type: ULC rated for 15.2m spacing or greater.

.3 Heat detectors, explosion-proof, rate of rise

.1 Self-restoring, rated 8.3°C per minute.

.2 Suitable for use in Class 1, Zone 2, Groups C & D hazardous areas.

.3 Spot type: ULC rated for 15.2m spacing or greater.

.4 Heat detectors, high humidity, rate of rise

.1 Self-restoring, rated 8.3°C per minute.

.2 Suitable for use in high humidity indoor environments and areas that area subject to potential corrosive elements, spray washing, and below freezing temperatures.

.3 Spot type: ULC rated for 22m spacing or greater.

.5 Addressable smoke detector.

.1 Photo-electric type.

.2 Electronics to communicate detector's status to addressable module/transponder.

.3 Detector address to be set on detector in field, or electronically by loop controller.

.4 Plug-in type with fixed base.

.5 Wire-in base assembly with integral red alarm LED.

.6 Spot type: ULC rated for 9.1m spacing or greater.

.6 Smoke detector: air duct type with sampling tubes with protective housing.

.1 Air velocity rating range of 0.5 to 20 m/s, or greater.

.2 Sampling tube sized to fit duct size indicated on drawings.

.3 Integral red alarm LED.

.7 Smoke detector: reflective beam type.

.1 Rapid obscuration of the beam to a level of 90% or greater will result in a trouble signal rather than an alarm signal.

.2 Coverage range of 30m or greater.

.3 Integral red alarm LED

.8 Flame detector.

.1 Infrared type.

.2 Minimum 80 degrees horizontal and 70 degrees vertical field of vision.

.3 Suitable for use in Class 1, Zone 2, Groups C & D hazardous areas.

.4 High immunity to false alarms caused by lightning, arc welding, and sunlight.

.5 Integral red alarm LED.

2.16 FAULT ISOLATOR MODULES

.1 General:

.1 Provide fault isolator modules to automatically isolate wire-to-wire short circuits on an SLC loop.

.2 Isolator module to automatically open-circuit (disconnect) the SLC loop opn a wire-to-wire short. Upon the short circuit condition being corrected, the isolator module is to automatically reconnect the isolated section of the SLC loop.

.2 Requirements:

.1 Address setting not to be required.

.2 Completely automatic operation.

.3 It shall not be necessary to replace or reset the fault isolator module after its normal operation.

.4 Mounting:

.1 A standard 54 mm (2-1/8") deep x 102 mm (4") square electrical box

.2 Surface-mounted backbox, or

.3 in the Fire Alarm Control Panel.

.5 A single LED which shall flash to indicate that the Isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

.6 Provide isolator complete with mounting plate and cover.

2.17 AUDIBLE SIGNAL DEVICES

.1 General

.1 Utilize the ISO 8201 Clause 4.2 Temporal Tone standard for all signalling devices to indicate an alarm signal.

.2 Horns – Unclassified Locations:

.1 Refer to drawings for db level settings

.2 Weatherproof where indicated on drawings

.3 24 Vdc.

.3 Horns – Class I, Zone 1 locations:

.1 Suitable for use in Class 1, Zone 2, Groups C & D hazardous areas

.2 Refer to drawings for db level settings

.3 24 V dc.

.4 Means provided to synchronize horn audible signals within each notification zone.

2.18 VISUAL ALARM SIGNAL DEVICES

.1 Strobe type: flashing, 24 V dc. Refer to drawings for brightness settings.

.2 Designed for surface mounting on walls.

.3 Means provided to synchronize flashes within corridors or rooms in the same field of view.

2.19 END-OF-LINE DEVICES

.1 End-of-line devices to control supervisory current in notification appliance circuits and non-addressable signalling circuits, sized to ensure correct supervisory current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at the FACPs and remote annunciator.

.2 Secure identifying label to the front of the cover plate, listing the zone served.

2.20 REMOTE ANNUNCIATORS

.1 LED and/or remote alphanumeric type, with designation cards to indicate zones. Capable of annunciating up to 50 zones.

.2 Display:

.1 Alarms and troubles for alarm initiating circuits.

.2 Supervisory alarms and troubles for supervisory initiating circuits.

.3 Common system trouble.

.3 Trouble buzzer.

.1 Acknowledging trouble at main panel to silence trouble buzzers in system.

.4 Supervised, with LED test button and alarm and trouble acknowledge buttons.

.5 Restrict operation of local controls to authorized personnel only.

.6 Minimum wiring configuration with main panel to be 18AWG TSP cable in aluminum conduit.

2.21 REMOTE PRINTER

.1 Not Applicable.

2.22 REMOTE TERMINAL

.1 Not Applicable.

2.23 COMMUNICATIONS BRIDGE

.1 Communications Bridge device by FieldServer Technologies compatible with selected FACPs.

.2 Provide Modbus TCP interface between FACPs and existing Bailey Infi90 DCS.

.3 Actively poll Central Control Unit to provide:

.1 Alarm and trouble indication for each zone monitored.

.2 General fire alarm system alarm and trouble indication.

.4 Provide Modbus TCP register map.

2.24 AS-BUILT RISER DIAGRAM

.1 Fire alarm system riser diagram: in glazed frame, minimum size 432 x 279 mm, mounted adjacent to annunciator panel.

.2 Facility baseplan, indicating locations of zones, including room number labels: in glazed frame, minimum size 432 x 279 mm, mounted adjacent to annunciator panel.

2.25 ANCILLARY DEVICES

.1 Remote relay unit to initiate fan shutdown of the following equipment:

.1 M681-AHU

.2 M652-AHU

.2 Electromagnetic door holder releases

.1 Provide as indicated.

.2 Mount armature portion on door. Armature complete with adjusting screw for setting angle of contact plate.

.3 Mount electro-magnetic release on wall or on floor.

.4 Activation of fire alarm system, including fire detector designated for door release service, to release doors on circuit to close.

.5 Door holders: do not require battery backup power.

Part 3 Execution

3.1 INSTALLATION

.1 Install systems in accordance with CAN/ULC-S524, manufacturer's instructions and recommendations, and in accordance with applicable codes and standards.

.2 Install FACPs and connect to AC essential power supply. Install data communications network between the two units.

.3 Install manual alarm stations and connect to alarm circuit wiring.

.1 Mount stations with operating lever/ring at 1.3 m above finished floor.

.2 Affix a notice to the wall near each manual station indicating that the alarm is local only, and instructing oFACPpants to phone 911 in case of fire.

.4 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 450 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.

.5 Connect alarm circuits to FACPs.

.6 Install horns and visual signal devices and connect to signalling circuits.

.7 Connect signalling circuits to FACPs.

.8 Install end-of-line devices as required at end of conventional NACs and IDCs.

.1 End-of-line devices to be in a separate enclosure, mounted less than 1800mm AFF.

.9 Install remote annunciator panels and connect to AC essential power supply. Connect to FACPs via data communications network.

.10 Install door releasing devices.

.11 Install remote relay units to control fan shut down.

.12 Splices are not permitted.

.13 Provide necessary conduit, cable and wiring to make interconnections to terminal boxes, annunciator equipment and FACPs, as required by equipment manufacturer.

.14 Ensure that wiring is free of opens, shorts or grounds, before system testing and handing over.

.15 Mount end-of-line resistors on terminal blocks.

.16 Identify circuits and other related wiring at FACPs, remote annunciator, and terminal boxes.

.17 Install identifying lamacoids adjacent to each device on all signalling circuits and initiating circuits, including each manual alarm station, automatic alarm initiating device, audible signal device, visual alarm signal device, and end-of-line device. Label each device in the format FAS-xxxx-yyyy, as shown in the drawings.

3.2 CONDUIT

.1 Install separate raceway system for the fire alarm system, independent of all other wiring.

.2 Conduit fill not to exceed 40%.

.3 Install pullboxes in each conduit at intervals not to exceed 30m. Pullboxes to be 100 mm square, minimum.

.4 Paint pull boxes, junction boxes, conduit bodies, and terminal cabinets red prior to installation. Provide touch-up painting prior to final acceptance testing.

.5

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical and CAN/ULC-S537.

.2 Fire alarm system:

- .1 Test each device and alarm circuit to ensure manual stations, thermal, smoke, and flame detectors transmit alarm to control panel and actuate general alarm and ancillary devices.
- .2 Check annunciator panels to ensure zones are shown correctly.
- .3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of systems.
- .4 Addressable circuits system style DCLA:
  - .1 Test each conductor on all DCLA addressable links for capability of providing 3 or more subsequent alarm signals on each side of single open-circuit fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.
  - .2 Test each conductor on all DCLA addressable links for capability of providing 3 or more subsequent alarm signals during ground-fault condition imposed near midmost point of each link. Operate

Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

.5 Addressable circuits system style DCLB:

.1 Test each conductor on all DCLB addressable links for capability of providing 3 or more subsequent alarm signals on line side of single open-circuit fault condition imposed near electrically most remote device on each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

.2 Test each conductor on all DCLB addressable links for capability of providing 3 or more subsequent alarm signals during ground-fault condition imposed near electrically most remote device on each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

3.4 MOUNTING HEIGHTS

.1 Mount fire alarm equipment at heights specified or if not specified, as indicated in CAN/ULC-S524.

.2 Manual Stations: 1300 mm above finished floor.

3.5 MODBUS TCP DEMONSTRATION

.1 Demonstrate communication over Modbus TCP interface to the satisfaction of the Contract Administrator.

.2 Provide all computers, equipment, and wiring for demonstration purposes.

.3 Demonstration to provide adequate evidence of specified functionality.

3.6 DEMONSTRATION AND TRAINING

.1 Provide on-site lectures and demonstration by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

.1 Prepare one classroom training session for City Operations personnel. Topics to be focussed on system functionality and operation.

.2 Prepare one classroom training session for City Electrical Maintenance personnel. Topics to be focussed on system functionality and operation, as well as maintenance. Minimum duration to be three hours.

.3

.2 Prepare and distribute appropriate training manual for use and reference during training sessions.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA C22.2 No. 152, Combustible Gas Detection Instruments.

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

1.2 STORAGE

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

1.3 SHOP DRAWINGS AND PRODUCT DATA

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

.1 Detailed shop drawings including panel layouts and wiring diagrams are required for the sample panel.

Part 2 Products

2.1 GENERAL

.1 All gas detection products to be supplied from the same manufacturer.

.2 Manufacturer: Draeger.

.1 Alternative manufacturers will not be accepted due to this product having been selected as the plant standard.

2.2 CONTROLLER

.1 Requirements:

.1 Microprocessor based.
.2 Power Supply: 120 VAC
.3 Enclosure: NEMA 4X Fiberglass
.4 Mounting: Wall
.5 Operating Temperature range: 0°C to 40°C.
.6 Operating Humidity: 0-90% RH, non-condensing
.7 Input Channels:
.1 Each Controller is to be capable of supporting up to 16 channels.
.2 Capability may be provided via an internal add-on module.
.3 Minimum channels in supplied units: 8
.4 Input Signal: 4-20 mA
.5 Configurable for gas, range, and units.

.6 Power for input channels supplied by controller.

.8 Alarms:

.1 Two levels of programmable alarms per channel, with two independent setpoints per channel

.9 Output:

.1 Capable of one 4-20 mA output per channel.

.2 Capability may be provided via an internal add-on module.

.10 Display

.1 Alphanumeric display configurable for:

.1 0.1 through 8,000 ppm for ppm levels, and

.2 0-100% for percentage levels.

.2 Allow viewing of all active channels simultaneously.

.3 Provide LED display of all channel alarms.

.1 One LED for Alarm 1.

.2 One LED for Alarm 2.

.3 One LED for Fault.

.11 Alarm Relays:

.1 All relays to be Form C, SPDT.

.2 Contacts rated for 5A at 30 VDC and 240VAC

.3 Configurable for fail-safe operation, where relays are normally energized.

.4 Configurable for latching or non-latching operation.

.5 Capability may be provided via an internal add-on module.

.6 Configurable for zoning together of input channels.

.7 Zoning to be configured as per drawings.

.12 Configuration:

.1 All configuration to be available from the unit front display, without requiring the enclosure to be opened.

.2 Password protected.

.3 Store data in non-volatile memory. Battery backed RAM for storing configuration data is not acceptable.

.13 Communication:

.1 Modbus RS-485 master or slave.

.2 Provide registers to access each channel gas level, as well as all alarm status indications.

.3 Register map to be fully documented and made available.

.14 Approvals:

.1 C22.2 No. 152.

.15 Manufacturer and Model: Draeger DraegerGard.

2.3 GAS DETECTOR

.1 H_2S Detector Requirements:

.1 Sensor

.1 The sensor of the gas detector shall be based on electrochemical principles.

.2 Sensor specifications include:

.1	Operating Temperature:	-40°C to 65°C.
.2	Operating Humidity:	0-99% RH, non-condensing
.3	Measurement range:	0 – 100 ppm.

.3 Sensor to be temperature compensated and able to operate within ambient temperature range.

.4 Sensor to contain on-board data memory capability which contains sensor type, part number, serial number, manufacture date and date of initial installation. Additionally it must contain calibration data such as zero, sensitivity and date of last calibration.

.5 Sensor to have capability for full calibration at a remote location (e.g. instrument shop) and then installed in field transmitters without further calibration required.

.6 Field replacement of sensor to be accomplished without the need to declassify the area or the need to turn off the entire system.

.2 Transmitter

.1 Transmitter must accept, recognize, and upload calibration data of a remotely calibrated sensor without the need to repeat configuration and/or calibration.

.2 Transmitter shall have a two line alphanumeric backlit LCD display with user selectable language options (English).

.3 Transmitter shall be microprocessor controlled and perform self-diagnostics with error detection and alphanumeric messages displayed on the LCD.

.4 Transmitter to produce 4 to 20 mA output for point-to point connection, and have HART® capability.

.5 Notwithstanding C13 the transmitter shall have a 1.5 year warranty.

.6 Transmitter shall have an option for on-board, user programmable relays.

.7 Transmitter to allow for non-intrusive, one-man, password protected calibration using transmitter pushbuttons, infrared remote control, HART handheld terminal, or HART controller.

.8 During calibration or configuration of the gas detector, a signal shall be transmitted to the central control system indicating that a calibration or configuration is in progress. The signal shall be compatible with standard equipment, not requiring a manufacturer specific interface.

.9 The transmitter shall meet or exceed the following specifications:

.1 Housing Material shall be a copper free aluminum enclosure with polyester powder paint coat (thermally treated)

.2 Signal Current: 4 mA to 20 mA

.3 Fault < 3.2 mA

.4 Supply Voltage: 10 to 32 VDC

.5 Power Input 100 mA @ 24 VDC

.6 Display

.1 LCD display

.2 Display gas concentration to within 1% of range.

.7 Remote Sensor:

.1 Provide capability to mount sensor remote from transmitter. Minimum distance to be 5m.

.8 Temperature range: –40°C to 65°C (–40 to 150° F)

.9 Approvals: Explosion proof UL, CSA

.1 Class I, Div 1, Groups B, C, D

.10 Protection: NEMA 7

.11 Connection: 2 ¾" NPT female conduit entries

.3 Manufacturer and Model: Draeger Polytron 2XP Tox with H_2S LC Sensor.

.2 IR Hydrocarbon Detector

.1 The combustible gas detector shall be based on infrared absorption principle incorporating both a double-compensated optical bench (2 lamps, 2 detectors) and non-focusing optics design. Measurement range shall be 0 to 100% LEL;

.2 The gas detector shall be microprocessor controlled and perform self-diagnostics with error detection.

.3 Recommended time between calibrations to exceed 24 months.

.4 Capability for remote calibration with both remote gas and HART connection.

.5 Transmitter to produce 4 to 20 mA output for point-to point connection and HART® signal.

.6 Transmitter to allow for non-intrusive, one-man, password protected calibration using a HART handheld terminal or HART controller.

.7 Calibration/configuration menu language to be user selectable (English).

.8 During calibration or configuration of the gas detector, a signal shall be transmitted to the central control system indicating that a calibration or configuration is in progress. The signal shall be compatible with standard equipment, not requiring a manufacturer specific interface.

.9 Notwithstanding C13 the transmitter shall have a 5 year warranty.

.10 The gas detector shall meet or exceed the following specifications:

.1 Housing Material: Stainless steel SS316

.2 Signal Current 4 mA to 20 mA

.3 Fault <3.2 mA

.4 Supply Voltage: 15 to 32 V DC

.5 Power Input 200 mA @ 24 VDC

.6 Temperature range: –40°C to 65°C (–40 to 150° F)

.7 Approvals: Explosion proof UL, CSA

.1 Class I, Div 1, Groups B, C, D

.8 Approvals: Explosion proof UL, CSA

.1 Class I, Div 1, Groups B, C, D

.9 Protection: NEMA 7

.10 2 ¾" NPT female conduit entries

.11 Manufacturer and Model: Draeger Polytron IR.

.3 Accessories

.1 Splash guard

.2 Mounting kit for Polytron IR

.3 Junction box c/w terminals. Ensure correct conduit entry locations for ceiling mounted detectors.

.4 Extension Box HHT-T for inaccessible detectors

.5 Extension Box HHT-H for inaccessible detectors

.6 HART programming cable for Polytron IR

2.4 SAMPLE PANEL

.1 The sample panel shall be an eductor based sampling system including the following:

.1 One instrument air connection.

.2 Solenoids to allow purging of the inlet line with instrument air controlled from the DCS.

.1 Solenoids to be 120 VAC rated.

.3 A pushbutton for manual purging with a signal going to the DCS.

.1 Pushbutton to be heavy-duty oiltight, operator flush, black, with 1-NO and 1-NC contacts rated 120 VAC, 5 A rated.

.4 Filters to remove water from the sample inlet

.5 A low flow switch for each sample line with signals going to the DCS.

.1 Flow switch to be 120 VAC, 5 A rated.

.6 Two gas detector units configured as per the drawings.

.7 A pressure regulator to drop instrument air pressure down to eductor operating pressure.

.8 NEMA 4 enclosure

.9 Manufactured by a CSA approved panel shop in accordance with 40 95 13.

2.5 SAMPLE AND CALIBRATION TUBING

.1 The sample tubing shall be 1/4” (8mm) stainless steel tubing.

.2 The sample tubing hung into the wet well shall be 8mm (1/4") flexible Teflon tubing.

.3 The calibration tubing shall be 6mm (1/8”) stainless steel tubing.

.4 Provide supports as required for all metal tubing.

2.6 AUDIBLE SIGNAL DEVICES - UNCLASSIFIED

.1 Requirements:

.1	Approvals:	CSA or cUL
.2	Type:	Vibrating grille
.3	Enclosure:	Corrosion resistant type 4X
.4	Voltage:	120 VAC
.5	Sound level at 3 m (10 ft)	103 db (Adjustable)

.6 Maximum current draw less than 0.2 A
.7 Mounting: Surface mount on wall
.8 Manufacturer and Model:
.1 Edwards 876 series
.2 Or approved equal in accordance with B6.

.2 Coordinate gas alarm horn sound with fire alarm system horns to have a distinctly different sound for gas alarm horns.

2.7 AUDIBLE SIGNAL DEVICES – CLASS I, ZONE 2

.1 Requirements:

.1 Approvals: CSA or cUL
.2 Type: Explosion Proof
.3 Rating: Class I, Zone 2, Group IIA
.4 Enclosure: Corrosion resistant type 4X
.5 Voltage: 120 VAC
.6 Sound level at 3 m (10 ft) 97 db
.7 Maximum current draw less than 0.2 A
.8 Mounting: Surface mount on wall
.9 Manufacturer and Model:
.1 Edwards 878EX series
.2 Or approved equal in accordance with B6.

.2 Coordinate gas alarm horn sound with fire alarm system horns to have a distinctly different sound for gas alarm horns.

2.8 VISUAL ALARM SIGNAL DEVICES - UNCLASSIFIED

.1 Requirements:

.1 Approvals: CSA or cUL
.2 Type: Strobe, flashing
.3 Enclosure: Corrosion resistant Type 4X
.4 Voltage: 120 VAC
.5 Light Intensity: 800,000 candela or greater
.6 Colour: Red
.7 Maximum current draw: less than 0.2 A
.8 Mounting: Surface mount on wall
.9 Provide mounting brackets as required.
.10 Manufacturer and Model:
.1 Edwards 105HIST series
.2 Or approved equal in accordance with B6.

.2 Means provided to synchronize flashes within corridors or rooms in the same field of view.

.3 Provide a sign adjacent to the strobe, readable from 10m indicating:

STROBE INDICATES HAZARDOUS GAS DETECTED
IF ACTIVATED LEAVE AREA IMMEDIATELY

2.9 VISUAL ALARM SIGNAL DEVICES – CLASS I, ZONE 1

.1 Requirements:

.1	Approvals:	CSA or cUL
.2	Type:	Explosion Proof, Strobe, flashing
.3	Classification:	Class I, Zone 1 (Div 1), Group IIA (D)
.4	Enclosure:	Corrosion resistant Type 4X
.5	Voltage:	120 VAC
.6	Light Intensity:	800,000 candela or greater
.7	Colour:	Red
.8	Maximum current draw:	less than 0.2 A
.9	Mounting:	Surface mount on wall

.10 Provide mounting brackets as required.

.11 Manufacturer and Model:

.1 Edwards 116EX series

.2 Or approved equal in accordance with B6.

.2 Means provided to synchronize flashes within corridors or rooms in the same field of view.

.3 Provide a sign adjacent to the strobe, readable from 10m indicating:

STROBE INDICATES HAZARDOUS GAS DETECTED
IF ACTIVATED LEAVE AREA IMMEDIATELY

Part 3 Execution

3.1 INSTALLATION

.1 All equipment shall be mounted in accordance with manufacturer's recommendations.

.2 Install gas detection equipment as per location drawings and installation details.

.3 Install a lamacoid nameplate directly on or adjacent to equipment with equipment name and description.

.4 Install remote calibration stations on wall at 1.5m above finished floor or grating. Install lamacoid on wall next to station with description (eg. G501-AP01 REMOTE CALIBRATION STATION FOR G501-AT01)

.5 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 CALIBRATION

.1 Calibrate all gas detection sensors.

3.3 TESTING

.1 Test the sound levels of notification horns in the areas covered by the horns. Provide a report indicating the ambient sound level, and the average, maximum, and minimum horn sound levels in dB.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

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

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

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

1.2 SUBMITTALS

.1 Prior to construction:

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

.2 Submit stamped red-line mark-ups of the proposed modifications to the control panels. If significant modifications are proposed/required, AutoCAD drawings will be supplied to the Contractor for revision.

.2 Prior to shipment:

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

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

.2 As-built drawings:

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

.2 Draft significant changes on AutoCAD drawings.

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

1.3 INSPECTION

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

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

1.4 CLOSEOUT SUBMITTALS

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

.2 Provide as-built layout drawings.

Part 2 Products

2.1 GENERAL

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

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

.3 Where manufacturer and model are specified, substitutions must be approved.

2.2 ENCLOSURES

.1 All indoor control panels shall be NEMA 12 or as shown on drawings.

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

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

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

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

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

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

.8 Manufacturer:

.1 Hoffman or approved equal in accordance with B6.

2.3 ENCLOSURE ACCESSORIES

.1 All control panels of a depth greater than or equal to twelve (12) inches shall be equipped with a fluorescent lighting device located in the cabinet's upper portion with a door switch. Whenever the door is opened, the lighting system shall automatically be activated.

.2 Provide a door drawing packet on the door interior.

2.4 POWER SOURCE

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

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

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

2.5 COMPONENTS

.1 Rails (DIN Rails)

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

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

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

.2 Terminals

.1 Requirements:

.1 TS-35 DIN Rail mounting.

.2 Voltage rating:

.1 600V for general control circuits.

.2 600V for power circuits.

.3 Manufacturer:

.1 Existing Control Panels

.1 Weidmuller SAK 4.

.2 New Control Panels:

.1 Phoenix Contact or approved equal in accordance with B6.

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

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

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

.3 Wire duct

.1 Narrow slot wiring duct, size as indicated on the drawings.

.2 Advise the Contract Administrator if the size indicated is of insufficient size for the wiring requirements.

.3 Manufacturer:

.1 Panduit

.2 Or approved equal in accordance with B6.

.4 Ground Bus Bar

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

.2 Requirements:

.1 Tapped holes with screws.

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

.3 Maximum one wire termination per screw.

.5 Pushbutton, Switch and Indicator Light

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

.2 Manufacturer to be Allen-Bradley or approved equal in accordance with B6.

.6 Programmable Logic Controllers

.1 Not required.

.7 Touch-screen HMI

.1 Not required.

.8 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.

.9 Ethernet Switch

.1 Not required.

2.6 WIRING AND ACCESSORIES

.1 Power wiring:

.1 TEW/MTW, 600V, 105°C insulation, stranded copper.

.2 12 AWG or larger where current requirements dictate.

.2 Control wiring

.1 TEW/MTW, 16 AWG, 105°C insulation, stranded copper.

.2 Voltage rating:

.1 600V if the voltage in any part of the panel exceeds 120V.

.2 300V if only 120V or less is located within the panel.

.3 Analog signal wiring

.1 300V, 18 AWG shielded twisted pairs such as Belden No. 8760, or approved equal in accordance with B6.

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

.5 Color code wires as follows:

.1 120VAC line – black

.2 120VAC control – red

.3 120VAC neutral – white

.4 24VDC supply - blue

.5 24VDC control – blue

.6 24VDC negative / return - brown

.7 24VAC supply – black

.8 24VAC control – red

.9 24VAC neutral – white
.10 10VDC supply - blue
.11 0-10VDC signal – blue
.12 10VDC common / return – brown
.13 Intrinsically safe – light blue
.14 4-20mA – (white+, black-)

.6 Ethernet Patch Cords

.1 Requirements:
.1 Cat-5e.
.2 Jacket colour: Blue.

.7 Wiring Duct

.1 All wires shall be run in narrow slot wiring duct.
.2 Wiring Duct shall be installed on both sides of the panel and between the DIN rails.
.3 Wire or cable, connected to internal device or arriving from external device, shall be uncovered by Wiring Duct for a maximum of 10 cm.
.4 120 VAC wires cannot share wiring duct with 10 VDC, 24 VDC or 4-20 mA wires, but can cross their path.

2.7 IDENTIFICATION

.1 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.

Part 3 Execution

3.1 COMPONENT INSTALLATION

.1 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.

.2 Mount all control devices so that any component can be replaced without removing the sub-panel.

.3 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.

.4 Supply and install all required fuses.

.5 Space devices to allow for cooling, replacement, servicing, and wiring access.

.6 Group devices according to voltage and function to reduce electrical noise.

3.2 IDENTIFICATION

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

.2 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.

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

.4 Perform terminal identification using a computerized device. Handwriting is not acceptable. Label terminals as shown on drawings.

.5 Install group label above each terminal block with terminal block name.

.6 Identify each component on the door interior with the functional identifier, in addition to the appropriate label/identification on the door exterior.

3.3 WIRING

.1 General Requirements:

.1 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.

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

.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 conductors shall be securely fastened to terminals at both ends.

.5 No splices are allowed inside the panel.

.6 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.

.7 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.

.8 Individual conductors or wires exiting a cable shall be.

.9 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.

.10 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.

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

.2 Analog Signal Wiring

.1 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.

.3 Ethernet Wiring

.1 Route Ethernet wiring separate from all other wiring.

3.4 GROUNDING

.1 Ground and bond all control panel components in accordance with the component manufacturer and CSA requirements, especially control system components.

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

3.5 TESTING

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

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

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

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

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

.5 Tests to include:

.1 Power supply functionality

.2 PLC component functionality

.3 Point to point tests of all inputs and outputs

.4 Power terminal voltage verification

.5 Relays and switches functionality

.6 E-stop system component functionality

.7 Receptacle and lighting functionality

.8 Ethernet switch and fibre transceiver functionality

3.6 SPARE COMPONENTS

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

3.7 DRAWINGS

.1 Provide as built control panel layout and wiring diagrams in a door pocket prior to shipping.

END OF SECTION

PART 1 General

1.1 DESCRIPTION

.1 The Work includes the provision of all instrument air supply and transmission devices.

Part 2 Products

2.1 PNEUMATIC AND PROCESS CONNECTIONS

.1 Pipe, fittings, valves, tubing, tube fittings, etc. required under this Section of the Contract to be Swagelok, Parker or Freelin-Wade and rated for the service in which they are to be employed.

.2 Tubing and fittings to be made of stainless steel or light stabilized black nylon 11.

.3 Dimensions:

.1 Process connections - 12 mm (nominal) O.D. tubing

.2 Output/signal - 10 mm (nominal) O.D. tubing

.3 Air supply - 12 mm pipe (nominal) to isolation valves and 10 mm O.D. tubing (nominal) from isolation valves to end devices (e.g. valves).

.4 Provide a continuous support channel or raceway for all tubing.

2.2 AIR SETS

.1 Provide all pneumatic devices with an air set.

.2 Provide Fisher 67FR air sets.

.3 Air set to be complete with filter regulator and output pressure gauge.

2.3 SOLENOID VALVES

.1 Provide Asco Redhat type solenoid valves unless specified otherwise.

.2 Maximum operating pressure: 850 kPa instrument air

.3 Minimum operating pressure: 20 kPa instrument air

Part 3 Execution

3.1 TUBING AND FITTING INSTALLATION

.1 Group instruments logically together. Orient instrument air and process connection isolation valves to provide consistent handle indication of normal open/closed status.

.2 Complete final location of field instruments to provide sufficient clearance for access to all maintenance settings, to provide unobstructed viewing of instrument indicators and to permit instrument calibration and maintenance during normal operation of the site.

.3 Slope tubing installations 20 mm per 2 m of run down to process connection.

.4 Support tubing in channel or raceway if exposed or in close proximity to rotating equipment or high traffic areas. Otherwise do not exceed 1 m between tubing supports.

.5 All turns shall have a minimum bending radius of 50 mm.

.6 Avoid non-terminal connections in tubing runs.

.7 Use teflon tape on all threaded stainless steel fittings. Do not apply tape on the first two threads.

.8 Complete the final 300 mm (nominal) of all stainless steel air tubing to instruments or control valves installed in process equipment with flexible reinforced neoprene hose. Support the tubing at the hose connection. Tubing shall terminate with fittings or 90° bends, to allow removal of neoprene tubing without disturbing the fixed tubing mounting. Locate the hose connection to facilitate unrestricted removal of the instrument or control valve and to minimize transmission of process equipment vibration into the tubing.

.9 Air tubing on outdoor runs to be insulated against cold.

.10 Ensure air supply is blown down and free from debris before connecting end devices.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

Part 2 Products

2.1 MODBUS RS232 TO MODBUS RS485 CONVERTER

.1 One RS-485 terminal block capable of communicating Modbus RTU.

.2 One RS-232 port capable of communicating Modbus RTU.

.3 Enclosure fit for industrial environments.

.4 Power Requirements: 24 VDC terminal block

.5 Approved Manufacturer and Model: B&B 485DRCI or approved equal in accordance with B6.

Part 3 Execution

3.1 Configuration

.1 Configure process control network equipment so as to create a correctly communicating installation.

.2 Ethernet installations shall be certified to Category 5e standards.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

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

.2 All Junction Boxes shall be factory assembled and pre-wired where possible. The Junction Box wiring shall be verified at the manufacturer's factory and completely tested before being shipped to the site.

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

1.2 SUBMITTALS

.1 Prior to construction:

- .1 Submit product datasheets, and wait for approval, prior to construction of the Junction boxes.
- .2 Submit stamped red-line mark-ups of the proposed modifications to the junction boxes. If significant modifications are proposed/required, AutoCAD drawings will be supplied to the Contractor for revision.

.2 Prior to shipment:

- .1 Submit electronic pictures of enclosure exterior and interior, including door interior.
  - .1 Pictures to be of sufficient resolution to read component labels.
- .2 As-built drawings:
  - .1 Submit as-built drawings. Minor changes may be made via red-line mark-ups.
  - .2 Draft significant changes on AutoCAD drawings.
- .3 Do not ship junction boxes until approval from Contract Administrator is received.

1.3 INSPECTION

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

.2 If requested, demonstrate and test the junction box in presence of the Contract Administrator designated representative.

1.4 CLOSEOUT SUBMITTALS

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

.2 Provide as-built layout drawings.

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 Where manufacturer and model are specified, substitutions must be approved.

2.2 ENCLOSURES

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

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

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

2.3 COMPONENTS

.1 Rails (DIN Rails)

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

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

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

.2 Terminals

.1 Requirements:

.1 TS-35 DIN Rail mounting.

.2 Voltage rating:

.1 600V for general control circuits.

.2 600V for power circuits.

.3 Manufacturer:

.1 Phoenix Contact or approved equal in accordance with B6.

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

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

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

.3 Wire duct

.1 Narrow slot wiring duct, size as indicated on the drawings.

.2 Advise the Contract Administrator if the size indicated is of insufficient size for the wiring requirements.

.3 Manufacturer:

.1 Panduit

.2 Or approved equal in accordance with B6.

.4 Ground Bus Bar

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

.2 Requirements:

.1 Tapped holes with screws.

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

.3 Maximum one wire termination per screw.

.5 Power Supplies

.1 Provide all necessary power supplies with capacity to power connected equipment. Requirements include:

.1 Mounting: DIN Rail

.2 Voltage: 120 VAC input / 24 VDC output

.3 Approvals: CSA or cUL

.4 Manufacturer and model: SolaHD SDN Series or approved equal in accordance with B6.

2.4 WIRING AND ACCESSORIES

.1 Power wiring:

.1 TEW/MTW, 600V, 105°C insulation, stranded copper.

.2 12 AWG or larger where current requirements dictate.

.2 Control wiring

.1 TEW/MTW, 16 AWG, 105°C insulation, stranded copper.

.2 Voltage rating:

.1 600V if the voltage in any part of the panel exceeds 120V.

.2 300V if only 120V or less is located within the panel.

.3 Analog signal wiring

.1 300V, 18 AWG shielded twisted pairs such as Belden No. 8760, or approved equal in accordance with B6.

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

.5 Color code wires as follows:

.1 120VAC line – black

.2 120VAC control – Red

.3 120VAC neutral – white

.4 24VDC supply - blue

.5 24VDC control – blue

.6 24VDC negative / return - brown

.7 24VAC supply – black
.8 24VAC control – red
.9 24VAC neutral – white
.10 10VDC supply - blue
.11 0-10VDC signal – blue
.12 10VDC common / return – brown
.13 Intrinsically safe – light blue
.14 4-20mA – (white+, black-)

2.5 IDENTIFICATION

.1 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.

Part 3 Execution

3.1 COMPONENT INSTALLATION

.1 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.

.2 Mount all control devices so that any component can be replaced without removing the sub-panel.

.3 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.

.4 Supply and install all required fuses.

.5 Space devices to allow for cooling, replacement, servicing, and wiring access.

.6 Group devices according to voltage and function to reduce electrical noise.

3.2 IDENTIFICATION

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

.2 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.

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

.4 Perform terminal identification using a computerized device. Handwriting is not acceptable. Label terminals as shown on drawings.

.5 Install group label above each terminal block with terminal block name.

.6 Identify each component on the door interior with the functional identifier, in addition to the appropriate label/identification on the door exterior.

3.3 WIRING

.1 General Requirements:

.1 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.

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

.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 conductors shall be securely fastened to terminals at both ends.

.5 No splices are allowed inside the panel.

.6 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.

.7 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.

.8 Individual conductors or wires exiting a cable shall be.

.9 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.

.10 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.

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

.2 Analog Signal Wiring

.1 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.

3.4 GROUNDING

.1 Ground and bond all control panel components in accordance with the component manufacturer and CSA requirements, especially control system components.

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

3.5 TESTING

.1 Testing of the junction boxes shall be fully completed prior to the FAT, and shall include at minimum:

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

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

3.6 SPARE COMPONENTS

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

3.7 DRAWINGS

.1 Provide as built junction box drawings in the junction box prior to shipping.

3.8 MOUNTING HEIGHTS

.1 Unless otherwise specified or a conflict exists, mount all panels 2000 mm to top of cover, or as approved by the Contract Administrator.

END OF SECTION