Part 1 General

1.1 COMMENCEMENT OF WORK

.1 Construction shall commence and hall continue without interruption until completion of all Work included in the Contract.

.2 The Contractor shall schedule an initial jobsite meeting for the purpose of laying out and phasing the Work as required.

1.2 BUILDING PERMIT

.1 The Building Permit application will be made prior to the award of the contract. The Building Permit application will be transferred to the Contractor upon award of the contract who will be responsible for coordinating, following up, etc. on the permit. The costs of the Building permit will be paid by the City and the costs shall not be included in the bid price. Contractor shall be responsible for applying for and paying for all other required permits.

1.3 DELIVERY, STORAGE AND HANDLING

.1 All materials shall be delivered to the site in ample time for proper incorporation into the Work in accordance with the normal progress of the job.

1.4 LAYOUT OF THE WORK

.1 The Contractor's superintendent on the jobsite shall lay out the Work correctly, establishing schedules and shutdowns, etc.

1.5 SCHEDULE OF WORK

.1 Within one week of award of Contract, the Contractor shall submit a schedule showing the times at which he proposes to do the various items of Work. This schedule shall include the following items:

.1 Schedules/length of time required for shut-downs.

.2 The Subcontractors schedule shall recognize and incorporate the following basic requirements.

.1 Timing of power and equipment interruptions and the amount of interruptions shall be kept as short as possible/to a minimum.

.2 Timing of all noise creating Work shall be coordinated with the City's Representative.

1.6 WORK PERIODS

.1 All Work shall be scheduled by the Contractor and approved by the City.

.2 It is imperative that all Work be carried out such that the period of interruption of services is minimized. All required interruptions must be scheduled with and co-ordinated with the City. Obtain signed services shutdown notice from The City prior to

proceeding with each shutdown required. Sample shutdown notice is included at the end of this section. Where deemed necessary by The City's representative, this Work shall be carried out at night and on weekends.

.3 All Work shall be done in such a manner that it does not disrupt the normal operation of the Building. All additional costs for overtime, or for Work required at other than normal working hours shall be included in the Bid Opportunity price.

1.7 SECURITY

.1 All mechanical room doors and doors leading to roof, crawlspace & mechanical rooms access shall be kept closed and locked.

1.8 ADDITIONAL REQUIREMENTS OF CONTRACTOR

.1 Comply with the following additional requirements as set out by the City:

.1 The City must be notified of all Subcontractors involved in the project, including a contact name and telephone number.

.2 Building Permit will be posted at the job site.

.3 Delivery or removal of building materials must be scheduled with the City.

.4 Co-ordinate with The City for weight restrictions, cab dimensions, door openings, etc.

.5 Carts for moving supplies will be supplied by Contractor.

.6 Requests for access must be submitted to the City with list of names for approval.

.7 Entrance keys must be issued to Subcontractors by the City.

.8 Public corridors are to be kept free of construction materials, tools or debris and are NOT to be used as storage areas.

.9 Contractor will leave all public areas in a neat and tidy appearance.

.10 WHMIS product data sheets will be supplied to the City prior to use on job site. This includes all chemicals, paints, glues, cleaners, or odour causing substances, etc. The City reserves the right to deny permission for use of substances deemed to be a health or safety hazard to building occupants.

.11 Use of all odour producing substances will be restricted to hours agreed to by The City.

.12 All garbage must be removed from the site by the Subcontractors. The City's

.13 garbage bins are NOT available to Subcontractors. Subcontractors must co-ordinate storage of garbage disposal bins on The City's property with The City. Contractor is responsible for after construction cleanup. Contractor will supply vacuums, brooms, etc. for use at the job site - equipment belonging to The City will NOT be used by Contractor's staff.

.2 FIRE SAFETY PRECAUTIONS:

.1 While brazing, soldering, grinding, cutting or welding, protect building and contents against heat, sparks and fire by shielding. Maintain a fire extinguisher (ABC Multipurpose Class, minimum 10 lb. capacity) in working order, at each workstation, within close reach of all personnel located at that station, including

stations where lead or lead joints are heated and where materials are heated with torches or open flames.

.2 Maintain cleanliness and order in all areas at all times. DO NOT ALLOW RUBBISH TO COLLECT. Keep fire alarm pull stations, alarm panels, doorways, exits and corridors free of obstructions. Do not use wood wedges or other objects to hold open fire doors.

.3 Fire Watch:

.1 Provide fire watch services when fire alarm or sprinkler system are shutdown during construction. Fire watch services shall include, at a minimum, fire watch at the alarm panel in the Storage Building and site walk around in both the Storage Building and the Maintenance & Repair Building. Full requirements shall be coordinated with Transit.

.4 Personnel shall know location of fire alarm pull stations, fire extinguishing equipment and fire exits and evacuation routes for areas in which they are working.

.5 Personnel shall know proper method of operating portable fire extinguishers, be familiar with various classifications of fire and appropriate method of extinguishers agent for each classification.

.6 Store flammable or combustible gases used on construction site in ULC containers. Use and storage of these materials is subject to approval of The City.

.7 Contractor shall provide additional staff to act as spotter for "hot Work" operations. Spotter's responsibility shall be to observe welding, soldering, flammable operations and to extinguish any sparks or fires resulting from Work.

1.9 PROJECT PHASING

.1 Contractor shall coordinate with operations staff for timing of Work to be performed. Facility to remain in operation throughout construction process. Work for project will need to be phased to ensure minimal interruptions to operations.

1.10 CONSTRUCTION MEETINGS

.1 The Contractor shall hold regular, bi-weekly, construction meetings on site at a time suitable for The City and Contract Administrator. Contractor shall lead the meetings and produce/issue meeting minutes within 5 working days after completion of the meeting.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section

1.2 REFERENCE STANDARDS

.1

1.3 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.

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

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

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

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

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

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

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 [Refer to CCDC 2 GC 3.11].

.2 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.

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

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

.4 Allow 5 working days review of each submission.

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

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

.7 Accompany submissions with transmittal letter, in [duplicate], 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.

.8 Submissions include:

- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.
  - .3 Manufacturer.
- .4 Contractor s stamp, signed by Contractor s authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Details of appropriate portions of Work as applicable:
  - .1 Fabrication.
  - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
  - .3 Setting or erection details.
  - .4 Capacities.
  - .5 Performance characteristics.
  - .6 Standards.
  - .7 Operating weight.
  - .8 Wiring diagrams.
  - .9 Single line and schematic diagrams.
  - .10 Relationship to adjacent work.

.9 After Contract Administrator’s review, distribute copies.

.10 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Contract Administrator may reasonably request.

.11 Submit 6 electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested Contract Administrator where shop drawings will not be prepared due to standardized manufacture of product.

.12 Submit 6 electronic copies of test reports for requirements requested in specification Sections and as requested by Contract Administrator.

.1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.

.2 Testing must have been within [3] years of date of contract award for project.

.13 Submit electronic 6 copies of certificates for requirements requested in specification Sections and as requested by Contract Administrator.

.1 Statements printed on manufacturer s letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.

.2 Certificates must be dated after award of project contract complete with project name.

.14 Submit electronic 6 copies of manufacturers instructions for requirements requested in specification Sections and as requested by Contract Administrator.

.1 Pre-printed material describing installation of product, system or material, including special notices and Safety Data Sheets concerning impedances, hazards and safety precautions.

.15 Submit electronic 6 copies of Manufacturer’s Field Reports for requirements requested in specification Sections and as requested by Contract Administrator.

.16 Documentation of the testing and verification actions taken by manufacturer s representative to confirm compliance with manufacturer s standards or instructions.

.17 Submit electronic 6 copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Contract Administrator.

.18 Delete information not applicable to project.

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

.20 If upon review by Contract Administrator, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

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

.1 This review shall not mean that the Contract Administrator approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of

responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

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

1.5 CERTIFICATES AND TRANSCRIPTS

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

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 BARRIERS

.1 Erect and maintain guard rails, fences, temporary enclosures, gates, warning signs and lighting, etc., as may be required by local by-laws, ordinances, and regulations, etc.

1.2 SECURITY

.1 All temporary doors, or other access to the Work shall be equipped with secure locking devices, and upon completion of each day's Work all such accesses shall be securely closed and locked.

1.3 PROTECTION OF WORK AND PROPERTY

.1 Weather Protection: This shall include protection of the Work from damage due to rain, water and snow. Provide and maintain temporary weathertight enclosures for all exterior openings as the need arises.

.2 Provide protective plywood walkways on all new and existing roof sections subject to roof traffic, including tie-ins, water stops, and overnight seals in order to maintain integrity during all phases of construction

1.4 FIELD OFFICES

.1 Space for a field office will not be provided in existing building by The City.

1.5 STORAGE OF MATERIALS ON SITE

.1 Some exterior space can be made available just west of gridline 59 and around gridline C for storage of materials on site as long as buses can still enter into the Track 25 overhead door. Additional space can also be made available north of the building in the fenced compound.

1.6 PARKING

.1 Comply with all local Parking Regulations.

1.7 CLEANING

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

.2 Maintain The City's grounds, and public properties free from accumulations of construction waste materials and rubbish.

.3 Provide trash receptacles where Work is being done, for storing trash and construction debris. Construction debris shall be removed from the premises in accordance with job progress.

.4 Dispose of waste materials, and rubbish at designated areas, or at authorized public refuse grounds.

.5 Vacuum clean interior building areas when ready for substantial completion or occupancy.

.6 Contain all Work that generates dust and contamination. Protect The City's Work areas to eliminate any cross contamination.

.7 If instructed to do so by the Contract Administrator or the City, the Contractor will clean any areas in question immediately.

END OF SECTION

Approved: 2009-06-30

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Pre-warranty Meeting:

.1 Convene meeting one week prior to contract completion with Contract Administrator and Departmental Representative to:

.1 Verify Project requirements.

.2 Review warranty requirements manufacturer's installation instructions.

.2 Departmental Representative to establish communication procedures for:

.1 Notifying construction warranty defects.

.2 Determine priorities for type of defects.

.3 Determine reasonable response time.

.3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.

.4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative and Contract Administrator, 2 final digital copies of operating and maintenance manuals in English.

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

.4 Provide evidence, if requested, for type, source and quality of products supplied.

1.4 FORMAT

.1 Organize data as instructional manual.

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

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

.1 Identify contents of each binder on spine.

.4 Cover: identify each binder with type or printed title Project Record Documents; list title of project and identify subject matter of contents.

.5 Arrange content by systems, under Section numbers and sequence of Table of Contents.

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

.7 Text: manufacturer s printed data, or typewritten data.

.8 Drawings: provide with reinforced punched binder tab.

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

.9 Provide [1:1] scaled CAD files in dwg format.

1.5 CONTENTS - PROJECT RECORD DOCUMENTS

.1 Table of Contents for Each Volume: provide title of project;

.1 Date of submission; names.

.2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.

.3 Schedule of products and systems, indexed to content of volume.

.2 For each product or system:

.1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

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

.4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.5 Typewritten Text: as required to supplement product data.

.1 Provide logical sequence of instructions for each procedure, incorporating manufacturer’s instructions.

.6 Training: refer to applicable specification section.

1.6 AS -BUILT DOCUMENTS AND SAMPLES

.1 Maintain, in addition to requirements in General Conditions, at site for Contract Administrator an Departmental Representative one record copy of:

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Change Orders and other modifications to Contract.

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

.6 Field test records.

.7 Inspection certificates.

.8 Manufacturer s certificates.

.2 Store record documents and samples in field office apart from documents used for construction.

.1 Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.

.1 Label each document PROJECT RECORD in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition.

.1 Do not use record documents for construction purposes.

.5 Keep record documents and samples available for inspection by Contract Administrator.

1.7 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

.1 Record information on set of black line opaque drawings.

.2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.

.3 Record information concurrently with construction progress.

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

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

.1 Measured depths of elements of foundation in relation to finish first floor datum.

.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

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

.4 Field changes of dimension and detail.

.5 Changes made by change orders.

.6 Details not on original Contract Drawings.

.7 Referenced Standards to related shop drawings and modifications.

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

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

.2 Changes made by Addenda and change orders.

.6 Other Documents: maintain [manufacturer’s certifications,] [field test records,] [inspection certifications,] required by individual specifications sections.

.7 Provide digital photos, if requested, for site records.

1.8 EQUIPMENT AND SYSTEMS

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

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

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

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

.3 Include installed colour coded wiring diagrams.

.4 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.5 Include manufacturer s printed operation and maintenance instructions.

.6 Include sequence of operation by controls manufacturer.

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

.8 Provide installed control diagrams by controls manufacturer.

.9 Provide Contractor’s co-ordination drawings, with installed colour coded piping diagrams.

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

.11 Additional requirements: as specified in individual specification sections.

1.9 MATERIALS AND FINISHES

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

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

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

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

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

1.10 MAINTENANCE MATERIALS

.1 Spare Parts:

.1 Provide spare parts, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to [location as directed] [site] ; place and store.

.4 Receive and catalogue items.

.1 Submit inventory listing to Contract Administrator and Departmental Representative.

.2 Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

.2 Extra Stock Materials:

.1 Provide maintenance and extra materials, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to site; place and store.

.4 Receive and catalogue items.

.1 Submit inventory listing to Departmental Representative, Contract Administrator.

.2 Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

.3 Special Tools:

.1 Provide special tools, in quantities specified in individual specification section.

.2 Provide items with tags identifying their associated function and equipment.

.3 Deliver to location as directed; place and store.

.4 Receive and catalogue items.

.1 Submit inventory listing to Contract Administrator, Departmental Representative.

.2 Include approved listings in Maintenance Manual.

1.11 DELIVERY, STORAGE AND HANDLING

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

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

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

.4 Store paints and freezable materials in a heated and ventilated room.

.5 Remove and replace damaged products at own expense and for review by Contract Administrator.

1.12 WARRANTIES AND BONDS

.1 Submit, warranty information made available during construction phase, to Contract Administrator and Departmental Representative for approval prior to each monthly pay estimate.

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

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

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

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within [ten] days after completion of applicable item of work.

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

.5 Co-execute submittals when required.

.6 Retain warranties and bonds until time specified for submittal.

.3 Except for items put into use with City s permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.

.4 Respond in timely manner to oral or written notification of required construction warranty repair work.

.5 Written verification to follow oral instructions.

.1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

END OF SECTION

ELECTRICAL SPECIFICATION INDEX

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 REFERENCE STANDARDS

.1 CSA Group
- .1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations, latest adopted edition.
- .2 CAN/CSA-C22.3 latest adopted edition, Overhead Systems.
- .3 CAN3-C235-83 (R2015), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
- .1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

.3 American Society for Testing and Materials International (ASTM)
- .1 ASTM E-814, Fire Tests of Penetration Fire Stops

.4 American National Standards Institute (ANSI)
- .1 ANSI/UL1479, Fire Tests of Through Penetration Firestops

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer s instructions, printed product literature and WHMIS MSDS and data sheets in accordance with Section 01 47 15 – Sustainable Requirement: Constructions and Section 02 81 01 –Hazardous Materials.

.3 Shop drawings:
- .1 Submit drawings stamped as reviewed by electrical contractor.
- .2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.
- .3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
- .4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
- .5 Submit 3 copies of 600 x 600 minimum size drawings (or PDF’s) to authority having jurisdiction.

.6 If changes are required, notify Contract Administrator and Departmental Representative of these changes before they are made.

.4 Certificates:

.1 Provide CSA certified equipment and material.

.2 Where CSA certified material and equipment are not available, submit such material/equipment to authority having jurisdiction for special approval before delivery to site.

.3 Submit test results of installed electrical systems and instrumentation.

.4 Permits and fees: in accordance with General Conditions of contract.

.5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative and Contract Administrator.

1.4 CLOSEOUT SUBMITTALS

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

.2 Operation and Maintenance Data: submit operation and maintenance data for

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

.4 Post instructions where directed.

.5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

.6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

.7 Submit as build drawings noting circuits, conduit runs, location revisions and any additional information as directed by the Contract Administrator.

1.5 WORKING TIMES

.1 Building A Office area: Work shall be completed outside of normal office house (after 4PM).

.2 Building B Truck parking garage: Work can be completed during normal working hours.

.3 Building A Service garage: Work can be completed during normal working hours.

1.6 CODES AND STANDARDS

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

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

1.7 QUALITY ASSURANCE

.1 Do complete installations in accordance with local standard.

.2 While not identified and specified by number in this Division, comply with CSA Electrical Bulletins in force at time of tender submission. Comply with the requirements of all Provincial and local laws, rules, ordinances and codes.

.1 Electrical installation shall be in accordance with the current edition of the Electrical Code, Provincial and other codes, rules and regulations. Supply material and labour required to meet the requirements of these codes, rules and regulations even though the work is not shown on the drawings or mentioned in the specifications. Where the electrical installation calls for better quality materials or construction than the minimum requirements of these codes, rules and regulations, the electrical installation shall be as shown on the drawings and as specified.

1.8 CARE, OPERATION AND START-UP

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

.2 Arrange and pay for services of manufacturer's factory service engineer 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.

.4 Demonstrate that equipment and systems meet the design intentions and specified requirements. Schedule a time for startup and commissioning. Sequence and schedule testing with other Contractors. Perform necessary tests. Provide instruments, meters, equipment and personnel necessary to conduct tests during and at the conclusion of the project. Carry out tests in the presence of engineer and City.

.5 Coordinate expected results with other divisions whose equipment is involved, prior to beginning any test. Specifically, ensure that no instruments can be damaged due to abnormal input conditions, and that no motors can cause equipment damage due to reverse rotation, etc.

.6 The Contractor is responsible to verify the interconnections for all control panels prior to start-up. The Contractor shall energize the control panels and verify operational readiness of the control equipment.

.7 In accordance with other specification sections, conduct loop checks for all applicable control circuits. Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at a time and check out operation of section. Upon completion of sectional test, undertake group testing. Check out complete system for proper operation. Submit a written report itemizing each circuit and its status.

.8 Instruct engineer and operating personnel in the operation, care and maintenance of equipment.

.9 Provide assistance to the City during start up to rectify deficiencies, conduct trouble shooting and otherwise take corrective action of the installed systems.

1.9 VOLTAGE RATINGS

.1 Operating voltages: to CAN3-C235-83.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.10 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 Contract Administrator will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost.

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

.5 Furnish Certificates of Acceptance from authorities having jurisdiction on completion of work to Contract Administrator.

1.11 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with drawings and specification.

.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 Factories assemble control panels and component assemblies.

1.12 REQUEST FOR EQUALS

.1 To be submitted to the Contract Administrator within 7 working day of tender closing

.2 Manufactures requesting equal status shall provide a point by point comply non comply statement from the original specification section and in the non comply statements the manufacture shall identify how they intend to comply.

.3 Provide two copies of all requests for equal documentation and one in PDF format.

1.13 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

1.14 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 outdoor electrical equipment "equipment green" finish to EEMAC Y1-1-1955.

.2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1-1958.

.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.

1.15 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates as follows:

.2 Nameplates:

.1 Lamicoid 3 mm thick plastic engraving sheet, black face, white 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	6 mm high letters

.3 Labels:

.1 Embossed plastic labels with 6 mm high letters unless specified otherwise.

.4 Wording on nameplates and labels to be approved by Contract Administrator prior to manufacture.

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

.6 Identification to be English.

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

.8 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

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

.10 Transformers: indicate capacity, primary and secondary voltages.

.11 Emergency battery banks/inverters: indicate voltage, circuit and panel.

1.16 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.

1.17 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed 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 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

1.18 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminium conductors.

1.19 MANUFACTURERS AND CSA LABELS

.1 Visible and legible, after equipment is installed.

1.20 WARNING SIGNS

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

.2 Porcelain enamel signs, minimum size 175 x 250 mm.

1.21 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 Confirm mounting hights on site prior to installation.

.4 When installing in block wall verify mounting with Contract Administrator if adjusting to nearest brick course prior to installation.

1.22 LOAD BALANCE

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Submit, at completion of work, report listing phase and neutral currents on panel boards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

1.23 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipes, sized for free passage of conduit, and protruding 50 mm. Refer also to details.

.2 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

1.24 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 Electrical contractor license as issued by the Province that the work is being constructed.

.3 Conduct and pay for following tests:

.1 Power generation and distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.5 Systems: fire alarm system, communications, etc.

.6 System ground tests and report.

.7 Distribution Testing and Commissioning

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

.5 Insulation resistance testing.

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.6 Carry out tests in presence of Contract Administrator.

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

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

1.25 CO-ORDINATION OF PROTECTIVE DEVICES

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

PART 2 EXECUTION

2.1 GENERAL

.1 Equipment shall be installed in accordance with manufacturers' instructions and code requirements.

.2 Verify that field measurements are as shown on the Drawings. Locate electrical components and equipment as shown on Drawings. Do not install electrical and control

equipment at locations where other equipment is to be installed, obstruct walkway, or made inaccessible or hard maintenance access.

.3 Exact locations may be moved up to 3 m. Provide changes without extra cost if called for before installation. Maintain adequate clearance between electrical and mechanical equipment.

.4 Provide all labour, materials, methods, equipment and accessories to do all demolition, renovations, alterations, removals Work.

.5 .1 Temporary, permanent shoring, protective devices, etc.

.6 Co-ordinate Work of trades, schedule elements of demolition, renovations Work, by procedures, methods to expedite completion.

.7 Cut, move or remove items as necessary to provide access, to allow alterations, new Work to proceed. Include such items as:

.1 Break through new openings, fill in openings, etc. in remaining construction indicated.

.2 Repair or remove hazardous conditions.

.3 Remove abandoned items, items serving no useful purpose, such as abandoned electrical as result of demolition identified in the contract documents.

.4 Clean surfaces, remove surface finishes as required to install new Work, and finishes.

.5 Other existing Work, materials, etc. required for new Work in this Contract.

.6 Patch, repair, refinish existing items and surfaces to remain to new condition for each material, with approved transition to adjacent new construction.

.7 Repair all damage done to remaining existing walls, other materials, surfaces, properties, etc. caused by Work of this Contract.

2.2 CLEANING

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

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

.2 Vacuum clean work areas with a hepa filter approved for asbestos materials.

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

.3 Waste Management: separate waste materials for recycling and reuse in accordance with Section 01 74 19 - Waste Management and Disposal.

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

.5 Wipe down and clean all lighting and equipment installed or handled during installation. Remove all finger prints dirt and or debris.

2.3 SPECIFIC INSTALLATION METHODS

.1 AC90 shall be permitted within steel stud walls.

.2 All exposed wiring shall be in conduit.

.3 Exposed AC90 in accessible ceilings shall be limited to 1m.

.4 Conceal all wiring as best as practical in office area of building A. Make all efforts to route wiring through accessible ceiling spaces and stub out with conduit as required.

.5 Install complete support system for electrical equipment regardless of whether it has been shown on the drawings or called for in this specification. Size material and hardware to support and carry the equipment, including wire and cable loads. Install pre-manufactured fastening system.

.6 Special notes to contractor:

- .1 Buildings A and B have been tested for asbestos containing materials. Various locations/materials have been identified as containing asbestos. Refer to asbestos report with this specification package.
- .2 Care shall be taken when drilling into or through block wall as they may contain asbestos materials inside them.
- .3 In general drywall compounds in these buildings contain asbestos, all drywall penetrations/contact is to be avoided.
- .4 Asbestos materials are along the top of the block walls in building B. Any necessary penetrations are to be 4 blocks below the material. Refer to asbestos report for further details on locations.
- .5 Do not fasten to or disturb the columns in building B as they contain asbestos.
- .6 Use approved asbestos containment equipment as required.
- .7 Painted ceilings in bus service shop may contain lead paint. Use appropriate PPE as required.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS (Not Applicable)

1.2 PRODUCT DATA

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

1.3 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 BUILDING WIRES

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

.2 Copper and ACM alloy conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE Non Jacketed.

.3 Copper conductors: size as indicated, with thermoplastic insulation type TWH rated at 600 V, used for insulated ground wires.

2.2 TECK 90 CABLE

.1 Cable: in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Conductors:

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

.3 Insulation:

- .1 Cross-linked polyethylene XLPE.
- .2 Rating: 600 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking galvanized steel.

.6 Overall covering: thermoplastic polyvinyl chloride, minimum FT-4 rated and compliant to applicable Building Code classification for this project.

.7 Fastenings:

- .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
- .2 Channel type supports for two or more cables at 1500mm centers

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

.8 Connectors:

.1 Watertight and explosion-proof where applicable or type approved for TECK cable.

2.3 MINERAL-INSULATED CABLES

.1 Conductors: solid bare soft-annealed copper, size as indicated.

.2 Insulation: compressed powdered magnesium oxide or silicon dioxide to form compact homogeneous mass throughout entire length of cable.

.3 Outer covering: annealed seamless copper sheath, Type M1 rated 600 V, 250 degrees C.

.4 Overall jacket: PVC applied over the sheath and fire rating to be compliant to applicable Building Code classification for this project, for direct buried and wet locations as indicated.

.5 Two hour fire rating.

.6 Connectors: watertight, explosion-proof (where applicable), field installed, approved for MI cable.

.7 Termination kits: field installed approved for MI cable

2.4 ARMOURED CABLES

.1 Conductors: insulated, copper and aluminum], size as indicated.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from aluminum strip.

.4 Type: ACWU90 thermoplastic jacket over armour and fire rating to be compliant to applicable Building Code classification for this project.

.5 Connectors: standard as required, complete with anti-short connectors.

2.5 ALUMINUM SHEATHED CABLE

.1 Conductors: ACM alloy, size as indicated.

.2 Insulation: cross linked polyethylene, typeRA90 rated 600 V.

.3 Sheath: aluminum applied to form continuous corrugated sheath.

.4 Outer jacket: thermoplastic applied over sheath and fire rating to be compliant to applicable Building Code classification for this project.

.5 Fastenings for aluminum sheathed cable:

.1 One hole aluminum straps to secure surface cables 25 mm and smaller. Two hole steel straps for cables larger than 25 mm. Use aluminum strap only with single conductor cable.

.2 Channel type supports for two or more cables at

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

2.6 CONTROL CABLES

.1 Type: LVT: 2 soft annealed copper conductors, sized as indicated:

.1 Insulation: thermoplastic.

.2 Sheath: thermoplastic jacket.

.2 Type: low energy 300 V control cable: stranded annealed copper conductors sized as indicated:

.1 Insulation: PVC, polyethylene, TW 40 degrees C.

.2 Shielding: tape coated with paramagnetic material, wire braid, over each conductor.

.3 Overall covering interlocked armour of aluminum.

.3 Type: 600 V stranded annealed copper conductor, size as indicated:

.1 Insulation: R90 (x-link).

.2 Shielding: metallized and magnetic tape over each pair of conductors.

.3 Overall covering: thermoplastic jacket with sheath of interlocked armour.

2.7 ACM Conductors

.1 Annealed, compacted aluminum alloy conductor material (ACM) for circuits 125 amps or more, single or multi-conductor, 600 volt insulation.

.2 Type: AC90, ACWU90 and TECK90.

.3 Armour: interlocked aluminum strip.

.4 Conductivity: 61% IACS to that of copper.

.5 Outer jacket: ACWU90 PVC jacket, FT-4 rated suitable for direct buried and Div. 1 and Div. 2 hazardous locations.

Part 3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 – Basic Electrical Materials and Methods.

.2 Perform 2 tests using method appropriate to site conditions and to approval of Department Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

.1 Install cable in trenches in accordance with Section 33 71 73.02 - underground Electrical Service.

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

.3 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).

.4 Cable Colour Coding: Section 26 05 01 – Basic Electrical Materials and Methods.

.5 Conductor length for parallel feeders to be identical.

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

.7 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.8 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.

.9 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

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

.2 In cable troughs in accordance with Section 26 05 36 – Cable Trays for Electrical Systems.

.3 In underground ducts and in trenches in accordance with Section 26 05 43.01 – Installation of Cables in Trenches and in Ducts.

.4 In underfloor distribution system in accordance with Section 26 05 39 – Underfloor Raceways for Electrical Systems.

.5 In surface and lighting fixture raceways in accordance with Section 26 50 00 – Lighting.

.6 In wireways and auxiliary gutters in accordance with Section 26 05 37 – Wireways and Auxiliary Gutters.

.7 Overhead service conductors in accordance with Section 26 24 01 Service Equipment.

3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)

.1 Group cables wherever possible on channels.

.2 Install cable, securely supported by straps, hangers.

3.5 INSTALLATION OF MINERAL-INSULATED CABLES

.1 Install cable exposed, securely supported by straps, hangers.

.2 Support 2 hour fire rated cables at 1 m intervals.

.3 Make cable terminations by using factory-made kits.

.4 Cable terminations: use thermoplastic sleeving over bare conductors.

.5 Where cables are buried in cast concrete or masonry, sleeve for entry and exit of cables.

.6 Do not splice cables.

3.6 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible on channels.

.2 Use permitted only for work in movable partitions and vertical power supply drops to lighting fixtures.

.3 Ensure all cables are terminated and made safe prior to ceiling grid being installed. All lighting drops to be terminated safely, with approved connectors, within an approved box, complete with cover.

3.7 INSTALLATION OF ALUMINUM SHEATHED CABLE

.1 Group cables wherever possible on channels.

.2 Terminate wires and cables with appropriate connectors in an approved manner.

3.8 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit as indicated

.2 Ground control cable shield.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS (Not Applicable)

1.2 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: remove for reuse by manufacturer and return of padding, crates, packaging materials, pallets, as specified in Construction Waste Management Plan in accordance with section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted suspended or set in poured concrete walls and ceilings as required.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to solid or hollow masonry, tile and plaster surfaces with lead anchors.

.2 Secure equipment to poured concrete with expandable inserts.

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

.4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

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

.6 Fasten exposed conduit or cables to building construction or support system using straps.

- .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
- .2 Two-hole steel straps for conduits and cables larger than 50 mm.
- .3 Beam clamps to secure conduit to exposed steel work.

.7 Suspended support systems.

- .1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.
- .2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.

.8 For surface mounting of two or more conduits use channels at

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

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

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

.12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.

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

3.2 CLEANING

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

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

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.1, Canadian Electrical Code, Part 1, latest adopted edition.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

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

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

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

1.3 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

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

Part 2 Products

2.1 SPLITTERS

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

.2 Terminations: main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 Spare Terminals: minimum three spare terminals on each set of lug block sized less than 400 A.

.4 Bus bracing short circuit rating as indicated.

2.2 JUNCTION AND PULL BOXES

.1 Construction: welded steel enclosure.

.2 Covers Flush Mounted: 25 mm minimum extension all around.

.3 Covers Surface Mounted: screw-on turned edge covers.

2.3 CABINETS

.1 Construction: welded sheet steel, hinged door, latch and catch.

.2 Type E Empty: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch for surface mounting.

.3 Type T Terminal: welded sheet steel, with hinged door, latch, lock, 2 keys, containing 19 mm plywood backboard for surface mounting.

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Mount plumb, true and square to 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.

.2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.

.3 Install terminal block as indicated in Type T cabinets.

.4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

3.3 IDENTIFICATION

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

.2 Identification Labels: size 2 indicating system name, voltage and phase or as indicated.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.1, Canadian Electrical Code, Part 1, latest adopted edition.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit samples for floor box in accordance with Section 01 33 00 - Submittal Procedures.

1.3 DELIVERY, STORAGE AND HANDLING

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

.2 Waste Management and Disposal:

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

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 347 V outlet boxes for 347 V switching devices.

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

2.2 GALVANIZED STEEL OUTLET BOXES

.1 One-piece electro-galvanized construction.

.2 Single and multi-gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.5 Extension and plaster rings for flush mounting devices in finished plaster walls.

2.3 MASONRY BOXES

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

2.4 CONCRETE BOXES

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

2.5 FLOOR BOXES

.1 Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with brass faceplate. Device mounting plate to accommodate short or long ear duplex receptacles. Minimum depth: 73 mm for receptacles and communication outlets.

.2 Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 16, and 27 mm conduit. Minimum size: 73 mm deep.

2.6 CONDUIT BOXES

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

2.7 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

.1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63 mm with two double clamps to take non-metallic sheathed cables. For use in wood stud construction only.

2.8 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

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

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

.4 Double locknuts and insulated bushings on sheet metal boxes.

.5 Double split-rings for AC-90 termination.

2.9 SERVICE FITTINGS

.1 ‘High tension’ receptacle fitting made of 2 piece die-cast aluminum with satin aluminum housing finish for 1 duplex receptacles. Bottom plate with two knockouts for centered or offset installation. 12 x 102 mm extension piece as indicated.

.2 Pedestal type ‘low tension’ fitting made of 2 piece stainless steel with satin aluminum housing finish to accommodate two amphenol jack connectors.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits, utilize ERICO TSGB24 for mounting boxes and for supporting conduits and cables within stud walls.

.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 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

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

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

.6 Identify systems for outlet boxes as required.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CAN/CSA C22.2 No. 18, latest adopted edition, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.

.2 CSA C22.2 No. 45, latest adopted edition, Rigid Metal Conduit.

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

.4 CSA C22.2 No. 83, latest adopted edition, Electrical Metallic Tubing.

.5 CSA C22.2 No. 211.2, latest adopted edition, Rigid PVC (Unplasticized) Conduit.

.6 CAN/CSA C22.2 No. 227.3, latest adopted edition, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

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

.1 Submit cable manufacturing data.

.3 Quality assurance submittals:

.1 Test reports: submit certified test reports.

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

.3 Instructions: submit manufacturer s installation instructions.

1.3 WASTE MANAGEMENT AND DISPOSAL

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

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

Part 2 Products

2.1 CABLES AND REELS

.1 Provide cables on reels or coils.

.1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer s lot number and reel number.

.2 Each coil or reel of cable to contain only one continuous cable without splices.

.3 Identify cables for exclusively dc applications.

.4 Reel and mark shielded cables rated 2,001 volts and above.

2.2 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, hot dipped galvanized steel threaded.

.2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.

.3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

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

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

.6 FRE conduit:

.7 Flexible pvc conduit: to CAN/CSA-C22.2 No. 227.3

2.3 CONDUIT FASTENINGS

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

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

.3 Channel type supports for two or more conduits at 1200m m oc.

.4 Threaded rods, 10 mm diameter, to support suspended channels.

2.4 CONDUIT FITTINGS

.1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.

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

.3 Ensure conduit bends other than factory “ells” are made with an approved bender. Making offsets and other bends by cutting and rejoining 90 degree bends are not permitted.

.4 Watertight connectors and couplings for EMT for exterior and category 1 locations, and entry into electrical panels in sprinklered areas.

.5 Set-screws connectors in general areas.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 FISH CORD

.1 Polypropylene.

Part 3 Execution

3.1 MANUFACTURER S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install all conduit, conduit fittings and accessories in accordance with the latest edition of the Canadian Electrical Code in a manner that does not alter, change or violate any part of the installed system components or the CSA/UL certification of these components.

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

.3 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.

.4 Surface mount conduits except in finished areas as indicated (refer to 26 05 01 2.2.3).

.5 Use electrical metallic tubing (EMT) except in cast concrete and above 2.4 m not subject to mechanical injury.

.6 Use rigid PVC conduit underground and buried in or under concrete slab on grade, c/w expansion fitting.

.7 Use flexible metal conduit for connection to motor in dry areas, connection to recessed fixtures without prewired outlet box, connection to surface or recessed fluorescent fixtures and work in movable metal partitions.

.8 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.9 Use explosion proof flexible connection for connection to explosion proof motors.

.10 Install conduit sealing fittings in hazardous areas, fill with compound.

.11 Minimum conduit size for lighting and power circuits: 21 mm. 16 mm conduit is acceptable for switch leg drops only where one two-wire circuit and ground is required.

.12 Install EMT conduit from computer room branch circuit panel to outlet boxes located in sub floor.

.13 Install EMT conduit from computer room branch circuit panel to junction box in sub-floor immediately below panel.

.1 Run flexible conduit from junction box to outlet boxes for each computer in sub-floor.

.14 Bend conduit cold:

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

.15 Mechanically bend steel conduit over 19 mm diameter.

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

.17 Install fish cord in empty conduits.

.18 Run 2-27 mm spare conduits up to ceiling space and 2-27 mm spare conduits down to ceiling space from each flush panel. Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in flush concrete type box.

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

.20 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended channels.

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

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

.7 All effort shall be made to conceal surface conduits on exposed CLT wood ceilings. Carefully choose routing to best conceal conduits, avoid routing main feeder conduits through exposed ceiling. Coordinate routing in these areas with Contract Administrator prior to installation.

3.4 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

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

3.5 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel.

.1 Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed.

.1 Use cold mastic between sleeve and conduit.

.5 Conduits in slabs: minimum slab thickness 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

3.6 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

.1 Run conduits 27 mm and larger below slab and encase in 75 mm concrete envelope.

.1 Provide 50 mm of sand over concrete envelope below floor slab.

3.7 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

.3 Use primer and solvent cements as recommended by manufacturer.

.4 Sleeve conduits through concrete slabs and provide expansion joints above slab where conduits rise up.

.5 Change from PVC to EMT conduit where conduit exits slab as close as practical to slab but no more than 1m of exposed PVC shall be permitted.

3.8 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

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

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer s instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Include time-current characteristic curves for breakers with ampacity of 15A and over.

.4 Include Series rating application Guide.

.5 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75 % of construction wastes were recycled or salvaged.

1.3 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store circuit breakers in accordance with manufacturer s recommendations in clean, dry, well-ventilated area.

.2 Store and protect circuit breakers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse by manufacturer and return of padding, crates, packaging materials, as specified in Construction Waste Management Plan in accordance with section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 BREAKERS GENERAL

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

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.3 Plug-in moulded case circuit breakers: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

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

.5 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.

.6 Circuit breakers with interchangeable trips as indicated.

.7 Circuit breakers to have minimum interrupting capacity rating as indicated in electrical drawings.

.8 Breakers and components of one manufacturer.

2.2 THERMAL MAGNETIC BREAKERS DESIGN A

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

2.3 MAGNETIC BREAKERS (DESIGN B)

.1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

2.4 CURRENT LIMITING AND SERIES RATED THERMAL MAGNETIC BREAKERS (DESIGN C)

.1 Thermal magnetic breakers with current limiters.

.1 Time current limiting characteristics of fuses limiters coordinated with time current tripping characteristics of circuit breaker.

.2 Co-ordination to result in interruption by breaker of fault-level currents up to interrupting capacity of breaker.

.2 Series rated breakers to be manufacturer tested and listed. Breakers to be applied following manufacturer s guidelines and accepted best practice.

.1 Breakers applied following manufacturer s guidelines and accepted best practice.

.2 Series rating for breakers located in main switchboard, MCC, CDP with 400A rating or greater, any panelboards with heavy motor load are not acceptable.

.3 Series rating application for electrical distribution system in Health Care facilities are not acceptable.

2.5 SOLID STATE TRIP BREAKERS (DESIGN D)

.1 Moulded case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, long time, short time, instantaneous tripping for phase and ground fault short circuit protection.

2.6 OPTIONAL FEATURES

.1 Include:

.1 Shunt trip.

.2 Auxiliary switch.

.3 Motor-operated mechanism [c/w time delay unit].

.4 Under-voltage release.

.5 On-off locking device.

.6 Handle mechanism.

2.7 MANUFACTURERS

.1 Acceptable manufacturers: Eaton, Schneider, or approved equal.

Part 3 Execution

3.1 INSTALLATION

.1 Provide circuit breakers as indicated for all new circuits. Coordinate breaker types with existing panels on site.

.2 All new breakers in existing panels shall be by that manufacturer, rated for use in that panel and be of the correct voltage and ampacity, and shall have a KAIC rating not less than the panel rating. If no rating is given it shall be not less than that of the main over current protection for that panel. Coordinate with Contract Administrator as required.

3.2 CLEANING

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

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

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

.3 Waste Management: separate waste materials for reuse and recycling in accordance with section 01 74 19 - Waste Management and Disposal.

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No.141, latest adopted edition, Emergency Lighting Equipment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer s instructions, printed product literature and data sheets for emergency lighting and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75 % of construction wastes were recycled or salvaged.

1.3 CLOSEOUT SUBMITTALS

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

.2 Operation and Maintenance Data: submit operation and maintenance data for emergency lighting for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect emergency lighting from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return of packaging materials as specified in Construction Waste Management Plan in accordance with section 01 74 19 - Waste Management and Disposal.

1.5 WARRANTY

.1 For batteries in this Section 26 52 13.13 - Emergency Lighting, 12 months warranty period is extended to 120 months.

Part 2 Products

2.1 EQUIPMENT

.1 Inverters

.1 Emergency lighting shall be provided by inverter unit equipment where indicated on the construction documents designed to operate designated LED fixtures on emergency power at their full nominal lumen rating during the full 30 minute emergency discharge cycle. System output will be rated as per the emergency lighting schedule for 30 minutes and provide fused output connections to the load. The system's voltage rating shall be 120VAC input/output nominal. The inverter unit shall allow for fused connected emergency fixture(s) to be normally on, normally off, switched or dimmed without affecting lamp operation during a power failure. Upon utility power loss, the inverter unit shall deliver 100% of its rated output to the emergency fixtures regardless of the local switch or dimmer (TRIAC) position, and will provide power to emergency fixtures at distances of up to 1000 feet. The housing shall be manufactured using 18-gauge steel for 300W & 600W/ 14-gauge steel for 1000W & 1440W with a white baked-on powder coat paint finish. The unit's electronics shall include a self-contained inverter section with a fully automatic, thermal-compensating variable-rate battery charger, AC lockout feature, low battery voltage disconnect, overload, short circuit and brownout protection as standard. The unit shall utilize a sealed lead acid battery with a 10-year design life. The inverter system shall be cUL Listed and labeled. The unit shall be covered under a 1-year warranty on the electronics and battery and a 9-year pro-rata warranty on the battery. It shall meet or exceed the requirements of CSA 141-15

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

.3 Supply voltage: 120 or 347 V, AC as indicated.

.4 Output voltage: 24 or 12 V DC as indicated.

.5 Operating time: 120 minutes for high building as defined and required by National building Code (NBC) or in rooms with automatic transfer switches, 60 minutes for a building of group B major occupancy classification or 30 minutes for a building of any other occupancy.

.6 Battery: sealed, maintenance free.

.7 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations.

.8 Solid state transfer circuit.

.9 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

.10 Signal lights: solid state, for AC Power ON.

.11 Lamp heads: integral on unit and remote, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: LED

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

.13 Finish:

.14 Auxiliary equipment:

.1 Ammeter.

.2 Voltmeter.

.3 Test switch.

.4 Time delay relay.

.5 Battery disconnect device.

.6 AC input and DC output terminal blocks inside cabinet.

.7 Bracket and Shelf.

.8 Cord and single twist-lock plug connection for AC.

.9 RFI suppressors.

2.2 WIRING OF REMOTE HEADS

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

.2 Conductors: RW90 type in accordance with section 26 05 21 - Wires and Cables (0-1000 V), sized as indicated in accordance with manufacturer s recommendations.

Part 3 Execution

3.1 INSTALLATION

.1 Install unit equipment and remote mounted fixtures.

.2 Direct heads.

.3 Connect exit lights to unit equipment.

.4 Coordinate locations of remote heads, battery banks, and inverters as to not interfere with existing infrastructure.

.5 Coordinate locations with other trades as required.

.6 Report installation location issues to Contract Administrator, contractor shall relocate equipment as required to avoid building infrastructure where directed by Contract Administrator at no additional cost.

.7 Contractor shall be responsible to verify voltage drop and pathways and not exceed 5% voltage drop, upsize all wiring as required to be under the maximum allowable voltage drop.

.8 Contractor shall site verify all circuits required to be monitored by voltage sensing relays and allow for all labour and materials to monitor lighting circuits within each area served by each battery bank. Review circuit findings on site with Contract Administrator prior to commencement of work.

.9 Provide all necessary materials and labour for a complete operating emergency lighting system as depicted on the tender documents.

3.2 CLEANING

.1 Progress Cleaning: clean in accordance with section 01 74 00 - Cleaning.

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

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

.3 Waste Management: separate waste materials for reuse and recycling in accordance with section 01 74 19 - Waste Management and Disposal.

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

3.3 PROTECTION

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

.2 Repair damage to adjacent materials caused by emergency lighting installation.

3.4 COMMISSIONING

.1 Verify all operations of emergency lighting, including but not limited to battery banks, exit signs, remote heads, inverters and their respective light fixtures. Confirm each unit operates for the minimum time specified. Repair and or replace all non-operational/defective equipment prior to requesting final certification by Contract Administrator.

.2 Additional site visits required to test emergency lighting by Contract Administrator may be subject to additional site review charges.

3.5 TRAINING

.1 Provide training to plant maintenance personal.

.1 Allow for 8h walk through to describe system installation, equipment locations and operation.

3.6 ACCEPTABLE MANUFACTURERS

.1 Lumacell, Emergi-lite, Ready-lite, Aim-lite.

END OF SECTION