

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 General requirements that are common to Sections of Division 26 – Electrical, Division 33 – Section 33 65 76.

1.2 RELATED SECTIONS

- .1 Division 01 – General Requirements.
- .2 Section 01 35 21 – LEED Requirements.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International) Latest Edition of the following:
 - .1 CSA C22.1-15, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.
 - .2 CSA C22.2 No. 0-M91 (R2006), General Requirements.
 - .3 CAN3-C235-83 (R2006) Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

1.4 SCOPE OF WORK

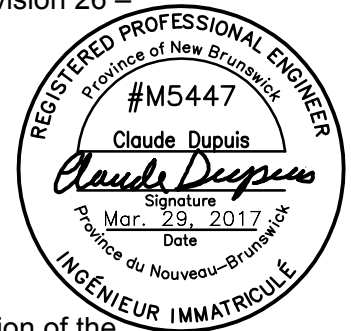
- .1 The work shall include all labour, materials and equipment necessary for the complete installation of the electrical, communications and electronic safety and security systems shown on the drawings and described in these specifications.
- .2 It is the requirement of this work to provide all systems completely functioning in intended system operation, notwithstanding that every item necessarily required may not be specifically mentioned.

1.5 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
 - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Overhead and Underground Electrical Services: CSA C22.3 No. 1 and CAN/CSA-C22.3 No. 3.
- .4 Barrier-Free access: design equipment and components in accordance with CAN/CSA-B651.

1.6 SUBMITTALS

- .1 Submittals: in accordance with Division 01 – General Requirements.
- .2 Submit requested documentation to Engineer.



- .3 Product Data: submit WHMIS MSDS in accordance with Division 01 – General Requirements.
- .4 All inquiries, shop drawings, requests for substitutions and similar items shall be submitted to the Engineer.
- .5 Shop drawings:
 - .1 Submit drawings in accordance with Division 01 – General Requirements.
 - .2 Submit installation details of proposed location, layout and arrangement of conduit and boxes, and other items that must be shown to ensure co-ordinated installation.
 - .3 Faxes are not acceptable for shop drawings. If sent by fax, they will not be reviewed.
 - .4 Do not begin fabrication until shop drawings have been reviewed by Consultant. Allow ten (10) working days for Consultant review.
 - .5 Consultant review of shop drawings does not relieve the contractor of the responsibility for co-ordination of field measurements required to complete the work.
 - .6 Contractor shall approve all shop drawings by signing and dating them prior to submitting to Consultant.
 - .7 If changes are required, notify Engineer of these changes before they are made.
- .6 Quality Control: in accordance with Division 01 – General Requirements.
 - .1 Provide CSA certified material.
 - .2 Where CSA certified material is not available, submit such equipment and material to authority having jurisdiction for approval before delivery to site.
 - .3 Pill testing of empty conduit system.
 - .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 Engineer.
- .7 Manufacturer's Field Reports: submit to Engineer written report, within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.
- .8 As-Built Drawings:
 - .1 On a set of drawings, record all changes as work progresses. Incorporate all information issued in Addenda, Site Instructions and Change Orders and all changes in actual installation as a result of site conditions and coordination.
 - .2 Identify each drawing in lower right hand corner in letters at least 13 mm high as follows: AS-BUILT DRAWING This drawing has been revised to show electrical systems as installed, Name of Contractor, Signature of Contractor and Date.
 - .3 Submit to the General Contractor for approval and make all corrections as directed.

1.7 SUBSTITUTIONS

- .1 It is the intent of these specifications to establish the required quality of materials. Where manufacturer's name, catalogue reference, data are used, it is done in order to establish the required quality, style, size or function. The decision as to suitability shall rest with the Engineer.
- .2 Refer to architectural Division 01 – General Requirements.
- .3 All materials not meeting the standards as set down by these specifications shall not be allowed on the job site.
- .4 Substitutions affecting the design will not be permitted. Additional costs to any other trade as a result of a change or substitution by this Contractor shall be borne by this Contractor.
- .5 The listing of a manufacturer as acceptable does not imply acceptance of all products of that manufacturer and only products of that manufacturer and only products meeting the standards as set out in the specifications will be accepted.
- .6 All requests for alternates must be submitted no later than five (5) working days prior to tender close.
- .7 Faxes are not acceptable for request for alternates. If sent by fax, they will not be reviewed.

1.8 SAMPLES

- .1 Submit samples in accordance with Division 01.
- .2 After review and acceptance, samples will be returned for incorporation into work.

1.9 TEST REPORTS

- .1 Submit certified test reports and certificates to Engineer from approved independent testing laboratories.
 - .1 Indicate compliance with specifications for specified performance characteristics and physical properties.
 - .2 Manufacturer's Field Services: submit copies of manufacturer's field inspection reports.

1.10 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into operation and maintenance manual as per Division 01 – General Requirements.
- .2 Include in Operation and Maintenance Data:
 - .1 Table of Contents.
 - .2 Names, addresses and telephone numbers of local suppliers for items included in Operation and Maintenance Manuals.
 - .3 Copy of reviewed Shop Drawings.
 - .4 Name and address of Electrical Contractor.
 - .5 Copy of all test certificates.

- .6 Copy of all final panelboard schedules.
- .7 Copy of signed transmittal verifying all maintenance materials turned over to the owner/user.
- .8 Two (2) paper copies of drawings and specifications.
- .9 Include details of design elements, component function and maintenance requirements to effectively operate, maintain or repair.
- .10 Include technical data, product data, component illustrations, technical descriptions and parts list, wiring and schematic diagrams not considered proprietary, test and verification reports. Advertising or sales literature is not acceptable.

1.11 MAINTENANCE MATERIALS

- .1 Provide maintenance materials in accordance with Division 01 – General Requirements and as indicated in respective specification sections.

1.12 FIRESTOPPING

- .1 All fire stopping work is to be performed by the General Contractor.
- .2 Electrical contractor shall coordinate all fire rated assembly penetrations with General Contractor.
- .3 Electrical Contractor shall provide required clearances between outside surface of conduits and inside surface of sleeves, core drilled holes or listed fire rated systems.

1.13 ACCESS HATCHES

- .1 All access doors shall be provided by individual trades, where required, and turned over to General Contractor. See Section 08 31 13 – Access Doors and Frames.

1.14 INTERPRETATION OF PLANS AND SPECIFICATIONS

- .1 These specifications are to be considered as an integral part of the plans which accompany them and neither the plans nor the specifications shall be used alone. Any item which is omitted in one but which is reasonably implied in the other shall be considered properly and sufficiently specified and must, therefore, be provided by this Contractor.
- .2 Drawings are diagrammatic. Building dimensions shall not be scaled from the Electrical plans.
- .3 Any discrepancy between the drawings and the building shall be questioned before proceeding with any installation.

1.15 CO-OPERATION OF CONTRACTORS

- .1 This Contractor shall become familiar with the work of other contractors and in laying out and installing the work shall co-operate with the other Contractors, so as to facilitate the progress of the work as a whole and avoid interference or delays. Where interference exists, this Contractor shall notify the General Contractor and/or project manager and the engineer before installing the work.

Any changes in the work or alterations of the Electrical Contractor's schedule required for such co-operation will not be considered as a claim for extra compensation.

- .2 Due to the complexities of many sub-trades, and the restrictive space available in this project, it is required that all trades co-operate closely so as to install all systems in their allotted locations as indicated on the drawings, or as coordinated on site.

1.16 ERRORS AND OMISSIONS

- .1 The drawings are not intended to show every item of accessory equipment, but the Contractor shall tender on and install all essential details to provide for efficiency of operation and ease of maintenance.
- .2 Should this Contractor discover errors or discrepancies in the plans or specification, he shall refer the matter to the Engineer for change or clarification and shall not proceed with that portion of the work until advised by the Engineer to do so.

1.17 DELIVERY, STORAGE, AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: in accordance with Division 01 – General Requirements.
- .2 Store and handle materials in accordance with Division 01 – General Requirements and manufacturer's written instructions.

1.18 SYSTEM STARTUP

- .1 Instruct operating personnel in operation, care and maintenance of systems, system equipment and components.
- .2 The Contractor shall provide training with all systems. Sessions shall be broken into segments which will facilitate the training of individuals in the operation of this system. Operators Manuals and Users Guides shall be provided prior to the time of training. Segments shall as a minimum, consist of the following periods:
 - .1 Upon completion of the installation;
 - .2 After six weeks use of the system and;
 - .3 During the last month of the warranty period.
 - .4 All training shall be Bilingual.

1.19 PERMITS, FEES AND INSPECTION

- .1 Submit to Electrical Inspection Department necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Obtain an electrical work permit and pay associated fees.
- .3 Notify Engineer of changes required by the Electrical Inspection Department.

- .4 Contractor shall coordinate inspection date with Engineer and shall provide labour for access to all equipment for inspection. Such access shall imply removal of panel covers, opening of disconnect switches, junction/pull boxes, starters and luminaires, to confirm work method.

1.20 WARRANTY

- .1 Warranty duration: 12 calendar months following Substantial Completion.
- .2 Coverage: warrant against failure to perform to characteristics as specified.
- .3 Manufacturer's warranty: submit manufacturer's warranty, for Engineer's acceptance.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

- .1 Provide material and equipment in accordance with Division 01– General Requirements.
- .2 Material and equipment to be certified by an accredited certification organization and bear that organizations certification mark as evidence of having conformed to the appropriate Canadian Standards Association (CSA) Standards established under the provisions of the Canadian Electrical Code. Where CSA or ULC certified material and equipment are not available, obtain special approval from authority having jurisdiction, before delivery to site.
- .3 Ensure labels are visible and readable after equipment is installed.
- .4 Factory assemble electrical panels and component assemblies.
- .5 All equipment purchased as specified within this specification to be purchased from an authorized distributor in the Province of New Brunswick.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
- .2 Division 26 responsibility is as follows:
 - .1 Supply and installation of breakers and/or switches.
 - .2 Supply and installation of power feeder (conduit and wire) from panel to starter, from starter to disconnect switch and from disconnect switch to motor.
 - .3 Supply and installation of starters complete with motor protection unless noted otherwise.
 - .4 Supply and installation of disconnect switches at motors unless noted otherwise.
 - .5 Supply and installation of branch wiring to mechanical equipment as indicated on drawings.

- .3 Control wiring and conduit is by Division 25 unless noted otherwise on electrical drawings.

2.3 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of authority having jurisdiction, inspection authorities and Engineer.
- .2 Signs, minimum size 178 x 254 mm.

2.4 WIRING TERMINATIONS

- .1 Ensure lugs, terminals and screws used for termination of wiring are suitable for copper and aluminum conductors.

2.5 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two (2) coats of finish enamel:
 - .1 Paint outdoor electrical equipment "equipment" green finish to EEMAC Y1-1.
 - .2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1.
- .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.

2.6 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
 - .1 Nameplates: 3 mm thick plastic engraving sheet, matt white finish face, black core, lettering accurately aligned and engraved into core, self-adhesive type.
 - .2 Sizes as follows:

<u>NAMEPLATE SIZES</u>			
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 Wordings on nameplates to be approved by Engineer prior to manufacture.
 - .5 Allow for minimum of twenty-five (25) letters per nameplate.
 - .6 Identification to be in French.

- .7 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics. Label both box and cover.
- .8 Disconnects, starters and contactors: indicate equipment being controlled and voltage. Terminal cabinets and pull boxes: indicate system and voltage.
- .9 Panelboards and switchboards: name and electrical characteristics (voltage, phase, wire, bus capacity, interrupting capacity, circuit number and designation).

Example:

Panel A – 225 A 120/208 V – 3 PH – 4 W Fed from panel DA Circuit #2, 4, 6	Minimum interrupting capacity of breakers installed in this panel is to be not less than 10 KAIC
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- .10 Switch board and panels: indicate panel designation, amperage, voltage and interrupting rating.
- .11 All power, switches, data and telephone outlets shall have a transparent identification permanently installed on coverplate.

2.7 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 coding: to CSA C22.1–12.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.8 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 primary colour and **20 mm** wide auxiliary colour.
- .4 All electrical and communications conduits shall be color coded as follows:

	<u>Prime</u>	<u>Auxiliary</u>
600 V Normal	Yellow	
208/120 V Normal	Black	
Fire Alarm	Red	
Telephone	Blue	
Data	White	Yellow
Public Address	White	Orange
CCTV	White	Blue
Security for Door Access	White	Red
Low Voltage	White	

- .5 Provide identification of equipment, components, and assemblies specified, using materials suitable to withstand anticipated operating environment.

Part 3 Execution

3.1 FIELD QUALITY CONTROL

- .1 Confirm other related work is complete to receive work of this and related electrical sections.
- .2 Commission electrical systems.
- .3 Qualifications:
 - .1 Electricians: qualified, licensed electricians or apprentices in accordance with Provincial Act respecting manpower vocational training and qualifications.
 - .2 Apprentices: employees registered in provincial apprentices program permitted, under direct supervision of qualified licensed electrician, to perform specific tasks. Permitted activities determined based on level of training attained and demonstration of ability to perform specific duties.
- .4 Contractor holding valid Master Electrical contractor licensed as issued by Province must oversee that work is being constructed.
- .5 Contractor must be familiar with and adhere to the requirements of CAN Z462-12 at all times.

3.2 INSTALLATION

- .1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, MSDS, and product datasheets.
- .2 Protect electrical equipment from dust and dirt. Plug or cap openings in conduit, fixtures and equipment during construction with Consultant approved materials.
- .3 Conceal conduit in finished areas, unless otherwise authorized. Run exposed conduit parallel to building lines, and maintain maximum headroom.
- .4 Install outlets, plates and other visible items parallel to building lines. Line up exposed raceways, parallel and at right angles to building walls, partitions, and ceilings.
- .5 Set equipment and components plumb and level, accurate to position intended, and position hanger rods plumb.

3.3 LOCATION OF OUTLET BOXES

- .1 Do not install outlet boxes back to back in same wall or partition:
 - .1 Provide minimum 150 mm horizontal separation between boxes.
 - .2 Prior to completion of rough-in, relocate outlets up to 3 m at no change in Contract cost.
 - .3 Locate disconnect devices on latch side of door.

- .2 Equipment mounting height, from finished floor to centerline of equipment item unless indicated otherwise:
 - .1 Local switches: 1200 mm
 - .2 Receptacles:
 - .1 General: 400 mm
 - .2 Above top of continuous baseboard heater: 200 mm
 - .3 Above top of counters or counter splash backs: 150 mm
 - .4 In Mechanical Room: 1200 mm
 - .3 Exit Light: 300 mm
above door frame
 - .4 Emergency Light: 300mm above door frame or 3.6 m A.F.F. in gym
- .3 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .4 Attach electrical equipment, components and devices directly to structure and structural supporting elements.
- .5 Coordinate device heights with Architectural room and casework elevations. Install telephone and electrical panel backboards with plywood sheeting material where equipment is to be wall mounted. Size the backboard by 300 mm (min.) beyond size of electrical panel. See Section 06 10 00 for further requirements.

3.4 NAMEPLATES AND LABELS

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

3.5 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete:
 - .1 Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 51 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.
- .4 Locate outlets in accordance with Section 26 05 32 – Outlet Boxes, Conduit Boxes and Fittings.

3.6 TESTING

- .1 Provide advance notice Consultant of proposed testing schedule.
- .2 Perform tests at time of acceptance of work.
- .3 Conduct and pay for field tests:
 - .1 Power distribution, including phase voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.

- .3 Motors, including sequenced operation.
- .4 Lighting and lighting control.
- .4 Perform tests in presence of Consultant.
 - .1 Provide instruments, meters, equipment and personnel required to conduct required tests.
 - .2 Test systems to verify operation as specified.
- .5 Conduct di-electric tests, hi-pot tests, insulation resistance tests and ground continuity tests as required by nature of various systems and equipment.
- .6 Perform following tests on completed power systems:
 - .1 Control and switching: test circuits for correct operation of devices, switches and controls.
 - .2 Polarity tests: test circuits for correct operation of devices, switches and controls.
 - .3 Voltage tests: test voltage at last outlet of each circuit; maximum potential drop 2% on 120 V, and 208 V branch circuits, 3% on feeder circuits based on load. Correct deficiencies.
 - .4 Phase balance: measure load on each phase at switchboards, splitter, distribution panel board and lighting and power panel board.
 - .1 Submit results to Consultant in writing.
 - .2 Re-arrange phase connections as necessary to balance load on each phase as instructed by Consultant.
 - .3 After marking such changes, submit revised drawings showing modified connections to Consultant.
 - .5 Supply voltage: measure line voltage of each phase at load terminals of main breakers and report results in writing to Engineer Consultant. Perform test with majority of electrical equipment in use.
 - .6 Motor loading: measure line current of each phase of motors with motor operating under load, and report results in writing to Consultant.
 - .1 Upon indications of imbalances or overloads, thoroughly examine electrical connections and rectify defective parts or wiring.
 - .2 If electrical connections are correct, report overloads due to defects in driven machines in writing to Consultant.
 - .7 Insulation resistance tests:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument. Minimum insulation resistance shall be 0.5MΩ.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument. Minimum insulation resistance shall be 1.0MΩ.
 - .3 Check resistance to ground before energizing.
 - .8 Co-ordinate and carry out motor testing at same time as driven equipment is being tested. In addition to motor loading tests, provide labour and instruments to read and record motor load readings required to supplement tests on driven equipment through various load sequences, as required by driven equipment tests.

- .7 General operations: energize and operate electrical circuit and item. Repair, alter, replace, test and adjust as necessary for a complete and operating electrical system.
- .8 Provide labour, instruments, apparatus and pay expenses required for testing. Consultant reserves right to demand proof of accuracy of instruments used.
- .9 Immediately prior to occupancy, test entire electrical system by performing loss and return of utility power test. Demonstrate operation of:
 - .1 High and low voltage service equipment and metering.
 - .2 Emergency lighting.
 - .3 User equipment shut-down and auto-restart.
- .10 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .11 Manufacturer's Field Services:
 - .1 Obtain written certificates from manufacturers verifying compliance of Work, in handling, installing, applying, protecting and cleaning of products for inclusion in operation and maintenance manuals.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions as indicated in respective specification sections.

3.7 TEST RESULTS

- .1 Submit test results to Consultant for review.
- .2 Testing methods and test results: to CSA, CEC and authorities having jurisdiction.
- .3 Remove and replace conductors found damaged, with new materials.
- .4 Provide required labour and tools, if during testing Consultant requests equipment be opened and removed from their housings to examine equipment, terminations and connections.

3.8 TRAINING

- .1 Train operating personnel in operation, care and maintenance of electrical equipment and systems as indicated in paragraph 1.18.2 System Start-Up.
- .2 Arrange and pay for manufacturer's factory service engineer to provide training. Ensure operating personnel are conversant with its care and operation.
- .3 Obtain and submit written confirmation from operating personnel that satisfactory training has been received.

3.9 CLEANING

- .1 Perform final cleaning of electrical equipment, systems and components.

3.10 DEMONSTRATION

- .1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .2 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .3 Owner's Representative may record these demonstrations on video tape for future reference.

3.11 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

3.12 CONTROL OF HAZARDOUS ENERGY

- .1 Lock out and tag out all electrical and other equipment before performing work as per CAN/CSA-Z460-05.

3.13 UTILITY COORDINATE

- .1 Electrical Contractor shall be responsible to coordinate all work related to obtaining service for existing Padmount transformer with Park Personnel prior to commissioning work.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for wire and box connectors.

1.2 RELATED SECTIONS

- .1 Division 01 – General Requirements.
- .2 Section 26 05 00 – Common Work Results – Electrical.
- .3 Section 26 05 21 – Wires and Cables 0-1000V.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International) Latest Edition of the following:
 - .1 CAN/CSA-C22.2, No.18 (R2009), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
 - .2 CSA C22.2 No.65 (R2008) Wire Connectors.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC) Latest Edition of the following:
 - .1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

Part 2 Products

2.1 MATERIALS

- .1 Pressure type wire connectors to: CSA C22.2 No. 65-03, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CSA C22.2 No. 65-03, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors to: EEMAC 1Y-2 to consist of:
 - .1 Connector body and stud clamp for stranded, copper conductors.
 - .2 Clamp for stranded copper conductors.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper conductors.
 - .5 Bolts for aluminum conductors.
 - .6 Sized for conductors as indicated.
- .4 Clamps or connectors for armoured cable, flexible conduit, as required to: CAN/CSA-22.2 No. 18.1.
- .5 Joints required in connecting all wiring up to and including # 8 are to be made using twist-on connectors.

- .6 Joints for all other wiring shall be made using colour-keyed compression type connectors followed by a layer of CSA approved vinyl plastic tape.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.
 - .2 Install fixture type connectors and tighten. Replace insulating cap.
 - .3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Division 01 – General Requirements.
- .2 Section 26 05 00 – Common Work Results – Electrical.
- .3 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.
- .4 Section 26 05 34 Conduits, Conduit Fastenings and Conduit Fittings.
- .5 Section 26 05 43 – Installation of Cables in Trenches and in Ducts.

1.2 REFERENCES

- .1 CSA C22.2 No .0.3-09 (R2005), Test Methods for Electrical Wires and Cables Latest Edition.
- .2 CAN/CSA-C22.2 No. 131-M89 (R2004), Type TECK 90 Cable Latest Edition.

Part 2 Products

2.1 BUILDING WIRES

- .1 Conductors: solid for #10 AWG and smaller; stranded for #8 AWG and larger. **Minimum size: #12 AWG.** For longer runs use minimum: #10 (20-40 m); #8 (40-55 m) or #6 (>55 m) at 120 volt. On 600V circuits size to assure maximum 1.5% voltage drop.
- .2 Conductors: size as indicated, with 600V insulation of chemically cross-linked thermosetting polyethylene material rated NMD90 (NMDU90 where specifically indicated).
- .3 Conductors: ACM (Nual) conductors may be used for feeders greater than 3/0 copper and longer than 5 m.
- .4 Neutral conductor insulated for 600V shall be continuous with no fuses, switches, or breaks of any kind.
- .5 Wiring requirements for specialized systems such as fire alarm, public address, etc. are indicated in the respective specification sections or on drawings.
- .6 The voltage drop shall in no case exceed **3%** of the line volts for branch circuits.
- .7 Voltage drop shall be calculated based on 80% of the circuit breaker current rating for all branch circuits unless noted otherwise.
- .8 Voltage drop for motor branch circuits shall be calculated based on current equal to 80% of the ampacity of the branch circuit conductors.

- .9 Branch circuit conductor sizes specified on drawings are the minimum required. Upsize branch circuit conductor sizes as required so that the voltage drop is less than the maximum value permitted.

2.2 TECK CABLE

- .1 Cable: to CAN/CSA-C22.2 No. 131.
- .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
- .3 Insulation:
 - .1 Type: ethylene propylene rubber.
 - .2 Chemically cross-linked thermosetting polyethylene rated type RW90, 600V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking.
- .6 Overall covering: thermoplastic polyvinyl chloride material.
- .7 Fastenings:
 - .1 Channel type supports for two or more cables at 1.5 m centers.
 - .2 Threaded rods: 13 mm dia. to support suspended channels.
- .8 Connectors:
 - .1 Watertight, approved for TECK cable.

2.3 ARMoured CABLES

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from galvanized steel strip.
- .4 Connectors: Steel set screw.
- .5 Complete with anti-short bushings.
- .6 AC-90 cables may only be used:
 - .1 As individual cable drops from junction boxes to devices and fixtures provided the horizontal components are not longer than 1.5 m, do not run from room to room, are adequately supported and are run concealed.
- .7 AC-90 shall not be permitted in masonry walls or run exposed in finished areas.

2.4 CONTROL CABLES

- .1 Low energy 300 V control cable: stranded annealed copper conductors sized as indicated, with PVC insulation type, TW wire braid over each group and overall covering of PVC jackets.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In underground ducts and trenches in accordance with Section 26 05 43.
 - .2 Use vibration proof expanding spring wire connectors for No. 10 and smaller.
 - .3 In conduit unless otherwise noted.

3.3 INSTALLATION OF TECK CABLE 0-1000 V

- .1 Group cables wherever possible on channels.
- .2 Terminate cables in accordance with Section 26 05 20- Wire and Box Connectors - 0 - 1000 V.
- .3 Use only for portions of feeders located outdoors, unless indicated otherwise.

3.4 INSTALLATION OF ARMOURED CABLES

- .1 Group cables wherever possible.
- .2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.
- .3 Fixture drops are to run from the junction box in the respective room and not to fixtures in other rooms. Fixture drops shall be from the side of the outlet boxes and not through the cover plate. Maximum of four fixture drops from any single junction box. AC 90 cables shall be secured within 300mm of the junction boxes. Loop between fixtures is not acceptable.
- .4 Support and securing of AC 90 cables shall not be derived from suspended ceiling support wires or by lying on top of the ceiling.

3.5 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in conduit or underground ducts as directed.
- .2 Ground control cable shield.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 32 – Outlet Boxes, Conduit Boxes and Fittings.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International):
 - .1 CSA C22.2 No.41-07, Grounding and Bonding Equipment.

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

- .1 Copper compression connectors to CSA C22.2 as required sized for conductors.

Part 3 Execution

3.1 INSTALLATION

- .1 Install, terminations, and splices in accordance with manufacturer's instructions.
- .2 Bond and ground as required to CSA C22.2 No.41.
- .3 Do not install more than three (3) connections per junction box unless specifically permitted by Engineer (in writing).

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Division 01 – General Requirements.
- .2 Section 26 05 00 – Common Work Results – Electrical.

1.2 REFERENCES

- .1 Canadian Standards Association, CSA C22.1–15, Canadian Electrical Code, Part 1.

Part 2 Products

2.1 EQUIPMENT

- .1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.
- .2 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, tinned, soft annealed, size as indicated.
- .3 Rod electrodes: copper clad steel 19 mm dia. by 3 m long.
- .4 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.
- .5 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.

2.2 MANUFACTURERS

- .1 Acceptable manufacturers: Burndy Corp., Erico Inc., Cadweld Div., Thomas & Betts (or approved equivalent).

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION GENERAL

- .1 Install complete permanent, continuous grounding system including electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to conductive water main and grounding electrodes using copper welding by thermit process.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.
- .7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .8 Install separate ground conductor to outdoor lighting standards.
- .9 Connect building structural steel and metal siding to ground by welding copper to steel.
- .10 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .11 Bond single conductor metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.
- .12 Install grounding conductors in conduit except where run in cable tray. Bond to EMT conduit.
- .13 Ground secondary enclosures.

3.3 ELECTRODES

- .1 Make ground connections to continuously conductive underground water pipe on street side of water meter.
- .2 Install water meter shunt.
- .3 Install rod electrodes and make grounding connections.
- .4 Bond separate, multiple electrodes together.
- .5 Use size 2/0 AWG copper conductors for connections to electrodes.

- .6 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.4 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list: Service equipment, transformers, duct systems, frames of motors, starters, control panels, building steel work, elevators, distribution panels, outdoor lighting.
- .2 Where feeders over 100 A capacity pass through junction or pull boxes the ground continuity through the box shall be ensured by the use of grounding bushings and conductors sized in accordance with table 18 of CSA 22.1.
- .3 Run continuous bond wire the entire length of cable tray. Bond to cable tray at each section.

3.5 GROUNDING BUS

- .1 Install copper grounding bus mounted on insulated supports, on walls of electrical rooms as indicated on drawings.
- .2 Use thermit weld connections for all connections to perimeter ground bus.

3.6 FIELD QUALITY CONTROL

- .1 Verifications requirements in accordance with Division 01 – General Requirements.
- .2 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .3 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Engineer and local authority having jurisdiction over installation.
- .4 Perform tests before energizing electrical system.
- .5 Disconnect ground fault indicator during tests.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Division 01 – General Requirements.
- .2 Section 26 05 00 – Common Work Results – Electrical.

Part 2 Products

2.1 SUPPORT CHANNELS

- .1 U shape, size 41 x 41 x 2.5 mm thick, surface mounted or suspended.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Secure equipment to hollow or solid masonry, tile and plaster surfaces with nylon shields.
- .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 51mm and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 51mm.
 - .3 Beam clamps to secure conduit to exposed steel work.
- .7 Suspended support systems:
 - .1 Support individual cable or conduit runs with 10 mm dia. threaded rods and spring clips.

- .2 Support 2 or more cables or conduits on channels supported by 10 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .8 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.
- .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 Engineer.
- .13 Install fastenings and supports as required for each type of equipment, cable and conduit, and in accordance with manufacturer's installation recommendations.
- .14 Do not support conduit from other conduit.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Division 01 – General Requirements.
- .2 Section 26 05 00 – Common Work Results – Electrical.

Part 2 Products

2.1 SPLITTERS

- .1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Main and branch lugs and connection bars to match required size and number of incoming and outgoing conductors as indicated.
- .3 At least three spare terminals on each set of lugs in splitters less than 400 A.

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.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 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.

3.3 JUNCTION AND PULL BOXES INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Install pull boxes so as not to exceed 30 m of conduit run or 2-90° bends between pull boxes.
- .3 Mount cabinets with top not higher than 1800 mm above finished floor.
- .4 Maximum three (3) connections per junction box unless explicitly permitted by Engineer.

3.4 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results – Electrical.
- .2 Install size 2 identification labels indicating system name, voltage and phase.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Division 01- General Requirements.
- .2 Section 26 05 00 – Common Work Results – Electrical.

1.2 REFERENCES

- .1 CSA C22.1-15, Canadian Electrical Code, Part 1.
- .2 CAN/CSA-C22.2 No. 18-98 (R2003) Outlet Boxes, Fittings and Associated Hardware.

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 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 SHEET STEEL OUTLET BOXES

- .1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 51 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.
- .2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted AC-90, minimum size 102 x 54 x 48 mm.
- .3 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .4 102 mm square outlet boxes with extension and plaster rings for voice and data outlets.

2.3 MASONRY BOXES

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

2.4 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 32 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.
- .5 EMT fittings to be steel set screw type.

2.5 IDENTIFICATION

- .1 All boxes installed above finished ceilings and in interstitial levels shall have their covers color coded, as described in these specifications, and shall be labelled as to room number they serve.

2.6 FLOOR BOXES

- .1 "Not Applicable"

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 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 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, and armored cable connections. Reducing washers are not allowed.
- .5 All boxes shall be installed recessed/flush unless indicated otherwise.
- .6 Install all outlet boxes in exterior walls with flexible vapour barrier and seal with caulking.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Division 01 – General Requirements.
- .2 Section 26 05 00 – Common Work Results – Electrical.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA) Latest Edition of the following:
 - .1 CAN/CSA C22.2 No. 18.1-04 (R2009), Metallic Outlet Boxes.
 - .2 CAN/CSA C22.2 No. 18.3-04 (R2009), Hardware for the Support of Conduit, Tubing and Cable Fittings.
 - .3 CAN/CSA C22.2 No. 18.5-02 (R2007), Positioning Devices.
 - .4 CSA C22.2 No. 45.1-07, Electrical Rigid Metal Conduit – Steel.
 - .5 CSA C22.2 No. 45.2-07, Electrical Rigid Metal Conduit – Aluminum, Red Brass and Stainless Steel.
 - .6 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .7 CSA C22.2 No. 83.1-07, Electrical Metallic Tubing – Steel.
 - .8 CSA C22.2 No. 211.2-06, Rigid PVC (Un-plasticized) Conduit.
 - .9 CAN/CSA C22.2 No.227.3-05, Non-Metallic Mechanical Protection Tubing (NMPT), National Standard of Canada (February 2006).

Part 2 Products

2.1 CONDUITS

- .1 Rigid PVC conduit: to CSA C22.2 No.211.2.
- .2 Flexible metal conduit and liquid-tight flexible conduit, complete with anti-short bushings: to CSA C22.2 No. 56-04, steel and liquid-tight flexible metal.
- .3 Flexible PVC conduit: to CAN/CSA-C22.2 No.227.3.

2.2 CONDUIT FASTENINGS

- .1 One-hole steel straps to secure surface conduits 51 mm and smaller. Two hole steel straps for conduits larger than 51 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1.5 m oc.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.

2.3 CONDUIT FITTINGS

- .1 Factory "ells" where 90 degree bends are required for 25 mm and larger conduits.
- .2 Connectors for flexible conduit shall be set screw galvanized steel.
- .3 Connectors for liquid tight flexible conduit shall be water tight, compression type galvanized steel.
- .4 Threaded plastic or metal bushings to be installed on all EMT connectors sizes 35 mm and larger.
- .5 Fittings: manufactured for use with conduit specified. Coating: same as conduit

2.4 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 datasheet.

3.2 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.
- .3 EMT shall be installed as a complete system.
- .4 Support of electrical systems raceway shall be independent of any type of suspended ceiling support rods, wires, etc. and mechanical piping or duct systems.
- .5 Use rigid PVC conduit underground (direct buried) or embedded in concrete walls or ceiling slabs for panels and equipment.
- .6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment, furniture and transformers. Include a separate ground wire.
- .7 Install fish cord in empty conduits.
- .8 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .9 Dry conduits out before installing wire.

- .10 Securely fasten in place within 83 mm of each outlet box, junction box, cabinet, coupling or fitting, maximum spacing between supports as follows:
 - .1 1.5 m for 21 mm trade size conduit and smaller.
 - .2 2 m for 27 mm to 35 mm trade size conduit.
 - .3 3 m for 41 mm trade size and larger.
- .11 Ground Wires:
 - .1 Provide a separate green ground wire in all conduit, including EMT.

3.3 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints (PVC accepted) with heavy coat of bituminous paint.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Division 01 – General Requirements.
- .2 Section 26 05 00 - Common Work Results - Electrical.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 CABLE INSTALLATION IN DUCTS

- .1 Install cables as indicated in ducts.
- .2 Install multiple cables in duct simultaneously.
- .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 lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.
- .5 After installation of cables, seal duct ends with duct sealing compound.

3.3 FIELD QUALITY CONTROL

- .1 Verification requirements in accordance with Division 01 – General Requirements.
- .2 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .3 Check phase rotation and identify each phase conductor of each feeder.
- .4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for breaker type panelboards.

1.2 RELATED SECTIONS

- .1 Division 01 – General Requirements.
- .2 Section 26 05 00 – Common Work Results – Electrical.
- .3 Section 26 28 21 - Moulded Case Circuit Breakers.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International) Latest Edition of the following:
 - .1 CSA C22.2 No.29–M 1989 (R2004), Panelboards and Enclosed Panelboards.

1.4 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 26 05 00 – Common Work Results – Electrical.
- .2 Drawings include electrical detail of panelboard, branch breaker type, quantity, ampacity and enclosure dimension, shown in the same layout as on panelboard schedules.
- .3 Sustainable Design – Provide LEED documentation certifying products contain no added urea-formaldehyde resins (lamine adhesive and plywood).

Part 2 Products

2.1 PANELBOARDS

- .1 Panelboards: to CSA C22.2 No.29–M 1989 (R2004) and product of one manufacturer:
 - .1 Install circuit breakers in panelboards before shipment.
 - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
 - .3 All provisional space shall be fully bussed and breaker ready.
- .2 250V panelboards: bus and breakers rated for 10 kA rms (symmetrical) interrupting capacity minimum or as indicated and 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 keys for each panelboard and key panelboards alike. Turn over keys to building Owner.
- .6 Aluminum bus with neutral of same ampere rating as mains, unless noted otherwise.
- .7 Mains: suitable for bolt-on breakers.
- .8 Trim with concealed front bolts and hinges.
- .9 Trim and door finish: baked grey enamel.
- .10 Copper ground bus.
- .11 Surface mounted panelboard shall be sprinkler proof.

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.
- .3 Main breaker: separately mounted on top or bottom of panel to suit cable entry.
- .4 Lock on devices for 10% of 15 to 30 A breakers installed as indicated. Turn over unused lock on devices to Owner.
- .5 Lock on devices for fire alarm, door supervisory, intercom, stairway, exit and night light circuits. Provide copy of receptacles of used breakers locked in operation and maintenance manuals.
- .6 Breakers shall be installed in panelboards as per schedule on drawings and load balancing. Shop drawings shall indicate above positioning.

2.3 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Nameplate for each panelboard size 4 engraved as indicated.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.
- .4 Provide typewritten circuit directory, indicating location and load for each circuit. Circuit directories shall be **written in French**.

2.4 ACCEPTABLE MANUFACTURERS

- .1 Acceptable Manufacturers:
 - .1 Square D.
 - .2 Eaton.
 - .3 Siemens.

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 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Install surface mounted panelboards on plywood backboards or either fire retardant type or painted on all sides with fire retardant paint.
- .3 Mount panelboards to height specified in Section 26 05 00 - Common Work Results - Electrical or as indicated.
- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus with respective neutral identified.
- .6 Each flush mounted panel shall have 2 – 1" empty conduits studded to accessible ceiling space for future connections.

3.3 TESTS

- .1 Test each branch breaker to verify that it controls the load indicated on the drawing and panel directory.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Division 01- General Requirements.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Division 01- General Requirements.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 01- General Requirements

Part 2 Products

2.1 "T" TYPE CABINETS

- .1 Enclosure constructed with 14 gauge steel, size as required.
- .2 Flush type with 21 mm lip all around for flush mounted.
- .3 ¼ turn lock with two (2) keys. Key alike.
- .4 Grey epoxy textured powder coating inside and outside.
- .5 Grounding lugs on doors and cabinet.
- .6 Woodback, 15 mm thick.
- .7 Acceptable product: Bel TCS & TCF series or approved equivalent by Hammond, Ralston, Hoffman or Eurobex.

Part 3 Execution

3.1 INSTALLATION

- .1 Assemble enclosure in accordance with manufacturer's instructions.
- .2 Mount equipment in enclosure and wire.
- .3 Test equipment in enclosure.

3.2 COMMISSIONING

- .1 Contractors are required to complete the commissioning, field quality assurance and testing and performance verification as outlined in this and subsequent sections.

- .2 The Commissioning Authority will conduct third party commissioning verification.
The following specification sections will also apply to the work to be performed
under this and subsequent sections:
 - .1 Section 01 91 13 - General Commissioning Requirements.
 - .2 Section 01 91 31 - Commissioning Plan.
 - .3 Appendix – Preliminary Commissioning Plan.
 - .4 Section 01 91 33 - Commissioning Forms.
 - .5 Section 01 91 41 - Commissioning Training.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Division 01 – General Requirements.
- .2 Section 26 05 00 – Common Work Results – Electrical.

1.2 SECTION INCLUDES

- .1 Switches, receptacles, wiring devices, cover plates and their installation.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International) Latest Edition of the following:
 - .1 CSA-C22.2 No.42-99 (R2004), General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CSA-C22.2 No.42.1-00 (R2004), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
 - .3 CSA-C22.2 No.55-M 1986 (R2003), Special Use Switches.
 - .4 CSA-C22.2 No.111-00, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.4 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 26 05 00 – Common Work Results – Electrical.

Part 2 Products

2.1 SWITCHES

- .1 15A, 120V and 347V single pole, 3-way and 4-way switches, commercial specification grade to: CSA-C22.2 No.55 and CSA-C22.2 No.111.
- .2 Manually-operated commercial specification grade ac switches with following features:
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Silver Alloy contacts.
 - .3 High strength thermoplastic polycarbonate toggle.
 - .4 Urea or melamine moulding for parts subject to carbon tracking.
 - .5 Suitable for back and side wiring.
 - .6 Toggle colour: white.
- .3 Toggle operated locking fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.
- .4 Acceptable products:
 - .1 Toggle switch:
 - .1 15A, 120V, single pole, and 3-way, specification grade, white color, toggle switch.

- .1 Standard of Acceptance: CSB115-W and #CSB3115-W.
- .2 Switches of one manufacturer throughout project.
- .3 Other approved manufactures; Leviton, Pass & Seymour.
- .5 Each light switch shown on plans shall have the circuit number and supplying panelboard identified. This identification shall be a label and shall be visible when the coverplate is in place, and shall be in a position not likely to be painted over.

2.2 RECEPTACLES

- .1 Duplex commercial specification grade receptacles, CSA types 5-15R and 5-20R 125V, U ground, specification grade, to: CSA-C22.2 No.42 with following features:
 - .1 Impact resistant nylon face.
 - .2 Thermoplastic back body.
 - .3 White urea moulded housing.
 - .4 Suitable for No. 10 AWG for back and side wiring.
 - .5 Break-off links for use as split receptacles.
 - .6 Triple wipe contacts and riveted grounding contacts.
 - .7 Plated steel mounting strap with integral ground contacts.
 - .8 Color: as indicated.
- .2 Acceptable Materials:
 - .1 Duplex receptacles (NEMA 5-15R) shall be rated for 15 amp, 125 volt, Receptacles shall be specification grade.
 - .1 Standard of Acceptance Hubbell BR15-W white.
 - .2 Duplex receptacles (NEMA 5-20R) shall be rated for 20 amp, 125 volt, with a T-slot. Receptacles shall be specification grade.
 - .1 Standard of Acceptance Hubbell BR20-W white.
 - .3 Other approved manufacturer; Cooper, Leviton, Pass & Seymour.
- .3 White housing for receptacles connected to non-essential power.
- .4 Devices shall be tamper proof where indicated on plans.
- .5 Receptacles of one manufacturer throughout project.

2.3 COVER PLATES

- .1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.
- .2 Cover plates from one manufacturer throughout project.
- .3 Cover plates for all flush-mounted switches and receptacles shall be as indicated on drawings.
- .4 FS-type cover plates for wiring devices installed in surface-mounted FS-type outlet boxes.

- .5 Recess weather protective covers as indicated on drawings.
- .6 Sheet steel utility box cover for wiring devices installed in surface mounted utility boxes.
- .7 Nylon coverplates, thickness 2.5 mm for wiring devices mounted in flush mounted outlet box. White coverplates for receptacles and switches connected to non-essential power.
- .8 Sheet metal cover plates for wiring devices mounted in surface mounted FS or FD type conduit boxes.
- .9 Exterior weatherproof, heavy duty cast aluminum, surface mounted, complete with while in use cover plate, complete with decora mounting plate, neoprene basket:
 - .1 Acceptable Manufacturers: Hubbel, Leviton, Pass & Seymour.

2.4 ACCEPTABLE MANUFACTURERS

- .1 Pass & Seymour, Hubbell, Leviton, Cooper.

2.5 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results – Electrical.
- .2 Label size: 1.
- .3 Provide one label for each wiring device indicating circuit number that the wiring device is connected to. Example: “A-23”.

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 Switches and dimmers:
 - .1 Install single throw switches with handle in "UP" position when switch closed.
 - .2 Install switches in gang type outlet box when more than one switch is required in one location.
 - .3 Mount toggle switches at height specified in Section 26 05 00 - Common Work Results - Electrical or as indicated.
 - .4 Install 3-way switches such that load is “OFF” when both toggles are down.
- .2 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

- .2 Where 2 receptacles are fed from different panelboards and installed in a common 2-gang outlet box, install voltage barrier between the receptacles.
- .3 Mount receptacles at height specified in Section 26 05 00 - Common Work Results - Electrical or as indicated.
- .4 All receptacles shall be installed with the "U" ground at the top.
- .5 All receptacles mounted horizontal shall be oriented with ground to the left.
- .3 Cover plates:
 - .1 Protect cover plate finish with paper or plastic film until painting and other work is finished.
 - .2 Install suitable common cover plates where wiring devices are grouped.
 - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.
- .4 General:
 - .1 All surface mounted wiring devices shall be installed in FS-type outlet boxes, c/w FS-type coverplates.

3.3 PROGRAMMING AND TRAINING

- .1 Provide training to users for programming and operation of Dimming Control Stations.

3.4 TESTS

- .1 Test each receptacle for polarity and retention of blades.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Division 01- General Requirements.
- .2 Section 26 05 00 - Common Requirements - Electrical.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International):
 - .1 CAN/CSA-C22.2 No.144.1-06, Ground Fault Circuit Interrupters.
- .2 National Electrical Manufacturers Association (NEMA):
 - .1 NEMA PG 2.2-1999, Application Guide for Ground Fault Protection Devices for Equipment.

1.3 SUBMITTALS AND SHOP DRAWINGS

- .1 Submittals in accordance with Division 01 - General Requirements.
- .2 Submit product data and shop drawings.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 01- General Requirements.

Part 2 Products

2.1 MATERIALS

- .1 Equipment and components for ground fault circuit interrupters (GFCI): to CAN/CSA-C22.2 No.144 NEMA PG 2.2.
- .2 Components comprising ground fault protective system to be of same manufacturer.

2.2 BREAKER TYPE GROUND FAULT INTERRUPTER

- .1 Single pole ground fault circuit interrupter (class “A”) for 15 A, 120 V, 1 phase circuit c/w test and reset facilities.

2.3 GROUND RECEPTACLE

- .1 Self-contained with 15 A, 120 V circuit interrupter and duplex single receptacle complete with:
 - .1 Solid state ground sensing device.
 - .2 Facility for testing and reset.
 - .3 Flush mounted with white nylon face plate.
 - .4 Tamper proof where indicated.

- .2 Acceptable product:
 - .1 Hubbell #GF15WLA
 - .2 Leviton #7599-W
 - .3 Pass & Seymour #1595W

Part 3 Execution

3.1 INSTALLATION

- .1 Connect supply and load wiring to equipment in accordance with manufacturer's recommendations.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Requirements - Electrical and co-ordinate with Division 01- General Requirements.
- .2 Demonstrate simulated ground fault tests.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials for moulded-case circuit breakers.

1.2 RELATED SECTIONS

- .1 Division 01 – General Requirements.
- .2 Section 26 05 00 – Common Work Results – Electrical.
- .3 Section 26 24 17 – Panelboards Breaker Type.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International) Latest Edition of the following:
 - .1 CSA-C22.2 No. 5-2 (R2007), Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).
 - .2 CAN/CSA-C22.2 No. 144-M91 (R2001), Ground Fault Circuit Interrupters.

1.4 SUBMITTALS

- .1 Submit Shop Drawings in accordance with Section 26 05 00 – Common Work Results – Electrical.
- .2 Include time-current characteristic curves for breakers with ampacity of 100 A and over.

Part 2 Products

2.1 BREAKERS GENERAL

- .1 Moulded-case circuit breakers: 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°C ambient.
- .3 Common-trip breakers: with single handle for multi-pole applications.
- .4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
 - .1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .5 Circuit breakers to have minimum symmetrical rms interrupting capacity rating to match panel.

2.2 THERMAL MAGNETIC BREAKERS

- .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 GFCI BREAKERS

- .1 Ground fault circuit interrupter (GFCI) breakers to CAN/CSA-C22.2 No. 144, Class "A" type.
- .2 Single pole GFCI breakers, rated as noted c/w test and reset facilities.

2.4 ACCEPTABLE MATERIALS

- .1 Breakers shall be compatible with panelboards specified in Section 26 24 17 – Panelboards Breaker Type and shall meet the short circuit interrupting ratings as indicated.

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 circuit breakers as indicated.

3.3 TESTS

- .1 Demonstrate simulated ground fault tests for all GFCI breakers.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for fused and non-fused disconnect switches.

1.2 RELATED SECTIONS

- .1 Division 01 – General Requirements.
- .2 Section 26 05 00 – Common Work Results – Electrical.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International) Latest Edition of the following:
 - .1 CAN/CSA C22.2 No.4-04 (R2009), Enclosed Switches.
 - .2 CSA C22.2 No.39-M 1987 (R2003), Fuse holder Assemblies.

1.4 SUBMITTALS

- .1 Submit Shop Drawings in accordance with Section 26 05 00 – Common Work Results – Electrical.

Part 2 Products

2.1 DISCONNECT SWITCHES

- .1 Fusible and non-fusible, heavy-duty horsepower rated disconnect switches to CAN/CSA C22.2 No.4, sized to match circuit ampacity and voltage, or as indicated.
- .2 Provision for padlocking in off switch position by three locks.
- .3 Mechanically interlocked door to prevent opening when handle is in ON position.
- .4 Quick-make, quick-break action.
- .5 ON-OFF switch position indication on switch enclosure cover.
- .6 Enclosure: NEMA Type 1 or as indicated.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Indicate name of load controlled on size 4 nameplate.

2.3 ACCEPTABLE MANUFACTURERS

- .1 Square D.
- .2 Eaton.

- .3 Siemens.

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 disconnect switches complete with fuses, if applicable, where indicated on drawings.
- .2 Disconnect switches for mechanical equipment shall be mounted on uni-strut frame work.

3.3 TESTS

- .1 Operate each disconnect switch to verify that the loads are disconnected.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Division 01 – General Requirements.
- .2 Section 26 05 00 – Common Work Results – Electrical.

1.2 SUBMITTALS

- .1 Submit Shop Drawings in accordance with Section 26 05 00 – Common Work Results – Electrical.
- .2 Shop Drawings shall indicate:
 - .1 Mounting method and dimensions.
 - .2 Starter size and type.
 - .3 Layout of identified internal and front panel components.
 - .4 Enclosure types.
 - .5 Wiring diagram for each type of starter.
 - .6 Interconnection diagrams.

1.3 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for motor starters for incorporation into Operation and Maintenance Manual specified in Division 01- General Requirements.
- .2 Include operation and maintenance data for each type and size of starter.

1.4 MAINTENANCE MATERIALS

- .1 Provide maintenance materials in accordance with Section 26 05 00.
- .2 Provide the following spare parts for each different size and type of starter:
 - .1 3 contacts, stationary.
 - .2 3 contacts, movable.
 - .3 1 contact, auxiliary.
 - .4 1 control transformer.
 - .5 1 operating coil.
 - .6 2 fuses.
 - .7 10% indicating lamp bulbs used.
- .3 Provide a copy of receipts of maintenance and materials in the maintenance and operation manuals.

Part 2 Products

2.1 MATERIALS

- .1 Starters: NEMA Type.

- .2 Half size starters not acceptable.
- .3 I.E.C. rated starters not acceptable.

2.2 MANUAL MOTOR STARTERS

- .1 Single and Three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:
 - .1 Switching mechanism, quick make and break.
 - .2 One or Three overload heater(s), manual reset, trip indicating handle.
- .2 Accessories:
 - .1 Toggle switch: standard.
 - .2 Indicating light: standard, red in color.
 - .3 Locking tab to permit padlocking in "ON" or "OFF" position.

2.3 MANUAL MOTOR SWITCHES

- .1 Manual motor switches as indicated on drawings.

2.4 FINISHES

- .1 Apply finishes to enclosure in accordance with Section 26 05 00 – Common Work Results – Electrical.

2.5 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Manual starter designation label, white face, black core (normal), size 1, engraved as indicated.
- .3 Magnetic starter designation label, white face, black core (normal), size 2 engraved as indicated.
- .4 Combination magnetic starter, designation label, white face, black core (normal), size 4, engraved as indicated.

2.6 ACCEPTABLE MANUFACTURERS

- .1 Square D.
- .2 Eaton.
- .3 Siemens.

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 starters, connect power and control as indicated.
- .2 Ensure correct fuses and overload device elements installed.
- .3 Install manual starters recessed where possible.

3.3 TESTS

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and manufacturer's instructions.
- .2 Operate switches and contactors to verify correct functioning.
- .3 Perform starting and stopping sequences of contactors and relays.
- .4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

- .1 American National Standards Institute (ANSI):
 - .1 ANSI C82.1-2004, For Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.
- .2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE):
 - .1 ANSI/IEEE C62.41-1991, IEEE Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
- .3 United States of America, Federal Communications Commission (FCC):
 - .1 FCC (CFR47) EM and RF Interference Suppression.

1.3 SUBMITTALS

- .1 Submit shop drawings in accordance with Division 01.
- .2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Consultant.

1.4 QUALITY ASSURANCE

- .1 Luminaires shall be provided with a five (5) year warranty covering LED's, drivers, parts and mechanical components.

Part 2 Products

2.1 DRIVERS

- .1 Rating: 120 V and 347 V, 60 Hz, for use with LED arrays.
- .2 Totally encased and designed for 40° C ambient temperature.
- .3 Power factor: minimum < 90%.
- .4 Mounting: integral with luminaire.
- .5 The Total Harmonic Distortion (THD), summarizing the second through thirty-ninth harmonic shall not exceed twenty percent (20%).
- .6 Acceptable manufacturers: Eldoled, Lutron, Osram, GE or Phillips.
- .7 Photometry must be compliant with IESNA LM-79-08.

- .8 Technical Requirements for LED luminaires:
 - .1 Electrical:
 - .1 Power Factor: The Luminaire shall have a power factor of 0.90 or greater.
 - .2 THD: Total harmonic distortion (current and voltage) induced into an AC power line by a Luminaire shall not exceed 20 percent.
 - .2 Photometric Requirements:
 - .1 All photometric data will be measured by the IESNA LM-79-08 standard.
 - .2 Illuminance: The illuminance shall not decrease by more than 30% over the expected operating life.
 - .3 Light Color/Quality: The luminaire shall have a correlated color temperature (CCT) range of 4000K. The color rendition index (CRI) shall be >80, and CRI shall be >85 in patient care areas.
 - .3 Thermal Management:
 - .1 The thermal management (of the heat generated by the LEDs) shall be of sufficient capacity to assure proper operation of the Luminaire over the expected useful life.
- .9 Submit shop drawings and product data for all lamps and ballasts specified, in accordance with Division 01.

2.2 FINISHES

- .1 Baked enamel finish:
 - .1 Conditioning of metal before painting:
 - .1 For corrosion resistance conversion coating to ASTM F1137.
 - .2 For paint base, conversion coating to ASTM F1137.
 - .2 Metal surfaces of luminaire housing and reflectors finished with high gloss to give smooth, uniform appearance, free from pinholes or defects.
 - .3 Reflector and other inside surfaces finished as follows:
 - .1 White, minimum reflection factor 85%.
 - .2 Colour fastness: yellowness factor not above 0.02 and after 250 hours exposure in Atlas fade-o-meter not to exceed 0.05.
 - .3 Film thickness, not less than 0.03 mm average and in no areas less than 0.025 mm.
 - .4 Gloss not less than 80 units as measured with Gardner 60E gloss meter.
 - .5 Flexibility: withstand bending over 12 mm mandrel without showing signs of cracking or flaking under 10 times magnification.
 - .6 Adhesion: 24 mm square lattice made of 3 mm squares cut through film to metal with sharp razor blade. Adhesive cellulose tape applied over lattice and pulled. Adhesion satisfactory if no coating removed.

- .2 Alzak finish:
 - .1 Aluminum sheet fabricated from special aluminum alloys and chemically brightened, subsequently anodically treated to specifications established by Alcoa, to produce:
 - .1 Finish for mild commercial service, minimum density of coating 7.8 g/m2, minimum reflectivity 83% for specular, 80.5% for semi-specular and 75% for diffuse.
 - .2 Finish for regular industrial service, minimum density of coating 14.8 g/m2, minimum reflectivity 82% for specular and 73% for diffuse.
 - .3 Finish for heavy duty service, minimum density of coating 21.8 g/m2, minimum reflectivity 85% for specular, 65% for diffuse.

2.3 LUMINAIRES

- .1 See schedule on Drawings.

Part 3 Execution

3.1 INSTALLATION

- .1 Locate and install luminaires as indicated.

3.2 WIRING

- .1 Connect luminaires to lighting circuits.

3.3 LUMINAIRE SUPPORTS

- .1 For suspended ceiling installations support luminaires independently of ceiling at two (2) diagonal corners minimum, for seismic protection.
- .2 Provide all supports and brackets for mounting luminaries. Confirm mounting method for all luminaires with Engineer prior to rough-in.

3.4 LUMINAIRE ALIGNMENT

- .1 Align luminaires mounted in continuous rows to form straight uninterrupted line.
- .2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Division 01- General Requirements.
- .2 Section 26 05 00 – Common Work Results – Electrical.

1.2 SUBMITTALS

- .1 Submit Shop Drawings in accordance with Section 26 05 00 – Common Work Results – Electrical.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International):
 - .1 CSA C22.2 No.141 (R2012), Unit Equipment for Emergency Lighting.

1.4 GUARANTEE

- .1 Provide a written guarantee stating that all batteries for emergency lighting are guaranteed against defects in material and workmanship for a period of five years, from the date of the Substantial Completion.

1.5 DELIVERY

- .1 Deliver batteries in dry state unless hermitically sealed.

Part 2 Products

2.1 BATTERY UNITS

- .1 Supply voltage: 120/347V.
- .2 Output voltage: 12 VDC.
- .3 Operating time: 30 minutes minimum.
- .4 Battery: sealed, maintenance free, 10 year life.
- .5 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 input variations.
- .6 Solid state transfer circuit.
- .7 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.
- .8 Signal lights: solid state, life expectancy 100,000 hour minimum, for AC Power On and High Charge.
- .9 Lamp heads: as indicated.

- .10 Cabinet: complete with knockouts for conduit. Removable or hinged front panel for easy access to batteries.
- .11 Automatic self-diagnostic circuitry.
- .12 Auxiliary equipment:
 - .1 Lamp disconnect switch.
 - .2 Test switch.
 - .3 Battery disconnect device.
 - .4 AC input and DC output terminal blocks inside cabinet.
 - .5 Bracket.

2.2 REMOTE UNITS

- .1 Refer to luminaire schedule on drawings.

2.3 WIRING OF REMOTE HEADS

- .1 Conduit: to section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.
- .2 Conductors: type RW90 to section 26 05 21 – Wires and Cables 0-1000 V, and in accordance with manufacturer's recommendations. Voltage drop shall not exceed 3%.

2.4 ACCEPTABLE MANUFACTURERS

- .1 Refer to luminaire schedule.

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 battery units and remote units as indicated.
- .2 Aim heads to illuminate path of egress in corridors and as indicated in open areas.
- .3 Mount directly to wall or ceiling as indicated.
- .4 Connect to lighting circuit of area served in accordance with CEC 46-304 (4) and 46- 400 (20). Provide relays as required.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Division 01 – General Requirements.
- .2 Section 26 05 00 – Common Work Results – Electrical.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International):
 - .1 CSA C22.2 No.141-02, Unit Equipment for Emergency Lighting.
 - .2 CSA C860-01 (December 2002), Performance of Internally-Lighted Exit Signs.
- .2 National Building Code of Canada 2010 (NBC 2010).

1.3 SUBMITTALS

- .1 Submit Shop Drawings in accordance with Section 26 05 00 – Common Work Results – Electrical.

Part 2 Products

2.1 EXIT SIGNS

- .1 Exit signs: to CSA C22.2 No.141, CSA C860 and NBC 2010 compliant.
- .2 Housing: 1.0 mm thick, extruded aluminum face, white finish.
- .3 Face and back plates: cast aluminum alloy.
- .4 Lamps: white LED, 25-year life, 5 watt max total consumption, solid-state board.
- .5 Pictogram type, green on white (or lightly tinted background) running man with arrow graphic viewable (where required).
- .6 Two (2) exit signs required where bi-directional arrows are indicated.
- .7 Mounting as indicated.
- .8 Single and double face units, as indicated.
- .9 Supply voltage: 120/347 V.
- .10 Face plate to remain captive for re-lamping.

2.2 ACCEPTABLE MANUFACTURERS

- .1 Refer to luminaire schedule on drawings.

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 exit lights as indicated in accordance with NBC 2010, local regulatory requirements, NFPA Standard and Listing Requirements..
- .2 Connect exit lights to circuits as indicated.
- .3 Ensure that exit light circuit breakers are locked in ON position. Provide lock-on devices.

END OF SECTION