

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1    Section 20 00 10 – General instruction of mechanical and electrical.
- .2    All contractual documents.
- .3    Obtain a copy of pertinent documents, read them attentively and determine requirements based on the scope of work.

**1.2                WORK**

- .1    Work Includes:
  - .1    In general, work consists of the supply of all required materials, workforce, equipment and tools required to complete the electrical installations as described in plans and specifications. Most notably, work is comprised of:
    - .1    3 PH distribution network of 347/600 V, normal and emergency.
    - .2    3 PH distribution network of 120/208 V, normal and emergency.
    - .3    Electrical and mechanical grounding.
    - .4    Interior lighting, normal and emergency.
    - .5    Emergency lighting.
    - .6    Lighting controls at 120 V, 347 V, and 24 V.
    - .7    Outlets.
    - .8    Connecting electrical partitions.
    - .9    Supply and connection of all motors and their controls.
    - .10   Connection only to the coils of the HVAC systems.
    - .11   Connection of other equipment as outlined in the plans.
    - .12   Modification of empty conduit network for telephone network.
    - .13   Modification of empty conduit network for IT network.
    - .14   Modification of Fire alarm system.
    - .15   Access control system.
    - .16   Connection of electrical hardware.
    - .17   All steel structural supports for conductors, cables, devices, and equipment.
    - .18   All specified tests.
    - .19   Relocation of existing equipment.
    - .20   Demolition and removal of equipment deemed obsolete.
    - .21   Installation of temporary equipment to ensure continuity of service.



### **1.3 RELATED WORK**

- .1 The following work must be carried out by following the prescribed requirements, and is also included in other sections of the specifications:
  - .1 Openings in the furniture to install cables and electrical conductors.
  - .2 Supply of electrical partitions.
  - .3 Installation and connection of control devices and their starters, with the exception of key-controlled circuit interrupters, and thermistor protection.
  - .4 Connection of low-voltage centralized lighting control system, refer to divisions 22 and 23.

### **1.4 MATERIALS**

- .1 Unless otherwise stated use new materials, without defect, and of the quality required, with the appropriate approval labels by CSA, ULC, FM, according to the specifications.

### **1.5 DOCUMENTS/SAMPLES TO SUBMIT FOR APPROVAL/INFORMATION**

- .1 Submit the documents and samples required in accordance with section 01 33 00 – Documents/Samples for submission.
- .2 Data Sheets:
  - .1 Submit the technical data sheets required in addition to the instructions and the Manufacturer's documentation. Technical data sheets must indicate product information, nameplate, performance criteria, product dimensions, product limitations.
  - .2 Shop Drawings:
    - .1 Wiring diagrams and device installation details must indicate proposed location, proposed layout, control panels, accessories, piping, ducts, and all other elements which must be shown in order to ensure a coordinated construction installation.
    - .2 Wiring diagrams must indicate the terminal ends, internal wiring of each device and in addition interconnections between the different devices.
    - .3 Drawings must indicate clearances for operation, maintenance and replacement of operating equipment devices.
    - .4 Submit 3 drawing samples of minimum, and technical data sheets, to the competent authority.
    - .5 If changes are requested, the consultant must be notified prior to making these changes.

### **1.6 DOCUMENTS/ITEMS TO SUBMIT UPON COMPLETION OF WORK**

- .1 Electrical contractor must submit to the owner six copies of the operating and maintenance manuals for each piece of equipment or device included in their contract.
- .2 The manuals must contain:
  - .1 An illustrated list of all equipment: controls, alarm panel, lighting fixtures, devices, and fire-alarm, etc.



- .2 An approved copy of drawings.
  - .3 List of subcontractors: name, address, telephone number.
  - .4 List of manufacturers of the equipment installed: name, address, telephone number.
  - .5 The instructions must contain all graphics, curves, operating capacity, and other information set forth by the manufacturer concerning the operating details of all the electrical equipment installed in the building.
- .3 All information must be assembled in French.
  - .4 Divide each manual into sections using a blank coloured sheet bearing the correct identification of the section. Example: "GENERATORS". At the front of the manual, insert a table of contents with the title of each section and indicate where in the manual to find the section.
  - .5 Cover each manual in a black cardboard stock paper, allowing for binding, by Dominion Loose Leaf, Acco Press or approved equivalent, ensuring a size of 215 mm x 275 mm (8½" x 11").
  - .6 Submit a copy to engineer for comments and deliver the five copies to the owner and engineer.
  - .7 The manuals must be submitted prior to final review/tests. Leave sufficient space in the manual to add additional reports.
  - .8 Upon completion of work, the electrical contractor must submit to the engineer a certificate of conformity which attests that the work has been completed as per the drawings and specifications and in accordance with the applicable codes and standards in place.
  - .9 Send this certificate to the engineer at the same time as the requested manuals.
  - .10 Have this form signed by a company administrator and affix their seal to it.

## **Part 2 Products**

### **2.1 DESIGN REQUIREMENTS**

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
  - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates labels for control items in English French.
- .4 Use one nameplate label for both languages.



## 2.2 MATERIALS AND EQUIPMENT

- .1 Equipment to be CSA certified. Where CSA certified equipment are not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in part 1 "ACTION AND INFORMATIONAL SUBMITTALS".

## 2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

## 2.4 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of authority having jurisdiction.
- .2 Porcelain enamel decal signs, minimum size 175 mm x 250 mm.

## 2.5 WIRING TERMINATIONS

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

## 2.6 EQUIPMENT PROTECTED BY SPRINKLERS

- .2 Any electrical equipment which is enclosed in a perforated box and that is installed in a sprinkler-protected area must be protected by a hood or non-combustible cover that is arranged in such a way that it does not impede the proper functioning of the sprinkler system.

## 2.7 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates or labels as follows:
  - .1 Nameplates: plastic laminate lamicoïd 3 mm thick plastic engraving sheet melamine, matt white finish face, black core, lettering accurately aligned and engraved into core, mechanically attached with glue.
  - .2 Sizes as follows:

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

- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates or labels to be approved by Consultant prior to manufacture.
- .4 Allow for minimum of twenty-five 25 letters per nameplate and label.



- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. [\_\_\_\_\_]" as directed by Consultant.
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .8 Terminal cabinets and pull boxes: indicate system and voltage.
- .9 Transformers: indicate capacity, primary and secondary voltages.
- .10 Devices:
  - .1 Identify all electrical equipment with visible safety labels on the device cover, the door of the device, or on the device frame.
  - .2 Use the same device code as indicated on drawings.
  - .3 Provide a list of all device identification for approval prior to the manufacturing.
  - .4 Assure that all device identifications are affixed to the equipment and that they are in French.
  - .5 List of equipment to identify:
    - .1 Distribution panel, secondary panel.
    - .2 Disconnects, starters, contacts, relays, relay box, live components, cabinets or enclosures.
    - .3 All specific elements identified in plans or in each section of the specifications.

## 2.8 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, numbered coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Use colour coded wires in communication cables, matched throughout system.
- .4 Phases:
  - .1 Identify with letters of size 5 cm in height, each phase A, B, C, N, on the inside of each transformer entry point, each low-voltage switchboard, and each motor control centre on all live components.
  - .2 Identify components and assigned phases using the colour codes outlined below:

Identification	120/208 V	120/240 V	347/600 V
Phase A	Red	Red	Red with stripe
Phase B	Black	Black	Black with stripe
Phase C	Blue	---	Blue with stripe
Neutral	White	White	White
Ground	Green	Green	Green

- .3 Use yellow coloured wiring for lighting return switches and orange coloured wiring for driver deflecting switches and inverters.



- .4 Use coloured tape placed at a distance of 150 mm from each end of the conductors to identify conductors that don't have any color choices. Use coloured tape on each end of the conductors inside junction and pull boxes.
- .5 Drivers:
  - .1 Identify in each panel, in each pull and junction box each wire with the use of identification tags of the E-Z-Code brand, model WB from Thomas & Betts.
  - .2 Indicate on the tag: the circuit number, zone number, and function, in a way that each wire can be easily identified.

**2.9 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 communication	Red	Blue
Other security systems	Red	Yellow

- .4 Conduits:
  - .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 Paint all junction and pull boxes.

**2.10 CIRCUIT IDENTIFICATION**

- .1 Secondary panels at 120/208 V and 347/600 V:
  - .1 Identify in type each of the circuits in the secondary panel on a protected plastic tab inserted in the panel box door. Use the same circuit number that appears in the plans. Be sure to describe succinctly the load.
- .2 Distribution Panel at 120/208 V, 347/600 V and 600V:
  - .1 Identify each circuit in the panel with a visible safety label and place the label near each disconnect and breaker.



## **2.11 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.
  - .2 Paint indoor switchgear and distribution enclosures light gray.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for equipment installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Consultant.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

### **3.2 INSTALLATION**

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

### **3.3 NAMEPLATES AND LABELS**

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

### **3.4 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 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

### **3.5 LOCATION OF OUTLETS**

- .1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.



- .4 Locate light switches on latch side of doors.
  - .1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.
- .5 Locate the exit in according to the indication in plan and align them in a symmetric way
- .6 Locate outlets for lighting and receptacles in hanging ceilings on line on both sides, without however damaging the suspensions of the ceiling. Make sure that the outlets are accessible.
- .7 Make the adjustment when the interior finition is ended.
- .8 Place lighting switches between 225 and 300 mm of the frame of simple doors on handle side and between 225 and 300 mm of the extremity of double doors.
- .9 The exact position of outlets will have to be coordinated with the architecture drawings before proceeding to the installation.

### **3.6 MOUNTING HEIGHTS**

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
  - .1 Local switches: 1200 mm.
  - .2 Wall receptacles:
    - .1 General: 400 mm.
    - .2 Above top of continuous baseboard heater: 200 mm.
    - .3 Above top of counters or counter splash backs: 175 mm.
    - .4 In mechanical rooms: 1065 mm.
  - .3 Panel boards: as required by Code or as indicated.
  - .4 Telephone and interphone outlets: 400 mm.
  - .5 Wall mounted telephone and interphone outlets: as per the instructions
  - .6 Fire alarm stations: 1200 mm.
  - .7 Fire alarm bells: 2300 mm.
  - .8 Television outlets: 400 mm.
  - .9 Wall mounted speakers: 2300 mm.
  - .10 Clocks: 2300 mm.
  - .11 Doorbell pushbuttons: 1200 mm.

### **3.7 COORDINATION OF PROTECTIVE DEVICES**

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.
- .2 Ensure circuit protective devices such as overcurrent trips, relays and fuses match the required capacity values according to their labels.



### 3.8 FIELD QUALITY CONTROL

- .1 Load Balance:
  - .1 Measure phase current to panel boards 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 Provide upon completion of work, load balance report as directed in part 1 "ACTION AND INFORMATIONAL SUBMITTALS", phase and neutral currents on panel boards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
  - .1 Control of phases, 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.
  - .6 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.
- .3 Carry out tests in presence of Consultant.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 Manufacturer`s Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in part 1 "ACTION AND INFORMATIONAL SUBMITTALS".
  - .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.

### 3.9 PERFORMANCE

- .1 Electrical contractor to collaborate with other trades in such a way that the performance of equipment can be tested in required delays.



- .2 Once testing of equipment is complete, devices can be adjusted in such a way to obtain maximum efficiency.
- .3 General Requirements:
  - .1 All testing must be completed in the presence of the engineer and to their satisfaction.
  - .2 The engineer may require their own testing prior to accepting the results.
  - .3 For temporary testing, obtain written permission to perform the tests.
  - .4 A written warning giving a notice of 48 h to the engineer is required prior to testing.
  - .5 Provide the necessary devices, equipment, meters, materials, and personnel required for the execution of testing throughout the project until such a time as the engineer accepts the performance.
  - .6 If a piece of equipment or a device does not operate as per the manufacturer's guarantee or the results of a test do not yield the desired results, the faulty piece of equipment must be replaced without delay and payment shall be deferred until the new piece of equipment is installed and desired operating results are obtained.
  - .7 Prevent dust, dirt, and other foreign materials from penetrating the openings in installations and devices during the testing phase.
  - .8 Provide the engineer with a certificate or a manufacturer's letter confirming that the power supply to the device has been installed to their satisfaction.
  - .9 Provide written confirmation of the results obtained from testing.
  - .10 Testing trials must be completed and accepted prior to the installation of thermal insulation.
  - .11 Do not hide or recess any outlets, accessories, or devices until testing is complete and results have been accepted.
- .4 Special Requirements:
  - .1 The presence of the electrical contractor may be required for a test conducted by another trade.
- .5 Factory Testing:
  - .1 The owner and engineer reserve the right to examine equipment in use and to assist in the testing to ensure factory device requirements are met.
  - .2 Advise the engineer and owner at least one week in advance with the exact date and time that testing will occur.
  - .3 Provide two certified copies of testing reports to the engineer.

### **3.10 SYSTEM STARTUP**

- .1 Instruct operating personnel in 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 aspects of its care and operation.

### **3.11 CLEANING**

- .1 General Information:
  - .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .2 Do not accumulate waste which may present a danger.
  - .3 It is the responsibility of the contractor to ensure protection against dust and debris, taking into consideration that users will be present outside the execution of work.
- .2 Cleaning During Construction:
  - .1 At least once a day, remove scrap material and debris.
  - .2 At the end of the working session, clean the work zone and ensure that circulation paths are free of debris.
  - .3 The disposing of debris and scrap materials is the responsibility of the contractor.
  - .4 Cleaning shall be organized in such a way as to minimize the possibility of dust and debris entering building systems.
- .3 Final Cleaning:
  - .1 Conduct final cleaning to prepare the site for issuance of the certificate of project completion.
  - .2 Sweep all hard surfaces.
  - .3 Remove all accessible debris and any surplus materials from hidden spaces.
- .4 Take all necessary precautions in order to keep the interior of panels, boxes, and other equipment clean. Upon completion of work, ensure the interior of each system is in proper working order and clean.
- .5 Once work is completed, clean the inside of all installed equipment and re-apply primer or finish as required.

### **3.12 DEMOLITION**

- .1 Remove and transport off-site all demolished equipment including the following: conduits, boxes, outlets, switches, lighting devices, power distribution devices, auxiliary systems, safety/warning communications systems, and all accessories.
- .2 Remove wiring and conduits back to the panel, or to the last remaining box.
- .3 Seal all openings left in accordance with the requirements contained in article “FIREPROOFING”.
- .4 Repair any power circuits, control wiring or communications wiring that may have been damaged during demolition work.



**3.13 REMOVAL AND RE-INSTALLATION OF EXISTING EQUIPMENT**

- .1 Remove and install all electrical devices, conduits and required conductors to allow for the completion of architectural, mechanical, and structural work as outlined in the drawings and specifications. Consult the drawings and specifications of other disciplines as required.

**3.14 WORK IN AN EXISTING BUILDING**

- .1 Coordinate with the owner's representative, work that is to be completed following the delimitation of certain areas indicated on the plans and drawings. In general, the work must be executed in more than a section at a time per floor.
- .2 All work that requires the de-energizing of equipment or a partial service interruption should be undertaken during scheduled periods as established by the owner(s) and authorized through advanced written consent.
- .3 Any request for a shutdown must be sent to stakeholders at least one week in advance.
- .4 Any request for a shutdown on emergency network must be sent to stakeholders at least one month in advance.
- .5 Provide a schedule of work to be completed in coordination with the owner, staff, and other divisions to determine these stop periods.
- .6 Coordinate the receipt and handling of materials with the owner or a representative.
- .7 Noise and dust shall be kept to a minimum.
- .8 Comply at all times with the regulations and requirements of the owner regarding security measures and other rules.
- .9 All staff, including subcontractors, must wear a badge or identification card when on the premises.

**END OF SECTION**



## **Part 1           General**

### **1.1           REFERENCES**

- .1 CSA International:
  - .1 CAN/CSA-C22.2 18-F98(C2003), Outlet Boxes, Conduit Boxes and Fittings.
  - .2 CAN/CSA-C22.2 No.65-F03(C2008), Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC):
  - .1 EEMAC 1Y-2-1961, Bushing Stud Connectors and Aluminum Adapters (1 200 A Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA).

### **1.2           ACTION AND INFORMATION 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 wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.

### **1.3           CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual, E&E.

### **1.4           DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements 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 materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect wire and box connectors from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.



## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper, copper alloy, aluminum, aluminum alloy, sized to fit copper or aluminum conductors as required.
- .2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper or copper alloy sized to fit copper conductors 10 AWG or less.
- .3 Clamps or connectors for armoured cable, TECK cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2 No.18.

### **2.2 CONDUCTOR SEALS**

- .1 Un-welded connectors of size 8 AWG or less, use 3M Scotchlock or Peggy by Thomas & Betts.
- .2 Un-welded copper-to-copper connectors of size 6 AWG or larger, use series type H from Thomas & Betts.
- .3 Un-welded copper-to-neutral connectors of size 6 AWG or larger, use APS type from Thomas & Betts.
- .4 Un-welded neutral-to-neutral connectors of size 6 AWG or larger, use HPS type from Thomas & Betts.

### **2.3 CONNECTING BLOCKS**

- .1 All conductor seals in boxes and panels as part of the fire-alarm, low-voltage lighting, other low-voltage systems, etc. Will be made on terminal blocks with sufficient quantities for each conductor.
- .2 Terminal blocks will be Wieland brand, No. 9700B, 10 A, 300 V, complete with rail, end plates, identification, extremity of flanges and jumpers.

### **2.4 ACCEPTABLE MANUFACTURERS**

- .1 Joints:
  - .1 3M
  - .2 Burndy
  - .3 Thomas & Betts
- .2 Connecting Blocks:
  - .1 Staffel
  - .2 Weidmüller
  - .3 Wieland



### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connector installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Consultant.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

#### **3.2 INSTALLATION**

- .1 Remove insulation carefully from ends of conductors and cables:
  - .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
  - .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65.
  - .3 Install fixture type connectors and tighten to CAN/CSA-C22.2 No. 65. Replace insulating cap.

#### **3.3 SEALS**

- .1 Tape connectors, not with their own jacket, use at least two rows of 3M tape No. 88 semi-overlapping.
- .2 The di-electric characteristics of wrapped seals must not be inferior to those of the isolating conductors.
- .3 Seals and connectors which do not have a smooth surface should be wrapped with 3M Scotchfil prior to being taped.

#### **3.4 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**



## **Part 1        General**

### **1.1        RELATED REQUIREMENTS**

- .1 Unless indicated otherwise, circuits at 15 A, 120 V will be of size as indicated in annex II of this section.

### **1.2        PRODUCT DATA**

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

## **Part 2        Products**

### **2.1        BUILDING WIRES**

- .1 Conductors: stranded for 8 AWG and larger. Minimum size: 12 AWG.
- .2 Unless indicated otherwise, copper conductors size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, Non Jacketed.
- .3 Where AL is specified in the plan, for size 1 AWG (100 A and greater), aluminum conductors (ACM): conductors: size as indicated, with thermoplastic insulation type RW90 XLPE, rated at 600 V.
- .4 Conductors in low-voltage system (25 V or less), of size 18 AWG minimum, integrated into multi-conductor cables, with PVC insulation.
- .5 Conductors and cables must bear the manufacturer's label, insulation type, size and voltage rating at regular intervals on the outer conductor or cable with permanent markings.

### **2.2        TECK 90 CABLE**

- .1 Conductors:
  - .1 Grounding conductor: Unless stated otherwise copper, where AL is specified in the plan, aluminum alloy ACM.
  - .2 Circuit conductors: Unless stated otherwise copper, where AL is specified in the plan, stranded aluminum alloy ACM, size as indicated.
- .2 Insulation:
  - .1 Cross-linked polyethylene (RW90 XLPE).
  - .2 Voltage rating: 1000 V.
- .3 Tape: Mylar
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: flat, interlocking, galvanized steel.
- .6 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.



- .7 Fastenings:
  - .1 One hole, malleable iron, steel, aluminum, in humid areas, straps to secure surface cables 50 mm and smaller. Two holes steel straps for cables larger than 50 mm.
  - .2 Channel type U supports for two or more cables. Threaded rods: 6 mm diameter to support suspended channels.
- .8 Connectors:
  - .1 Watertight, approved for TECK cable.
- .9 Three-phase cable details:
  - .1 Class B stranded copper conductors.
  - .2 Class B stranded copper to ground.
  - .3 Filling with non-hygroscopic material.

## 2.3 ARMOURED CABLES

- .1 Conductors: insulated, unless otherwise indicated, copper RW-90, unless AL is specified in the plan, aluminum alloy ACM, size as indicated.
- .2 Armour: interlocking type fabricated from galvanized steel aluminum strip.
- .3 Connectors: anti short connectors.
- .4 Type AC90 (BX) for connection:
  - .1 Lightings recessed in suspended ceilings with a maximum length of 3 m.
  - .2 Sockets installed in existing plasterboard or suspended ceilings.
  - .3 Light switches installed in existing plasterboard.
  - .4 Hanging devices such as motorized dampers, valves, and other similar devices (approximate length of  $\pm 900$  mm between the ductwork and the suspended device).
- .5 Type ACWU90, PVC coated, fire retardant covering, and compliant to applicable Building Code classification for this project, for wet locations.

## 2.4 APPROVED MANUFACTURERS

- .1 Conductors:
  - .1 Alcan (General Cable)
  - .2 Nexans
  - .3 Phillips
  - .4 Pirelli
- .2 Teck Cables:
  - .1 Alcan (General Cable)
  - .2 Nexans
  - .3 Phillips



- .3 AC90 and ACWU90 cables:
  - .1 Alcan (General Cable)
  - .2 Nexans
  - .3 Phillips
  - .4 Pirelli

### **Part 3 Execution**

#### **3.1 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform tests using method appropriate to site conditions and to approval of Consultant and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.

#### **3.2 GENERAL CABLE INSTALLATION**

- .1 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors – 0-1 000 V.
- .2 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.
- .3 Conductor length for parallel feeders to be identical.
- .4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .5 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.
- .6 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.
- .7 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.
- .8 Supply and install drivers and cables required for connecting all equipment and electrical devices to make them fully operational even in the event that the conductors or cables are not explicitly shown on the plans.
- .9 Install conductors or cables in conduits or metal sheaths as indicated in this section.
- .10 Install a neutral conductor bypass circuit at 120 V.
- .11 Use only lubricants approved by the manufacturer for cable pulling.
- .12 Install cables and leads continuously without joints from their point of origin to the powered device. If necessary, create joints in approved boxes.



- .13 Support conductors in vertical conduit with Type M carriers, manufactured by OZ Products. Space them as follows:
  - .1 Conductors of size 1/0 and smaller: supports every 30 m.
  - .2 Conductors of size 2/0 to 4/0: supports every 25 m.
  - .3 Conductors of size 250 to 350 MCM: support every 20 m.
  - .4 Conductors of size 350 to 500 MCM: supports every 15 m.
  - .5 Conductors of size 600 to 700 MCM: supports every 12 m.
- .14 Support vertically mounted armored cables or type TECK such as AC90, ACU90, RP90, RC90, or TECK90 according to the requirements outlined in Table 21, Chapter V – Electrical Construction Code of Québec:
  - .1 Incorporate 90° bends in the vertical conduit at intervals not exceeding the distances outlined in Table 21, Chapter V – Electrical Construction Code of Québec.
    - .1 Use a cable specifically designed for vertical conduit.
- .17 Use Annex 1 to determine the maximum number of conductors/lines.

### **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.

### **3.4 INSTALLATION OF TECK90 CABLE (0 -1 000 V)**

- .1 Group cables wherever possible on U channels.
- .2 Install exposed or concealed cable securely supported by staples, straps, hangers.

### **3.5 INSTALLATION OF ARMoured CABLES**

- .1 Group cables wherever possible on U channels.
- .2 Secure cables directly to the frame at a distance of 300 mm from each side of the outputs and at 1500 mm maximum on all lines.
- .3 Cut the metal casing of the cables with a suitable tool and provide insulating sleeves at the ends.

### **3.6 INSTALLATION OF CONTROL CABLES**

- .1 Install control cables by direct burial in conduit.
- .2 Ground control cable shield

### **3.7 TESTING RESISTANCE IN INSULATION**

- .1 Measure the di-electric value of circuits, power cables, and equipment with a maximum voltage of 350 V and a 500 V megger.
- .2 Measure the di-electric value of circuits, power cables, and equipment with a maximum voltage of 350 V and 600 using a meg-ohmmeter of 1000 V.



- .3 In either case, ensure that the value of the resistance to ground, before power is applied, is not less than the requirement as set forth by the manufacturer.
- .4 Provide certification that all drivers have been checked and that any defective conductors have been replaced.



**ANNEX I**

<b>MAXIMUM NUMBER OF RW-90 CONDUCTORS PER CONDUIT</b>						
Conductor size AWG	Size of conduit in mm					
	16	21	27	35	41	53
12	4	10	16	30	40	66
10	4	6	12	20	30	50
8	---	3	6	10	16	26
6	---	---	3	8	9	18
4	---	---	---	3	6	12
3	---	---	---	3	6	12
2	---	---	---	---	6	9
1	---	---	---	---	4	6
1/0	---	---	---	---	---	6

**Note :**  
 For dimensions not listed, consult Chapter V of the Electrical Construction Codes of Québec.



## ANNEX II

<b>MAXIMUM LENGTH (IN METERS) OF BYPASS CIRCUIT AT 120 V VERSUS VOLTAGE DROP</b>			
Conductor size AWG	Rating in Amps (A)		
	15	20	30
12	20	15	---
10	30	25	15
8	50	40	25
6	90	65	40

Notes :

- For non-specified loads, refer to Chapter V – Electricity Construction Code of Québec (table no. D3).
- Distance calculated for copper conductors at a temperature of 60°C.

**END OF SECTION**



## **Part 1        General**

### **1.1            REFERENCES**

- .1        American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE):
  - .1        ANSI/IEEE 837-02, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

### **1.2            ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Submit in accordance with Section 26 05 00.

## **Part 2        Products**

### **2.1            EQUIPMENT**

- .1        Grounding conductors: bare stranded copper, tinned, soft annealed, size as indicated.
- .2        Insulated grounding conductors: green, copper conductors, size as indicated.
- .3        Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.

### **2.2            RECOMMENDED MANUFACTURERS**

- .1        Burndy Corp.
- .2        McGraw-Edison (Canada) Ltd.
- .3        Thomas & Betts

## **Part 3        Execution**

### **3.1            EXAMINATION**

- .1        Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for grounding equipment installation in accordance with manufacturer's written instructions.

### **3.2            INSTALLATION GENERAL**

- .1        Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories as outlined in Chapter V- Electrical Code of Construction of Québec.
- .2        Install connectors in accordance with manufacturer's instructions.
- .3        Protect exposed grounding conductors from mechanical injury.
- .4        Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5        Soldered joints not permitted.



- .6 For flexible conduits, provide a bonding wire connected at each end to a ground terminal.
- .7 Install a separate ground conductor for each conduit.
- .8 Ensure the grounding of all electrical equipment provided in another section, is fueled by that division.
- .9 Arrange the grounding conductors in radial form and route all connections directly to a single common point grounding. Avoid loop connections

### **3.3 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, distribution panels, cable trays.
- .2 Linking built engines or other devices transmitting vibrations with a separate conductor, green, to a grounding terminal in the junction box or connection placed between the rigid pipe and the flexible conduit connecting the device.

### **3.4 GROUNDING BUS**

- .1 Install copper grounding bus mounted on insulated supports on wall of electrical room and communication equipment room.
- .2 Ground items of electrical equipment in electrical room and IT equipment in communication equipment room to ground bus with individual bare stranded copper connections size 2/0AWG.

### **3.5 COMMUNICATION SYSTEMS**

- .1 Install grounding connections for telephone, sound, fire alarm, security systems, intercommunication systems as indicated.

### **3.6 GROUNDING ISOLATED COMPUTERS**

- .1 Install insulated grounding bars of the box in each distribution panel and secondary panel as indicated in the plans.
- .2 Ground the conductor, gauge as indicated, from the grounding bar of each branch circuit panel to the grounding bar of the main switchboard.
- .3 Install a grounded conductor, as indicated, from the main switchboard to the center tap of the common transformer and from there to the main water supply pipe. Ensure good electrical conductivity.
- .4 Ensure that the grounding resistance is a maximum of 5 ohms.

### **3.7 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform tests before energizing electrical system.
- .3 Disconnect ground fault indicator during tests.



**END OF SECTION**



**Part 1            General**

**1.1                NOT APPLICABLE**

- .1            Not applicable.

**Part 2            Products**

**2.1                SUPPORT CHANNELS**

- .1            U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted suspended set in poured concrete walls and ceilings.
- .2            Roof installation: Hot-dip galvanized steel or stainless steel or other rustproof material approved.

**2.2                ACCEPTABLE MANUFACTURERS**

- .1            Supports :
  - .1            Burndy
  - .2            Canstrut
  - .3            Hilti
  - .4            Pilgrim
  - .5            Unistrut

**Part 3            Execution**

**3.1                INSTALLATION**

- .1            Secure equipment to hollow or solid masonry, tile and plaster surfaces with lead anchors 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            Recessed mount lighting fixtures must be independently supported from the ceiling and fixed directly to the structure in order to stay horizontally at the same level. The contractor must provide an approved installation method by a member of OIQ. This document must be verified by the owner representative.
- .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 malleable iron or 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 (2”) in diameter.



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

**END OF SECTION**



## **Part 1        General**

### **1.1            REFERENCES**

- .1        Canadian Standards Association (CSA International):
  - .1        CSA C22.1-F06, Canadian Electrical Code, Part 1, 20th 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        Provide drawings stamped and signed by professional engineer registered or licensed in Province of Québec, Canada.

## **Part 2        Products**

### **2.1            SPLITTERS**

- .1        Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position, of calibre 14.
- .2        Terminations: main and branch lugs or connection blocks to match required size and number of incoming and outgoing conductors as indicated.
- .3        Spare Terminals: minimum three spare terminals or lugs on each connection or lug block sized less than 400 A.

### **2.2            JUNCTION AND PULL BOXES**

- .1        Construction: 16 gauges minimum steel, welded steel cans, painted with a coat of paint applied with an electrostatic process, dimensions as indicated.
- .2        Covers Flush Mounted: 25 mm minimum extension all around.
- .3        Covers Surface Mounted: screw-on flat, turned edge covers.
- .4        Without knockouts, factory made.
- .5        When apparent, TC type with frame, covered/concealed hinges, lock, no visible screws.
- .6        Boxes with large dimensions equipped with steel angle frame to form a rigid assembly, easily removable lids.



## **2.3 ACCEPTABLE MANUFACTURERS**

- .1 Junction and pull boxes:
  - .1 Bel Products
  - .2 Iberville
  - .3 Roger Girard
  - .4 Temco

## **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 INSTALLATION**

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.
- .3 Install all junction and pull boxes as indicated in the plans or where necessary.

### **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 REFERENCES**

- .1 Canadian Standards Association (CSA International):
  - .1 CSA C22.1-06, Canadian Electrical Code, Part 1, 20th Edition.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

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

**Part 2 Products**

**2.1 OUTLET AND CONDUIT BOXES GENERAL**

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required, steel, 14 gauge minimum, with thickness of 40 mm, and dimensions outlined in the Canadian Electrical Code.
- .3 Gang boxes where wiring devices are grouped in the same area.
- .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.
- .7 All boxes protruding less than 2.4 m from the ground will be of the FS type.

**2.2 GALVANIZED STEEL OUTLET BOXES**

- .1 One-piece electro-galvanized construction.
- .2 Single or 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 or tile walls.

**2.3 MOUNTING BOXES IN MASONRY OR GYPSUM BOARD**

- .1 Electro-galvanized sheet steel outlet boxes, single or and multi, gang, flush mounting into masonry walls, block or gypsum board.
- .2 Recessed box 101 mm x 101 mm, plaster to cover 12.5 mm or more.
- .3 Boxes in exterior walls with insulation and vapor barrier, Thomas & Betts No. BCR2000.



## **2.4 CONCRETE BOXES**

- .1 Electro-galvanized sheet steel outlet boxes of NBD type, for flush mounting, encased in concrete, with extension frames and frames plastering matched as required.
- .2 Box of projection type FS (one gang), if for a single conduit, or 101 mm x 101 mm, if more than one conduit.

## **2.5 CEILING BOXES**

- .1 Octagonal box projecting from 101 mm diameter, serial number 54151, to the required depth.
- .2 Sunken octagonal box of 101 mm diameter, serial number 54521, to the required depth.

## **2.6 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.

## **2.7 APPROVED MANUFACTURERS**

- .1 Outlet boxes:
  - .1 Temco
  - .2 Iberville
  - .3 Thomas & Betts

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges, 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, armoured cable connections. Do not install reducing washers.
- .5 The openings in the box must correspond to the dimensions of conduits, mineral insulated cables and armored cable. The use of reducers is not permitted.
- .6 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .7 Identify systems for outlet boxes as required.
- .8 Group in one box: switches, outlets, and other similar devices, placed side by side. If there are more than two devices, GSB boxes with GBC plaster rings must be used.



- .9 Outlet boxes shown as back-to-back on the plans must be placed a minimum of 300 mm apart.
- .10 In the gypsum walls, attach the boxes to metal studs, as shown in the plans.

**END OF SECTION**



## **Part 1 General**

### **1.1 REFERENCES**

- .1 Canadian Standards Association (CSA International):
  - .1 CAN/CSA C22.2 No. 18-F98(C2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
  - .2 CSA C22.2 No. 45-FM1981(C2003), Rigid Metal Conduit.
  - .3 CSA C22.2 No. 56-F04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
  - .4 CSA C22.2 No. 83-FM1985(C2003), Electrical Metallic Tubing.
  - .5 CAN/CSA C22.2 No. 227.3-F05, Non-metallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).

### **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.

## **Part 2 Products**

### **2.1 CONDUITS**

- .1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings, and expanded ends.
- .2 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal steel aluminum.
- .3 The size required by Chapter V - Electricity of the Quebec Construction Code (Code d'Électricité du Québec), unless otherwise indicated, is a minimum of 21 mm diameter.
- .4 Galvanized steel, rigid, thin-walled, unless otherwise indicated.
- .5 Aluminum, rigid, installed, projecting outside.
- .6 Galvanized steel, flexible type, for primary and secondary connection of dry transformers between the ductwork and the transformer (maximum length of  $\pm 2$  m).
- .7 Galvanized steel, flexible waterproof kind, between the ductwork and the unit's connections box ( $\pm 900$  mm in length) for connecting motors and kitchen appliances.
- .8 Connectors and conduit fittings, thin-walled steel, compression type.

### **2.2 CONDUIT FASTENINGS**

- .1 One hole, steel straps to secure surface conduits where the diameter is equal to 50 mm or less.



- .1 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 1.5 m on centre.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.

### **2.3 CONDUIT FITTINGS**

- .1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified.  
Coating: same as conduit.
- .2 Factory made "L" shape where 90 degrees bends are needed for conduits 25 mm and larger.
- .3 Watertight connectors and couplings for EMT.
  - .1 Set-screws are not acceptable.

### **2.4 FISH CORD**

- .1 Polypropylene.

### **2.5 ACCEPTABLE MANUFACTURERS**

- .1 EMT ducts:
  - .1 Columbia International Ltd.
  - .2 Siezfried Kreser Industries Ltd.
- .2 Flexible Conduit:
  - .1 Nexans
  - .2 Columbia International Ltd.

## **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 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 in unfinished areas.
- .3 Use flexible metal conduit for connection to motors in dry areas connection to recessed incandescent fixtures without prewired outlet box connection to surface or recessed fluorescent fixtures work in movable metal partitions.



- .4 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .5 Use epoxy coated conduit underground or in corrosive areas.
- .6 Minimum conduit size for lighting and power circuits: 21 mm.
- .7 Bend cold conduit: Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .8 Mechanically bend steel conduit over 21 mm diameter.
- .9 Run 2- 27 mm spare conduits from ceiling space down to 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 surface type box.
- .10 Remove and replace blocked conduit sections do not use liquids to clean out conduits.
- .11 Dry conduits out before installing wire.
- .12 Unless otherwise indicated, all conduits are to be concealed in walls, floors, ceilings and suspended ceilings.
- .13 Install protruding conduits in parallel with structural lines and so as not to harm the equipment of other trades.
- .14 No drilling is to be done through the beams for the passage of conduits.
- .15 Maintaining the continuity of the grounding throughout the facility, taking care to make solid connections between the conduits and equipment. A green grounding wire must be added to each conduit.
- .16 The inner radius of curvature of the conduits is at least six times the internal diameter of the pipe. When a group of ducts run side by side, the bending radii are concentric.
- .17 During construction, equip conduits with plugs to prevent foreign bodies from entering.
- .18 Leave a nylon cord at least 3 mm in diameter in each empty conduit where the installation of cables is part of another section.
- .19 Conduit raceways between two outlets, pull boxes or sliding sleeves must not have more than three 90 ° elbows or equivalent or be more than 60 m in length, except the external telephone network, where indicated in the plans.
- .20 Attach conduits as follows:
  - .1 Supply and install all the necessary supports for electrical work. Use galvanized steel.
  - .2 Conduits:
    - .1 When the insulated conduits are in contact with a surface of concrete or masonry, affix them using cast iron or steel straps.
    - .2 Where a group of conduits (four or more) are installed in parallel, affix them to the steel supports by anchoring them directly to the frame or by means of threaded rods or other supports.
    - .3 The size of the rods, supports, and spacing of supports are based on weight as required by the code. When conduits of various sizes are



grouped, the spacing of the supports is determined by the smallest conduit of the group.

- .3 Install cross braces spaced up to 12 m center-to-center and longitudinal braces on all horizontal runs of suspended conduits to 300 mm of the ceiling tile. This requirement may be omitted if the maximum diameter is less than 65 mm for a conduit or if conduits of an individual group has a total weight less than 15 lb/m.
- .21 Support conduits suspended using galvanized brackets, as described elsewhere in this book.
- .22 The spacing of supports and fasteners must be in accordance with the latest edition of the Electrical Code of Québec.
- .23 Support vertical conduits at floor level and use intermediate supports required by the code.
- .24 In suspended ceilings, support the metal sheath cables to the frame and not the ceiling structure.
- .25 The conduits should not touch the conduit insulation, mechanical equipment, or be buried in the insulation or fireproofing materials.
- .26 When a recessed panel is located in a room with a suspended ceiling, install three empty conduits of 21 mm diameter between the panel and the interior of the suspended ceiling and three upper pipes 21 mm between the panel and the suspended ceiling of the lower stage. These conduits must be easily accessible for future work/maintenance.

### **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 surface 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.

### **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.
- .4 No conduit is to be installed in concrete slabs.

### **3.5 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - 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            ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Product Data:
  - .1    Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
- .2    Shop Drawings:
  - .1    Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
  - .2    Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Québec, Canada.
- .3    Closeout Submittals:
  - .1    Submit maintenance data in accordance with Section 01 78 00 - Closeout Submittals.
- .4    Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
  - .1    Test reports:
    - .1    Submit certified test reports indicating compliance with specifications for specified performance characteristics and physical properties.
  - .2    Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .3    Manufacturer's Instructions: submit manufacturer's installation instructions.
  - .4    Manufacturer's Field Reports: manufacturer's field reports specified.

### **1.2            QUALITY ASSURANCE**

- .1    Health and Safety:
  - .1    Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

### **1.3            DELIVERY, STORAGE, AND HANDLING**

- .1    Packing, shipping, handling and unloading:
  - .1    Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
  - .2    Deliver, store and handle materials in accordance with manufacturer's written instructions.



## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Control system: by one manufacturer and assembled from compatible components. The system and the components already are of the manufacturer PDM Douglas. The company responsible for modifications and for the maintenance of the system is: electric Products ST - LAURENT'S PDM LTÉE, Quebec.

### **2.2 REMOTE CONTROL SWITCHES**

- .1 Single pole, double throw, momentary contact, heavy duty, rated 3 A, 25 V, double push-button action with pilot lights.
- .2 Such as model WR-8501 de PDM Douglas

### **2.3 LOW VOLTAGE RELAYS**

- .1 Electrically operated by momentary impulse, mechanically latched until activated.
- .2 Two coil solenoid type with one coil to close relay contacts and one coil to open relay contacts.
- .3 Operating voltage: 24 V, A.C.
- .4 Load contacts: 20 A, 347V, A.C.
- .5 Auxiliary contacts for pilot light.
- .6 Coloured pre-stripped leads.
- .7 Such as model WR-6161 de PDM Douglas.

### **2.4 CONTROL TRANSFORMER**

- .1 Low voltage power Class 2, input 347 V, A.C., 60 Hz, output 40 VA at 24 V.

## **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 Locate and install equipment in accordance with manufacturer's recommendations and as indicated.

### **3.3 FIELD QUALITY CONTROL**

- .1 Site Tests:
  - .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.



- .2 Actuate control units in presence of Departmental Representative to demonstrate lighting circuits are controlled as designated.
- .3 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in part 1 "SUBMITTALS".
  - .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.
  - .3 Schedule site visits, to review Work, as directed in part 1 "QUALITY ASSURANCE".

**END OF SECTION**



## **Part 1      General**

### **1.1          REFERENCES**

- .1      CSA International:
  - .1      CAN/CSA-C22.2 No.47-FM90 (C2007), Air-Cooled Transformers (Dry Type).
  - .2      CSA C9-02 (R2007), Dry-Type Transformers.
  - .3      CAN/CSA-C802.2-06, Minimum Efficiency Values for Dry Type Transformers.
- .2      National Electrical Manufacturers Association (NEMA)

## **Part 2      Products**

### **2.1          MODEL FOR NON-LINEAR LOADS**

- .1      Dry type transformers, copper windings, CSA approved C22.2 our 47, C9 and C802-2.
- .2      Transformers for nonlinear loads are indicated on the plans by the suffix K13, following the rated power of the transformer (example: 75 kVA - K13), according to the requirements.
- .3      Three-phase dry transformers for nonlinear loads will possess the following characteristics:
  - .1      Type: ANN
  - .2      Class H insulation (220) with a winding temperature rise not exceeding 150° C.
  - .3      Dielectric insulation can withstand a voltage of 1.2 kV.
  - .4      Withstand impulse voltage: 10 kV.
  - .5      Equipped with four outlets of 2.5%, where two are FCAN and two are FCBN.
  - .6      Ventilated housing, NEMA - 3R (proof sprinkler) with lifting eyes and removable metal panel on the front and sides.
  - .7      Terminal primary and secondary voltages identified permanently with banded, solderless connectors.
  - .8      Impedance varying from 3 to 5 %.
  - .9      Acceptable sound level according to CSA:
    - .1      45 dB at 15 to 50 kVA.
    - .2      50 dB at 51 to 150 kVA.
    - .3      55 dB at 151 to 300 kVA.
    - .4      60 dB at 301 to 500 kVA.
  - .10     Neutral terminal (X0) calibrated at twice the nominal current, secondary phase for connecting two parallel neutral conductors.
  - .11     Paint finish: gray baked enamel ASA No. 61.
  - .12     Transformer must connect the housing and neutral (X0) of the transformer to the ground bar. Y install four terminals for cables, each capacity of 1.25 times the rated current to the secondary.



- .4 Transformer is provided with a primary winding connected in a triangle in order to capture the triple current harmonic (3, 9, 15, 21, 27, 33, 39, 49) generated by the load so that these are not transmitted to the main power supply.
- .5 The design of the transformer should enable it to withstand the effects of non-linear loads.
- .6 The transformer is fitted with a coil connected to the secondary star.
- .7 The transformer must withstand, without overheating, and without loss of life expectancy under maximum operating conditions.
  - .1 100% of the rated load in kVA.
  - .2 Crest factor: 3.0.
- .8 K Factor: 13. The K-factor of the transformer is determined by the specifications of the AS/IEEE C57.110 and its revisions.
- .9 Electrostatic screens between the windings allow noise mitigation transmitted "shared" mode (line - ground and neutral - ground) and noise in "normal" mode (line to line and line -to-neutral) at the transformer secondary. The electrostatic screens must be connected to the grounding bar and the transformer must allow the following mitigations:
  - .1 Common noise mode: -60 dB approximately.
  - .2 `Normal` noise mode: -20 dB per decade approximately.
- .10 Acceptable Manufacturers:
  - .1 Delta Transformers, division VA Protection Tech.
  - .2 Hammond Transformers.
  - .3 Square D. Transformers.
  - .4 P.D.I. Transformers, distributed by Stanex.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for dry type transformers installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect surfaces/materials in the presence of the Consultant.
  - .2 Immediately inform the Consultant of unacceptable conditions.
  - .3 Proceed with installation only after correcting the unacceptable conditions and with written approval of the Consultant.

### **3.2 INSTALLATION**

- .1 Mount dry type transformers up to 75 kVA, as indicated.
- .2 Mount dry type transformers above 75 kVA on floor.
- .3 Ensure adequate clearance around transformer for ventilation.



- .4 Install transformers in level upright position.
- .5 Remove shipping supports only after transformer is installed and just before putting into service.
- .6 Loosen isolation pad bolts until no compression is visible.
- .7 Make primary and secondary connections in accordance with wiring diagram.
- .8 Energize transformers after installation is complete.
- .9 Make conduit entry into bottom 1/3 of transformer enclosure.
- .10 Install transformers following the details shown in the drawings.
- .11 All transformers must be isolated from the building structure by shear neoprene insulators selected for deflection under load of 12.7 mm (½"). The seismic isolators will be of the brand Mason Industries Inc., Type BR, or equivalent Vibro Acoustics or Vibron International. The electrical contractor must ensure that these isolators meet all seismic regulations.

### **3.3 COMMISSIONING**

- .1 Parameters to be controlled:
  - .1 Appropriate contact between mobile components (screws, nuts, bolts, etc.)
- .2 Method of testing:
  - .1 Live components thermography.
- .3 Compliance of the parameters:
  - .1 No hot spot indicating a bad contact.
- .4 Include all results in a report indicating the methodology and conclusions.

**END OF SECTION**



**Part 1 General**

**1.1 REFERENCES**

- .1 CSA International:
  - .1 CSA C22.2 No.29-11, Panelboards and Enclosed Panelboards.

**Part 2 Products**

**2.1 PANELBOARDS**

- .1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.
  - .1 Install circuit breakers in panelboards before shipment.
- .2 250 to 600 V panelboards: bus and breakers rated for 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 Two keys for each panelboard and panelboards lock alike.
- .5 Aluminum bus with neutral of same ampere rating of phases. Aluminium bus with double neutral when indicated.
- .6 Mains: suitable for bolt-on breakers.
- .7 Trim with concealed front bolts and hinges.
- .8 Trim and door finish: baked enamel.
- .9 Isolated ground bus.
- .10 Include grounding busbar with 3 of terminals for bonding conductor equal to breaker capacity of the panel board.
- .11 Steel Case paints grey, of calibre 12 minimum, concerns hinges hidden with lock for access from circuit breakers and outside door integrated (joined) on hinges with lock for access into the zone of the spaces of cabling.
  - .1 Types of panels:
    - .1 Lighting in 120/208 V: PRL1
    - .2 The models are of the company Cutler-Hammer. The equivalents of Group Schneider, Siemens, General Electric are accepted
  - .2 The panels should have either nominal short-circuit holding or the nominal value of integrated protection of the equipment with the upstream protective device as shown in the panel paperwork. The panel's face value protection equipment must meet CSA C22.2 testing requirements No. 29 and must be labeled to show the face value of integrated protection, voltage, and enabled devices downstream.
  - .3 All panels installed in mechanical or electrical room must be sprinkler proof



## **2.2 BREAKERS**

- .1 Breakers: to Section 26 28 16.02 - Moulded Case Circuit Breakers.
- .2 Breakers with thermal and magnetic tripping in panel boards except as indicated otherwise.
- .3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .4 Lock-on devices for receptacles, fire alarm clock outlet, emergency, door supervisory, intercom, stairway, exit and night light circuits.

## **2.3 EQUIPMENT IDENTIFICATION**

- .1 Complete circuit directory with typewritten legend showing location and load of each circuit, mounted in plastic envelope at inside of panel door.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for panelboards installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Consultant.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

### **3.2 INSTALLATION**

- .1 Locate panel boards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Install surface mounted panel boards on plywood backboards - Rough Carpentry. Where practical, group panel boards on common backboard.
- .3 Mount panelboards to height as indicated.
- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus with respective neutral identified.
- .6 Supply 3 conduits empty of 27 mm from every panel embeded in walls and end conduits in a box of drawing in the ceiling.
- .7 Measure the currents of load in tension stabilized on each of the food systems of panels and reorganize circuits into the trap to balance loads on the phases with a maximal gap from 20 % between each. Maintain a putting in adequate phase on the circuits of diversions multiphase. Submit the report of loads to the Consultant for approval and make the correctives if you need.



- .8 Verify that the screwed connections and the connections of circuit breakers are squeezed well by means of a torque spanner or of a dynamometric screwdriver according to the specifications of the manufacturer

**END OF SECTION**



## **Part 1            General**

### **1.1                REFERENCES**

- .1    CSA International:
  - .1    CSA C22.2 No.42-10, General Use Receptacles, Attachment Plugs and Similar Devices.
  - .2    CAN/CSA C22.2 No.42.1-F00 (C2009), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
  - .3    CSA C22.2 No.55-FM1986 (C2008), Special Use Switches.
  - .4    CSA C22.2 No.111-10, General-Use Snap Switches (Bi-national standard, with UL 20).

### **1.2                COLOUR CODE**

- .1    Assigning a color code to the sockets and switches:
  - .1    Normal network of 120 V, 15 A:        white
  - .2    Emergency network of 120 V, 15 A:    red
  - .3    Outlets with isolated ground:         orange
  - .4    Cleaning outlets:                        white

### **1.3                IDENTIFICATION**

- .1    Identify all electrical outlets with an adhesive tape of "P -Touch" type made by Brothers and marked with the following: circuit, number, panel, identification.

## **Part 2            Product**

### **2.1                RECEPTACLES**

- .1    Duplex receptacles, 5-15 CSA Type R, 125 V, 15 A, grounded U socket to conform to CSA C22.2 No. 42, with the following characteristics:
  - .1    Lateral or rear connection of wire size 10 AWG.
  - .2    Severing links for conversion in divided doses.
  - .3    Eight (8) rear connection ports, four (4) screw terminals for side connections.
  - .4    Triple sliding contacts and riveted grounding contact.
- .2    Normal receptacles, type CSA 5-15 R, 125 V, 15 A, dimpled grounded U, with the following characteristics:
  - .1    Lateral or rear connection of wire size 10 AWG.
  - .2    Four (4) rear connection ports, two (2) screw terminals for side connections.
- .3    Other voltage outlets and permissible intensity as indicated.
- .4    For the entire installation, use only components from a single manufacturer.



- .5 All outlets and switches grouped together must be of the same model and covered with a single plaque.
- .6 For quality " Specifications Grade", equipped with a ground, such that:

Description	Standard	Decora
Normal receptacles :		
- 15 A, 120 V :	5261	16241
- 20 A, 120 V :	5361	16341
- 15 A, 208 V, 1 PH, 3 F :	5661	16641
- 20 A, 208 V, 1 PH, 3 F :	5461	16441
- 30 A, 120/208 V, 1 PH, 3 F :	2710 (3)	---
- 50 A, 120/208 V, 3 PH, 4 F :	CS-6369	---
- 30 A, 120 V, 1 PH :	5371	---
Duplex receptacles :		
- 15 A, 120 V (commercial quality) :	5262	16252
- 20 A, 120 V (commercial quality) :	5362	16352
- 15 A, 208 V, 1 PH, 3 F :	5662	16662
- 20 A, 208 V, 1 PH, 3 F :	5462	16462
Cleaning receptacles :		
- 20 A, 120 V (5-20R) :	5362	16352
Dry outlets :		
- 30 A, 120/208 V, 1 PH, 3 F :	278	---
Kitchen receptacles :		
- 50 A, 120/208 V, 1 PH, 3 F :	279/004	---
Ground detection receptacles :		
- 15 A, 120 V :	---	7599
Clock receptacles :		
- 15 A, 120 V :	688/001	---
Exterior receptacles :		
- 15 A, 120 V :	5262 et plaque 4970	---
The numbers are from Leviton Company unless otherwise indicated.		

## 2.2 SPECIAL WIRING DEVICES

- .1 Special Wiring Devices:
- .1 Clock hanger outlets, 15 A, 125 V, 3 wire, grounding type, suitable for No. 10 AWG for installation in flush outlet box.

## 2.3 COVER PLATES

- .1 Equip all wiring devices with a cover plate such that it complies with CSA Standard C22.2 No. 42.1.



- .2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .3 Stainless steel cover plates, vertically brushed, 1 mm thick for wiring devices mounted in recessed flush-mounted outlet boxes.
- .4 Lid plates: sheet metal for wiring devices mounted in boxes for conduit type FS or FD type conduit boxes.
- .5 Lids - molded plates, aluminum, weatherproof, two (2) spring-loaded doors with seals for double sockets, as indicated.
- .6 Lids - molded plates, aluminum, spring-loaded, weather -proof, with gaskets for single outlets or switches, as indicated.
- .7 In general, stainless steel.
- .8 In mechanical rooms, local electricity, telephone, storage, and concierge, galvanized steel.
- .9 In the washrooms, chromed brass, 0.75 mm thick.
- .10 Plates on FS boxes are made of steel with rounded corners.
- .11 Outdoors or in very humid conditions, cast aluminum, two spring covers, gasket, fastening with four brass screws.

## **2.4 SOURCE QUALITY CONTROL**

- .1 Cover plates from one manufacturer throughout project.

## **2.5 LIST OF MANUFACTURERS**

- .1 Electrical outlets, switches, and low voltage lighting controls:
  - .1 Receptacles:
    - .1 Cooper (Arrow-Hart)
    - .2 Hubbell
    - .3 Leviton
    - .4 Pass & Seymour
  - .2 Switches and receptacles plates:
    - .1 Cooper (Arrow-Hart)
    - .2 Hubbell
    - .3 Leviton
    - .4 Pass & Seymour
    - .5 Temco

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wiring devices installation in accordance with manufacturer's written instructions.



- .1 Visually inspect substrate in presence of the Consultant.
- .1 Inform the Consultant of unacceptable conditions immediately upon discovery.
- .2 Proceed with installation only after unacceptable conditions have been remedied, and after receipt of written approval to proceed from the Consultant.

### **3.2 INSTALLATION**

- .1 Switches:
  - .1 Install switches in gang type outlet box when more than one switch is required in one location.
- .2 Dimmer:
  - .1 Ensure compatibility between the dimmer for fluorescent lamps with the ballast of fluorescent fixtures before installation.
  - .2 Ensure compatibility between the dimmer for LED lamps with the light controller before installation.
- .3 Receptacles:
  - .1 Install receptacles in gang-type outlet box when more than one receptacle is required in one location.
  - .2 Mount receptacles at height as indicated.
  - .3 Where split receptacles has one portion switched, mount vertically and switch in upper position.
  - .4 Install GFI type receptacles as indicated.
- .4 Cover plates:
  - .1 Install suitable common cover plates where wiring devices are grouped.
  - .2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

**END OF SECTION**



**Part 1 General**

**1.1 REFERENCES**

- .1 HRC fuse type, comply with CSA C22.2 No. 106-05 standard (R2010), high breaking capacity fuse (HRC).
- .2 Low Voltage Fuses conform to CSA C22.2, No. 248.6 - series F00 (C2010), Low-Voltage Fuses.

**1.2 EXTRA MATERIALS**

- .1 Six (6) spare fuses of each type and size installed up to and including 600 A.

**Part 2 Products**

**2.1 FUSES - GENERAL**

- .1 Fuse type references J have been adopted for use in this specification.
- .2 Fuses: product of one manufacturer.

**2.2 FUSE TYPES**

- .1 Class J fuses.
  - .1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
  - .2 Type J2, fast acting.
- .2 With high breaking capacity type, Class J, size I, timed action 0-600 A and class L, I format, for larger current than 600 A.
  - .1 AJT Type by Ferraz-Shawmut: 0-600 A
  - .2 In HSJ Type by Ferraz-Shawmut (ultrafast): protection of semiconductor type starters (SCR) and the drive units with variable speed.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install fuses in mounting devices immediately before energizing circuit.
- .2 Ensure correct fuses fitted to assigned electrical circuit.
- .3 Ensure correct fuses fitted to physically match mounting devices.

**END OF SECTION**



## **Part 1 General**

### **1.1 REFERENCES**

- .1 CSA International:
  - .1 CSA C22.2 No. 5-09, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2010).

## **Part 2 Products**

### **2.1 BREAKERS GENERAL**

- .1 Molded-case circuit breakers to standard CSA C22.2 No. 5
- .2 Bolt-on molded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .3 Common-trip breakers: with single handle for multi-pole applications.
- .4 Circuit breakers to have interrupting capacity rating as indicated.

### **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 Minimum short-circuit interrupting capacity:
  - .1 120/208 V: 10 kA or as per the instructions in the electrical panel
  - .2 347 V: 14 kA or as per the instructions in the electrical panel.
  - .3 600 V: 14 kA or as per the instructions in the electrical panel.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of the Consultant.
  - .2 Inform the Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from the Consultant.

### **3.2 INSTALLATION**

- .1 Install circuit breakers as indicated.



- .2 Provide hardware fittings when required.
- .3 Include a proof of purchase of all circuit breakers after the approval of shop drawings.

**END OF SECTION**



## **Part 1        General**

### **1.1            REFERENCES**

- .1    CSA International:
  - .1        CAN/CSA C22.2 No.144-M91 (C2006) - Ground Fault Circuit Interrupters.
- .2    National Electrical Manufacturers Association (NEMA):
  - .1        NEMA PG 2.2-1999 (C2009) - Application Guide for Ground Fault Protection Devices for Equipment.

## **Part 2        Products**

### **2.1            MATERIALS**

- .1    Equipment and components for ground fault circuit interrupters : to CAN/CSA C22.2 No.144 and 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, two pole ground fault circuit interrupter for 1 phase circuit c/w test and reset facilities.

### **2.3            GROUND FAULT PROTECTOR UNIT**

- .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        CSA Enclosure type 1, surface, flush mounted with stainless steel painted face plate.

## **Part 3        Execution**

### **3.1            EXAMINATION**

- .1    Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for ground fault circuit interrupters installation in accordance with manufacturer's written instructions.
  - .1        Visually inspect substrate in presence of the Consultant.
  - .2        Inform the Consultant of unacceptable conditions immediately upon discovery.
  - .3        Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from the Consultant.



### **3.2           INSTALLATION**

- .1     Do not ground neutral on load side of ground fault relay.
- .2     Pass phase conductors, including the neutral, through zero sequence transformers.
- .3     Connect supply and load wiring to equipment in accordance with manufacturer's recommendations.

**END OF SECTION**



## **Part 1           General**

### **1.1             REFERENCES**

- .1    CSA Group:
  - .1     CAN/CSA-C22.2 No.4-F04 (C2009), Enclosed and Dead-Front Switches (Tri-National Standard, with ANCE NMX-J-162-2004 and UL 98).
  - .2     CSA C22.2 No.39-F13, Fuse holder Assemblies.

## **Part 2           Products**

### **2.1             DISCONNECT SWITCHES**

- .1    Mechanically interlocked door to prevent opening when handle in ON position.
- .2    Fuse-holders: to CSA C22.2 No.39, relocatable and suitable without adaptors, for type and size of fuse indicated.
- .3    Quick-make, quick-break action.
- .4    ON-OFF switch position indication on switch enclosure cover.
- .5    Intensive use type, to sudden opening and closing, with or without fuses, as indicated, locked door in the closed position with the possibility of cancellation by qualified personnel, possible lockout by three (3) padlocks, portfolio fuses class J fuses, solid neutral, NEMA -1 housing inside, NEMA -3R and technical rooms sprinklered and NEMA -4X outdoors, model H series Cutler Hammer or equivalent by Siemens.

## **Part 3           Execution**

### **3.1             EXAMINATION**

- .1    Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for disconnect switches - fused and non-fused installation in accordance with manufacturer's written instructions.
  - .1     Visually inspect substrate in presence of the Consultant.
  - .2     Inform the Consultant of unacceptable conditions immediately upon discovery.
  - .3     Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from the Consultant.

### **3.2             INSTALLATION**

- .1    Install disconnect switches complete with fuses if applicable.
- .2    Ensure the required 1 m clearance in front of disconnects.

**END OF SECTION**



**Part 1 General**

**1.1 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Provide complete photometric data (IES file) prepared by independent testing laboratory for luminaires where specified, for review by Consultant.

**1.2 ENVIRONMENTAL REGULATIONS**

- .1 Remove and recycle fluorescent lamps in accordance with local regulations.
- .2 Dispose of old ballasts containing PCBs.
- .3 Deal with the free program RecycFluo ([www.recycfluo.ca](http://www.recycfluo.ca)) for the recovery of all fluorescent tubes contained in existing fixtures to relocate and to remove. Provide to the Departmental Representative a document issued by RecycFluo certifying the amount of recovered tubes.

**Part 2 Products**

**2.1 LAMPS**

- .1 Unless otherwise indicated, of 3500K color, 32 W, T-8, 2950 lumens, CRI: 0.85 minimum, low mercury content, lumen maintenance of 95%, consistent with their ballasts, pre-burned for installation dimmers.
- .2 Based on usage of twelve hours per day, with an instant start ballast 40000 hours.
- .3 Based on usage of twelve hours per day, with a programmed start ballast: 46 000 hours.
- .4 Type FL32:
  - .1 Bulb shape T-8, 4'
  - .2 Base: bi-pin medium
  - .3 Power: 32 W
  - .4 Light output: 2 950 lumens
  - .5 Life: 36 000 h
  - .6 Colour temperature: 3500K
  - .7 Colour rendering index: 85
  - .8 Model: Philips no. F32T8 TL835 XLL ALTO



- .5 Type FL25:
  - .1 Bulb shape: T-8, 3'
  - .2 Base: bi-pin medium
  - .3 Power: 25 W
  - .4 Light output: 2 150 lumens
  - .5 Life: 36 000 h
  - .6 Colour temperature: 3500K
  - .7 Colour rendering index: 85
  - .8 Model: Philips no. F32T8 TL835 XLL ALTO
- .6 Type FL28:
  - .1 Bulb shape: T-5, 4'
  - .2 Base: bi-pin miniature
  - .3 Power: 28 W
  - .4 Light output: 2`900 lumens
  - .5 Life: 25 000
  - .6 Colour temperature: 3500K
  - .7 Colour rendering index: 85
  - .8 Model: Philips no. F28T5/835/ALTO
- .7 Type FL54:
  - .1 Bulb shape: T-5, HO, 4'
  - .2 Base: bi-pin miniature
  - .3 Power: 54 W
  - .4 Light output: 5 000 lumens
  - .5 Life: 25 000 h
  - .6 Colour temperature: 3500K
  - .7 Colour rendering index: 85
  - .8 Model: Philips no. F54T5 TL835 HO ALTO

## 2.2 BALLASTS

- .1 Electronic ballast having the following features:
  - .1 Start programmed.
  - .2 Input voltage as indicated in the plans.
  - .3 Noise Class A minimum.
  - .4 Minimum power factor of 98%.
  - .5 Operating frequency greater than 42,000 Hz.
  - .6 Crest factor less than 1.7.
  - .7 Total harmonic distortion less than 10%.



- .8 Meets the following standards:
  - .1 CSA - C108.6 -M91 "Limits and methods of measurements of electromagnetic disturbance characteristics of industrial scientific and medical (IDM) radio frequency equipment".
  - .2 Withstand transients according to IEEE C No. 62.41-1991.
  - .3 Requirements of the Federal Communications Commission Rules and Regulations (FCC / CFR 47, Part 18, Class C).
- .9 Variation of the supply voltage to an "output" constant illumination of  $\pm 15\%$ .
- .10 Operate lamps specified within the limits set by the manufacturer of the lamps.
- .2 Must be compatible with the dimmer when the lighting apparatus is controlled by this device.

### 2.3 LIGHTING FLUORESCENTS

- .1 Built to prevent light leakage from the frame or construction joints.
- .2 Metal parts cleaned, processed, phosphate painted with baked enamel.
- .3 Joints welded and grinded construction, hidden hinges and latches.
- .4 Ballasts held in place by nuts.
- .5 Each luminaire fluorescent lamp installed in a branch circuit, where the voltage exceeds 150 V to ground, must:
  - .1 Featuring an isolating device installed in the luminaire section which simultaneously cuts all phase conductors between the conductors of the bypass and the ballast supply leads.
  - .2 With conspicuous markings, legible and permanent, adjacent to the cutting device, identifying the intended use.
- .6 Acrylic diffusers, 100% pure, 2.4 mm thick maximum width of 30 cm and width greater than 3.2 mm.
- .7 Threaded suspension rods at the ends (fitted with ball joints), the same color as the unit for all suspended devices.

### 2.4 FINISHES

- .1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

### 2.5 OPTICAL CONTROL DEVICES

- .1 As indicated in luminaire schedule.

### 2.6 LUMINAIRES

- .1 As indicated in luminaire schedule.



## 2.7 LIST OF MANUFACTURERS

- .1 Lamps:
  - .1 General Electric of Canada
  - .2 Osram/Sylvania
  - .3 Philips
- .2 Fluorescent lights (T- 8):
  - .1 Focal Point
  - .2 Acuity Brands Group
  - .3 Cooper Lighting Group
  - .4 Philips Group
- .3 Interior LED luminaires:
  - .1 Acuity Brands Group
  - .2 Cooper Lighting Group
  - .3 Philips Group
  - .4 Lumenpulse
  - .5 Lumenwerx
- .4 Ballasts:
  - .1 Advance
  - .2 Osram/Sylvania
  - .3 Lutron

## Part 3 Execution

### 3.1 INSTALLATION

- .1 Locate and install luminaires as indicated.
- .2 Provide adequate support to suit ceiling system.
- .3 Coordinate on site the exact position of all luminaires installed in mechanical rooms or in ventilation units after the mechanical equipment has been installed.
- .4 Perform the lighting installation work only after more dirty work has been completed.
- .5 Do not use lamps and lenses until having obtained the consent of the engineer. The lamps must not at any time be used as temporary lighting in the building.
- .6 Clean all light fixtures, lamps and lenses immediately prior to acceptance of work.
- .7 Install joints between luminaires installed in continuous rows.
- .8 In some places, some light fixtures are installed in ventilation ducts.
- .9 Provide and install all materials (brackets, plaster frames, supports, etc.) required for the complete installation of lighting.
- .10 Unless otherwise indicated, install an isolating device in all existing fluorescent fixtures powered to 347 V.



- .11 Fasten directly to the structure using minimum 12 gauge steel wires for all light fixtures.
- .12 Replace all existing reused lighting fixtures lamps.

### **3.2 LUMINAIRE SUPPORTS**

- .1 Recessed mount lighting fixtures must be independently supported from the ceiling and fixed directly to the structure in order to stay horizontally at the same level. The contractor must provide an approved installation method by a member of OIQ. This document must be verified by the owner representative.
- .2 Attach suspended luminaires through suspension rods provided with a ball joint. Determining the exact length of stems and approval by the engineer before installation. Add galvanized brackets fixed to the frame when lights should be hung in the ventilation ducts.

### **3.3 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            REFERENCES**

- .1        Canadian Standards Association (CSA International)
  - .1        CSA C22.2 No.141, Unit Equipment for Emergency Lighting.
  - .2        CSA C860, Performance of Internally-Lighted Exit Signs.
- .2        National Fire Protection Association (NFPA)
  - .1        NFPA 101, Life Safety Code.

## **Part 2        Products**

### **2.1            STANDARD UNITS**

- .1        Exit lights: to CSA C22.2 No.141 and CSA C860.
- .2        Housing: extruded aluminum piece covered with white enamel finish
- .3        Face and back plates: extruded white aluminum.
- .4        Lamps: LED, operating at 347 V, with 25 years of life.
- .5        Letters: 150 mm high x 19 mm, with 13 mm thick stroke, red on white glass, reading EXIT and SORTIE.
- .6        Wall mounted, overhang or ceiling mounted according to the indications.
- .7        Simple or double face according to the indications.
- .8        Right or left arrow according to the indications.
- .9        Face plate to remain integral to the housing when relamping.

## **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 to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.
- .2        Connect fixtures to exit light circuits.
- .3        Connect emergency lamp sockets to emergency circuits.



- .4 Ensure that exit light circuit breaker is locked in on position.

**END OF SECTION**

