## 1. GENERAL

### 1.1 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with Section 16010 - Electrical General Requirements.

.2 Indicate on shop drawings.

.1 Floor anchoring method and foundation template.

.2 Dimensioned cable entry and exit locations.

.3 Dimensioned position and size of bus.

.4 Overall length, height and depth.

.5 Dimensioned layout of internal and front panel mounted components.

.3 Include time-current characteristic curves for circuit breakers and fuses.

.4 Submit for review by the consultant, shop drawings of all items specified in this Section.

.5 Submit complete schematic wiring for all controls. Prepare drawing showing each control wire for all controls, instruments, switches, devices and terminals in one circuit on same drawing. Indicate all ratings and loads.

### 1.2 Maintenance Data

.1 Provide maintenance data for service entrance board for incorporation into manual specified in Section 16010 - Electrical General Requirements.

.2 Submit copies of maintenance data for complete assembly including components.

### 1.3 Source Quality Control

.1 Perform all normal mechanical and electrical production tests as detailed in CSA Standards C22.1 and C22.2 in the factory prior to shipment, and as described in Section 16010.

.2 Submit 4 copies of certified test results.

### 1.4 Electrical Services

.1 Arrange with the local utility company to supply and install a pad mounted transformer adjacent to the building as indicated on the drawings.

.2 Be responsible for obtaining the correct location and elevation of the transformers from the electrical service company and for scheduling the installation of the transformer with the

utility company. Provide secondary lugs on all transformers to utility company requirements.

## 2. PRODUCTS

### 2.1 Service Entrance Board

.1 Rating: 347/600 V, 3 phase, 4 wire, 1200 A, short circuit current 42 kA (rms symmetrical).

.2 Cubicles: floor mounted, dead front, size as indicated.

.3 Barrier metering section from adjoining sections.

.4 Provision for installation of power supply authority metering in barriered section.

.5 Owners Digital metering.

.6 Distribution section.

.7 Hinged access panels with captive knurled thumb screws.

.8 Bus bars and main connections; 99.3% copper.

.9 Bus from load terminals of main [breaker] [disconnect switch] [via metering section] to main lugs of distribution section.

.10 Identify phases with colour coding.

.11 The service entrance switchboard to consist of fixed mounted moulded case main circuit breaker with solid state relay of the trip rating shown on the drawings, main bus or cable, metering transformers enclosure, and CDP with moulded case breakers of the size and trip indicated; enclosed in a code gauge galvanized steel box with cold rolled steel trim, painted as code gauge galvanized steel box with cold rolled steel trim, painted as specified and suitable for floor mounting.

.12 Submit shop drawings for service entrance switchboard, panelboards, CDP's, and motor control centres.

.13 Provide a metering cubicle of the size necessary to suit the utility supplied current and potential transformers.

### 2.2 Main Circuit Breaker

.1 Provide breaker with silver-tungsten contacts which operate under high pressure. The arcing contacts to be of arc-resisting silver-tungsten. Incorporate in design of contacts, means for accelerating deionization of arc path. Provide arc chutes which effectively enclose the arcing contacts and confine the arc to reduce the disturbance caused by short circuit

interruption. Provide the breaker with a position indicator, mechanically connected to the circuit breaker mechanism.

.2 Breaker to be fixed mounted, complete with stored energy operating mechanisms. The closing springs of the breaker shall be capable of being charged manually by means of a charging handle.

.3 Provide the breaker with a solid state tripping system Unit to consist of one current sensor per pole, one solid state trip unit and one trip actuator. The unit to have continuously adjustable long delay current pick-up, long delay time, short delay current pickup, short delay time and instantaneous pickup and continuously adjustable ground current pickup and ground, overcurrent short circuit tripping indication. The trip unit to be dipped in polyurethane resin to prevent deterioration of components due to atmospheric contamination.

## 2.3 Finishes

.1 Apply finishes in accordance with Section 16010 - Electrical General Requirements.

.1 Service entrance board exterior: Sand

.2 Service entrance board interior: white

.3 Touch-up on site as required.

## 2.4 Equipment Identification

.1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.

.2 Nameplates:

.1 White plate, black letters, size [7].

.2 Complete board labeled: 1200 Amps, 347/600 Volt, 3 phase, 4 wire."

.3 Main disconnect labeled: "Main Breaker".

.4 Branch disconnects labeled: as indicated on drawings.

## 2.5 Arrangement

.1 The arrangement shall be as indicated on drawings. Minor modifications to arrangement may be made to suit site conditions.

## 2.6 Housing Construction

.1 Fabricate housing of metal enclosed dead front sections, made from code gauge sheet steel of formed and welded construction and built for 600 volts indoor rating. Isolate circuit breaker compartments from bus compartment by grounded metal barriers. Self support on

formed channel sills. When sections are bolted together, form a continuous integral structure.

.2 Before painting, clean and bonderize the metal and then apply a prime rust-resistant coat. Furnish ventilating louvres and screens to suit application.

.3 For distribution breaker unit, provide hinged access doors on front with concealed hinges and formed edges, and bolted rear access panels.

.4 Mount pop rivet lamacoid nameplates on front of sections for each device, meter, switch, etc.

.5 Provide non-ferrous cable entry and non-magnetic exit plates as required.

.6 The switchgear assembly to be complete with necessary secondary wiring. Control wiring to be Type T.B.S. minimum size 14 extra flexible wire with thermoplastic insulation and an overall flame retarding cotton braid.

.7 Terminal blocks to be of the clamp type complete with removable marking strips. Control wiring not to be closer than 150 mm from the bottom of the switchboard.

.8 Provide channel iron sills to be cast in concrete housekeeping pad under switchboard.

## 2.7 Bus Bars

.1 For switchboard provide three phase, four wire, 600 volt horizontal and vertical bus. Design bus in accordance with NEMA Standard SG5-3-02 and amendments thereto. Use hard drawn copper bus with continuous ampere rating shown. Design cross section area of bus bars and connections so that temperature rise when carrying full rated current will not exceed 65°C, above an ambient temperature of 40°C. Adequately brace bus to withstand 50,000 RMS amperes symmetrical, three phase, 60 cycle short circuit at 600 volts. Silver flash all joints and connections. Use cadmium plated bolts, nuts and lock washers.

.2 Extend the copper ground bus the full length of the switchgear assembly complete with lugs for ground connections as required. Connect all non-current carrying components of the assembly to this bus.

## 2.8 Accessories

.1 The switchboard assembly shall be complete with all necessary accessories needed for proper operation, such as levering in device, circuit breaker operating handles, etc., as applicable.

.2 Provide line connection from the breaker to suit feeder conductors as indicated on the drawings. Connections to be solderless cable connectors. Provide neutral connections and ground lugs as required.

## 3. APPROVED MANUFACTURER

.1 Service entrance boards to be manufactured by Cutler Hammer, Schnieder Electric or Seimens

## 4. EXECUTION

### 4.1 Installation

.1 The switchboard shall be mounted on a 100 mm concrete housekeeping pad. Refer to Section 16010 - Electrical General Requirements, item 3.14. Ensure equipment is mounted in accordance with seismic requirements for that geographical area.

.2 Locate meter cabinet separately on wall adjacent to service entrance switchboard. Provide 32 mm empty conduit to meter enclosure.

.3 Provide and connect the main service and distribution system shown and specified. Make all necessary arrangements with the utility company for service entrance, energization and metering of the services.

.4 Connect all systems neutrals as required. Check and test ground fault trip device.

.5 Run 2 grounding conductor 4/0 AWG bare copper in 25 mm conduit from ground bus to building ground. Check and test ground fault trip device.

.6 Check factory made connections for mechanical security and electrical continuity.

.7 Level switchboard on channel sills poured in housekeeping pads and bolt switchboard on sills.

.8 Connect incoming bus and outgoing cables.

.9 Connect all system neutrals as required, and connect switchboard ground stud to provide switchboard grounding.

.10 Adjust all relay and trip settings to requirements of the Coordination Study Report. Using a low voltage power source test unit, test tripping action of all circuit breakers and report results in writing to the consultant.

.11 Provide drip hoods, non-ferrous entry plates and other special features as required.

**END OF SECTION**

## 1. GENERAL

### 1.1 Description

.1 Provide disconnect switches for 347/600 volt and 120/208 volt distribution as indicated on the drawings, as manufactured by Cutler Hammer, Schnieder Electric or Seimens.

## 2. PRODUCTS

### 2.1 Disconnect Switches

.1 Ratings: 600 Volts for 347/600 volt distribution, 240 volts for 120/208 volt distribution. Unless otherwise shown, 3 pole for 3 phase, 3 wire distribution, 3 pole and solid neutral for 3 phase 4 wire distribution. Ampere ratings as shown on the drawings or to suit load requirements. For motors, use disconnect switches with HP ratings at least equal to motor HP.

.2 Enclosures: CSA code gauge galvanized steel, hinged doors, external operating handles. Disconnect switches in dry locations shall be EEMAC-1 and EEMAC-3 where exposed to weather. Provide ON-OFF switch position indication on switch enclosure cover.

.3 Finish: One primer coat and one finish coat on all metal surfaces, colours as per Section 16010 - Electrical General Requirements.

.4 Switch mechanisms: Quick make and quick break action with self wiping contacts, solderless pressure lug connectors. For switches 100 amperes and over, provide non-tracking arc shrouds. All switch poles to operate together from a common operating bar. Provide for padlocking disconnect switches in "Off" position. Doors to be interlocked and complete with defeat mechanism, to prevent opening when handle in ON position.

.5 Neutral Bars: Where distribution system has grounded neutral conductor, provide neutral bar where required with ampere rating equal to switch rating, in enclosure. Provide ground bar for terminating ground conductors.

.6 Fuse Holders: Provide fuse holders (relocatable and suitable without adapters) on load side of switches, ampere rating equal to switch ratings, suitable for fuses specified.

### 2.2 Fuses

.1 All fuses to be 100,000 ampere (minimum) interrupting capacity of the current limited type. In addition, fuses feeding motors to be of the time delay type. Provide one full set of spare fuses, three for each different ampere rating used, stored in suitable enclosure.

## 3. EXECUTION

### 3.1 Disconnect Switches

.1 Mounting: Provide supports independent of conduits. Wall mount where possible, otherwise provide Unistrut frame support. Where switches are grouped mount in uniform arrangement.

.2 Wiring: Connect line and load cable to all switches.

.3 Fuse Rating: Install so that rating is visible.

.4 Identification: Provide lamacoid plate in accordance with Section 16010 - Electrical General Requirements, on each switch showing voltage, source of supply and load being fed, for example:

Backwash Pump
600 Volt 3 Phase
Fed from MCC #2

**END OF SECTION**

# DRY TYPE TRANSFORMERS UP TO 600 V PRIMARY

## 1. GENERAL

.1 Provide enclosed dry type transformers 600 volts primary to 120/208 volts.

.2 Product Data - Three Phase, Four Wire Secondary

.1 Submit product data in accordance with Section 16010 - Electrical General Requirements.

.3 Transformers to conform to CSA C57.12 and L2 standards, and are to be approved to CSA Code Part 2, Standard C22.2, No. 47 and CSA C9.

## 2. PRODUCTS

### 2.1 Transformers

.1 General: Dry type, air cooled, self ventilated. Enclosures to be EEMAC-1 type, code gauge steel, complete with ventilating openings, access panels, mounting brackets, and solderless primary and secondary cable connectors. Enclosures to have zinc chromate prime coat and enamel finish coat per Section 16010. Transformers to be single or three phase as noted on the drawings. Dry type transformers shall be Westinghouse, FPE, or approved equivalent.

.2 Design

.1 Type: ANN, K factor 13

.2 3 phase, 3 winding, kVA as indicated on drawings, 600V input 120/208 volt 3 phase 4 wire output, 60 Hz.

.3 Voltage primary taps: 2.5% Full capacity above and below normal

.4 Insulation: Class H.

.5 Basic Impulse Level (BIL): 10 kV B.I.L.

.6 Hipot: 4 kV

.7 Average Sound Level: To meet the local municipal & building codes and meet at minimum the following criteria:

45 dB max. up to 45 kVA
50 dB max. up to 150 kVA
55 dB max. up to 300 kVA
60 dB max. above 500 kVA

.8 Impedance at 170°C: 6.0% max. up to 112½ kVA
5.5% max. above 112½ kVA

.9 Enclosure: EEMAC 1, removable metal front panel

.10 Mounting: Up to 45 kVA suitable for wall or floor mounting and above 45 kVA suitable for floor mounting unless otherwise shown

.11 Finish: In accordance with Section 16010 - Electrical General Requirements.

.12 Three Phase Windings: Arrange with three primary windings connected in delta and three secondary windings connected in wye.

.13 Max. Winding Temperature: 150°C rise with temperature continuous full load

.14 Max. Lead Connection: 55°C rise with temperature continuous full load

## 2.2 Equipment Identification

.1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.

.2 Label Size: 7

# 3. EXECUTION

## 3.1 Installation

.1 Mount dry type transformers up to 45 kVA as indicated.

.2 Mount dry type transformers above 45 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 Mount transformers as indicated on drawings and connect primary, secondary, neutral and ground conductors. Provide brackets and bolts for wall mounted transformers. Ensure all transformers have good ventilation.

.9 Do not use permanent distribution system dry type transformers for temporary power distribution without permission for the Consultant.

.10 Mount transformers to reduce direct and transmitted noise. Mount core and coils of transformers on vibration and sound absorbing pads.

.11 Record secondary voltage when transformers are carrying approximately 75% of full load. Adjust tap connections to give a continuous secondary voltage of 120 volts phase to neutral. Set tap connections for above 120 volts rather than below.

.12 Connections to transformers shall be in flexible conduit and shall enter the enclosure below the coils.

.13 Before energization, keep transformers or storage room enclosures above 10°C ambient.

**END OF SECTION**

# PANELBOARDS - BREAKER TYPE

## 1. GENERAL

### 1.1 Related Work

.1 Rough Carpentry - Plywood Backboard: Division 06

### 1.2 Shop Drawings

.1 Submit shop drawings in accordance with Section 16010 - Electrical General Requirements.

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension. Quantity of breakers to be confirmed by contractor.

## 2. PRODUCTS

### 2.1 Panelboards

.1 Panelboards: product of one manufacturer.

.1 Install circuit breakers in panelboards before shipment.

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

.2 347/600 V panelboards: bus and breakers rated for 14kA (symmetrical) interrupting capacity.

.3 120/208 V panelboards: bus and breakers rated for 10kA (symmetrical) interrupting capacity.

.4 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.

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

.6 Two keys for each panelboard and key panelboards alike.

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

.8 Mains: suitable for bolt-on breakers.

.9 Trim with concealed front bolts and hinges.

.10 Trim and door finish: baked grey enamel as per colour schedule.

## 2.2 Breakers

.1 Breakers: to Section 16477 - Moulded Case Circuit Breakers.

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

.3 Lock-on devices for exit light and fire alarm feeder breakers installed as indicated.

## 2.3 Equipment Identification

.1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.

.2 Nameplate for each panelboard size 4 engraved as indicated.

.3 Complete circuit directory with typewritten legend showing location and load of each circuit.

# 3. EXECUTION

## 3.1 Installation

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

.2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height specified in Section 16010 - Electrical General Requirements or as indicated.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus with respective neutral identified.

**END OF SECTION**

# MOULDED CASE CIRCUIT BREAKERS

## 1. GENERAL

### 1.1 Product Data

.1 Submit product data in accordance with Section 16010 - Electrical General Requirements.

.2 Include time-current characteristic curves for breakers with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

## 2. PRODUCTS

### 2.1 Breakers General

.1 Bolt-On Moulded Case Circuit Breaker: Quick-make, quick-break type, for manual and automatic operation [with temperature compensation for 40°C ambient].

.2 Common-Trip Breakers: With single handle for multi-pole applications.

.3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from [3-8] times current rating.

.4 Circuit breakers with interchangeable trips as indicated.

### 2.2 Thermal Magnetic Breakers

.1 Moulded case circuit breakers, 200amps and larger are to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

### 2.3 Solid State Trip Breakers

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

.2 Main breaker to be provide with solid state trip as referenced in "Section 16421, Service Entrance Board"

### 2.4 Optional Features

.1 Include where indicated on drawings:

.1 Shunt trip
.2 Auxiliary switch
.3 Motor-operated mechanism [c/w time delay unit]

.4 Under-voltage release
.5 On-off locking device
.6 Handle mechanism
.7 Keyed interlocks
.8 Non-auto
.9 Solid state trip units.

## 3. EXECUTION

### 3.1 Installation

.1 Install circuit breakers as indicated.

.2 Identification: Provide lamicoid plate on each breaker showing source being fed -.

**END OF SECTION**

# POWER SURGE PROTECTORS

## 1. GENERAL

### 1.1 Related Work

| | | |
|---|---|---|
| .1 | General Electrical Requirements: | Section 16010 |
| .2 | Service Entrance Board: | Section 16421 |
| .3 | Panelboards - Breaker Type: | Section 16471 |

### 1.2 System Description

.1 A transient voltage surge suppressor for the protection of downstream electronic equipment connected to the building power supply. The specified unit shall be compatible with non-linear loads and shall provide effective high-energy transient voltage suppression, surge current diversion and high-frequency electrical noise filtering while connected in parallel with a facility's distribution system. The filtering unit shall utilize non-linear voltage dependent metal oxide varistors or selenium cells. The suppression system's components shall not utilize gas tubes, spark gaps, or silicon avalanche diodes. The device shall be referred to as a TVSS filter for the purpose of this document and drawings.

## 2. PRODUCT

### 2.1 Operation and Environment

.1 Voltage: The TVSS devices shall be suitable for the voltage and systems configuration as indicated on the single line diagram(s).

.2 Maximum Continuous Operating Voltage (MCOV): The maximum continuous operating voltage of the suppressor unit shall be greater than 125% for 120/208 V systems and 115% for 347/600 V systems.

.3 Protection Modes: Transient voltage surge suppression paths shall be provided for all possible common and normal modes (between each line and ground, neutral and ground, line to line and each line and neutral). The primary suppression path shall not be to ground.

## 2.2 Suppression Component

| | | | |
|---|---|---|---|
| .1 | Peak surge Current per Phase | 240,000 Amps | (Main entrance panel applications) |
| | | 120,000 Amps | (Branch Panel Applications) |
| | | 30,000 Amps | (Plug-in / Cord -- connected individual equipment protection) |
| .2 | Let Through Voltage (L-N) | 120 V (individual equipment units) | 330 V |
| | | 208 V Units | 500 V |
| | | 600 V Units | 1200 V |
| .3 | TVSS clamping components response time | < 1 nanosecond | |

## 2.3 Filtering

.1 TVSS shall contain a high frequency extended range tracking filter.

.2 Noise attenuation ≥45 dB @ 1`00 kHz.

.3 Main entrance panel application effective filtering bandwidth - 180 Hz to 50 Mhz. Branch panel application effective filtering bandwidth - 1 kHz to 50 Mhz. Plug-in/Cord - Connected Individual Equipment application effective filtering bandwidth - 100 kHz to 100 Mhz.

## 2.4 General Features

.1 Connectors: Terminals shall be provided for all the necessary input and output power and ground connections on the TVSS.

.2 Enclosure: The specified system shall be provided in a heavy duty NEMA 12 dust tight enclosure with no ventilation openings for maintenance and branch panel applications. Indication of surge current module status shall be visible without opening the door.

.3 Internal Connections: All surge current diversion connections shall be by way of low impedance wiring. Surge current diversion components shall be wired for reliable low impedance connections. No plug-in component modules, quick disconnect terminals or printed circuit boards shall be used in surge suppression paths.

.4 Unit Status Indicators: Red status indicators shall be provided on the hinged front cover to indicate unit phase status. The absence of the red light shall reliably indicate that one or more surge current diversion phases have failed and that service is needed to restore full operation.

.5 Fuses: The unit shall utilize internal fuses rated with a minimum interrupting capability of 2000,000 A or greater.

.6 Identification: The unit shall include manufacturer's nameplate, UL rating, and a CSA approval on the exterior enclosure.

.7 Warranty: The manufacturer shall provide a five-year warranty on the TVSS filter, a on-year warranty on the panelboard and circuit breakers, and a one-year warranty on individual equipment plug-in units. These warranties shall commence from date of shipment.

.8 Testing: Testing at each unit shall include assurance checks, "Hi-Pot" test at two times rated voltage plus 1000 volts per UL requirements, and operation and calibration tests.

## 2.5 Approved Manufacturers

.1 Current Technologies

| | |
|---|---|
| -- Main panel application | Model MP |
| -- Branch panel application | Model DPA |
| -- Integrated TVSS panel | Model EGP |
| -- Individual Equipment Protection | |

.2 Liebert Corporation

| | |
|---|---|
| -- Main panel applications | Model LCG-C3 |
| -- Branch panel applications | Model LCG-C2 |
| -- Integrated TVSS panel | Model LPG |

.3 Tycor International Corporation

| | |
|---|---|
| -- Main panel applications | Model PTY-HE |
| -- Branch panel applications | Model PTY-SA |
| -- Individual Equipment Protection | |

# 3. EXECUTION

## 3.1 Installation

.1 Install with manufacturer's recommended conductors tapped from the electrical service switchboard conductor system. Conductors are to be as short and straight as possible. Input conductors to the TVSS shall be twisted together to reduce impedance during high frequency filtering.

.2 An appropriately sized manual safety disconnect shall be installed before and in line with the TVSS from the electrical service for the purpose of electrically isolating the device from the system should service be required without interrupting the main service. Coordinate required disconnect ampacity with TVSS manufacturer.

.3 The TVSS should be following the manufacturer's recommended practices as outlined in the manufacturer's installation and Maintenance Manual and in compliance with all applicable electrical codes.

**END OF SECTION**

# CONTACTORS

## 1. GENERAL

### 1.1 Description

.1 Supply and install contactors as indicated on drawings and specified herein to ensure a complete operational system.

.2 This specification covers contactors for voltages up to 600 V. Refer to drawings for voltage, amperage, number of poles, and auxiliary contacts.

### 1.2 Product Data

.1 Submit product data in accordance with Section 16010 - Electrical General Requirements.

## 2. PRODUCTS

### 2.1 Contactors

.1 Contactors: to EEMAC No.1CS.

.2 Electrically held controlled by pilot devices as indicated and rated for type of load controlled. This rating shall be on the basis of incandescent or non-inductive loading for continuous operation. Half size contactors not accepted. All contactors shall have 120V operating coils.

.3 Complete with quantity of contacts indicated.

.4 Mount in CSA Enclosure 1 unless otherwise indicated.

.5 Include the following options in cover:

- .1 Red indicating lamp
- .2 Stop-Start push-button
- .3 Hand-Off-Auto selector switch

.6 Control transformer: sized to manufacturers recommendations mounted in contactor enclosure.

### 2.2 Equipment Identification

.1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.

.2 Provide a size 4 nameplate indicating name of load controlled.

## 3. EXECUTION

### 3.1 Installation

.1 Install contactors and connect auxiliary control devices where indicated on drawings and specified herein.

.2 Contactors shall be mounted separately in suitable CEMA-1 enclosures.

**END OF SECTION**

# GENERAL PROVISIONS FOR INTERIOR LIGHTING

## 1. GENERAL

### 1.1 Work Included

.1 Supply and install lighting fixtures complete with lamps, ballasts and all necessary fittings.

### 1.2 Code Requirements

.1 Installation of lighting equipment to conform to Section 30, Canadian Electric Code, Part 1, and as amended or supplemented by provincial, municipal or other regulatory agencies having jurisdiction.

### 1.3 Shop Drawings

.1 Submit a complete list of the types of lighting fixtures, lamps, ballasts and accessories with catalogue illustrations, data sheets, etc. for review. Bind in a suitable booklet and keep one copy of this booklet at the job site at all times.

.2 Submit complete photometric data, based on actual fixtures proposed for project. Substantiate brightness and efficiency requirements. Photometric data must be produced by a recognized independent laboratory.

### 1.4 Manufacturer's Operational Test

.1 Test fixtures for acceptance of lamp made to maximum tolerance as required in ANS standards listed in 16.4-3.

.2 Test fixtures with rated lamps for starting and operation.

.3 Check wiring for agreement with design circuit.

.4 Test for short circuits and improper grounds.

.5 Test operation of fixture and lamp with ballast.

### 1.5 Lamps Used for Temporary Lighting

.1 Fluorescent lamps may be used for temporary light and lamps used for this purpose will be accepted when the project or portions of the work are turned over to the Owner. Spot relamp faulty or burned out lamps prior to this acceptance, without additional cost to Owner.

.2 Metal halide, sodium, incandescent and quartz lamps are not to be used for temporary lighting, unless all lamps so used are replaced with new lamps immediately prior to completion at no additional cost to Owner.

## 2. PRODUCTS

.1 Different fixtures may be supplied by different manufacturers. Similar fixtures shall be supplied by the same manufacturer.

.2 Provide only lighting fixtures which are structurally well designed and constructed and which use new parts and materials of highest commercial grade available. Unless otherwise specifically noted, fixtures shall be of the quality stated in the manufacturer's catalogues and data sheets.

.3 Refer to related sections for details of fixtures and accessories.

.4 Use self-aligning ball joint hangers for rod suspended fixtures.

.5 Use cadmium plated chains for suspended fixtures in unfinished areas.

## 3. EXECUTION

### 3.1 Installation

.1 Install fixtures in accordance with the manufacturer's requirements, code requirements, and as shown on the drawings.

.2 Confirm compatibility and interface of other materials with luminaire and ceiling systems. Examine the room finish schedule and reflected ceiling drawings. Report discrepancies and defer ordering until clarified.

.3 Ground lighting equipment to a separate grounding conductor.

.4 Co-ordinate with other trades to avoid conflicts between luminaires, supports and fittings and mechanical and structural equipment.

.5 Provide guards where fixtures are subject to mechanical damage as required by code or shown on the drawings.

### 3.2 Workmanship

.1 Completely clean all glassware, lamps, and hangers. Polish metal parts before completion.

.2 Provide suitable extension couplings for row mounted fixtures.

.3 Protect fixtures, hangers, supports, fastenings and accessory fittings at the site prior to and during installation. Unless fixtures are erected immediately, after delivery to site, deliver in original cartons or enclosed in air-tight plastic wrapping. Store in a dry and secure space on site. Protect hangers, supports, fastenings and accessory fittings against corrosion. Take care during installation to ensure that insulation and corrosion protection is not damaged.

.4 Fixtures which show evidence of corrosion, rough handling, scratching of finishes, etc. are to be replaced with new fixtures at no additional cost.

.5 Hang and mount fixtures to prevent distorting fixture frame, housing, sides or lens frame, and permit correct alignment of several fixtures in a row.

.6 Support fixtures as shown on drawings, level, plumb and true with structure and other equipment in horizontal or vertical position as intended. Install wall or side bracket mounted fixture housings rigidly and adjust to a neat flush fit with mounting surface.

.7 Adjust length of hangers of suspended fixtures to hang fixture bodies level and in same horizontal plane, unless shown otherwise on drawings.

.8 Install ceiling canopies to cover suspension attachments and fit tightly to ceiling without restricting alignment of hanger.

.9 For recessed fluorescent fixtures mounted in suspended ceiling with exposed tee bar grid system, support by the ceiling tee bar grid structure. Provide any additional support necessary for oversize fixtures, or to meet code requirements.

.10 Metal inserts, expansion bolts or toggle bolts which do not carry wiring shall be accurately located in relation to outlet boxes, for perfect alignment and spacing of suspension stems or other hangers.

.11 Remove any noisy ballasts from the fixtures and replace at no additional cost to the Owner prior to completion.

**END OF SECTION**