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**Part 1            General**

**1.1            GENERAL**

- .1        This Section covers items common to Sections 26, 27 & 28. This section supplements requirements of Section 01.

**1.2            CODES AND STANDARDS**

- .1        Do complete installation in accordance with CSA C22.1 latest edition unless specified otherwise.
- .2        Do overhead and underground systems in accordance with CSA C22.3 NO. 1:20 except where specified otherwise.
- .3        Operating voltages shall conform to CAN3-C235-83 (R2015).
- .4        Switchgear and distribution paint shall conform to EEMAC 2Y-1-1958.

**1.3            DRAWINGS AND SPECIFICATIONS**

- .1        Before submitting bid and commencing work, check drawings and specifications of other trades for conflicts with the electrical work, if such conflicts exist, obtain a ruling from the Departmental Representative as to what adjustments are to be made before proceeding. Carefully examine the site and ascertain all related conditions, and verify all dimensions.
- .2        Should any discrepancy appear between the electrical drawings and the specifications which leaves the trade in doubt as to the true intent and meaning of the drawings and specifications, obtain a ruling from the Departmental Representative before submitting a tender. If this is not done, it will be assumed the more expensive alternative has been allowed.
- .3        The electrical drawings and specifications include work that is not normally performed by the electrical contractor however the electrical contractor is responsible for ensuring that this work is included in the tender price. This work shall be performed by a contractor who is normally engaged in that type of construction.

**1.4            SHOP DRAWINGS**

- .1        Submit shop drawings to the Departmental Representative for electrical equipment and material specified in the following specification sections:
  - .1        Section 26 05 31 – Splitters, Junction, Pull Boxes and Cabinets
  - .2        Section 26 05 36 – Cable Trays for Electrical Systems
  - .3        Section 26 09 24 – Lighting Control
  - .4        Section 26 09 436 – Network Lighting Controls
  - .5        Section 26 24 16.01 – Panelboards Breaker Type
  - .6        Section 26 27 26 – Wiring Devices

- .7 Section 26 28 16.02 – Moulded Case Circuit Breakers
- .8 Section 26 28 23 – Disconnect Switches-Fused & Non-Fused
- .9 Section 26 29 10 – Motor Starters to 600V
- .10 Section 26 52 00 –Lighting
- .11 Section 26 52 13.16 – Exit Signs
- .12 Section 27 05 13 – Communications Systems
- .13 Section 27 05 14 – Structured Cabling for Communications Systems
- .14 Section 28 31 00.02 – Multiplex Fire Alarm System and Voice Communications
- .2 Submit all shop drawings electronically in PDF format. Provide a separate PDF file for each specification section complete with bookmarks for each individual piece of equipment or material. Bookmark names shall correspond to equipment/material names, numbers or labels indicated on the plans or in the specifications.
- .3 Ensure all shop drawings contain information pertinent to this project only. Clearly identify all accessories, options, mounting provisions, etc. on each shop drawing.
- .4 Include all light fixture shop drawings in a single submission. Arrange light fixture types within the PDF in alphabetical order complete with a bookmark for each fixture. Include LED driver cut sheets for each light fixture type. Provide IES format photometric reports for each fixture submitted.
- .5 Submit distribution equipment shop drawings with corresponding arc flash and protective device coordination studies.
- .6 All shop drawings shall be reviewed and marked as such by the Div 26/27/28 contractor.
- .7 Shop drawings which do not comply with the submission requirements listed above will be rejected without review and returned to the contractor for revision and re-submission.

## **1.5 MAINTENANCE MANUALS AND AS-BUILT DRAWINGS**

- .1 Compile and submit to the Consultant for review three (3) sets of printed maintenance manuals and one (1) digital set. Each manual shall contain shop drawings for all major electrical equipment, a list of suppliers providing components, original factory manuals, name and address of contractors, test results and certificates. Manuals shall be bound in blue 3 ring binders with project name, address and date of completion embossed in white on the binding and the cover. Digital maintenance manuals shall be in PDF format on a storage medium, compact disc or USB Flash Drive, compatible with Windows and Mac OS. Label jewel case and compact disc, or flash drive with Project Name, Address and Date of Completion.
- .2 Submit one (1) digital copy of the maintenance manual in PDF format for review by the Departmental Representative prior to printing hard copies.
- .3 Submit to the Departmental Representative as-built drawings detailing electrical systems as installed. Include the following:
  - .1 All addenda, approved change orders and site instructions. These shall be indicated on the drawings using the consultant's symbols. Where this is not practical, attach all related documents to the appropriate drawing.

- .2 Ensure all panel schedules and circuit numbers reflect on site changes.

## **1.6 WARRANTY**

- .1 Unless specified elsewhere, all materials and workmanship shall be warranted for a period of one (1) year from the date of final acceptance. During this time, the contractor shall repair or replace, at their expense, any defective materials or workmanship.

## **1.7 CARE, OPERATION, START-UP, AND TRAINING**

- .1 Instruct Departmental Representative's operating personnel in the operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for the services of manufacturer's factory trained service representative to supervise the start-up of installation and to 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 familiar with all aspects of its care and operation.
- .4 Where systems require programming, provide initial programming to allow system to operate in all functional modes. As part of the Departmental Representative's training demonstrate how to make changes to all programmable functions and modes. Refer to individual specification sections for further training requirements.
- .5 Arrange and pay for digital audio/video recording of all owners training sessions. Upon completion of all training sessions, provide three (3) complete sets of recorded training session on DVD. Recording and playback formats shall be compatible with all standard PC's or DVD players. Arrange all files in an easy to read, logical format using a menu system.
- .6 Training sessions shall be attended by Departmental Representative's personnel and the consultant. Training sessions shall be arranged a minimum of 10 working days in advance. The contractor shall direct the training session and training shall be provided by the manufacturer's representative. Contractor shall provide an attendance sheet which shall be completed by all individuals present at the training session. The attendance sheet shall indicate the system being demonstrated, the name of the contractor, the name and qualifications of the manufacturers representative, the date of the session, the names and positions of the Departmental Representative's personnel, the names and positions of the consultants and the project name.

## **1.8 VOLTAGE RATINGS**

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

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**1.9 VOLTAGE DROP CALCULATIONS**

- .1 Perform voltage drop calculations on feeder and branch circuit wiring. Adjust conduit and wire sizes as required to conform to a maximum of 5% voltage drop from the supply side of the customer's service to the point of utilization, maximum 2% voltage drop in feeders and maximum 3% voltage drop in branch circuits. Refer to CEC section 8 and NECB Part 7.

**1.10 PERMITS, FEES AND INSPECTION**

- .1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Pay associated fees.
- .3 Consultant will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost.
- .4 Notify Departmental Representative of changes required by Electrical Inspection Department prior to making changes.
- .5 Provide Certificates of Acceptance from authorities having jurisdiction on completion of work to Departmental Representative.

**1.11 MATERIALS AND EQUIPMENT**

- .1 Provide materials and equipment in accordance with Section 01 61 00 - Common Product Requirements.
- .2 All equipment and material shall be new and shall be CSA certified. Where there is no alternative to supplying equipment, which is not CSA certified, obtain special approval from Electrical Inspection Department.
- .3 Factory assemble control panels and component assemblies.

**1.12 MECHANICAL CONTROLS AND CONTROL WIRING**

- .1 Refer to mechanical contract documents for all information related to mechanical controls and control wiring including responsibility for supply and installation.

**1.13 FINISHES**

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

## 1.14 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
  - .2 Nameplates:
    - .1 Lamacoid 3 mm thick plastic engraving sheet, black face, white core, attached with adhesive back.
- | NAMEPLATE SIZES |             |         |                    |
|-----------------|-------------|---------|--------------------|
| Size 1          | 10 x 50 mm  | 1 line  | 3 mm high letters  |
| Size 2          | 12 x 70 mm  | 1 line  | 5 mm high letters  |
| Size 3          | 12 x 70 mm  | 2 lines | 3 mm high letters  |
| Size 4          | 20 x 90 mm  | 1 line  | 8 mm high letters  |
| Size 5          | 20 x 90 mm  | 2 lines | 5 mm high letters  |
| Size 6          | 25 x 100 mm | 1 line  | 12 mm high letters |
| Size 7          | 25 x 100 mm | 2 lines | 6 mm high letters  |
- .3 Labels: Embossed plastic labels with 6 mm high letters unless specified otherwise.
  - .4 Wording on nameplates and labels shall be approved by Departmental Representative prior to manufacture.
  - .5 Allow for average of twenty-five (25) letters per nameplate and label.
  - .6 Identification to be English.
  - .7 Use one nameplate or label.
  - .8 Nameplates for terminal cabinets and junction boxes shall indicate system and/or voltage characteristics.
  - .9 Identify equipment with Size 3 labels engraved "ASSET INVENTORY No. \_\_\_\_". Number as and if directed by Departmental Representative.
  - .10 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
  - .11 Terminal cabinets and pull boxes: indicate system and voltage.
  - .12 Transformers: indicate capacity, primary and secondary voltages and feeder origin
  - .13 Each panel shall be supplied with a directory card holder welded to inside of door, complete with a neatly typewritten list showing information as follows:

PANEL BOARD NAME.....B

PANEL CIRCUIT.....120/208 VOLTS

CIRCUIT NUMBER	DESCRIPTION	LOAD
1	LIGHTING ROOM 100	1200 WATTS
2	RECEPTACLES ROOM 100	6-15 AMPS
3	ROOM 220 EXHAUST FAN	500 WATTS

.14 Receptacle Identification:

- .1 Provide size 1 lamacoid label indicating circuit number(s) (ie. 2A-21) on each receptacle cover plate.
- .2 Emergency receptacles shall have red lamacoid labels instead of black.
- .3 UPS receptacles shall have blue lamacoid labels instead of black.

**1.15 WIRING IDENTIFICATION**

- .1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour code: to latest edition of CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.
- .5 Branch circuit wiring at all receptacles shall be labelled with circuit number (ie. 2A-21) using slide-on, collar type identifiers with factory printed numbering. Use black lettering on white background.

**1.16 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
Voice	Green	
Data	Green	Blue
Fire Alarm	Red	
Security Systems	Red	Yellow

- .1 Identify conduits, boxes and metallic sheathed cables except for branch circuit conduits less than 25mm.
- .2 Identification shall consist of self-adhesive printed labels, white label with minimum 20mm black lettering.
- .3 Identify all junction boxes on the side and on the cover.
- .4 Identify conduits at 10m intervals and/or in every room.
- .5 Identify conduits and boxes such that labeling is clearly visible from floor level.
- .6 Junction boxes that contain branch circuitry shall identify each circuit on the label including panel designation and voltage.
- .7 Conduits 25mm and larger that contain branch circuitry shall identify the panel description, voltage and indicate 'branch circuits'.
- .8 Feeder conduits shall identify the load being fed and the voltage.
- .9 Systems conduits and boxes shall identify the system.
- .10 Provide a sample of the labeling to the Departmental Representative for approval prior to the installation.

#### **1.17 WIRING TERMINATIONS**

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

#### **1.18 MANUFACTURERS AND CSA LABELS**

- .1 Visible and legible, after equipment is installed.

#### **1.19 WARNING SIGNS**

- .1 As specified and to meet requirements of Electrical Inspection Department and Departmental Representative.
- .2 Decal signs, minimum size 175 x 250 mm.

#### **1.20 LOCATION OF OUTLETS**

- .1 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .3 Locate light switches on latch side of doors.

### **1.21 VAPOUR BARRIER INTEGRITY**

- .1 Maintain the integrity of the building vapour barrier where penetrations occur as a result of the work under this division. Refer to appropriate specification sections under other divisions to determine the extent and quality of work.
- .2 Use vapour barrier back box covers in all exterior walls and insulated ceilings.
- .3 Seal all interior conduits that pass through unheated spaces using duct seal or approved alternate product.

### **1.22 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.

### **1.23 LOAD BALANCE**

- .1 Measure phase current to panelboards under normal operating conditions. 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.

### **1.24 CONDUIT AND CABLE INSTALLATION**

- .1 Core all conduit and/or cable penetrations through exterior walls and grade beams. Provide and install Roxtec RS seals on interior and exterior of wall or grade beam to provide water tight seal between concrete and conduit/cable. Provide additional Roxtec seals on interior of wall or grade beam to provide water tight seal between conductors in conduit and conduit interior.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

### **1.25 DEPARTMENTAL REPRESENTATIVE'S EQUIPMENT**

- .1 Prior to ordering any equipment, the Contractor shall confirm the details, specifications and installation requirements for all Departmental Representative supplied equipment requiring electrical connections. The Departmental Representative shall supply technical information including electrical ratings and installation details. The coordination of electrical provisions for this equipment is the responsibility of the Contractor and no electrical equipment shall be ordered without written confirmation from the Departmental Representative. No allowance shall be made to the Contractor for failure to complete this coordination work, thereby resulting in an incorrect installation.



## **1.26 EQUIPMENT SUPPLIED BY OTHER DIVISIONS**

- .1 The Electrical Contractor shall be fully responsible for obtaining electrical ratings, specifications, installation requirements and approved shop drawings of all equipment requiring electrical connections that is supplied by other divisions. No electrical equipment shall be ordered prior to obtaining this information. No electrical equipment shall be ordered prior to a formal review and acceptance of this information by the Consultant. The Electrical Departmental Representative shall issue written acceptance of the information and shall also provide, if required, documented changes to the electrical design resulting from the review of this information. No allowance shall be made to the Electrical Contractor for failure to complete this coordination work, thereby resulting in an incorrect installation.

## **1.27 FIRE STOPPING FOR ELECTRICAL CABLES**

- .1 Provide fire stop assemblies, at all required fire separations, for any power and communications cables passing through a fire separation.
- .2 Where individual conduits or power cables pass through a fire separation, provide fire rated caulking as specified in Section 07 84 00.
- .3 Where multiple conduits, cable trays, or power cables pass through a single opening in a fire separation, provide a factory assembled steel, rectangular pass-through frame with removable intumescent material. Dorn Equipment FIRSTO or equal.

## **1.28 EXAMINATION OF SITE**

- .1 Prior to submitting a tender, the electrical contractor shall inspect the site to review conditions, existing equipment, etc., to ensure that there are no conflicts and that all work can be carried out as directed herein. No extra shall be made after tender award for work which would have been evident if a thorough investigation was carried out.

## **1.29 FIELD QUALITY CONTROL**

All electrical work shall be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting vocational training and qualification. Employees registered in a provincial apprentice's program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.

## **1.30 ELECTRICAL TESTING**

- .1 Conduct and pay for the following tests:

Section	System	Test Criteria	Report
26 05 21	Wires and Cables 0-1000V	As per miscellaneous feeder test schedule	As per miscellaneous feeder test schedule
26 09 24	Lighting Control Devices	As per 26 09 24 Item. 3.2	Submit manufacturers' start-up report

26 24 16.01	Panelboards Breaker Type	As per panelboard test schedule	As per panelboard test schedule
26 28 16.02	Moulded Case Circuit Breakers	As per 26 28 16.02 Item 3.1.2	Submit manufacturers' start-up report
27 05 14	Structured Cabling for Communications Systems	As per 27 05 14 Item 3.3	As per 27 05 14 Item 3.3
28 31 00.02	Multiplex Fire Alarm System and Voice Communications	As per 28 31 03 Item 3.2	Submit manufacturers' start-up and test reports

- .3 Carry out tests in presence of Departmental Representative.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 Submit test results for Departmental Representative's review.

### **1.31 INTEGRATED LIFE SAFETY SYSTEMS TEST**

- .1 Once the contract has been deemed substantially complete, the contractor shall perform an Integrated Life Safety Systems Test in accordance with The National Building Code and CAN/ULC S1001. The testing of these integrated systems must be performed as a whole to ensure the proper operation and inter-relationship between the systems.
- .2 The sequence of the test shall be provided by the Consultant. The Contractor shall conduct the test and shall arrange for all necessary trades to assist in the test.
- .3 In general, the test will include initiating a fire alarm, simulating a power failure and, if applicable, simulating an activated sprinkler head. The intent is to witness the function of all life safety systems and apparatus to ensure proper integration has been achieved.
- .4 Upon completion of a successful test, the Departmental Representative and prime consultant will issue a copy of the completed test with signatures.

### **1.32 ARC FLASH STUDY**

- .2 Conduct and pay for an Arc Flash Study on the emergency and normal equipment added through this project to the power distribution systems. Statement will confirm all components are fully coordinated.
- .3 Review the site and all relative equipment information as required to collect all information necessary to conduct the study.

- .4 Submit report, sealed by a professional Departmental Representative, to Departmental Representative for review prior to manufacturing.
- .5 Provide Arc Flash warning signs and labels on all equipment as per the results of the study.

**1.33 CO-ORDINATION OF PROTECTIVE DEVICES**

- .1 Ensure circuit protective devices such as overcurrent trip units, relays and fuses are installed to required values and settings.
- .2 Conduct and pay for a complete coordination study of the protective devices added to the normal and emergency distributions as part of this project. Review the site to obtain all information necessary to carry out the study including existing equipment ratings.
- .3 Provide printouts of all determined breaker settings as well as a detailed single line diagram showing all short circuit fault levels.
- .4 Submit report to Departmental Representative for review prior to manufacturing.

**Part 2 Products**

**2.1 NOT USED**

**Part 3 Execution**

**3.1 NOT USED**

**END OF SECTION**

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**Part 1            General**

**1.1                SUMMARY**

- .1            This Section includes requirements for selective demolition and removal of electrical communications and security components including removal of conduit, junction boxes, and panels to source (home run removal) and incidentals required to complete work described in this Section ready for new construction.

**1.2                RELATED REQUIREMENTS**

- .1            Section 02 41 16 - Structure Demolition
- .2            Section 02 41 00.08 - Demolition - Minor Works

**1.3                REFERENCE STANDARDS**

- .1            CSA Group (CSA)
  - .1            CSA S350 M1980 (R2003), Code of Practice for Safety in Demolition of Structures

**1.4                DEFINITIONS**

- .1            Demolish: Detach items from existing construction and legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .2            Remove: Planned deconstruction and disassembly of electrical items from existing construction including removal of conduit, junction boxes, cabling and wiring from electrical component to panel taking care not to damage adjacent assemblies designated to remain; legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .3            Remove and Salvage: Detach items from existing construction and deliver them to Departmental Representative ready for reuse.
- .4            Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- .5            Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed and salvaged, or removed and reinstalled.

**1.5                ACTION AND INFORMATIONAL SUBMITTALS**

- .1            Action Submittals: Provide in accordance with Section 01 33 00 - Submittal Procedures before starting work of this Section:
  - .1            Construction Waste Management Plan (CWM Plan): Submit plan addressing opportunities for reduction, reuse, or recycling of materials prepared in accordance with Section 01 74 19 - Waste Management and Disposal.
  - .2            Landfill Records: Indicate receipt and acceptance of selective demolition waste.

## **1.6 ADMINISTRATIVE REQUIREMENTS**

- .1 Coordination: Coordinate work of this Section to avoid interference with work by other Sections.
- .2 Scheduling: Account for Departmental Representative's continued occupancy requirements during selective demolition with Section 02 41 19.16 - Selective Interior Demolition and schedule staged occupancy and worksite activities as a defined Critical Path in Section 01 32 16.16 - Construction Progress Schedule - Critical Path Method (CPM).

## **1.7 QUALITY ASSURANCE**

- .1 Regulatory Requirements: Perform work of this Section in accordance with:
  - .1 Government of Canada, Labour Program: Workplace Safety and Provincial/Territorial Occupational Health and Safety Standards and Programs.

## **1.8 SITE CONDITIONS**

- .1 Existing Conditions: Condition of materials identified as being salvaged or demolished are based on their observed condition on date that tender is accepted.
- .2 Discovery of Hazardous Substances: It is not expected that Hazardous Substances will be encountered in Work; immediately notify Departmental Representative if materials suspected of containing hazardous substances are encountered and perform following activities:
  - .1 Refer to Section 01 41 00 - Regulatory Requirements for directives associated with specific material types.
  - .2 Hazardous substances will be as defined in Hazardous Products Act.
  - .3 Stop work in area of suspected hazardous substances.
  - .4 Take preventative measures to limit users' and workers' exposure, provide barriers and other safety devices and do not disturb.
  - .5 Hazardous substances will be removed by Departmental Representative under a separate contract or as a change to Work.
  - .6 Proceed only after written instructions have been received from Departmental Representative

## **1.9 SALVAGE AND DEBRIS MATERIALS**

- .1 Demolished items become Contractor's property and will be removed from Project site; except for items indicated as being reused, salvaged, or otherwise indicated to remain.
- .2 Carefully remove materials and items designated for salvage and store in a manner to prevent damage or devaluation of materials in accordance with Section 02 42 00 - Removal and Salvage of Construction Materials.

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**Part 2 Products**

**2.1 MATERIALS**

- .1 General Patching and Repair Materials: Refer to Section 02 41 19.16 - Selective Interior Demolition for listing of patching and repair materials incidental to removal or demolition of components associated with work of this Section.
- .2 Electrical Repair Materials: Use only new materials, CSA or ULC labelled as appropriate and matching components remaining after work associated with components identified for removal or demolition are completed.
- .3 Fire stopping Repair Materials: Use fire stopping materials compatible with existing fire stopping systems where removal or demolition work affects rated assemblies, restore to match existing fire rated performance.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Existing Conditions: Visit site, thoroughly examine and become familiar with conditions that may affect the work of this Section before tendering the Bid; Departmental Representative will not consider claims for extras for work or materials necessary for proper execution and completion of the contract that could have been determined by a site visit.

**3.2 PREPARATION**

- .1 Protection of Existing Systems to Remain: Protect systems and components indicated to remain in place during selective demolition operations and as follows:
  - .1 Prevent movement and install bracing to prevent settlement or damage of adjacent services and parts of existing buildings scheduled to remain.
  - .2 Notify Departmental Representative and cease operations where safety of buildings being demolished, adjacent structures or services appears to be endangered and await additional instructions before resuming demolition work specified in this Section.
  - .3 Prevent debris from blocking drainage inlets.
  - .4 Protect mechanical systems that will remain in operation.
- .2 Protection of Building Occupants: Sequence demolition work so that interference with the use of the building by the Departmental Representative and users is minimized and as follows:
  - .1 Prevent debris from endangering safe access to and egress from occupied buildings.
  - .2 Notify Departmental Representative and cease operations where safety of occupants appears to be endangered and await additional instructions before resuming demolition work specified in this Section.

### **3.3 EXECUTION**

- .1 Demolition and Removal: Coordinate requirements of this Section with information contained in Section 02 41 19.16 - Selective Interior Demolition and as follows:
  - .1 Disconnect electrical circuits and panel feeders; maintain electrical service and main distribution panel as is, ready for subsequent Work.
  - .2 Remove existing luminaires, electrical devices and equipment including associated conduits, boxes, wiring, and similar items unless specifically noted otherwise.
  - .3 Disconnect and remove existing fire alarm system including associated conduits, boxes, wiring, and similar items unless specifically noted otherwise.
  - .4 Disconnect and remove communication systems including associated conduits, boxes, cabling, and similar items unless specifically noted otherwise.
  - .5 Disconnect and remove telephone outlets, associated conduit and cabling; maintain telephone service and main terminal backboard as is.
  - .6 Perform demolition work in a neat and workmanlike manner:
    - .1 Remove tools or equipment after completion of work, and leave site clean and ready for subsequent renovation work.
    - .2 Repair and restore damages caused as a result of work of this Section to match existing materials and finishes.
  - .7 Disconnect panel feeders back to main distribution panel and re label respective circuit breaker as "SPARE".
  - .8 Place weatherproof blank cover plates on exterior outlet boxes remaining after demolition and removal activities.
  - .9 Remove existing conduits, boxes, cabling and wiring associated with removed luminaires, electrical devices and equipment.
  - .10 Grind off conduits and make flush with surface of concrete where conduits are cast into concrete; seal open ends of conduit with silicone sealant and leave in place.
  - .11 Seal open ends of conduit with silicone sealant and leave in place where they are inaccessible or cannot be removed without damaging adjacent construction.

### **3.4 CLOSEOUT ACTIVITIES**

- .1 Demolition Waste Disposal: Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle centre) except where explicitly noted otherwise for materials being salvaged for re use in new construction in accordance with Section 02 42 00 - Removal and Salvage of Construction Materials.

**END OF SECTION**

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**Part 1            General**

**1.1            REFERENCES**

- .1    Canadian Standards Association (CSA International)
  - .1        CAN/CSA C22.2 NO.65-18, Wire Connectors (Trinational standard with NMX-J-543-ANCE and UL 486A-486B), Includes Update No. 1 (2019)
- .2    Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

**Part 2            Products**

**2.1            MATERIALS**

- .1    Pressure type wire connectors: with current carrying parts of copper sized to fit copper conductors as required.
- .2    Fixture type splicing connectors: with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3    Bushing stud connectors: to EEMAC 1Y-2 to consist of:
  - .1        Connector body and stud clamp for round copper conductors.
  - .2        Clamp for round copper conductors.
  - .3        Clamp for conductors.
  - .4        Stud clamp bolts.
  - .5        Bolts for copper conductors.
  - .6        Bolts for aluminum conductors.
  - .7        Sized for conductors as indicated.
- .4    Clamps or connectors for armoured cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required.

**Part 3            Execution**

**3.1            INSTALLATION**

- .1    Remove insulation carefully from ends of conductors and:
  - .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 CSA C22.2 No.65.
  - .3        Install fixture type connectors and tighten. Replace insulating cap.
  - .4        Install bushing stud connectors in accordance with EEMAC 1Y-2.

**END OF SECTION**



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**Part 1            General**

**1.1            RELATED SECTIONS**

- .1        Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

**1.2            REFERENCES**

- .1        CSA C22.2 No .03-09 (R2019), Test Methods for Electrical Wires and Cables.

**1.3            PRODUCT DATA**

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

**1.4            WASTE MANAGEMENT AND DISPOSAL**

- .1        Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal, and with the Waste Reduction Workplan.
- .2        Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .3        Fold up metal banding, flatten and place in designated area for recycling.

**Part 2           Products**

**2.1            BUILDING WIRES**

- .1        Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2        Copper conductors: size as indicated, with minimum 600V insulation of chemically cross-linked thermosetting polyethylene material rated RW90 or RWU90.
- .3        Conductors with 1000V insulation when servicing loads connected to variable frequency drives.

**2.2            ARMoured CABLES**

- .1        Type: AC90.
  - .1        Conductors: insulated, copper, size as indicated.
  - .2        Armour: interlocking type fabricated from aluminum strip.

## **2.3 COMMUNICATIONS AND SYSTEMS CABLES**

- .1 Refer to individual sections elsewhere in this specification for cable specifications.

### **Part 3 Execution**

## **3.1 INSTALLATION OF BUILDING WIRES**

- .1 Install wiring as follows:
  - .1 All building wires shall be installed in conduit in accordance with Section 26 05 34.
  - .2 In cable troughs in accordance with Section 26 05 36.

## **3.2 INSTALLATION OF ARMOURED CABLES**

- .1 Group cables wherever possible.
- .2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.
- .3 AC90 cable shall be used above accessible ceilings for drops to luminaires recessed into the accessible ceiling. The horizontal portion of the AC90 cable drop running from the junction box mounted above the ceiling to the luminaire location shall not exceed 1800mm in length. The vertical portion of the drop shall be secured to the ceiling suspension cables using spring steel clips.
- .4 AC90 cables shall be used in areas with accessible ceilings for drops to wiring devices and wall mounted luminaires in drywall stud partitions. The horizontal portion of the AC90 cable drop running from the junction box mounted above the ceiling to the device or luminaire location on the wall shall not exceed 1800mm in length. The vertical portion of the drop shall be secured to the studs inside the partition with the appropriate steel clip and self-tapping screws.
- .5 AC90 cables shall be used for vertical drops to suspended luminaires in areas where no ceiling is provided below the structure. Provide a junction box within 300mm of the fixture suspension point and secure the AC90 cable drop to the luminaire suspension rod, chain or cable using clear tie wraps. AC90 cable is not allowed if a manufacturer supplied power drop assembly has been specified for the luminaire.
- .6 AC90 cable shall not be run horizontally inside walls, except where used to connect wiring devices located on opposite sides of the same wall. The horizontal length of AC90 cables run in between devices located on opposite sides of the same wall shall not exceed 610mm.
- .7 AC90 cables shall be used to connect luminaires in inaccessible ceilings in a daisy chain manner providing the cable is installed prior to the ceiling finish and cables are supported from the structure above. Do not allow cables to rest on ceiling finish.

## **3.3 INSTALLATION OF COMMUNICATIONS AND SYSTEMS CABLES**

- .1 Install all cables in conduit unless specifically indicated otherwise on the drawings.
- .2 Refer to individual sections for additional requirements.

**END OF SECTION**

---

**Part 1            General**

**1.1            REFERENCES**

- .1      American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)

**Part 2            Products**

**2.1            EQUIPMENT**

- .1      Grounding conductors: bare stranded copper, soft annealed, size as indicated.
- .2      Insulated grounding conductors: green, type RW-90.
- .3      Ground bus: copper, 100mm wide, 610mm long, 7mm thick, complete with insulated supports, fastenings, connectors.
- .4      Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
  - .1          Grounding and bonding bushings.
  - .2          Protective type clamps.
  - .3          Bolted type conductor connectors.
  - .4          Thermit welded type conductor connectors.
  - .5          Bonding jumpers, straps.
  - .6          Pressure wire connectors.

**Part 3            Execution**

**3.1            INSTALLATION GENERAL**

- .1      Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.
- .2      Install connectors in accordance with manufacturer's instructions.
- .3      Protect exposed grounding conductors from mechanical injury.
- .4      Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5      Soldered joints are not permitted.
- .6      Install bonding wire for flexible conduit, connected at end to grounding bushing, solderless lug, clamp or cup washer and screw.
- .7      Connect building structural steel and metal siding to ground by welding copper to steel.

### **3.2 SYSTEM AND CIRCUIT GROUNDING**

- .1 Install system and circuit grounding connections to neutral of primary system.

### **3.3 EQUIPMENT GROUNDING**

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list; Service equipment, transformers, frames of motors, starters, control panels, cable trays and distribution panels.

### **3.4 COMMUNICATION SYSTEMS**

- .1 Install grounding connections for intercommunication systems as follows:
  - .1 Intercommunication systems as indicated.

### **3.5 FIELD QUALITY CONTROL**

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

**END OF SECTION**

**Part 1            General**

**1.1               RELATED SECTIONS**

- .1        Section 01 74 19 - Waste Management and Disposal.

**Part 2            Products**

**2.1               SUPPORT CHANNELS**

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

**2.2               COMMUNICATIONS CABLING ROUTING HOOKS**

- .1        Galvanized steel construction.
- .2        Minimum 50mm dia.
- .3        Clasp type cable retainer.
- .4        Suitable for fastening to building structure.

**Part 3            Execution**

**3.1               INSTALLATION**

- .1        Secure equipment to solid masonry, tile and plaster surfaces with lead anchors or nylon shields.
- .2        Secure equipment to poured concrete with expandable inserts.
- .3        Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4        Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.
- .5        Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .6        Fasten exposed conduit or cables to building construction or support system using straps.
  - .1        One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
  - .2        Two-hole steel straps for conduits and cables larger than 50 mm.
  - .3        Beam clamps to secure conduit to exposed steel work.
- .7        Suspended support systems.

- .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
- .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .8 For surface mounting of two or more conduits use channels at 3 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 Departmental Representative.
- .13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

**END OF SECTION**

**Part 1 General**

**1.1 SHOP DRAWINGS AND PRODUCT DATA**

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

**1.2 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal, and with the Waste Reduction Workplan.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .3 Fold up metal banding, flatten and place in designated area for recycling.

**Part 2 Products**

**2.1 JUNCTION AND PULL BOXES**

- .1 Welded steel construction with screw-on flat covers for surface mounting.
- .2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

**Part 3 Execution**

**3.1 JUNCTION, PULL BOXES AND CABINETS INSTALLATION**

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

**3.2 IDENTIFICATION**

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

**END OF SECTION**



**Part 1 General**

**1.1 REFERENCES**

- .1 CSA C22.1-2009, Canadian Electrical Code, Part 1.

**1.2 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal, and with the Waste Reduction Workplan.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

**Part 2 Products**

**2.1 OUTLET AND CONDUIT BOXES GENERAL**

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 347 V outlet boxes for 347 V switching devices.
- .6 Combination boxes with barriers where outlets for more than one system are grouped.

**2.2 SHEET STEEL OUTLET BOXES**

- .1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .3 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .4 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished walls.

**2.3 CONDUIT BOXES**

- .1 Cast FS or FD ferrous alloy boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

**2.4 FITTINGS - GENERAL**

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.
- .5 Outlet boxes installed on opposite sides of fire rated walls shall be complete with wall opening protective materials (fire rated putty pads) where outlet boxes are not separated by a minimum of 610mm.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA)
  - .1 CSA C22.2 No 18.1-13 (R2018) Metallic Outlet Boxes
  - .2 CSA C22.2 No. 18.5-13 (R2018) Positioning Devices
  - .3 CSA C22.2 No. 18.3-12 (R2017) Conduit, Tubing and Cable Fittings
  - .4 CSA C22.2 No. 45.1-2007 Electrical Rigid Metal Conduit – Steel
  - .5 CSA C22.2 No. 56-17, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
  - .6 CSA C22.2 No. 83-M1985 (R2017), Electrical Metallic Tubing.
  - .7 CSA C22.22 No. 227.3-15 (R2019) Nonmetallic Mechanical Protection Tubing (NMPT) and fittings (Bi-National standard with UL 1696).

**1.2 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal, and with the Waste Reduction Workplan.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.
- .4 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

**Part 2 Products**

**2.1 CONDUITS**

- .1 Rigid metal conduit: to CSA C22.2 No. 45, hot dipped galvanized steel, threaded.
- .2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .3 Flexible metal conduit: to CSA C22.2 No. 56, steel.
- .4 Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.3.

**2.2 CONDUIT FASTENINGS**

- .1 One hole steel straps to secure surface conduits 51 mm and smaller. Two hole steel straps for conduits larger than 51 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 3 m oc.

- .4 Threaded rods, 6 mm dia., to support suspended channels.

## **2.3 CONDUIT FITTINGS**

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory "ells" where 90° bends are required for 27 mm and larger conduits.

### **PULL CORD**

- .3 Polypropylene.

## **Part 3 Execution**

### **3.1 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 unfinished areas.
- .3 Use rigid hot dipped galvanized steel threaded conduit except where specified otherwise.
- .4 Use electrical metallic tubing (EMT) above 2.4 m not subject to mechanical injury.
- .5 Use flexible metal conduit for connection to motors in dry areas, connection to recessed light fixtures without a prewired outlet box, connection to surface or recessed fixtures and work in movable metal partitions.
- .6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .7 Install conduit sealing fittings in hazardous areas. Fill with compound.
- .8 Minimum conduit size for lighting and power circuits: 21 mm.
- .9 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .10 Mechanically bend steel conduit over 21 mm dia.
- .11 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .12 Install pull cord in empty conduits.
- .13 Run 2-27 mm spare conduits up to ceiling space and 2-27 mm spare conduits down to ceiling space from each flush panel. Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.
- .14 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

- .15 Dry conduits out before installing wire.

### **3.2 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 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.

### **3.3 CONCEALED CONDUITS**

- .1 Run parallel or perpendicular to building lines.

**END OF SECTION**

---

**Part 1            General**

**1.1            RELATED SECTIONS**

- .1        Section 01 33 00 - Submittal Procedures.
- .2        Section 01 74 19 - Waste Management and Disposal.

**1.2            REFERENCES**

- .1        Canadian Standards Association (CSA International)
  - .1        CAN/CSA C22.2 No.126.1-17 Metal Tray Systems (Bi-National Standard, with VE 1- 2017)
- .2        National Electrical Manufacturers Association (NEMA) standards
  - .1        NEMA VE 1-2017, Metal Cable Tray Systems.
- .3        TIA-607-C Telecommunications Bonding and Grounding (Earthing) for Customer Premises.
- .4        Government of Canada Workplace Fit Up Standards, guideline A4.

**1.3            SHOP DRAWINGS AND PRODUCT DATA**

- .1        Submit shop drawings and product data in accordance with section 01 33 00 - Submittal Procedures.
- .2        Identify types of cable tray used.
- .3        Show actual cable tray installation details and suspension system.

**1.4            WASTE MANAGEMENT AND DISPOSAL**

- .1        Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.
- .2        Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3        Fold up metal banding, flatten and place in designated area for recycling.

**Part 2            Products**

**2.1            WIRE MESH CABLE TRAY**

- .1        Wire shall be hot dipped galvanized, sized and welded to meet load designation.

- .2 Fittings: horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion joints and reducers where required, manufactured accessories for cable tray supplied.
- .3 Minimum radius on elbows shall be 610mm.
- .4 Provide barriers as indicated on drawings.
- .5 Bonding jumpers at every section or fitting joint.
- .6 Dimensional details and suspension detail as indicated on the drawings.

### **Part 3 Execution**

#### **3.1 INSTALLATION OF CABLE TRAY**

- .1 Install complete cable tray system.
- .2 Support cable tray on both sides as detailed on the drawings.
- .3 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.
- .4 Provide fire stop assembly as required in areas indicated on drawings and where cable tray passes through fire separations.
- .5 Cable tray shall have adequate separation from AC power circuits and light fixtures.
- .6 Cable tray must not have conduits, mechanical piping or other impediments passing through the cabling pathway.
- .7 Cable tray shall have adequate clearance for addition or removal of cabling.

#### **3.2 CABLES IN CABLE TRAY**

- .1 Install cables individually.
- .2 Lay cables into cable tray. Use rollers when necessary to pull cables.
- .3 Secure cables in cable tray at 6 m centres, with nylon ties.
- .4 Identify cable tray every 10m with size 2 nameplates in accordance with Section 26 05 00.
- .5 Install ground wire continuous over length of tray or install ground jumpers if tray rating permits.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

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

**1.2 SHOP DRAWINGS**

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

**Part 2 Products**

**2.1 OCCUPANCY SENSORS**

- .1 Low Voltage Dual Technology
  - .1 Wall switch sensor with the following features:
    - .1 18-24VDC, 24VAC; 35mA.
    - .2 Isolated relay with 1-N/O and N/C outputs, rated for 1 amp at 30VDC.
    - .3 Time delays: Automatic, self-adjusting delay, fixed (5, 15 or 30 minutes), walk-through, test-mode.
    - .4 Integral ON/OFF pushbutton.
    - .5 Coverage: PIR minor motion 20'x15', Ultrasonic minor motion 15'x15'.
    - .6 Sensitivity: Ultrasonic (fully variable), PIR (high/low).
    - .7 Integral light level sensing.
    - .8 40kHz high frequency Ultrasound.
    - .9 Flush mounted in decorator style wall plate.
    - .10 Compatible with lighting control system specified in Section 26 09 43.
  - .2 Ceiling mounted sensor with the following features:
    - .1 24VDC/VAC, 43mA.
    - .2 Isolated relay with 1-N/O and N/C outputs, rated for 1 amp at 30VDC/VAC.
    - .3 Time delays: Automatic, self-adjusting delay, fixed (5, 10, 15, 20 or 30 minute), walkthrough, test-mode.
    - .4 Sensitivity: PIR (automatic or reduced sensitivity), Ultrasonic (fully variable).
    - .5 Multi-level, 360° Fresnel lens.
    - .6 Integral light level sensor: 10-300, footcandles (107.6 to 3,229.2 lux).
    - .7 Coverage: 40'x40'.
    - .8 40kHz high frequency ultrasound.
    - .9 Compatible with lighting control system specified in Section 26 09 43.
- .2 Occupancy sensor power pack
  - .1 Primary voltage 347V.
  - .2 Secondary voltage 24V/DC.
  - .3 Output: 150mA.
  - .4 Capable of switching up to 20 amp ballast, 13 amp incandescent and 1HP motor loads.
  - .5 12mm snap-in nipple to attach to 12mm knockouts.
  - .6 Compatible with lighting control system specified in Section 26 09 43.



## **2.2 PHOTOCELLS**

### **.1 Interior Photocell**

- .1** Indoor type, flush mounted.
- .2** Dual programmable set point operation allowing for two (2) distinct outputs.
- .3** Compatible with occupancy sensors and other devices on the system.
- .4** Adjustable set points from 0 to 5000 footcandles.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1** Install devices as per manufacturers' recommendations.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

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

**1.2 SYSTEM DESCRIPTION**

- .1 Wireless lighting control system designed to provide remote switching and / or dimming of lighting loads by use of:
  - .1 Low voltage control stations.
  - .2 Wireless managers.
  - .3 Low voltage emergency operation relays.
  - .4 Dimming modules.
  - .5 Wall mount dimming raise / lower stations.
  - .6 Photocells, analog and discrete.
  - .7 Astronomical time clocks.
  - .8 External contact closures.
- .2 New wireless lighting control system shall connect to and be compatible with the existing building Osram Encelium wireless lighting control system. The system is connected to the existing Building Management System.
- .3 **DESIGN INTENT**

**The intent of the lighting control system is to provide an integrated, wireless low voltage relay system and dimming system. The drawings and details on the drawings indicate the basic sequence of operation. This specification describes the minimum performance of the system. The supplier is responsible for providing all of the required equipment to give a functioning system with the flexibility described herein. Suppliers may propose alternate methods of delivering the system while still maintaining the minimum performance described.**

**1.3 SHOP DRAWINGS**

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

**1.4 SUBMITTALS**

- .1 **IN ORDER TO BE CONSIDERED AN APPROVED SUPPLIER, EACH SUPPLIER SHALL SUBMIT THE FOLLOWING DURING THE TENDER PERIOD AND NOT LATER THAN EIGHT (8) DAYS PRIOR TO TENDER CLOSE. THIS INFORMATION IS MANDATORY.**
- .2 Provide a detailed overall schematic of the system showing each component and interconnecting wiring. Provide wire types and recommended conduit sizes.

- .3 Provide detailed floor plans of the building showing each component and interconnecting wiring. Show all wire types.
- .4 Provide a data sheet for each component.
- .5 Provide a sequence of operation for the system.

## **1.5 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal, and with Waste Reduction Workplan.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.

## **Part 2 Products**

### **2.1 SYSTEM OPERATION**

- .1 Any lighting zone may be programmed to operate alone or in a group of zones.
- .2 Any dimming module may be programmed to operate alone or in a group of dimming modules.
- .3 Lighting zones may be operated from any low voltage pushbutton switch(es), time clock, photocell, or external contact closure.
- .4 Dimming modules or dimming module groups may be operated from any raise lower station within its control area, time clock, photocell, or external contact closure.
- .5 Any lighting zone may be programmed to operate in a different configuration depending on the input from the control device. Example: relays 1 to 5 operate together when activated by the time clock, but when the photocell is activated relays 4 to 6 will operate. Dimming modules or dimming module groups shall operate in a similar fashion.
- .6 Any lighting zone programming may be altered through the existing lighting control software.
- .7 Relays or dimming modules designated as controlling emergency lighting shall automatically energize when emergency power is connected to the system regardless of the previous status of the relay or dimming module.

### **2.2 System Components**

- .1 Wireless Manager:
  - .1 Ceiling or wall mounted.
  - .2 Connected to existing wireless lighting control system by PoE.
  - .3 Shall collect, process and distribute all wireless signal information via mesh network based upon ZigBee standards, AES 128-bit encryption for wireless communication.
  - .4 Capable of controlling up to 100 nodes.

- .5 wireless range shall be 25m within line of site, 12m through walls.
- .6 Unit shall have LED status light in front of unit.
- .7 Operation temperature shall be 0°C to 40°C.
- .2 Wireless Area Lighting Control Module:
  - .1 Shall provide control for 0-10V dimmable and fixed output LED drivers.
  - .2 Shall have a terminal block for direct sensor connection.
  - .3 Shall enable wireless control for loads up to 20A.
  - .4 Shall utilize multi-tech sensors.
  - .5 Shall allow customization of lighting scenes.
  - .6 Shall be able to automatically adjust lighting levels to respond to variable lighting.
  - .7 Shall be capable of adjusting luminaire group assignments for future space layout changes.
  - .8 Shall communicate to the wireless systems via mesh network based upon ZigBee standards.
- .3 Wireless Control Module:
  - .1 Allows equipment to be independently controlled and configured in the wireless lighting control system software.
  - .2 Shall control system 0-10V dimmable luminaires.
  - .3 Shall control system occupancy sensors.
  - .4 Shall communicate to the wireless systems via mesh network based upon ZigBee standards.
- .4 Low Voltage Control Stations
  - .1 Decorator style with color as per wiring devices.
  - .2 LED status indicator.
  - .3 Label.
  - .4 Maximum eight (8) pushbuttons on a single gang cover plate.
  - .5 Refer to lighting plans and details for number of pushbuttons and function.
- .5 Daylight Harvesting Photocell
  - .1 Indoor type, flush mounted.
  - .2 Dual programmable set point operation allowing for two (2) distinct outputs.
  - .3 Compatible with occupancy sensors and other devices on the system.
  - .4 Adjustable set points from 0 to 5000 foot candles.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 The manufacturer's factory representative shall provide three (3) site visits during the construction period:
  - .1 One (1) visit prior to electrical contractor rough-in to review the shop drawing submission, confirm wiring, and to meet with the consultant.

- .2 One (1) visit during construction and after rough-in is complete to verify the wiring installation and review the overall installation.
- .3 One (1) after the system is installed to perform start-up, verification, programming and training.
- 2. Install system as per manufacturers' recommendations. Once completed, provide start-up and verification report to the Departmental Representative.
- .3 Provide a minimum of three (3) hours of instructional and operational training to the Departmental Representative. After training is complete, provide system programming which shall include input of all Owners schedules, photocell input settings, occupancy sensor input settings and external input settings.
- .4 Connect low voltage and dimming circuits in accordance with manufacturer's recommendations.
- .5 Connect line voltage circuits from designated panels.
- .6 All low voltage wiring shall be installed in EMT conduit.

**END OF SECTION**

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**Part 1            General**

**1.1            SHOP DRAWINGS**

- .1       Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2       Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

**Part 2            Products**

**2.1            PANELBOARDS**

- .1       Panelboards shall be the 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       250V and 600 V panelboards: bus and breakers rated for 10 KA (symmetrical) interrupting capacity minimum or as indicated.
- .3       Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .4       Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .5       Two keys for each panelboard and key panelboards alike.
- .6       Tin plated aluminum bus with neutral of same ampere rating as mains.
- .7       Mains: suitable for bolt-on breakers.
- .8       Trim with concealed front bolts and hinges.
- .9       Trim and door finish: baked grey enamel.
- .10      Custom built panelboard assemblies.
- .11      Double stack panels as indicated.
- .12      Contactors in mains as indicated.
- .13      Feed through lugs as indicated.
- .14      Surface mount panels complete with sprinkler hoods in areas with sprinklers.

**2.2            BREAKERS**

- .1       Breakers: to Section 26 28 16.02 - Moulded Case Circuit Breakers.

- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .4 Tandem and mini style breakers are not allowed.

### **2.3 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Nameplate for each panelboard size 4 engraved as indicated.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit.

## **Part 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 26 05 00 - Common Work Results - Electrical or as indicated.
- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus with respective neutral identified.
- .6 Provide (2) two empty 27mm conduits stubbed into the nearest ceiling space from each recess panelboard.

**END OF SECTION**

**Part 1            General**

**1.1                SHOP DRAWINGS AND PRODUCT DATA**

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

**1.2                REFERENCE STANDARDS**

- .1        CSA Group (CSA)
  - .1        CSA C22.2 No.42-10 (R2020), General Use Receptacles, Attachment Plugs and Similar Devices.
  - .2        CAN/CSA C22.2 No.42.1-13 (R2017) Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
  - .3        CSA C22.2 No.55:15 (R2020) Special Use Switches.
  - .4        CSA C22.2 No.111-18, General-Use Snap Switches (Tri-national Standard with UL20 and NMX-J-005-ANCE), includes update No. 1 (2021).

**Part 2            Products**

**2.1                SWITCHES**

- .1        15, 20A, 120 V, 277 V        or 347 V single pole, double pole, three-way, four-way switches.
- .2        Manually-operated general purpose ac switches with following features:
  - .1        Terminal holes approved for No. 10 AWG wire.
  - .2        Silver alloy contacts.
  - .3        Urea or melamine moulding for parts subject to carbon tracking.
  - .4        Suitable for back and side wiring.
  - .5        Rocker operated, fully rated for all specified lamps, and up to 80% of rated capacity of motor loads.
  - .6        White rectangular decorator rocker type.

**2.2                COMMERCIAL GRADE RECEPTACLES**

- .1        Commercial grade duplex receptacles, CSA type 5-15R, 125V, 15A, U ground, with the following features:
  - .1        White thermoplastic nylon molded body and face.
  - .2        Suitable for No.10 AWG for back and side wiring.
  - .3        Break-off links for use as split receptacles.
  - .4        Eight (8) back wired entrances, four (4) side wiring screws.
  - .5        Triple wipe contacts and riveted grounding contacts.
  - .6        White rectangular decorator style.



- .2 Commercial grade ground fault circuit interrupter receptacles, CSA type 5-15R and 5-20R, 125V, 15A with the following features:
  - .1 Terminals accommodate No. 14-12 AWG wire.
  - .2 Silver alloy contacts.
  - .3 Test and reset button shall match face cover.
  - .4 Eight (8) back wired entrances, four (4) side wiring screws.
  - .5 Heavy duty double wipe contacts.
  - .6 Green LED indicator light.
  - .7 White thermoplastic nylon molded body and face, rectangular decorator style.
  - .8 AC horsepower rating at rated voltage: 1 ½ HP.
  - .9 Temp. rise: Max 30°C after 50 cycles OL at 150% rated current.
  - .10 Current limiting: 10kA.
  - .11 Meet CSA C22.2 No. 42: File LR-57811.

### **2.3 SPECIALTY WIRING DEVICES**

- .1 Pac Poles with the following features:
  - .1 Painted aluminum pole. Final paint colour shall be selected by Departmental Representative.
  - .2 Cross section of 54mmx60mm.
  - .3 3660mm high
  - .4 Two (2) separate compartments.
  - .5 Provide receptacles and communication outlets as indicated on drawings.
  - .6 Power cord shall be 3m long.
  - .7 Pole top mounted utility box.
  - .8 Ceiling escutcheon.

### **2.4 COVER PLATES**

- .1 Cover plates for wiring devices.
- .2 Cover plates from one manufacturer throughout project.
- .3 Stainless steel, 1 mm thick cover plates, thickness 2.5 mm for wiring devices mounted in flush-mounted outlet box.

### **2.5 GENERAL**

- .1 Other receptacles with ampacity and voltage as indicated.
- .2 Receptacles of one manufacturer throughout project.
- .3 Receptacles connected to essential power supply shall be red.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Switches:
  - .1 Install single throw switches with handle in "UP" position when switch closed.
  - .2 Install switches in gang type outlet box when more than one switch is required in one location.
  - .3 Mount switches at height specified on drawings.
- .2 Receptacles:

- .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
- .2 Mount receptacles at height specified on drawings.
- .3 Cover plates:
  - .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
  - .2 Install suitable common cover plates where wiring devices are grouped.
  - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 26 05 01 – Common Work Results - Electrical

**1.2 REFERENCES**

- .1 CSA International
  - .1 CSA C22.2 No. 5-16, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2016), includes Update No. 1 (2019).

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Include time-current characteristic curves for breakers with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage with ampacity of 200A and over.
- .4 Certificates:
  - .1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit 3 copies of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.
    - .1 Production certificate of origin must be submitted to Departmental Representative for approval.
  - .2 Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.
  - .3 Any work of manufacturing, assembly or installation to begin only after acceptance of production certificate of origin by Departmental Representative. Unless complying with this requirement, Departmental Representative reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.
  - .4 Production certificate of origin must contain:
    - .1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.
    - .2 Licensed dealer's name and address and person of distributor responsible for Contractor's account.
    - .3 Contractor's name and address and person responsible for project.

- .4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.
- .5 Name and address of building where circuit breakers will be installed:
  - .1 Project title: \_\_\_\_\_.
  - .2 End user's reference number: \_\_\_\_\_.
  - .3 List of circuit breakers: \_\_\_\_\_.

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

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store circuit breakers indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect circuit breakers from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

#### **1.5 SHOP DRAWINGS AND PRODUCT DATA**

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

### **Part 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.
  - .1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .4 Circuit breakers with interchangeable trips as indicated.
- .5 Circuit breakers to have minimum 10,000A symmetrical rms interrupting capacity rating.

#### **2.2 OPTIONAL FEATURES**

- .1 Include:
  - .1 Under-voltage release.
  - .2 On-off locking device.
  - .3 Handle mechanism.

**2.3 ENCLOSURE**

- .1 As indicated on the drawings.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install circuit breakers as indicated.

**END OF SECTION**

---

**Part 1            General**

**1.1            RELATED SECTIONS**

- .1      Section 01 33 00 - Submittal Procedures.
- .2      Section 01 74 19 - Waste Management and Disposal.
- .3      Section 26 05 00 - Common Work Results - Electrical.

**1.2            REFERENCE STANDARDS**

- .1      CSA Group
  - .1      CAN/CSA-C22.2 No.4-16, Enclosed and Dead-Front Switches (Tri-National Standard, with ANCE NMX-J-162-2004 and UL 98).
  - .2      CSA C22.2 No.39-13 (R2017), Fuseholder Assemblies.

**1.3            PRODUCT DATA**

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

**1.4            WASTE MANAGEMENT AND DISPOSAL**

- .1      Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.
- .2      Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .3      Fold up metal banding, flatten and place in designated area for recycling.

**Part 2           Products**

**2.1            DISCONNECT SWITCHES**

- .1      Fusible, non-fusible, horsepower rated disconnect switch in CSA Enclosure, size as indicated.
- .2      Provision for padlocking in off switch position by three locks.
- .3      Mechanically interlocked door to prevent opening when handle in ON position.
- .4      Fuseholders: relocatable and suitable without adaptors, for type and size of fuse indicated.
- .5      Quick-make, quick-break action.
- .6      ON-OFF switch position indication on switch enclosure cover.

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**2.2 EQUIPMENT IDENTIFICATION**

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

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install disconnect switches complete with fuses if applicable.

**END OF SECTION**

---

**Part 1            General**

**1.1            RELATED SECTIONS**

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

**1.2            REFERENCES**

- .1        International Electrotechnical Commission (IEC)
  - .1        IEC 947-4-1-1990, Part 4: Contactors and motor-starters.

**1.3            SHOP DRAWINGS AND PRODUCT DATA**

- .1        Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Indicate:
  - .1        Mounting method and dimensions.
  - .2        Starter size and type.
  - .3        Layout of identified internal and front panel components.
  - .4        Enclosure types.
  - .5        Wiring diagram for each type of starter.
  - .6        Interconnection diagrams.

**1.4            CLOSEOUT SUBMITTALS**

- .1        Provide operation and maintenance data for motor starters for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2        Include operation and maintenance data for each type and style of starter.

**1.5            EXTRA MATERIALS**

- .1        Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2        Provide listed spare parts for each different size and type of starter:
  - .1        3 contacts, stationary.
  - .2        3 contacts, movable.
  - .3        1 contacts, auxiliary.
  - .4        1 control transformers.
  - .5        1 operating coil.
  - .6        2 fuses.
  - .7        10% indicating lamp bulbs used.



## **1.6 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal, and with the Waste Reduction Workplan.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Starters: to IEC 947-4 with AC4 utilization category.

### **2.2 MANUAL MOTOR STARTERS**

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

### **2.3 FULL VOLTAGE MAGNETIC STARTERS**

- .1 Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
  - .1 Contactor solenoid operated, rapid action type.
  - .2 Motor overload protective device in each phase, manually reset from outside enclosure.
  - .3 Wiring and schematic diagram inside starter enclosure in visible location.
  - .4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
- .2 Combination type starters to include circuit breaker with operating lever on outside of enclosure to control circuit breaker, and provision for:
  - .1 Locking in "OFF" position with up to 3 padlocks.
  - .2 Independent locking of enclosure door.
  - .3 Provision for preventing switching to "ON" position while enclosure door open.
- .3 Starter Components:

- .1 Hand/Off/Auto Selector Switch.
- .2 120 volt control transformer, secondary grounded, with primary protective HRC fuses.
- .3 Phase loss protection on all 3 phase starters.
- .4 Run, Stop and Overload Pilot lights.
- .5 2-N/O and 2-N/C spare auxiliary contacts.
- .6 Solid state motor overload protective device in each phase manually reset, from outside of enclosure.
- .7 CEMA 1 enclosure except where indicated otherwise. Enclosure complete with provisions for padlocking in "ON" or "OFF" position.

## **2.4 CONTROL TRANSFORMERS**

- .1 Single phase, dry type, control transformer with primary voltage as indicated and 120V secondary, complete with secondary fuse, installed in with starter as indicated.
- .2 Size control transformer for control circuit load plus 20% spare capacity.

## **2.5 FINISHES**

- .1 Apply finishes to enclosure in accordance with Section 260500 – Common Work Results – Electrical.

## **2.6 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.
- .3 Magnetic starter designation label, white plate, black letters, size 5 engraved as indicated.

# **Part 3 Execution**

## **3.1 INSTALLATION**

- .1 Install starters, connect power and control as indicated.
- .2 Ensure correct fuses and overload devices elements installed.

## **3.2 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and manufacturer's instructions.
- .2 Operate switches, contactors to verify correct functioning.
- .3 Perform starting and stopping sequences of contactors and relays.

- .4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

**END OF SECTION**

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**Part 1            General**

**1.1            REFERENCES**

- .1        CSA 22.1-18, 24<sup>th</sup> Edition, Canadian Electrical Code, Part 1
- .2        IEEE C62.41.1-2002: IEEE Guide on the Surge Environment in Low Voltage (1000V and less) AC Power Circuits.
- .3        IEEE C62.41.2-2002: IEEE Recommended Practice on Characterization of Surges in Low Voltage (1000V and less) AC Power Circuits.
- .4        FCC 47 CFR Part 15, Federal Code of Regulation (CFR) testing standard for electronic equipment.
- .5        IESNA LM-79-19, Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products.
- .6        IESNA LM-80-20, Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules.
- .7        IESNA TM-15, Luminaire Classification System for Outdoor Luminaires.
- .8        UL1598, Standard for Safety of Luminaires.
- .9        NEMA SSL 3-2010, High-Power White LED Binning for General Illumination.
- .10       NEMA IEC60529, Degrees of Ingress Protection by Enclosures.
- .11       ASTM F1137/F1137M-19: Standard Specifications for Phosphate/Oil Corrosion Protective Coatings for Fasteners.

**1.2            RELATED SECTIONS**

- .1        Section 01 33 00 - Submittal Procedures.
- .2        Section 01 74 19 - Waste Management and Disposal.
- .3        Section 01 45 00 - Quality Control.

**1.3            SHOP DRAWINGS AND PRODUCT DATA**

- .1        Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Consultant.
- .3        Photometric data to include: VCP Table spacing criterion.

#### **1.4 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.

#### **1.5 QUALITY ASSURANCE**

- .1 Manufacturers of LED luminaires shall demonstrate a suitable quality assurance program incorporating high heat, high humidity and thermal shock test regimens to ensure system reliability and to substantiate lifetime claims.
- .2 Luminaires shall be provided with a 5-year warranty covering, LEDs, drivers, paint and mechanical components.

### **Part 2 Products**

#### **2.1 LED LUMINAIRES**

- .1 General: Except as otherwise indicated, provide LED luminaires, of types and sizes indicated on fixture schedules.
- .2 Material and specifications for each luminaire are as follows:
  - .1 Each luminaire shall consist of an assembly that utilizes LEDs as the light source. In addition, a complete luminaire shall consist of a housing, LED array and electronic driver (power supply).
  - .2 The rated operating temperature range shall be 0°C to +40°C for interior fixtures. Exterior fixture operating range shall be -40°C to +40°C.
  - .3 Photometry must be compliant with IESNA LM-79-08 and shall be conducted at 25°C ambient temperature.
  - .4 Each luminaire shall meet all parameters of this specification throughout the minimum operational life.
  - .5 The individual LEDs shall be constructed such that a loss or the failure of one or more LEDs will not result in the loss of the entire luminaire.
  - .6 Luminaire shall be constructed such that LED modules may be replaced or repaired without replacement of whole luminaire.
  - .7 Each luminaire shall be listed with CSA or cUL under UL1598 for luminaires.

#### **2.2 TECHNICAL REQUIREMENTS**

- .1 Electrical
  - .1 Power Consumption: Maximum power consumption allowed for the luminaire shall be determined by application. The luminaire shall not consume power in the off state.

- .2 Operation Voltage: The luminaire shall operate from a 60Hz +/-3 Hz AC line over a voltage ranging from 108 VAC. The fluctuations of line voltage shall have no visible effect on the luminous output.
- .3 Power Factor: The luminaire shall have a power factor of 0.90 or greater.
- .4 THD: Total harmonic distortion (current and voltage) induced into an AC power line by a luminaire shall not exceed 10% over entire load range 0-100%.
- .5 The power supply driver for exterior fixtures enclosure should be sealed. This area should be sealed to minimum Ingress Protection level 65 (IP65).
- .6 RF Interference: LED Drivers must meet Class A emission limits referred in Federal Communications Commission (FCC) Title 47, Subpart B, Section 15 regulations concerning the emission of electronic noise.

## **2.3 PHOTOMETRIC REQUIREMENTS**

- .1 The Luminaire shall have minimum efficacy as noted in the Light Fixture Schedule.
- .2 All photometric data will be measured by the IESNA LM-79-08 standard and formatted per IESNA LM-63-02 as an electronic .ies file.
- .3 Measurements shall be calibrated to standard photopic calibrations. The LED device manufacturer shall have tested the lumen maintenance characteristics of the LED package in accordance with the guidelines of IESNA LM-80-08 "Approved Method for Lumen Maintenance Testing of LED Light Sources". A copy of the manufacturer's LM – 80 reports shall be submitted for review.
- .4 The color rendition index (CRI) shall be as noted in the Light Fixture Schedule. Binning of LEDs shall conform to ANSI/G. NEMA SSL 3-2010 and shall be within a 3-step McAdam ellipse.

## **2.4 THERMAL MANAGEMENT**

- .1 The thermal management of the heat generated by the LEDs shall be of sufficient capacity to assure proper operation of the luminaire over the expected useful life.
- .2 The LED manufacturer's maximum thermal pad temperature for the expected life shall not be exceeded.
- .3 Thermal management shall be passive by design. The use of fans or other mechanical devices shall not be allowed.
- .4 The luminaire shall have a minimum heat sink surface such that LED manufacturer's maximum junction temperature is not exceeded at maximum rated ambient temperature of 40 degrees Celsius (supply heat test).
- .5 The heat sink material shall be aluminum.

## **2.5 FINISHES**

- .1 Metal surfaces of luminaire housing and reflectors finished with high gloss baked enamel to give smooth, uniform appearance, free from pinholes or defects.
- .2 Reflector and other inside surfaces finished as follows:

- .1 White, minimum reflection factor 85%.
- .2 Colour fastness: yellowness factor not above 0.02 and after 250 hours exposure in Atlas fade-ometer not to exceed 0.05.
- .3 Film thickness, not less than 0.03 mm average and in no areas less than 0.025 mm.
- .4 Gloss not less than 80 units as measured with Gardner 60° gloss meter.
- .5 Flexibility: withstand bending over 12 mm mandrel without showing signs of cracking or flaking under 10 times magnification.
- .6 Adhesion: 24 mm square lattice made of 3 mm squares cut through film to metal with sharp razor blade. Adhesive cellulose tape applied over lattice and pulled. Adhesion satisfactory if no coating removed.

## **2.6 LUMINAIRES**

- .1 Refer to light fixture schedule.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Locate and install luminaires as indicated.
- .2 Provide plaster frame and trim as required, and turn over to trade providing ceiling installation.
- .3 Support luminaries directly from building structure.
- .4 Install recessed LED luminaries so that they can be completely removable from below the finished ceiling.
- .5 Recessed downlights installed in t-bar ceilings shall be secured to blocking spanning between ceiling grid members. Secure recessed downlight to blocking to ensure that luminaire does not move when trim is adjusted, or removed for servicing.
- .6 Recessed lighting luminaries in inaccessible ceilings shall be secured to blocking attached to building structure.
- .7 Where no finished ceiling exists, luminaries shall be suspended on rigid conduit hangers complete with ball aligner, and outlet box canopy. All suspension components shall be degreased and painted white, unless otherwise noted.
- .8 Replace fixtures, which in the opinion of the electrical consultant, are found to exhibit excessive noise.
- .9 Coordinate installation of luminaries with mechanical contractor to avoid conflicts between luminaries, and mechanical system components.

**3.2 WIRING**

- .1 Connect luminaires to lighting circuits.

**3.3 LUMINAIRE SUPPORTS**

- .1 For luminaires mounted in suspended ceilings, support luminaires from ceiling grid in accordance with local inspection requirements
- .2 Support luminaires mounted in continuous rows once every three meters minimum.

**3.4 LUMINAIRE ALIGNMENT**

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

**END OF SECTION**



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**Part 1            General**

**1.1                REFERENCES**

- .1     Atomic Energy Control Board Regulations
- .2     Canadian Code for Preferred Packaging
- .3     Canadian Standards Association (CSA)
  - .1        CSA C22.2 No.141-15 (R2020), Emergency Lighting Equipment.
  - .2        CSA C860- 11 (R2016), Performance of Internally-Lighted Exit Signs.
- .4     National Fire Protection Association (NFPA) requirements

**1.2                SUBMITTALS**

- .1     Submit product data in accordance with Section 01 33 00 - Submittals.
- .2     Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 61 33 - Hazardous Materials. WHMIS acceptable to Labour Canada, and Health and Welfare Canada.
- .3     Submit product data sheets for exit lights. Include product characteristics, performance criteria, physical size, limitations and finish.
- .4     Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, and cleaning procedures.

**1.3                WASTE MANAGEMENT AND DISPOSAL**

- .1     Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal, and with Waste Reduction Workplan.
- .2     Place materials defined as hazardous or toxic waste in designated containers.
- .3     Ensure emptied containers are sealed and stored safely for disposal away from children.
- .4     Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .5     Fold up metal banding, flatten and place in designated area for recycling.

**Part 2            Products**

**2.1                STANDARD UNITS**

- .1     Packaged in accordance with the Canadian Code for Preferred Packaging guidelines.
- .2     Housing: cast anodized extruded aluminum housing, as per schedule.

- .3 Face and back plates: extruded aluminum.
- .4 Lamps: as per schedule.
- .5 Green pictorial running man style with die cast aluminum construction.
- .6 Downlight: translucent acrylic in bottom of unit.
- .7 Face plate to remain captive for relamping.
- .8 Exit light shall be suitable for wall, end or ceiling mounting as determined on site.
- .9 Blank faceplate for the back of single face exit signs, shall not have any knockouts.
- .10 The exit light shall be illuminated with a minimum of 21 LED's along the top, and 19 LED's along the bottom of the exit light interior. The LED's shall be contained in an acrylic lens panel, which shall evenly distribute light on the lettering. The module containing the LED's shall be capable of illuminating both single and double face exit signs.
- .11 LED's shall be connected in parallel (not series) so that failure of an LED shall not cause more than 5 LED's to be extinguished.
- .12 Exit light input shall be maximum 2 watts.
- .13 LED's shall operate on 347 volt, as well as DC voltage provided by remote emergency battery units (refer to drawings for voltage), without the use of any external transformer.
- .14 Design life for the exit light shall be minimum 25 years.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install exit lights in plain view as indicated, and in accordance with the latest edition of the National Building Code.
- .2 Exit lighting shall be connected to a separate AC circuit dedicated to exit lighting only, and shall also be connected to an emergency power supply source.
- .3 Coordinate installation of exit lights with ceiling or wall construction. If necessary, provide hanger to suspend exit light below visual obstructions.

**END OF SECTION**