

## **PART 1 – GENERAL**

### **1.1 RELATED WORK**

- .1 Division 01 – General Requirements.

### **1.2 REFERENCE STANDARDS**

- .1 Canadian Standards Association (CSA International)
  - .1 C22.1-18, Canadian Electrical Code (CEC), Part 1 (24<sup>th</sup> Edition), Safety Standard for Electrical Installations.
  - .2 CAN3-C235-83(R2015), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
  - .3 Z462-18, Workplace Electrical Safety.
- .2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
  - .1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.
- .3 Institute of Electrical and Electronics Engineers (IEEE)
  - .1 IEEE C37.2-2008, Standard for Electrical Power System Device Function Numbers, Acronyms, and Contact Designations.
  - .2 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.
- .4 National Research Council of Canada
  - .1 National Building Code of Canada (NBCC) 2010.

### **1.3 DEFINITIONS**

- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

### **1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Division 01 – General Requirements.
- .2 Submit WHMIS SDS in accordance with Division 01 – General Requirements.
- .3 Submit to Technical Inspection Services, Department of Public Safety, necessary number of drawings and specifications for examination and approval prior to commencement of work. Pay all associated fees.
- .4 Shop drawings:
  - .1 Submit manufacturer shop drawings of all products and equipment.
  - .2 Part numbers for submitted products and equipment **to be clearly highlighted, boxed or arrowed** with all required accessories and components indicated.
  - .3 Submitted information must be specific, detailed and relevant to the project. Bulk, generic information is not acceptable.

- .4 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.
- .5 Identify circuit terminals on wiring diagrams and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
- .6 Indicate on drawings clearances for operation, maintenance, and replacement of operating equipment devices.
- .7 If changes are required, resubmit corrected shop drawings.
- .8 Where the use of electronic shop drawings has been agreed to by the Departmental Representative, the following additional electronic submittal requirements are to be followed:
  - .1 Shop drawings to be submitted in PDF format, legible and clear.
  - .2 Shop drawings to be grouped by specification section, with one PDF file per specification section. The file name to indicate the section number and name, i.e. "26 50 00 Lighting Rev0.PDF" with resubmissions appended Rev1, Rev2, etc.
  - .3 Supplemental information not previously submitted to be identified as follows: "26 50 00 Lighting Supplement 1.PDF", Supplement 2, etc.
  - .4 A cover sheet is to be incorporated into each PDF submission and indicate the project name and number, specification section number and name, the Contractor's name, supplier's name, date submitted, Contractor's stamp and signature identifying that the Contractor has reviewed the information prior to submission for correctness and completeness. Sufficient white space (minimum of ¼ page) is to be left for Departmental Representative's stamp and comments.
  - .5 Electronic shop drawing transmittal forms, where provided, must be submitted as separate PDF files and not bound in with the shop drawings.
- .5 Certificates:
  - .1 Provide CSA certified equipment and material.
  - .2 Where CSA certified equipment and material is not available, submit such equipment and material to inspection authorities for special approval before delivery to site.
  - .3 Submit test results of installed electrical systems and instrumentation.
  - .4 Permits and fees: in accordance with General Conditions of contract.
  - .5 Submit, upon completion of Work, load balance report as described in PART 3 – FIELD QUALITY CONTROL.
  - .6 Submit, upon completion of Work, Contractor's guarantee and warranty certificates in accordance with Division 01 – General Requirements.
  - .7 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.
- .6 Manufacturer's Field Reports: submit manufacturer's written report to Departmental Representative within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 – FIELD QUALITY CONTROL.

- .7 Upon completion of project, submit as-built drawings and maintenance manuals in accordance with Division 01 – General Requirements.

## **1.5 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Division 01 – General Requirements.
- .2 Operation and Maintenance Data:
  - .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
  - .2 Operating instructions to include following:
    - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
    - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
    - .3 Safety precautions.
    - .4 Procedures to be followed in event of equipment failure.
    - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
  - .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
  - .4 Post instructions where directed.
  - .5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
  - .6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

## **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Material Delivery Schedule: provide Departmental Representative with schedule within 2 weeks after award of Contract.
- .2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Division 01 – General Requirements.

## **1.7 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Division 01 – General Requirements.
- .2 Qualifications: electrical work to be carried out by qualified, licensed electricians or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Act respecting manpower vocational training and qualification.
  - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
  - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.
  - .3 Ratio must not exceed one apprentice to one licensed electrician.

## **1.8 SITE VISIT**

- .1 Prior to tender submission, visit the site and become familiar with the job and all conditions which may affect costs. Ignorance of existing conditions will not be considered as basis for extra claims.
- .2 Refer to Division 01 – General Requirements for further information.

## **1.9 SCHEDULE**

- .1 Note that the Owner intends to carry on business as usual and work activities must be coordinated to maintain electrical services in occupied areas. Provide any required temporary work.
- .2 Work activities which disrupt occupants of the building, such as excessive noise caused by drilling of walls, floors or ceilings must be approved and scheduled in writing with the building maintenance superintendent at least 48 hours in advance, and done outside normal working hours.
- .3 All power shutdowns which affect building occupants or building operation must have prior approval of Owner and must be scheduled in writing at least 7 days in advance with the building maintenance superintendent.
- .4 Overtime work and work outside normal work hours deemed necessary to accomplish scheduling are the responsibility of the Contractor. All costs resulting from such overtime work including overtime costs for Commissionaires must be included in the Contractor's total tender price.
- .5 Owner may require work to be done in phases. Refer to Division 01 – General Requirements for additional information and requirements. All costs associated with phasing must be included in the Contractor's total tender price.

## **1.10 ESSENTIAL SERVICES**

- .1 Electrical and communication services including fire alarm, emergency and exit lighting, are considered essential services and must be maintained in operation at all times.
- .2 Should interruptions to these services be deemed absolutely necessary they must be approved and scheduled in writing with the Owner at least 7 days in advance.
- .3 Interruptions must be taken when acceptable to the Owner and may include weekday and weekend nights.
- .4 If an interruption in an essential service is taken, work must progress continuously until the service is restored.

## **PART 2 – PRODUCTS**

### **2.1 DESIGN REQUIREMENTS**

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

### **2.2 MATERIALS AND EQUIPMENT**

- .1 Provide material and equipment in accordance with Division 01 – General Requirements.
- .2 Material and equipment to be CSA certified. Where CSA certified material and equipment is not available, obtain special approval from inspection authorities before delivery to site and submit such approval as described in PART 1 – ACTION AND INFORMATIONAL SUBMITTALS.
- .3 Factory assemble control panels and component assemblies.
- .4 Where electrical equipment rooms are sprinklered in accordance with the National Building Code of Canada, the electrical equipment contained in such rooms is to have enclosures which comply with Canadian Electrical Code Rule 26-008.

### **2.3 WARNING SIGNS**

- .1 Warning Signs: in accordance with requirements of authority having jurisdiction and Departmental Representative.
- .2 Decal signs, minimum size 175 x 250 mm.

### **2.4 WIRING TERMINATIONS**

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

### **2.5 EQUIPMENT IDENTIFICATION**

- .1 Identify electrical equipment with nameplates and labels as follows:
  - .1 Nameplates: plastic laminate lamicaid 3 mm thick plastic engraving sheet, matte white finish face, black core, lettering accurately aligned and engraved into core, attached with double sided tape.

.2 Sizes as follows:

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

- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates and labels to be in English and approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate and label.
- .5 Nameplates for terminal cabinets, junction and pull boxes to indicate system and/or voltage characteristics.
- .6 Transformers: indicate designated name of equipment, capacity, primary and secondary voltages.
- .7 Nameplates installed on distribution panelboards, motor control centres and splitter troughs shall indicate the following:
- .1 Designated name of equipment.
  - .2 Voltages, number of phases and wires.
  - .3 Overcurrent protection device rating.
  - .4 Designation of power source.
  - .5 The following is an example:

**PANEL A – 120/208V – 3PH – 4W  
FED FROM 100A BKR IN PANEL DP1**

- .8 Nameplates installed on combination starters, magnetic starters, variable frequency drives, manual starters and all various system controls, control panels, contactors, disconnect switches, and large junction and pull boxes shall contain the following information:
- .1 Designated equipment tag and description of equipment.
  - .2 Voltage(s), number of phases.
  - .3 Designated name of power source.
  - .4 Branch circuit breaker number(s) where possible.
  - .5 The following is an example:

**CP-1 HEATING CIRCULATING PUMP  
600V – 3PH, FED FROM MCC #1**

- .9 All junction and/or pull boxes (volume less than 8500 cu cm) shall be marked with an indelible ink marker to designate the circuit number of enclosed wiring, the designated panel name and electrical characteristics where applicable.
- .10 Install an additional nameplate on all, or any piece of electrical equipment, or apparatus, i.e. Main Switchboard, CDP panels, panelboards, motor control centres, and fusible switches, etc. that may contain overcurrent devices, i.e. circuit breakers and/or fuses, that have been designed for, and incorporate an interrupting capacity sized “larger” than 10 KAIC.

Example:

<b>Minimum interrupting capacity of breakers installed in this panel is to be not less than 22 KAIC</b>	<b>Minimum interrupting capacity of fuses installed in this MCC is to be not less than 100 KAIC</b>
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## 2.6 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, indicating panel and circuit number; i.e., A-1. Normal ground circuits to have ground, neutral and phase wires identified with black on white background tape. Tape to be preprinted vinyl, self-adhesive. Circuits to be identified at both ends and at all pull and junction boxes.
- .2 Use coloured plastic tapes to identify feeders on both ends of conductors and at junction and pull boxes if conductor insulation colours are other than red, black, blue, white and green.
- .3 Maintain phase sequence and colour coding throughout.
- .4 Colour coding: to CSA C22.1.
- .5 Use colour coded wires in communication cables, matched throughout system.

## 2.7 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.
- .4 Colour coding legend:

	<u>Prime</u>	<u>Auxiliary</u>
50V to 249V Normal	Green	
50V to 249V Emergency	Orange	
Controls	Brown	Orange
Data (incl. fiber, multimedia)	White	Yellow
Door Access	Red	Orange
Emergency Lighting Remote Head	Red	Brown
Fire Alarm	Red	
Intercom (point to point)	White	Blue
Intrusion Alarms	Red	Blue
Telephone (wired and wireless)	White	

## **2.8 FINISHES**

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

## **PART 3 – EXECUTION**

### **3.1 INSTALLATION**

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

### **3.2 VAPOUR BARRIER PENETRATIONS**

- .1 Outlet and junction boxes installed in walls or ceilings equipped with a vapour barrier are to be surrounded with a moisture resistant barrier or boxes that are specifically designed for vapour barrier penetrations are to be used.
- .2 Penetrations through vapour barriers shall be effectively sealed to maintain the integrity of the vapour barrier.

### **3.3 CUTTING AND PATCHING**

- .1 Provide cutting, coring and drilling as required for installation of electrical services. Hole sizes to be kept to a minimum.
- .2 Cutting and patching of finished walls and restoration and making good of surfaces to pre-construction condition is by other trades in accordance with Division 01 – General Requirements.
- .3 Provide cutting, coring and drilling as required for installation of electrical services. Hole sizes to be kept to a minimum. Restoration and making good of surfaces to pre-construction condition will be by Division 26.

### **3.4 FIRE STOPPING**

- .1 Fire stopping to be in accordance with Section 07 84 00 – Fire Stopping.
- .2 In walls requiring a fire-resistance rating, where outlets are on opposite sides within a single stud cavity or within 600 mm of one another measured horizontally (150 mm minimum back-to-back separation); or where the area of the penetration(s) exceed the requirements of the NBCC, the outlet boxes are to be protected by a firestop system. Supply and install ULC/cUL listed intumescent elastomer fire-stopping and smoke seal moldable putty pads to maintain fire-resistance rating equal to assembly. Acceptable manufacturer or approved equal:
  - .1 3M Fire Barrier Moldable Putty Pads MPP+.
  - .2 Hilti Firestop Putty Pad, Firestop Box Insert and CFS-P PA Firestop Putty Pad.



- .3 Specified Technologies Inc. (STI) Powershield Electrical Box Insert and Series SSP Putty Pads.
- .3 Installation of fire-stopping and smoke seal materials and components to be in accordance with ULC/cUL certification and manufacturer's instructions.

### **3.5 NAMEPLATES AND LABELS**

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

### **3.6 CONDUIT AND CABLE INSTALLATION**

- .1 All horizontal conduit and cable runs must be installed in the interstitial space. Only vertical drops are permitted in ceiling spaces and walls. Horizontal conduit and cable runs in walls are not permitted.
- .2 Prior to rough-in, coordinate locations of conduit runs with other trades. Do not block access to valves and devices requiring access by operating and maintenance personnel.

### **3.7 LOCATION OF OUTLETS AND EQUIPMENT**

- .1 Verify size, location and wiring requirements of equipment with appropriate trade, reviewed shop drawings and site conditions prior to rough-in.
- .2 Maintain working clearances around all equipment in accordance with CSA C22.1, Canadian Electrical Code (CEC).
- .3 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .4 Do not install outlets back-to-back in walls; allow a minimum 150 mm horizontal or vertical clearance between boxes.
- .5 In walls requiring a fire-resistance rating, where outlets are on opposite sides within a single stud cavity or within 600 mm of one another measured horizontally (150 mm minimum back-to-back separation); or where the area of the penetration(s) exceed the requirements of the NBCC, the outlet boxes are to be protected by a firestop system. Supply and install ULC/cUL listed intumescent elastomer fire-stopping and smoke seal moldable putty pads to maintain fire-resistance rating equal to assembly.
- .6 Change location of outlets, equipment and connections at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .7 Locate light switches on latch side of doors.
- .8 Locate telephone and data outlets adjacent associated receptacle.

### **3.8 MOUNTING HEIGHTS**

- .1 Mounting height of equipment is from finished floor to centerline of equipment unless specified or indicated otherwise.

- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
  - .1 Local switches: 1150 mm.
  - .2 Wall receptacles:
    - .1 General: 450 mm.
    - .2 Above top of continuous baseboard heater: 200 mm.
    - .3 Above top of counters: 150 mm.
    - .4 Above top of counters with splash backs: 225 mm.
    - .5 In mechanical rooms: 1150 mm.
  - .3 Panelboards: 1500 mm or as required by Code.
  - .4 Telephone outlets: 450 mm.
  - .5 Wall mounted telephone outlets: 1150 mm.
  - .6 Emergency lighting battery units and remote heads: 2300 mm.
  - .7 Exit signs: 2300 mm.
  - .8 Fire alarm stations: 1150 mm.
  - .9 Fire alarm audible signals: 2300 mm, 150 mm minimum from ceiling to top of device.
  - .10 Fire alarm visual signals: 2300 mm, 150 mm minimum from ceiling to top of device.
  - .11 Fire alarm end-of-line resistors: 1800 mm.
  - .12 Data outlets: 450 mm.
  - .13 Intercom audio door stations: 1150 mm.
  - .14 Intrusion alarm detectors: 2400 mm.
  - .15 Access control card readers and keypads: 1150 mm.
  - .16 Thermostats: 1500 mm.
- .4 Generally, masonry outlet boxes are to be installed in bottom of concrete blocks to approximate heights indicated.
- .5 Refer to all detail drawings and confirm mounting of outlet boxes prior to roughing-in.

### **3.9 COORDINATION OF PROTECTIVE DEVICES**

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

### **3.10 FIELD QUALITY CONTROL**

- .1 Load Balance:
  - .1 Measure phase current to panelboards with typical loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
  - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

- .3 Provide upon completion of work, load balance report as directed in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct following tests in accordance with Division 01 – General Requirements.
  - .1 Power and distribution system including phasing, voltage, grounding and load balancing.
  - .2 Circuits originating from branch distribution panels.
  - .3 Lighting and its control.
  - .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
  - .5 Systems: data/telephone, access control, fire alarm system, etc.
  - .6 Insulation resistance testing:
    - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
    - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
    - .3 Check resistance to ground before energizing.
- .3 Carry out tests in presence of Departmental Representative.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
  - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

### **3.11 SYSTEM STARTUP**

- .1 Instruct Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

### **3.12 CLEANING**

- .1 Progress Cleaning: clean in accordance with Division 01 – General Requirements.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 01 – General Requirements.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Division 01 – General Requirements.

**END OF SECTION**

## **PART 1 – GENERAL**

### **1.1 RELATED WORK**

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

### **1.2 REFERENCE STANDARDS**

- .1 Canadian Standards Association (CSA International)
  - .1 C22.1-18, Canadian Electrical Code (CEC), Part 1 (24<sup>th</sup> Edition).
  - .2 Z462-18, Workplace Electrical Safety.

### **1.3 DESCRIPTION OF WORK**

- .1 In general, work of this Section consists of the removal of obsolete or abandoned electrical, communications and electronic safety & security services, equipment and materials in the area to be renovated including services associated with obsolete or abandoned mechanical systems. It also covers alterations to existing services affected by the renovations.
- .2 All removal or alteration work of electrical construction to be done in accordance with the safety standards outlined in the Canadian Electrical Code and CSA Z462.

### **1.4 SITE SURVEY**

- .1 Prior to Tender submission, visit the site and survey and quantify the extent of the removals/alterations required for this contract and include for all costs in the total tendered price. Any existing conditions information indicated on the drawings is for general guidance only.
- .2 In conjunction with site visit, review architectural, mechanical and electrical drawings and include all costs due to existing conditions in total tendered price.

### **1.5 PROTECTION**

- .1 Protect existing equipment from debris, dust and environmental conditions.
- .2 The Contractor is responsible for any damages to existing structure as a result of the work.

### **1.6 SALVAGE MATERIAL**

- .1 Materials and equipment identified as being reused are to be taken down, stored, cleaned, re-installed, etc. as required to allow for new construction.
- .2 Identify any damaged equipment or materials intended for reuse prior to demolition and point out deficiencies to the Departmental Representative at that time.
- .3 Prior to demolition Departmental Representative will identify any items or equipment which is to be set aside as directed for future use by Owner.

- .4 All other materials and equipment removed under work of this Section becomes the property of the Contractor for disposal off the property.

## **1.7 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling in accordance with Division 01 – General Requirements.
- .2 Remove from site and dispose of all materials at appropriate recycling facilities.
- .3 Collect and separate packaging material for recycling in accordance with Waste Management Plan.
- .4 Divert unused wiring materials from landfill to metal recycling facility as approved by Departmental Representative.
- .5 Comply with all Federal, Provincial and Municipal laws and regulations when disposing of waste.

## **PART 2 – PRODUCTS**

NOT APPLICABLE

## **PART 3 – EXECUTION**

### **3.1 GENERAL REMOVALS**

- .1 Remove all obsolete or abandoned electrical, communications and electronic safety & security services, equipment and materials including wire and conduit, except those designated for reuse.
- .2 Install blank coverplates on all empty device boxes that remain.
- .3 Remove services associated with obsolete or abandoned mechanical systems.
- .4 Coordinate work of this Section with other trades.
- .5 Schedule all removal work with the Departmental Representative. Do not disrupt building operations except as permitted by the Schedule.
- .6 Any existing conduit, wiring, boxes or equipment that is to remain in service is to be properly supported as required by the CEC. Any additional hangers, straps or fasteners required are to be supplied under this contract.
- .7 Make alterations to existing electrical services as required and make good all circuits affected by the renovations.
- .8 Any existing electrical circuits and/or equipment that are interrupted during construction to accommodate alterations but are to remain in service are to be reconnected and circuits made good.

- .9 Any relocating of existing equipment and any rerouting of existing wire and conduit to coordinate with new work or as required to meet current standards, to be included in total tendered price.

### **3.2 IDENTIFICATION OF EXISTING CIRCUITS AND EQUIPMENT**

- .1 All circuits in existing panelboards serving renovated area are to be traced out to identify any devices not labeled on existing directories and to confirm all circuits indicated on directories are accurate. Provide new, updated, typewritten circuit directories in all panelboards serving renovated area.
- .2 Provide identification indicating circuit and panel number at all new and existing wiring devices in renovated area.
- .3 Provide equipment nameplates and labels for all new and existing equipment in renovated area.
- .4 Equipment identification, wiring identification and conduit and cable identification is to be in accordance with Section 26 05 00 – Common Work Results for Electrical.

### **3.3 CEILING TILES**

- .1 New ceiling to be installed by Division 9.
- .2 Remove and reinstall ceiling tiles as required of work.
- .3 Prior to removal, photograph and document existing conditions and noted damage.
- .4 Replace ceiling tiles damaged during installation with new to match existing.

### **3.4 CUTTING**

- .1 Cutting required for removals and alterations to be to the approval of the Departmental Representative and performed with appropriate power tools.

### **3.5 CLEANING**

- .1 Progress Cleaning: clean in accordance with Division 01 – General Requirements.
  - .1 Leave Work area clean at end of each day.
- .2 Materials and equipment to be reused to be cleaned and stored in secure location.

**END OF SECTION**

## **PART 1 – GENERAL**

### **1.1 RELATED WORK**

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

### **1.2 REFERENCE STANDARDS**

- .1 Canadian Standards Association (CSA International)
  - .1 C22.2 No.18.3-12, Conduit, Tubing and Cable Fittings (Tri-National Standard with ANCE NMX-J-017 and UL 514B).
  - .2 C22.2 No.65-13, Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE).
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
  - .1 EEMAC 1Y-2-1961, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Division 01 – General Requirements.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.

### **1.4 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Division 01 – General Requirements.
- .2 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

### **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Division 01 – General Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground indoors in clean, dry, well-ventilated location and in accordance with manufacturer's recommendations.
  - .2 Store and protect wire and box connectors from damage.
  - .3 Replace defective or damaged materials with new.



## **PART 2 – PRODUCTS**

### **2.1 MATERIALS**

- .1 Crimp style wire connectors, nylon insulated, with current carrying parts of copper alloy, for conductors #16 AWG and smaller.
- .2 Fork tongue, nylon insulated, crimp style terminals for connecting conductors #16 AWG and smaller to screw down terminals.
- .3 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper alloy sized to fit copper conductors as required. Use twist-on connectors for #14 AWG to #8 AWG wires.
- .4 Crimp style wire connectors, nylon insulated with current carrying parts of copper alloy, for connecting solid to stranded conductors.
- .5 Compression type connectors for connecting #6 AWG conductors and larger, unless indicated otherwise. Compression type connectors to have a temperature rating of 90 deg. C.
- .6 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper alloy sized to fit copper conductors 10 AWG or less.
- .7 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
  - .1 Connector body and stud clamp for stranded round copper conductors.
  - .2 Clamp for stranded round copper conductors.
  - .3 Stud clamp bolts.
  - .4 Bolts for copper conductors.
  - .5 Sized for conductors as indicated.
- .8 Clamps or connectors for armoured cable, flexible conduit, as required to: CAN/CSA-C22.2 No.18.3.

## **PART 3 – EXECUTION**

### **3.1 INSTALLATION**

- .1 Remove insulation carefully from ends of conductors and:
  - .1 Install mechanical pressure type connectors with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65.
  - .2 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65.
  - .3 Install bushing stud connectors in accordance with EEMAC 1Y-2.
- .2 Use waterproof silicone filled connectors for splices located less than 500mm above finished floor.

- .3 Use waterproof silicone filled connectors for splices in damp or wet locations, including but not limited to connections inside of exterior light fixtures, receptacles and junction boxes.

### **3.2 RESTRICTIONS**

- .1 No splices are allowed in panelboards (distribution, lighting and power) or in equipment enclosures.

**END OF SECTION**

## **PART 1 – GENERAL**

### **1.1 RELATED WORK**

- .1 Section 26 05 00 – Common Work Results for Electrical.
- .2 Section 26 05 20 – Wire and Box Connectors (0-1000 V).
- .3 Section 26 05 29 – Hangers and Supports for Electrical Systems.
- .4 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

### **1.2 REFERENCE STANDARDS**

- .1 Canadian Standards Association (CSA International)
  - .1 C22.2 No.0.3-09 (R2014), Test Methods for Electrical Wires and Cables.
  - .2 C22.2 No. 208-14, Fire Alarm and Signal Cable.
- .2 National Research Council of Canada
  - .1 National Building Code of Canada (NBCC) 2010.
- .3 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S139-17, Standard Method of Fire Test for Evaluation of Integrity of Electrical Power, Data and Optical Fibre Cables.

### **1.3 PRODUCT DATA**

- .1 Provide product data in accordance with Division 01 – General Requirements.

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

- .1 Packaging Waste Management: separate and recycle waste materials in accordance with Division 01 – General Requirements.

## **PART 2 – PRODUCTS**

### **2.1 BUILDING WIRES**

- .1 Conductors:
  - .1 Solid for 10 AWG and smaller, stranded for 8 AWG and larger.
  - .2 Minimum size: 12 AWG for branch circuits, 14 AWG for bonding, 14 AWG for control circuits.
- .2 Copper conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, non-jacketed.
- .3 Single conductor metal sheathed cables are not permitted.

## **2.2 TECK 90 CABLE**

- .1 Cable: to CAN/CSA C22.2 No. 131-M89 (R1994), Type TECK 90 Cable.
- .2 Conductors:
  - .1 Grounding conductor: copper.
  - .2 Circuit conductors: copper, size as indicated.
- .3 Insulation:
  - .1 Cross-linked polyethylene XLPE.
  - .2 Rating: 600 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking aluminum.
- .6 Overall covering: thermoplastic polyvinyl chloride, FT4 rated.
- .7 Fastenings:
  - .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
  - .2 Channel type supports for two or more cables at 1500 mm centers.
  - .3 Threaded rods: 6 mm diameter to support suspended channels.
- .8 Connectors:
  - .1 Watertight approved for TECK cable.

## **2.3 ARMOURED CABLES**

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90, ISO-BX with minimum size 12 AWG insulated bonding conductor.
- .3 Armour: interlocking type fabricated from aluminum strip.
- .4 Overall jacket: none.
- .5 Connectors: to Section 26 05 20 – Wire and Box Connectors (0–1000V).

## **2.4 CONTROL CABLES**

- .1 Type: LVT: soft annealed copper conductors, number and size as indicated:
  - .1 Insulation: thermoplastic.
  - .2 Sheath: thermoplastic jacket, FT4 rated.
- .2 Type: low energy 300 V control cable: solid annealed copper conductors sized as indicated:
  - .1 Colour coded conductors.
  - .2 Insulation: PVC.

- .3 Shielding: aluminum/mylar with tinned copper drain wire.
- .4 Overall covering: Flame retardant PVC jacket, FT4 rated.

## **2.5 FIRE ALARM COMMUNICATIONS CABLES**

- .1 Conductors: twisted pair, shielded as required plus bonding conductor, annealed solid copper, size and type as indicated to suit application and in accordance with manufacturer's specifications.
- .2 Conductor insulation: color coded, 35 mil layer of thermoset low smoke, zero halogen silicone rubber.
- .3 Utilization voltage: 72 V to ground maximum.
- .4 Shield: copper/polyester foil tape with stranded copper drain wire as required.
- .5 Overall jacket: red flame-retardant, low smoke, zero halogen polyolefin, rated 300 V for communications applications.
- .6 CSA certified Type FAS 105.
- .7 Vertical flame rating: FT4.

## **2.6 COLOUR CODING**

- .1 All conductors to be colour coded to Section 26 05 00 – Common Work Results for Electrical.

# **PART 3 – EXECUTION**

## **3.1 WIRING METHODS**

- .1 All work to be concealed in finished areas.
- .2 Service: building wire in conduit, copper conductors.
- .3 Panel feeders:
  - .1 Building wire in conduit.
- .4 Branch circuit work:
  - .1 Concealed work in wall partitions: building wire in conduit or armored cable.
  - .2 Concealed work in casework: building wire in flexible conduit or armored cable.
  - .3 Horizontal work above accessible ceilings: building wire in conduit.
  - .4 Surface work in unfinished areas: building wire in conduit.
  - .5 Branch circuit wiring to be sized for a maximum voltage drop of 3%. This will require that 15A circuits exceeding 20 m in length and 20A circuits exceeding 15 m in length utilize **#10 AWG conductors**.

- .5 Mechanical equipment:
  - .1 Building wire in conduit.
  - .2 TECK cable where indicated.
- .6 Drops to light fixtures, rotating and vibrating equipment: building wire in flexible conduit or armoured cable, maximum length 1500 mm.
- .7 Fire rated cabling:
  - .1 Two hour fire rated cabling for power and communications conductors as indicated and as required by National Building Code of Canada.

### **3.2 GENERAL CABLE INSTALLATION**

- .1 Cable routing where indicated is in diagrammatic form only. Review existing conditions and all tender drawings when planning routing. Implement all required offsets to coordinate with site conditions, equipment and other trades. Adjust cable routing on site as required. Include all costs in tender submission for cable routing.
- .2 Support cables in accordance with Section 26 05 29 – Hangers and Supports for Electrical Systems.
- .3 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .4 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.
- .5 Conductor length for parallel feeders to be identical.
- .6 Wiring in walls: drop vertically from above to better facilitate future renovations.
- .7 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

### **3.3 INSTALLATION OF BUILDING WIRES**

- .1 Install wiring as follows:
  - .1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

### **3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)**

- .1 Group cables wherever possible on channels.
- .2 Install cable securely supported by straps.
- .3 Fasten in place at 1500 mm intervals and 300 mm from terminations.

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

- .1 Group cables wherever possible on channels. Do not bundle cables.

- .2 Install anti-short insulators, metal support straps and connectors as required.

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

- .1 Install control cables in conduit.
- .2 Install control cables directly in construction where concealed and where permitted by National Building Code and Canadian Electrical Code. Cable jackets must be rated FT4 or FT6 as required by NBCC. Install control cables in conduit otherwise and for any surface work and as indicated.
- .3 Ground control cable shield.

### **3.7 INSTALLATION OF FIRE ALARM COMMUNICATIONS CABLES**

- .1 Install fire alarm communications cables in conduit in accordance with Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings and Section 28 31 00 – Fire Detection and Alarm.

### **3.8 RESTRICTIONS**

- .1 Splices in wire and cable #6 AWG and larger are not permitted.
- .2 Wiring and cabling must be run parallel and perpendicular to building lines. Wherever possible, wiring and cabling is to follow a common pathway.
- .3 Flexible conduit or armoured cable drops to light fixtures to be installed from junction box to fixture. Loops between fixtures are not acceptable.
- .4 Maximum exposed length of armoured cable from junction box to wall partition to be 3000 mm.
- .5 All wiring for services within the building must be installed on the warm side of the vapour barrier unless prior approval is obtained from the Departmental Representative to run on the cold side.
- .6 Refer to Section 26 05 29 – Hangers and Supports for Electrical Systems, for acceptable support methods.
- .7 Do not install cables, raceways and boxes directly to underside of roof decking. Support cables, raceways and boxes so that their nearest outside surface is not less than 38 mm from bottom of roof decking.

### **3.9 FIELD QUALITY CONTROL**

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

**END OF SECTION**

## **PART 1 – GENERAL**

### **1.1 RELATED WORK**

- .1 Section 26 05 00 – Common Work Results for Electrical.
- .2 Section 26 05 21 – Wires and Cables (0–1000 V).
- .3 Section 27 05 26 – Grounding and Bonding for Communications Systems.

### **1.2 REFERENCE STANDARDS**

- .1 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE)
  - .1 ANSI/IEEE 837-2014, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.
- .2 Canadian Standards Association (CSA International)
  - .1 C22.2 No.41-13, Grounding and Bonding Equipment (Tri-National Standard with NMX-J-590-ANCE and UL 467).

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Division 01 – General Requirements.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

### **1.4 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Division 01 – General Requirements.
- .2 Operation and Maintenance Data: submit operation and maintenance data for grounding equipment for incorporation into manual.

### **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Division 01 – General Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground indoors in clean, dry location and in accordance with manufacturer's recommendations.
  - .2 Store and protect grounding equipment from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.



- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Division 01 – General Requirements.

## **PART 2 – PRODUCTS**

### **2.1 EQUIPMENT**

- .1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.
- .2 Grounding conductors: bare stranded copper, soft annealed, size as indicated.
- .3 Insulated grounding conductors: green, Type R90, copper conductors, size as indicated, in accordance with Section 26 05 21 – Wires and Cables (0-1000 V).
- .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 All grounding connectors, components and accessories to be installed in accordance with manufacturer's instructions.
- .2 Install green insulated bonding conductor in all conduit.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.
- .6 Install an integral bonding wire in all flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw.
- .7 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

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

- .1 Install system and circuit grounding connections to neutral of secondary 600 V and 208 V systems.

### **3.3 EQUIPMENT BONDING AND GROUNDING**

- .1 Install bonding and grounding connections to typical equipment included in, but not necessarily limited to the following list: service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, panelboards, outdoor lighting, cable trays, raised flooring systems.

### **3.4 COMMUNICATION SYSTEMS**

- .1 Grounding and bonding to be in accordance with Section 27 05 26 – Grounding and Bonding for Communications Systems.
- .2 Install grounding connections for telephone, data, sound, fire alarm, security systems, intercommunication systems as follows:
  - .1 Telephones: make telephone grounding system in accordance with ANSI J-STD-607-A and telephone company's requirements.
  - .2 Data: make data grounding system in accordance with ANSI J-STD-607-A and data installer's requirements.
  - .3 Sound, fire alarm, security systems, intercommunication systems as indicated.

### **3.5 FIELD QUALITY CONTROL**

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

**END OF SECTION**

## **PART 1 – GENERAL**

### **1.1 RELATED WORK**

- .1 Section 26 05 00 – Common Work Results for Electrical.
- .2 Section 26 05 21 – Wires and Cables (0-1000 V).

### **1.2 REFERENCE STANDARDS**

- .1 ASTM International Inc.
  - .1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .2 ASTM A153/A153M-16a, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Products.
  - .3 ASTM A240/A240M-17, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
  - .4 ASTM A307-14e1, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength.
  - .5 ASTM B633-15, Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
- .2 Canadian Standards Association (CSA International)
  - .1 C22.2 No. 18.4-15, Hardware for the Support of Conduit, Tubing and Cable (Bi-National Standard with UL 2239).

### **1.3 WASTE MANAGEMENT AND DISPOSAL**

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

## **PART 2 – PRODUCTS**

### **2.1 SUPPORT CHANNELS**

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended as required.
- .2 Material & finish: hot-dipped galvanized steel to ASTM A123.

### **2.2 BRACKETS, POST BASES & FITTINGS**

- .1 Specific purpose support channel accessories including brackets, post bases & fittings as required for channel assembly.
- .2 Material & finish: hot-dipped galvanized steel to ASTM A123.

## **2.3 SPECIFIC PURPOSE FASTENERS**

- .1 Specific purpose heat treated, spring fasteners to support boxes, conduit and cable from main structure, channels, metal studs and T-bar ceilings.
- .2 Material & finish:
  - .1 Channel nuts & spring nuts: steel, electro-plated zinc to ASTM B633 SC1 Type III.
  - .2 Strut clamps, conduit straps, beam clamps, specific purpose fasteners, etc.: steel, electro-plated zinc to ASTM B633 SC1 Type III.

## **2.4 HARDWARE & FASTENERS**

- .1 Bolts, nuts, washers and threaded rod as required.
- .2 Material & finish:
  - .1 Steel, electro-plated zinc to ASTM B633 SC1 Type III.

# **PART 3 – EXECUTION**

## **3.1 GENERAL**

- .1 Hangers and supports including support channels, brackets, post bases, fittings, specific purpose fasteners, hardware and fasteners to be of material and finish suitable for their use as follows:
  - .1 Indoor use in dry locations: steel, electro-plated zinc.
  - .2 Outdoor use or where exposed to wet environments: hot-dipped galvanized steel.

## **3.2 INSTALLATION**

- .1 Secure equipment to hollow or solid masonry, tile and plaster surfaces with nylon shields.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Secure recessed and surface mounted equipment to inverted T bar ceilings with bar type box hangers fastened to grid. Ensure that T-bars and box hangers are adequately supported to carry weight of equipment specified before installation. Box hangers to be connected to building structure with independent hanger wire.
- .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. Provide sufficient quantity of rod hangers to support total weight of cables or conduits as well to ensure support channels remain horizontal and level.
- .8 For surface mounting of two or more conduits use channels at 1500 mm 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 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.
- .12 Install fastenings and supports for fire rated cables in accordance with Section 26 05 21 – Wires and Cables (0-1000 V).
- .13 Electrical boxes concealed in hollow gypsum board or plaster walls to be supported by specific purpose brackets designed for stud wall construction. For steel stud walls use screw gun box brackets installed between studs.

### **3.3 RESTRICTIONS**

- .1 Do not use wire lashing, perforated strap, nylon or plastic self locking cable ties (Ty-raps) to support or secure raceways or cables.
- .2 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.
- .3 Do not use T-bar ceiling hanger wires to support conduit and cable.
- .4 Do not install cables, raceways and boxes directly to underside of roof decking. Support cables, raceways and boxes so that their nearest outside surface is not less than 38 mm from bottom of roof decking.

**END OF SECTION**

## **PART 1 – GENERAL**

### **1.1 RELATED WORK**

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

### **1.2 REFERENCE STANDARDS**

- .1 Canadian Standards Association (CSA International)
  - .1 C22.1-18, Canadian Electrical Code (CEC), Part 1, 24<sup>th</sup> Edition.
  - .2 C22.2 No. 40-M1989 (R2014), Cutout, Junction and Pull Boxes.

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Division 01 – General Requirements.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Provide shop drawings: in accordance with Division 01 – General Requirements.

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

- .1 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Division 01 – General Requirements.

## **PART 2 – PRODUCTS**

### **2.1 JUNCTION AND PULL BOXES**

- .1 Construction: welded steel enclosure, flush or surface mounted as required.
- .2 Covers Flush Mounted: 25 mm minimum extension all around.
- .3 Covers Surface Mounted: screw-on flat covers.
- .4 Water resistant where mounted less than 300mm above finished floor.

### **2.2 FINISHES**

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

## **PART 3 – EXECUTION**

### **3.1 JUNCTION AND PULL BOXES INSTALLATION**

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Install junction and pull boxes as required by CSA C22.1. Provide pull boxes so as not to exceed 30 m of conduit run between pull boxes.
- .3 Size and install junction and pull boxes to CSA C22.1.

### **3.2 IDENTIFICATION**

- .1 Equipment Identification: to Section 26 05 00 - Common Work Results for Electrical.
- .2 Identification Labels: size 2 indicating system name, voltage and phases.

### **3.3 RESTRICTIONS**

- .1 Do not install junction and pull boxes directly to underside of roof decking. Support junction and pull boxes so that their nearest outside surface is not less than 38 mm from bottom of roof decking.

**END OF SECTION**

## **PART 1 – GENERAL**

### **1.1 RELATED WORK**

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

### **1.2 REFERENCE STANDARDS**

- .1 Canadian Standards Association (CSA International)
  - .1 C22.1-18, Canadian Electrical Code (CEC), Part 1, 24<sup>th</sup> Edition.
  - .2 C22.2 No.18.1-13, Metallic Outlet Boxes (Tri-National Standard with UL 514A and ANCE NMX-J-023/1).
- .2 National Research Council of Canada
  - .1 National Building Code of Canada (NBCC) 2010.

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Division 01 – General Requirements.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Provide shop drawings: in accordance with Division 01 – General Requirements.

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

- .1 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Division 01 – General Requirements.

## **PART 2 – PRODUCTS**

### **2.1 OUTLET AND CONDUIT BOXES GENERAL**

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



## **2.2 GALVANIZED STEEL OUTLET BOXES**

- .1 One-piece electro-galvanized construction.
- .2 Single and multi gang flush device boxes for flush installation, minimum size 76 x 51 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .3 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .4 Extension and plaster rings for flush mounting devices in finished plaster or tile walls.
- .5 Round type plaster rings to be used in plaster construction only.
- .6 Extension rings for flush mounting devices in manufactured casework as required.

## **2.3 OUTLET BOXES FOR EXTERIOR WALLS/VAPOUR BARRIERS**

- .1 Molded high strength plastic.
- .2 Closed cell foam gasket around the drywall flange and cable entry tabs, forms an automatic 100% airtight seal when installed.
- .3 Self-clamping cable entry tabs.
- .4 External mounting flange. All boxes pre-measured for 16 mm drywall.
- .5 Ground screws.

## **2.4 MASONRY BOXES**

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

## **2.5 CONCRETE BOXES**

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

## **2.6 CONDUIT BOXES**

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

## **2.7 FITTINGS - GENERAL**

- .1 Set-screw type steel couplings and connectors for EMT. Connectors to have integral, factory installed, nylon insulated throats.
- .2 Set-screw type steel connectors for flexible conduit. Connectors to have integral, factory installed, nylon insulated throats.
- .3 Bushings and connectors with nylon insulated throats.

- .4 Knock-out fillers to prevent entry of debris.
- .5 Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.
- .6 Double locknuts and insulated bushings on sheet metal boxes.

## **2.8 SERVICE FITTINGS**

- .1 'High tension' receptacle fitting made of 2 piece stainless steel frame with brushed aluminum housing finish for two duplex receptacles. Bottom plate with two knockouts for centered or offset installation.
- .2 Pedestal type 'low tension' fitting made of 2 piece stainless steel frame with brushed aluminum housing finish to accommodate two or more keystone style modules as indicated.

## **PART 3 – EXECUTION**

### **3.1 INSTALLATION**

- .1 Support boxes independently of connecting conduits.
- .2 Outlet boxes installed in steel stud partition walls to be supported with steel screw gun box brackets installed between studs.
- .3 Outlet boxes and conduit boxes to be flush mounted. Outlet and conduit boxes in existing construction to be flush mounted except in existing masonry filled block walls or existing concrete walls where flush mounting is impossible.
- .4 The use of surface mounted conduit boxes is to be minimized, limited to unfinished areas and is subject to the approval of the Departmental Representative.
- .5 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .6 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .7 Refer to architectural details for boxes to be mounted in or behind casework and ensure box comes within 6 mm of opening. Install box extensions as required.
- .8 Provide correct size of openings in boxes for conduit and armoured cable connections. Do not install reducing washers.
- .9 Identify systems for outlet boxes as required.

### **3.2 RESTRICTIONS**

- .1 The use of surface type device boxes in finished areas is not permitted.
- .2 Do not install outlets back-to-back in walls; allow a minimum 150 mm horizontal or vertical clearance between boxes.
- .3 In walls requiring a fire-resistance rating, where outlets are on opposite sides within a single stud cavity or within 600 mm of one another measured horizontally (150 mm minimum back-to-back separation); or where the area of the penetration(s) exceed the requirements of the NBCC, the outlet boxes are to be protected by a firestop system. Supply and install ULC/cUL listed intumescent elastomer fire-stopping and smoke seal moldable putty pads to maintain fire-resistance rating equal to assembly.
- .4 Do not install outlet boxes, conduit boxes and fittings directly to underside of roof decking. Support outlet boxes, conduit boxes and fittings so that their nearest outside surface is not less than 38 mm from bottom of roof decking.

**END OF SECTION**

## **PART 1 – GENERAL**

### **1.1 RELATED WORK**

- .1 Section 26 05 00 – Common Work Results for Electrical.
- .2 Section 26 05 29 – Hangers and Supports for Electrical Systems.

### **1.2 REFERENCE STANDARDS**

- .1 Canadian Standards Association (CSA International)
  - .1 C22.2 No. 18.3-12, Conduit, Tubing, and Cable Fittings (Tri-National Standard with ANCE NMX-J-017 and UL 514B).
  - .2 C22.2 No. 18.4-15, Hardware for the Support of Conduit, Tubing and Cable (Bi-National Standard with UL 2239).
  - .3 C22.2 No. 56-13, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
  - .4 C22.2 No. 83-M1985 (R2013), Electrical Metallic Tubing.
  - .5 C22.2 No. 211.2-06 (R2011), Rigid PVC (Unplasticized) Conduit.

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Division 01 – General Requirements.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheets.

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

- .1 Separate waste materials for reuse and recycling in accordance with Division 01 – General Requirements.

### **1.5 LOCATION OF CONDUITS**

- .1 Drawings do not show all conduits. Those shown are in diagrammatic form only.

### **1.6 CONDUIT SIZE**

- .1 Conduit sizing, where indicated, is based on copper conductors and rigid steel conduit. Where conduit type requires an additional bond wire, adjust conduit size to suit.

## **PART 2 – PRODUCTS**

### **2.1 CONDUITS**

- .1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with steel set-screw couplings and connectors.
- .2 Rigid PVC conduit: to CSA C22.2 No. 211.2.

- .3 Flexible metal conduit: to CSA C22.2 No. 56, aluminum, flexible metal conduit and liquid-tight flexible metal conduit.

## **2.2 CONDUIT FASTENINGS**

- .1 One hole steel straps to secure surface conduits 50 mm and smaller.
  - .1 Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1500 mm on centre.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.

## **2.3 CONDUIT FITTINGS**

- .1 Fittings: to CAN/CSA C22.2 No. 18.3, manufactured for use with conduit specified. Coating: same as conduit.
- .2 Set-screw type steel couplings and connectors for EMT. Connectors to have integral, factory installed, nylon insulated throats.
- .3 Set-screw type steel connectors for flexible conduit. Connectors to have integral, factory installed, nylon insulated throats.
- .4 Use factory "ells" where 90 degrees bends for 27 mm and larger conduits.

## **2.4 FISH CORD**

- .1 Polypropylene.

# **PART 3 – EXECUTION**

## **3.1 MANUFACTURER'S INSTRUCTIONS**

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

## **3.2 INSTALLATION**

- .1 All wiring and conduit are shown in diagrammatic form only.
- .2 Be familiar with building ceiling spaces. Most conduit runs shown as straight runs will consist of several offsets due to site conditions, equipment and services. Alternate paths to achieve similar runs may be proposed after detailed review of site conditions. Include all costs for alternate routes to suit conduit runs.
- .3 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

- .4 Install conduit parallel or perpendicular to building lines.
- .5 Conceal horizontal conduits except in mechanical and electrical service rooms and in unfinished areas.
- .6 Conceal all conduit drops to devices within walls.
- .7 Use electrical metallic tubing (EMT) for feeders and branch circuit work except in poured concrete, underground and where subject to mechanical damage unless indicated otherwise. Install a separate integral bond wire sized in accordance with CEC in all EMT.
- .8 Use rigid PVC conduit for feeders and branch circuit work under ground floor slab and in poured concrete unless indicated otherwise. Apply cleaning and solvent compounds to manufacturer's recommendations and make joints watertight. Install a separate integral bond wire sized in accordance with CEC in all rigid PVC conduit. Restrictions for use:
  - .1 Do not use in hazardous locations.
  - .2 Do not use where enclosed in thermal insulation.
  - .3 Do not use where exposed.
  - .4 Must contain an integral bond wire sized in accordance with CEC.
- .9 Use flexible metal conduit for connection to motors in dry areas, connection to recessed light fixtures without prewired outlet box and for connection to surface or recessed fluorescent or LED fixtures, maximum length 1500 mm. Install anti-short insulators at terminations.
- .10 Use flexible metal conduit for power, lighting and communications services located within architectural casework. Install anti-short insulators at terminations.
- .11 Minimum conduit size for lighting and power circuits: 16 mm.
- .12 Bend conduit cold:
  - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .13 Mechanically bend steel conduit over 21 mm diameter.
- .14 Install fish cord in empty conduits.
- .15 Remove and replace blocked conduit sections.
  - .1 Do not use liquids to clean out conduits.
- .16 Dry conduits out before installing wire.

### **3.3 SURFACE CONDUITS**

- .1 Run parallel or perpendicular to building lines.
- .2 Group conduits wherever possible on suspended/surface channels.
- .3 Do not pass conduits through structural members except as indicated.

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

### **3.4 CONCEALED CONDUITS**

- .1 Run parallel or perpendicular to building lines.
- .2 Group conduits wherever possible on suspended/surface channels.
- .3 Do not pass conduits through structural members except as indicated.
- .4 Do not install horizontal runs in walls.
- .5 Do not install conduits in terrazzo or concrete toppings.
- .6 Do not install conduits in concrete slab or under slabs at grade level except as indicated.

### **3.5 VAPOUR BARRIER PENETRATIONS**

- .1 Conduit and wire penetrations of vapour barriers must be effectively sealed to maintain the integrity of the vapour barrier.

### **3.6 CLEANING**

- .1 Proceed in accordance with Division 01 – General Requirements.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

### **3.7 RESTRICTIONS**

- .1 Exposed surface mounted conduit in finished areas is not permitted.
- .2 Do not install conduit vertically within metal studs. i.e. not within the channel of the metal stud.
- .3 Horizontal conduit runs in steel stud partition walls are not permitted.
- .4 Do not install raceways and boxes directly to underside of roof decking. Support raceways and boxes so that their nearest outside surface is not less than 38 mm from bottom of roof decking.

**END OF SECTION**

## **PART 1 – GENERAL**

### **1.1 RELATED WORK**

- .1 Section 26 05 00 – Common Work Results for Electrical.
- .2 Section 26 27 30 – Occupancy Sensor Lighting Control.
- .3 Section 26 50 00 – Lighting.

### **1.2 REFERENCE STANDARDS**

- .1 Canadian Standards Association (CSA International)
  - .1 C22.2 No.184.1-15, Solid-State Dimming Controls (Bi-national standard with UL 1472).

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Division 01 – General Requirements.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature and data sheets for lighting control devices and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

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

- .1 Deliver, store and handle materials in accordance with Division 01 – General Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground indoors in clean, dry, well-ventilated location and in accordance with manufacturer's recommendations.
  - .2 Store and protect lighting control devices from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Division 01 – General Requirements.



## **PART 2 – PRODUCTS**

### **2.1 EQUIPMENT - DESCRIPTION**

- .1 Dimming system: to CSA C22.2 No.184.1, packaged in accordance with Canadian Code for Preferred Packaging guidelines.
  - .1 Components: an integrated system from one manufacturer.
- .2 System to start, and operate continuously, within intensity setting of 1 to 100%, or as indicated.
- .3 Where indicated, system to operate in conjunction with low voltage occupancy sensor in accordance with Section 26 27 30 – Occupancy Sensor Lighting Control.
- .4 System to include approved radio and TV interference suppressors.
- .5 System voltage as indicated.

### **2.2 LED DRIVERS**

- .1 LED drivers: in accordance with Section 26 50 00 - Lighting.
- .2 Supplier to verify that intensity selector is compatible with specified led drivers and will dim to minimum intensity indicated.

### **2.3 INTENSITY SELECTOR WITH ON-OFF CONTROL**

- .1 Intensity selector unit, containing 0-10V solid state control circuit, paddle type intensity selector, manually operated, providing for continuous adjustment from maximum intensity to 1 % of maximum intensity, factory trimmed for optimum performance, suitable for installation in single gang wall box and complete with faceplate.
- .2 On-off switch integrated into intensity selector.
- .3 Direct LED driver control.
- .4 Designed to operate in conjunction with low voltage occupancy sensor.
- .5 Provide power pack for on-off switching where required by manufacturer.
- .6 Colour: White.

### **2.4 POWER PACKS**

- .1 Power packs to provide line voltage on-off switching for intensity selectors where required.
- .2 Self-contained transformer relay system.
- .3 Input power supply: 120V AC.
- .4 Secondary voltage: 24V DC.

- .5 cUL Listed.
- .6 Five year warranty.

## **2.5 WIRING**

- .1 Wire type and number of conductors as recommended by equipment manufacturer and in accordance with Section 26 05 21 – Wires and Cables (0-1000 V).

## **PART 3 – EXECUTION**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates and surfaces to receive lighting control devices previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's instructions prior to lighting control devices installation.
  - .1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .2 Proceed with installation only after unacceptable conditions have been remedied.

### **3.2 INSTALLATION**

- .1 Install components comprising dimming system in accordance with manufacturer's instructions, and as indicated.
- .2 Install power packs within junction boxes for voltage separation and for protection from damage.
- .3 Where indicated, connect to occupancy sensors in accordance with Section 26 27 30 – Occupancy Sensor Lighting Control.
- .4 Install wiring in conduit in accordance with Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.
- .5 Install wiring, shielding, grounding in accordance with manufacturer's instructions.
- .6 Ensure shielded leads have outer insulating jackets and are connected to ground at one point only.
- .7 Radio, TV and communications wiring:
  - .1 Minimum of 1.8 m away from dimming circuitry.
  - .2 Where crossing of wiring is essential, ensure grounded shields surround wiring, and crossings take place at 90 degrees.
- .8 Locate intensity controls as indicated.
- .9 Ensure connections are correctly made and to same phase before energizing.

### **3.3 IDENTIFICATION**

- .1 Provide lighting control device identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Provide identification at all lighting control devices using pre-printed thermal non-smear labels, clear with black lettering, attached to coverplate identifying panel and circuit number.
- .3 Where lighting control devices are grouped, provide identification labels clearly indicating load controlled, i.e. pot lights, room lights, etc.”

### **3.4 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Demonstrate dimming systems are installed as indicated.
- .3 Demonstrate dimming systems operate as intended and there are no problems in starting lamps, nor in keeping them lit, and free of perceptible flicker setting of dimming intensity control.
- .4 Demonstrate that no radio or TV interference is carried by system and that there is no interference between dimming system and locally used infrared-based remote/integral controls.
- .5 Where applicable, demonstrate occupancy sensor operation in accordance with Section 26 27 30 – Occupancy Sensor Lighting Control.

### **3.5 ADJUSTING**

- .1 Adjust lighting control devices for correct function and operation in accordance with manufacturer's written instructions.

### **3.6 CLEANING**

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

### **3.7 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by lighting control devices installation.

**END OF SECTION**

## **PART 1 – GENERAL**

### **1.1 RELATED WORK**

- .1 Section 26 05 00 – Common Work Results for Electrical.
- .2 Section 26 05 32 – Outlet boxes, Conduit Boxes and Fittings.

### **1.2 REFERENCE STANDARDS**

- .1 Canadian Standards Association (CSA International)
  - .1 C22.2 No.42-10 (R2015), General Use Receptacles, Attachment Plugs and Similar Wiring Devices.
  - .2 C22.2 No.42.1-13, Cover Plates for Flush-Mounted Wiring Devices (Bi-National Standard with UL 514D).
  - .3 C22.2 No.55-15, Special Use Switches.
  - .4 C22.2 No.111-10 (R2015), General-Use Snap Switches (Bi-National Standard with UL 20).
  - .5 CAN/CSA C22.2 No. 144.1-06 (R2011), Ground Fault Circuit Interrupters (Tri-National Standard with UL 943 and NMJ-J-520-ANCE).

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Division 01 – General Requirements.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.

### **1.4 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Division 01 – General Requirements.
- .2 Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.

### **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Division 01 – General Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground indoors in clean, dry, well-ventilated location and in accordance with manufacturer's recommendations.
  - .2 Store and protect wiring devices from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

- .4 Packaging Waste Management: separate waste materials for reuse and recycling in accordance with Division 01 – General Requirements.

## **PART 2 – PRODUCTS**

### **2.1 SWITCHES**

- .1 15 A, 120 V, specification grade, single pole, three-way, four-way switches as indicated to: CSA C22.2 No.55 and CSA C22.2 No.111.
- .2 Manually-operated general purpose AC switches with following features:
  - .1 Terminal holes approved for No. 14 to 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 White toggle.
- .3 Toggle operated fully rated for tungsten filament lamps, fluorescent ballasts, LED drivers and up to 80% of rated capacity of motor loads.
- .4 Switches of one manufacturer throughout project.

### **2.2 RECEPTACLES**

- .1 Duplex receptacles, heavy duty specification grade, CSA 5-20R, 125 V, U ground, to: CSA C22.2 No.42 with following features:
  - .1 White urea moulded housing.
  - .2 Suitable for No. 14 to No. 10 AWG for back and side wiring.
  - .3 Duplex receptacles: eight back wired entrances, four side wiring screws, break-off links for use as split receptacles.
  - .4 Triple wipe brass contacts and rivetted grounding contacts.
- .2 Receptacles of one manufacturer throughout project.

### **2.3 COVER PLATES**

- .1 Cover plates for wiring devices to: CSA C22.2 No.42.1.
- .2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .3 High impact resistant, non-flammable, unbreakable thermoplastic cover plates, thickness 1.8 mm, for wiring devices mounted in flush-mounted outlet boxes, color to match wiring device.
- .4 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .5 Cover plates from one manufacturer throughout project.

## **PART 3 – EXECUTION**

### **3.1 INSTALLATION**

- .1 Install wiring devices in outlet and conduit boxes in accordance with Section 26 05 32 – Outlet Boxes, Conduit Boxes and Fittings.
- .2 Do not use back entrances for connecting wiring devices to circuits. Wrap conductors around screw terminals and tighten.
- .3 Utilize stainless steel mounting screws and hardware for exterior coverplates.
- .4 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 as indicated in Section 26 05 00 - Common Work Results for Electrical.
- .5 Receptacles:
  - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
  - .2 Mount receptacles at height as indicated in Section 26 05 00 - Common Work Results for Electrical or as indicated.
  - .3 Install heavy duty specification grade receptacles throughout unless indicated otherwise.
- .6 Cover plates:
  - .1 Install suitable common cover plates where wiring devices are grouped.
  - .2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.
  - .3 For general use install high impact thermoplastic coverplates.

### **3.2 IDENTIFICATION**

- .1 Provide wiring device identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Provide identification at all wiring devices using pre-printed thermal non-smear labels, clear with black lettering, attached to coverplate identifying panel and circuit number.

### **3.3 CLEANING**

- .1 Progress Cleaning: clean in accordance with Division 01 – General Requirements.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 01 – General Requirements.
- .3 Ensure all wiring devices and coverplates are free of paint, plaster and dirt.

- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Division 01 – General Requirements.

### **3.4 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by wiring device installation.

**END OF SECTION**

## **PART 1 – GENERAL**

### **1.1 RELATED WORK**

- .1 Section 26 05 00 – Common Work Results for Electrical.
- .2 Section 26 09 23.05 – Lighting Control Devices – LED Dimming.
- .3 Section 26 50 00 – Lighting.

### **1.2 REFERENCE STANDARDS**

- .1 National Electrical Manufacturers Association (NEMA)
  - .1 NEMA WD 7-2011, Occupancy Motion Sensors Standard.

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Division 01 – General Requirements.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature and data sheets for occupancy sensor lighting control devices and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

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

- .1 Deliver, store and handle materials in accordance with Division 01 – General Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground indoors in clean, dry, well-ventilated location and in accordance with manufacturer's recommendations.
  - .2 Store and protect occupancy sensor lighting control devices from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

### **1.5 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling in accordance with Division 01 – General Requirements.

### **1.6 TRAINING**

- .1 Provide services of manufacturer's technician as necessary to train operating and maintenance personnel designated by Owner. Training to include detailed recommendations on the operation and adjustment for each type of occupancy sensor.



## **1.7 SPARE PARTS**

- .1 Provide a minimum of one (1) spare occupancy sensor of each type used and one (1) spare power pack.
- .2 Supply to Departmental Representative a receipt signed by the Owner verifying that Owner has taken delivery of the spare parts.

## **PART 2 – PRODUCTS**

### **2.1 EQUIPMENT - DESCRIPTION**

- .1 Occupancy Sensors: to NEMA WD-7.
- .2 All occupancy sensors to be from one manufacturer.
- .3 Occupancy sensors to turn lighting on when a person enters a controlled area and off after the area has been vacated for a set period of time.
- .4 In situations where nuisance operation occurs, occupancy sensors are to be programmed for manual-on, auto-off operation. (vacancy operating mode)
- .5 Where indicated, occupancy sensors to operate in conjunction with dimming controls in accordance with Section 26 09 23.05 – Lighting Control Devices – LED Dimming.

### **2.2 TECHNOLOGY**

- .1 Passive infrared (PIR) sensing systems are passive and react only to energy sources. They detect the difference between heat emitted by the human body and the background space.
- .2 Ultrasonic sensors (US) detect volumetric motion using the Doppler Principle to sense movement.
- .3 Dual technology (DT) sensors use both PIR and US technologies.

### **2.3 DUAL TECHNOLOGY WALL SWITCH SENSOR**

- .1 Light switch to provide automatic control of lighting.
- .2 Advanced PIR and US technologies.
- .3 Programmable for either Manual-ON or Automatic-ON.
- .4 Digital time delay of 5 to 30 minutes.
- .5 Selectable walk-through setting.
- .6 Red and green LEDs to indicate occupancy detection by PIR and US sensors.
- .7 Separate sensitivity adjustments for PIR and US detectors.

- .8 Four occupancy logic options, selectable by DIP switches.
- .9 Vandal-resistant hard lens.
- .10 Selectable audible alert for impending shut-off.
- .11 No minimum load requirement.
- .12 No leakage to load in OFF mode – Manual and Auto-ON models.
- .13 Voltage drop protection.
- .14 Compatible with all ballasts.
- .15 CUL listed.
- .16 Five-year warranty.
- .17 Load: 800W @ 120V.
- .18 Coverage: 180 deg. – designed for optimal operating in spaces of dimensions 5.5 m x 4.5 m.
- .19 Finish: White.

## **2.4 DUAL TECHNOLOGY CEILING SENSOR**

- .1 Advanced PIR and US technologies.
- .2 Designed to operate in conjunction with dimmer switch where indicated in accordance with Section 26 09 23.05 – Lighting Control Devices – LED Dimming.
- .3 24V DC power supply.
- .4 40 kHz frequency ultrasonic transmission.
- .5 Coverage:
  - .1 180 deg, 46 sq.m. of desktop motion for offices and smaller spaces.
  - .2 360 deg, 93 sq.m. of coverage for service spaces and larger areas.
- .6 Logic Key/On bypass.
- .7 Multi-level lens.
- .8 Adjustable time-delay of 5 minutes to 30 minutes, set to 30 minutes.
- .9 Selectable walk-through mode setting.
- .10 LED to indicate occupancy detection.
- .11 Adjustable unit sensitivity.

- .12 ASIC for reliability and immunity to RFI and EMI.
- .13 Pulse count processing and digital signature analysis eliminate false activations and increase sensitivity to minor motion.
- .14 Built-in light level sensor.
- .15 No minimum load requirement.
- .16 Isolated auxiliary relay to interface with building HVAC systems.
- .17 CUL listed.
- .18 Five-year warranty.
- .19 Finish: White.

## **2.5 POWER PACKS**

- .1 Power packs to provide 24V DC operating voltage to all 24V DC sensors and be capable of load switching.
- .2 Self-contained transformer relay system.
- .3 Easy snap-on installation.
- .4 Input power supply: 120V AC as indicated.
- .5 Secondary voltage: 24V DC.
- .6 Secondary output: 100mA.
- .7 Enclosure: UL rated 94V-0 plastic enclosure.
- .8 CUL listed.
- .9 Five-year warranty.

## **PART 3 – EXECUTION**

### **3.1 INSTALLATION**

- .1 Obtain complete installation instructions from manufacturer prior to rough-in.
- .2 Review sensor locations with manufacturer's representative prior to rough-in and install in location(s) within room that provides maximum sensor coverage but confines coverage to the room. Motion outside the room is not to activate lighting within the room. Include one eight hour site visit from the Manufacturer's representative.
- .3 Install occupancy sensor lighting control devices in accordance with manufacturer's instructions, and as indicated.

- .4 Where indicated, connect occupancy sensor lighting control devices to dimming controls in accordance with Section 26 09 23.05 – Lighting Control Devices – LED Dimming.
- .5 Install power packs within junction boxes for voltage separation and for protection from damage.
- .6 Install wiring and grounding in accordance with manufacturer's instructions.
- .7 Wire sensors into circuits or relays as indicated to control luminaires in the indicated areas of coverage.

### **3.2 ADJUSTING**

- .1 Adjust occupancy sensor lighting control devices for correct function and operation in accordance with manufacturer's written instructions.
- .2 Program sensors for “Auto On”. Occupancy sensors to turn lighting on when a person enters a controlled area and off after the area has been vacated for a set period of time.
- .3 In situations where nuisance operation occurs, occupancy sensors are to be programmed for manual-on, auto-off operation. (vacancy operating mode)
- .4 Rooms with ceiling mounted sensors and local switches to be programmed for “Manual On”.
- .5 Occupancy sensors to time delay off after 15 minutes without detecting activity within the room.
- .6 Occupancy sensors to be individually adjusted in accordance with the manufacturer’s recommendations for the specific room in which they are installed taking into account room shape, size and usage.

### **3.3 IDENTIFICATION**

- .1 Provide lighting control device identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Provide identification at all lighting control devices using pre-printed thermal non-smear labels, clear with black lettering, attached to coverplate identifying panel and circuit number.

### **3.4 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Occupancy sensors to be commissioned by manufacturer’s representative prior to interim inspection to verify optimum operation.
- .3 Sensors to be added or relocated and patterns adjusted as required to eliminate nuisance turning on/off of luminaires.

- .4 Test for acceptable operation.
- .5 Where applicable, test operation with dimming controls in accordance with Section 26 09 23.05 – Lighting Control Devices – LED Dimming.
- .6 Demonstrate operation to Owner and Departmental Representative.
- .7 Following two week period of building occupancy by Owner, manufacturer's representative to adjust problematic sensors identified by Owner. Repeat adjustments after another one week period. Perform as many visits as required on weekly basis until Owner has indicated satisfactory performance of all sensors.

### **3.5 CLEANING**

- .1 Progress Cleaning: clean in accordance with Division 01 – General Requirements.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 01 – General Requirements.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Division 01 – General Requirements.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.6 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by occupancy sensor lighting control device installation.

**END OF SECTION**

## **PART 1 – GENERAL**

### **1.1 RELATED WORK**

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

### **1.2 REFERENCE STANDARDS**

- .1 ASTM International Inc.
  - .1 ASTM A1008/A1008M-16, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
  - .2 ASTM F1137-11, Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.
- .2 Canadian Standards Association (CSA International)
  - .1 CAN/CSA C22.2 No. 250.0-08 (R2013), Luminaires (Tri-National Standard, with UL 1598 and NMJ-J-307/1-ANCE).
  - .2 CAN/CSA C22.2 No. 250.13-17, Light Emitting Diode (LED) Equipment for Lighting Applications.
  - .3 CSA C866-17, Performance of LED Luminaires.
- .3 Design Lights Consortium (DLC)
- .4 Illuminating Engineering Society of North America (IESNA)
  - .1 IES LM-79-08, Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products
  - .2 IES LM-80-15, Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules
  - .3 IES TM-21-11, Projecting Long Term Lumen Maintenance of LED Light Sources
  - .4 IES, The Lighting Handbook, 10<sup>th</sup> Edition, Reference and Application.
- .5 Industry Canada
  - .1 ICES-005-15, Lighting Equipment.
- .6 Institute of Electrical and Electronics Engineers (IEEE)
  - .1 IEEE C62.41.1-02 (R2008), IEEE Guide on the Surge Environment in Low-Voltage (1000 V and less) AC Power Circuits.
- .7 Underwriter's Laboratories of Canada (ULC)
- .8 Underwriter's Laboratories (UL)
  - .1 UL 94-13, Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.
  - .2 UL 508-13, Standard for Industrial Control Equipment.
  - .3 UL 8750-15, Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products.

### **1.3 SYSTEM DESCRIPTION**

- .1 Lighting system consists of light fixtures specified in the section, including all associated frames, supports, hangers, spacers, stems, aligner canopies, junction boxes and other hardware required for a complete and proper installation.
- .2 Surface luminaires to have frames that are compatible with the ceiling systems for which they are intended.
- .3 Luminaire voltage to match the voltage of the circuit serving the same.

### **1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Division 01 – General Requirements.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Provide complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Departmental Representative.
  - .3 Photometric data to include: VCP Table where applicable, spacing criterion, electronic IES files.
- .3 Quality assurance submittals: provide following in accordance with Division 01 – General Requirements.
  - .1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence and cleaning instructions and procedures.

### **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Division 01 – General Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Division 01 – General Requirements.
  - .1 Disposal and recycling of fluorescent lamps as per Municipal regulations.
  - .2 Disposal of old PCB filled ballasts as per Federal, Provincial and Municipal laws and regulations.
  - .3 Comply with all Federal, Provincial and Municipal laws and regulations when disposing of waste.

## **PART 2 – PRODUCTS**

### **2.1 LED LUMINAIRES**

- .1 Luminaires and all components (LEDs, driver, housing, etc.) to have a complete 5-year manufacturer warranty.
- .2 LED luminaire performance to be in accordance with CSA C866.
- .3 Luminaires to be DLC Standard version 4.4 listed.
- .4 Luminaire efficacy: in accordance with DLC requirements.
- .5 Surge protection to: IEEE C.62.41 and UL8750.
- .6 In situ temperature measurement test (ISTMT) provided by an OSHA or UL testing laboratory.
- .7 LEDs
  - .1 LED lifetime projections to: IES TM-21.
  - .2 Performance measurement to: IES LM-79.
  - .3 Lumen maintenance testing to: IES LM-80.
  - .4 Minimum 50,000 hours.
  - .5 Colour bin size to: ANSI C78 377A.
  - .6 Minimum colour rendering index (CRI): 80.
  - .7 Colour temperature 3500K or as indicated.
  - .8 IES L70 minimum 50,000 hours at 25 degrees Celsius.
- .8 LED array to be field replaceable.
- .9 LED Drivers
  - .1 Voltage as indicated.
  - .2 Solid-state electronic.
  - .3 Power factor: minimum 90% lagging or leading.
  - .4 Harmonics: 20 % maximum THD.
  - .5 Short circuit and overload protection.
  - .6 0-10V dimming standard.
- .10 Luminaires to be Restriction of Hazardous Substance Directive (RoHS) compliant.
- .11 Compatibility: manufacturer to submit in writing compatible external control components for each luminaire used.
- .12 Luminaire manufacturer shall be a company with a minimum of 5 years of success manufacturing LED light fixtures for the Canadian market. The agency representing the manufacturer shall be an established company that has had and currently maintains a locally run and operated business in New Brunswick for at least five years. A listing of five (5) projects shall be provided (if requested) where the manufacturer's similar products have been used in Canada, including location, contact person and telephone number.



## **2.2 FINISHES**

- .1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.
- .2 Baked enamel finish:
  - .1 Conditioning for metal before painting:
    - .1 For corrosion resistance, conversion coating to ASTM F1137.
    - .2 For paint base, conversion coating to ASTM F1137.
  - .2 Metal surfaces of luminaire housing and reflectors finished with high gloss baked enamel to give smooth, uniform appearance, free from pinholes or defects.
  - .3 Reflector and other inside surfaces finished as follows:
    - .1 White: minimum reflection factor 85%.
    - .2 Colour fastness: yellowness factor not above 0.02 and after 250 hour exposure in Atlas fadeometer not to exceed 0.05.
    - .3 Film thickness: not less than 0.3 mm average and in no areas less than 0.025 mm.
    - .4 Gloss: not less than 80 units as measured with Gardner 60 degree glossmeter.
    - .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.
  - .4 Alzak finish:
    - .1 Aluminum sheet fabricated from special aluminum alloys and chemically brightened, subsequently anodically treated to specifications established by Alcoa, to produce:
      - .1 Finish for mild commercial service, minimum density of coating 0.8 mg/sq. cm., minimum reflectivity 83% for specular and 75% for diffuse.
      - .2 Finish for regular industrial service, minimum density of coating 1.2 mg/sq. cm., minimum reflectivity 82% for specular and 73% for diffuse.
      - .3 Finish for heavy duty service, minimum density of coating 1.5 mg/sq. cm., minimum reflectivity 78% for specular and 65% for diffuse.

## 2.3 LUMINAIRES

- .1 Acceptable manufacturer or approved equal:

TYPE	DESCRIPTION	LAMP	MOUNTING
A	610 x 1220mm LED FLAT PANEL, SPECIFICATION GRADE, LOW PROFILE, FLAT OPAL LENS, ACRYLIC DIFFUSER, WHITE ENAMEL FINISH, 0-10V DIMMING, 120V DRIVER	LED 80 CRI 3500K 3800 LMNS	SURFACE ON T-BAR CEILING IN SURFACE ENCLOSURE
A1	610 x 1220mm LED CENTRE BASKET, ARCHITECTURAL GRADE, CURVED LINEAR PRISM ACRYLIC DIFFUSER, MATTE WHITE POLYESTER POWDER COAT, 0-10V DIMMING, 120V DRIVER	LED 80 CRI 3500K 3800 LMNS	SURFACE ON T-BAR CEILING IN SURFACE ENCLOSURE
B	610 x 610mm LED FLAT PANEL, SPECIFICATION GRADE, LOW PROFILE, FLAT OPAL LENS, ACRYLIC DIFFUSER, WHITE ENAMEL FINISH, 0-10V DIMMING, 120V DRIVER	LED 80 CRI 3500K 3800 LMNS	SURFACE ON T-BAR CEILING IN SURFACE ENCLOSURE
B1	610 x 610mm LED CENTRE BASKET, ARCHITECTURAL GRADE, CURVED LINEAR PRISM ACRYLIC DIFFUSER, MATTE WHITE POLYESTER POWDER COAT, 0-10V DIMMING, 120V DRIVER	LED 80 CRI 3500K 3800 LMNS	SURFACE ON T-BAR CEILING IN SURFACE ENCLOSURE
C	305 x 1220mm LED FLAT PANEL, SPECIFICATION GRADE, LOW PROFILE, FLAT OPAL LENS, ACRYLIC DIFFUSER, WHITE ENAMEL FINISH, 0-10V DIMMING, 120V DRIVER	LED 80 CRI 3500K 3800 LMNS	SURFACE ON T-BAR CEILING IN SURFACE ENCLOSURE

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- .1 Locate and install luminaires as indicated.
- .2 Provide adequate support to suit ceiling system.
- .3 Supply and install all materials and accessories as required for proper mounting of all luminaires.

### 3.2 WIRING

- .1 Connect luminaires to lighting circuits:
- .1 Install ceiling space junction boxes and rewire luminaires and switches from junction boxes with flexible conduit.

### 3.3 LUMINAIRE SUPPORTS

- .1 For t-grid ceiling surface installations support luminaires with heavy duty pre-galvanized steel hangers and fasteners from ceiling grid and in accordance with local inspection requirements.

### **3.4 LUMINAIRE ALIGNMENT**

- .1 Align luminaires mounted individually parallel or perpendicular to building grid lines.
- .2 Connect to switches and occupancy sensors.

### **3.5 CLEANING**

- .1 Clean in accordance with Division 01 – General Requirements.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Clean luminaires, lenses and reflectors in accordance with manufacturer's cleaning instructions and procedures.

**END OF SECTION**

## **PART 1 – GENERAL**

### **1.1 RELATED WORK**

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

### **1.2 RESPONSIBILITY**

- .1 Work and materials for this section are the responsibility of the electrical Contractor.

### **1.3 REFERENCE STANDARDS**

- .1 Canadian Standards Association (CSA International)
  - .1 C22.2 No.46-13, Electric Air-Heaters.
- .2 Underwriters' Laboratories (UL) Inc.
  - .1 UL 1042-2009, Standard for Electric Baseboard Heating Equipment.

### **1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Division 01 – General Requirements.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence and cleaning procedures.

### **1.5 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Division 01 – General Requirements.
- .2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

### **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Division 01 – General Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground indoors in clean, dry location and in accordance with manufacturer's recommendations.
  - .2 Store and protect materials from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Division 01 – General Requirements.

## **PART 2 – PRODUCTS**

### **2.1 BASEBOARD CONVECTORS**

- .1 Heaters: to CSA C22.2 No.46 and UL 1042, with standard wattage density as indicated with connection box on both ends.
  - .1 Element through-type fitted with aluminum convactor vanes and resistor wire enclosed in mineral insulation in stainless steel tubular sheath.
  - .2 Voltage: 208V, 1 phase.
- .2 Element: locked to cabinet and supported at additional points throughout length to allow for linear expansion with non-metallic supports.
- .3 Watt density: standard density 820 W/m.
- .4 Cabinet: to CSA C22.2 No.46 and UL 1042, pre-drilled back for securing to wall. Integral air diffusion reflector with wireway at bottom and built-in clamps.
  - .1 Front inlet/top outlet.
  - .2 Sloped top.
  - .3 Panel: steel, metal thickness, cabinet 1.2 mm, front 1.6 mm thick.
  - .4 Grille: 6.4 mm openings to prevent insertion of foreign objects.
  - .5 Finish: phosphatized and finished with epoxy/polyester powder coated finish, almond colour.
- .5 Blank cabinet sections with inside and outside corners, with wireway in sections including splice plates, to match heater cabinets for continuous baseboard effect as indicated.

### **2.2 CONTROLS**

- .1 Integral thermostats: 2-pole to control load as indicated.

## **PART 3 – EXECUTION**

### **3.1 INSTALLATION**

- .1 Install baseboard convactor heaters, blank sections and controls.
- .2 When wireway is used, remove knock-outs and insert insulating bushing between units.
- .3 Install grounding wire to maintain ground integrity between heating, blank, and auxiliary sections.
- .4 Make power and control connections.

### **3.2 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Ensure heaters and controls operate correctly.

**END OF SECTION**