

**Section**      **Title**

**Division 26 – Electrical**

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**Division 28 – Electrical**

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## **1. General**

### **1.1. GENERAL**

1. The Executed Agreement including General Conditions and Supplementary Conditions, applicable sections of Division 00 and Division 01, Section 26 05 00 - Common Work Results for Electrical, Section 26 05 01 - Electrical Submittals and Section 26 05 02 - Electrical Contract Closeouts, applicable drawings and amendments are part of and to be read in conjunction with this Section.
2. This section shall be considered as minimum standard of acceptance of all sections within Division 26, 27 and 28 of the tender documents for the contract.

### **1.2. FUNCTIONAL PERFORMANCE TESTING (FPT)**

1. Refer to Section 26 91 13 - Testing and Verification for Functional Performance Testing (FPT).
2. The correction of all electrical deficiencies identified throughout the project associated with the Work shall be a condition of Substantial Performance and shall be corrected prior to achieving Substantial Performance.
3. A condition of Substantial Performance shall be an Owner performed Functional Performance Testing (FPT) Program independent of other processes specified, upon receipt of written verification from the General Contractor that:
  1. All systems are complete and operational in all respects.
  2. All specified reports and documents have been submitted and approved.
  3. All tests, commissioning and start-up processes described elsewhere in the specification are complete.
  4. All demonstrations have been completed and documented.
  5. All defects and deficiencies identified during the commissioning of all electrical systems have been corrected.
4. Prior to Functional Performance Testing (FTP), submit the following documentation:
  1. Record drawings.
  2. Operations and maintenance manuals.
  3. Documentations listed in Section 26 05 02 - Electrical Contract Closeouts.
  4. Written confirmation of System Demonstration and Operating and Maintenance Instructions have been performed in accordance with Section 26 05 02 - Electrical Contract Closeouts.
5. Deficiencies or discrepancies discovered during the FPT process are to be immediately rectified by the Electrical Contractor. A condition of Substantial Performance shall be the correction of all electrical deficiencies identified throughout the project associated with this work.
6. The contractor shall return copies of the deficiency lists to owner via the Engineer with all corrected items signed off.

7. The FPT Deficiency list will form part of the Substantial Performance Inspection list specified in Division 01.

### **1.3. INTENT**

1. It is the intent of these specifications to outline the method, materials, and quality of equipment to be furnished and installed hereinafter specified and/or shown on the drawings.

### **1.4. DEFINITIONS**

1. “CONCEALED” – electrical services and equipment in hung ceiling spaces and non-accessible chases and furred spaces.
2. “EXPOSED” – will mean “not concealed” as defined herein.
3. “PROVIDE” – means supply and install. Wherever in the Contract Documents the word “provide” is used in any form, it shall mean that the Work concerned shall include both supply and installation of the products required for completion of that part of the Work.

### **1.5. CODES AND STANDARDS**

1. Do complete installation in accordance with CSA C22.1 latest edition except where specified otherwise.
2. Ensure that all electrical equipment is field marked to warn persons of the potential electric shock and arc flash hazards, as per CSA C22.1 latest edition, Rule 2-306.
3. Comply with CSA Certification Standards and Electrical Bulletins in force at time of tender submission.
4. Abbreviations for electrical terms: to CSA Z85-1983.

### **1.6. CARE, OPERATION AND START-UP**

1. Instruct operating personnel in the operation, care and maintenance of equipment.
2. Arrange and pay for the services of manufacturer’s factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components.
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.

### **1.7. VOLTAGE RATINGS**

1. Operating voltages: to CAN3-C235-83.

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

#### **1.8. PERMITS, FEES AND INSPECTIONS**

1. Electrical Permits
  1. Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
  2. Pay associated fees.
  3. Furnish Certificates of Acceptance from Inspection Department and authorities having jurisdiction on completion of work.
  4. The electrical contractor is responsible for submitting the tender drawings to the electrical utility for the purposes of plan review upon obtaining an electrical permit.

#### **1.9. MATERIALS AND EQUIPMENT**

1. Provide materials and equipment in accordance Division 01.
2. Equipment and material to be CSA certified and manufactured to standard quoted.
3. Factory assembled control panels and component assemblies by a CSA approved shop.
4. Arrange and pay for field certification by CSA, as may be required.

#### **1.10. FINISHES**

1. Shop finish metal enclosure surfaces by removal of rust and scale, cleaning, application of rust resistant primer inside and outside, and at least two coats of finish enamel.
  1. Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1-1958.
2. Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
3. Clean, prime, and paint exposed hangers, racks, fastenings to prevent rusting.

#### **1.11. WIRING TERMINATIONS**

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

2. Panel boards are to be equipped in the factory with proper sized lugs to suit the conductor size.
3. All stranded conductors (including phase, neutrals, grounds and bonds) prior to terminating under device bolts are to be twisted together so as to form a single conductor.
4. Ensure all bonding conductors entering electrical enclosures, such as panel tubs, splitters, junction and pull boxes 150 mm x 150 mm (6 in. x 6 in.) and larger, etc. are terminated on terminal strips which are electrically continuous and fastened to the metal non-current carrying portion of the enclosure with a minimum of two bolts, c/w lock washers.

**1.12. MANUFACTURER'S AND CSA LABELS**

1. Visible and legible after equipment is installed.

**1.13. WARNING SIGNS**

1. Provide warning signs, as specified and/or to meet requirements of Inspection Department.

**1.14. SINGLE LINE ELECTRICAL RISER DIAGRAMS**

1. Riser diagrams are required on this project.

**1.15. ELECTRICAL POWER QUALITY STUDY**

1. The manufacturer of the power distribution equipment shall provide a short-circuit and protective device evaluation study report in accordance with IEEE 1584:18 at the time of shop drawing submission. The purpose of the study is to verify the power distribution equipment being supplied under this contract have the required fault current withstand ratings that exist at this facility. Utility fault conditions for the purpose of this project are to be as follows:

Nominal Primary Voltage(L-L) (kV)	24.94	12.47	4.16
Fault Level (MVA)	346	195	65
X/R Ratio	15	15	15

2. The above-mentioned short circuit study shall be resubmitted as part of the O&M manual with updates to account for all electrical system installations conditions. The as-built arc fault study submitted with the O&M manual shall include a copy of CSA Z462:21 labels for all switchboards, panelboards and 600V disconnect switches. The CSA Z462:21 warning label listing incident energy, arc flash boundary, and hazard risk category. shall be applied to the equipment as part of the equipment manufacturer's functional performance process.
3. The manufacturer of the power distribution equipment shall provide a protective device coordination study report as part of the shop drawing review process. The study shall

utilize the same utility and electrical distribution equipment parameter as the above-mentioned short circuit study. The purpose of the study is to confirm the equipment being supplied under this contract are coordinated. The equipment manufacturer is responsible for raising device miscoordination issues prior to tender closing.

**1.16. MOUNTING HEIGHTS**

1. Mounting height of equipment is from finished floor to centre line of equipment unless specified or indicated otherwise.
2. Verify mounting height of equipment before proceeding with installation.

**1.17. PROTECTION**

1. Protect exposed live equipment during construction for personnel safety.
2. Shield and mark live parts “LIVE 120 VOLTS”, or with appropriate voltage.
3. Ensure no exposed wiring is left unattended.

**1.18. CONDUIT AND CABLE INSTALLATION**

1. Install cables, conduits, and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to a minimum.
2. All wiring and conduit are to be concealed, unless noted otherwise. Where this is not possible due to existing construction, metal surface mounted raceways are to be used. Refer to the contract documents for more detail.
3. Where conduits cross building expansion joints, provide conduit expansion joints with telescoping sleeve and insulated bushings.

**1.19. SLEEVES AND FIRESTOPPING**

1. Where conduits, cables and cable troughs pass through assemblies, provide firestopping.

**1.20. FIELD QUALITY CONTROL**

1. All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices’ program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks — the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.
2. External Agent tests not required.

3. Furnish Manufacturer's, certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
4. Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
5. Submit test results for Engineer's review.

#### **1.21. DRAWINGS**

1. Electrical drawings are not intended to show structural details or architectural features.
2. The electrical drawings are not to be scaled.
3. Electrical drawings, except where dimensioned, indicate general layouts only. Investigate structural and finish conditions and the work of all other trades affecting this work and arrange work accordingly.
4. Coordinate the elevation of all outlet boxes with architectural drawings and report any conflicts to Engineer prior to installation.
5. All electrical junction boxes must be accessible at the completion of the project. Coordinate the location of each junction box with the proposed location of mechanical services prior to installation.
6. Layouts on the electrical drawings are based on the specified equipment including electrical power connections, number of conductors and conduit sizes, and physical dimensions. Alternate equipment and systems proposed by the Contractor for use on this project which necessitate changes in service connections, numbers of conductors and conduit sizes to perform the specified functions may be considered by the Engineer, however, any required modifications or additions to the electrical contract or the work of other trade contractors shall be done at no additional cost to the Owner. Furthermore, if it is found that the provisions made regarding space conditions and code required clearances are not met, the right is reserved by the Consultant to require installation of the equipment specified.

#### **1.22. ACCESS DOORS**

1. The electrical contractor is to provide access doors to concealed electrical junction boxes, pull boxes and miscellaneous equipment for operating, inspecting, adjusting and servicing. Access doors are to be supplied which meet or exceed the fire resistance rating of the partition or ceiling in which they are being installed.
2. Flush mounted 600 mm x 600 mm (24 in. x 24 in.) for body entry and 300 mm x 300 mm (12 in. x 12 in.) for hand entry unless otherwise noted. Doors to open 180 degrees, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.
3. Material:

1. Special areas such as tiled or marble surfaces: use stainless steel with brushed satin or polished finish as directed by Consultant.
  2. Remaining areas: use prime coated steel.
  3. Fire rated where installed in fire rated construction.
  4. Provide panels in glazed tile walls of 2.5 mm (12 gauge) 304 stainless steel #4 finish, with recessed frames secured with counter-sunk flush-head screws.
  5. Provide panels in plaster surfaces with recessed doors with welded metal lath ready to accept plaster and with a plaster grommet for door key access.
  6. Provide other access doors of 2.5 mm (12 gauge), flush with concealed hinges, anchor strap and lock, all factory prime coated.
  7. Supply details of doors prior to installation.
  8. Mark all lay-in tiles that are used for access in a manner approved by the Consultant.
4. Installation:
1. Locate so that concealed items are accessible.
  2. Locate so that hand or body entry (as applicable) is achieved.
  3. Installation is specified in applicable sections.
5. Acceptable Manufacturers:
1. Acudor
  2. LeHage
  3. SMS
  4. Zurn

### **1.23. CONNECTION OF EQUIPMENT**

1. Provide all connections required by the equipment supplied by this Division.
2. Provide all connections required by equipment supplied by the Owner or by other Divisions. Examine all Drawings and Specifications and identify all requirements.
3. Provide all necessary accessories to make connections, including flexible connectors, etc.

### **1.24. SPRINKLER PROOF HOODS**

1. All distribution equipment located in the building shall be protected from direct spray from sprinkler heads to the satisfaction of the Inspection Authority by the use of non-combustible hoods.
2. Distribution conduits existing or entering enclosures equipped with sprinkler hoods shall be installed with rain-tight EMT connectors equipped with rubber O-rings including vertical portions of the runs.

### **1.25. INSTALLATION REQUIREMENTS**

1. Install all products and services to follow building planes. Installation shall permit free use of space and maximum headroom to the satisfaction of the Consultant.

2. Confirm the exact location of fixtures, outlets and connections.
3. Install all equipment and appurtenances to allow free access for adjustment, maintenance and/or replacement.
4. Provide all hangers, supports and fasteners such that no undue stresses are imposed on the structure and systems. Ensure that the load onto structures does not exceed the maximum loading. Equipment supports not supplied by equipment manufacturer are to be fabricated using structural grade steel.
5. Exterior supports are to be galvanized, unless noted otherwise.
6. Install all products and services in accordance with the respective manufacturer's recommendations.
7. High velocity explosive activated tools shall not be used. Low velocity system types are permitted.
8. Provide caps and seal all open ends of installed conduits to prevent the entrance of foreign substances.
9. Install all services capped for future possible use such that easy access is provided for future connections.

**1.26. FIELD REVIEW**

1. The Consultant and Owner shall have access to the site at all times for review of the work.
2. Correct any deficiencies as they are reported during the performance of the Work.

**1.27. UNIFORMITY**

1. All equipment and materials which serve a similar function shall be from one manufacturer and one product line.

**1.28. CUTTING AND PATCHING**

1. It is the responsibility of the Electrical Contractor to provide all required cutting and patching associated with the installation of electrical systems, devices, conduit, wire, etc., unless noted otherwise.
2. Restore all surfaces to a finish acceptable to the Owner.

**1.29. TORQUES FOR WIRE TERMINATION**

1. For proper termination of conductors, it is very important that field connections be made properly tight.
2. Where possible, obtain and comply with Manufacturer's instructions on the equipment.
3. In the absence of Manufacturer's instructions, make terminations in conformance with the values given in Tables D6 and D7 of the 2015 CEC.

**1.30. CABLE TIES AND TYE WRAPS**

1. Cable ties and tye wraps are only permitted to be used to provide limited support for marshalling purposes only. These devices are not intended to provide the primary support for conduits or cables as required by the Canadian Electrical Code.

**1.31. WORKING SPACE ABOUT ELECTRICAL EQUIPMENT**

1. Arrange installation as required to maintain minimum working space around electrical equipment in conformance with CSA C22.1 latest edition.

**1.32. LOW V.O.C. MATERIALS**

1. All site applied coatings, adhesives & sealants must be low VOC content.
2. Provide Material Safety Data Sheets for all products & materials of these types incorporated into the work.

**1.33. EXISTING SERVICES**

1. The Electrical Contractor shall ensure that all fire alarm, light, power, heat, telephone and other electrical systems and services remain operational during the course of the project and this Contractor shall be responsible for providing such temporary services by cutting off, altering, adapting, relocating and connecting existing services and disconnecting and removing such temporary or existing services upon providing new permanent services as detailed on all drawings. The site shall be examined to determine the extent of the temporary services and all co-ordination shall be made with the Owner's Representative. All costs shall be included in the Tender Price.
2. Existing equipment, wiring etc. not being re-used under new schemes, shall be removed whether shown on drawings or not. The Electrical Contractor shall repair all openings resulting from the removal of existing electrical equipment and services. All unused outlet boxes (where it is not practical to remove same) shall be blanked with coverplates. All costs shall be included in the Tender.

**1.34. PROJECT COMMISSIONING**

1. The contractor shall coordinate with the project's third-party commissioning agent for the purposes of LEED compliance.

2. The contractor is responsible for all fees and the scope of work to obtain a third-party commissioning agent for the purposes of compliance with the ULC S1001 standard for integrated systems testing of fire protection and life safety systems.

### **1.35. LEED SUBMITTALS**

1. Construction Waste Management. Adhere to the requirements of the Construction Waste Management plan as per Section 01 74 21 Construction Waste Management. Adhesives & Sealants: All workers on-site, including sub trades, using wet applied adhesives and sealants inside the building envelope are required to provide the following for each product to the construction manager to be reviewed by the LEED Consultant:
  1. A LMDF (LEED Material Declaration Form) included in Section 01 35 21 LEED Requirements with the following information:
    1. Manufacturer Name
    2. Product Name/Model/Number
    3. VOC content in g/L
  2. Submit product data/MSDS sheets for VOC emitting materials that clearly identifies the VOC content in g/L by product type as per SCAQMD Rule 1168. A table of LEED compliant VOC limits can be found in Appendix D of Section 01 35 21 LEED Requirements.
  3. Paints & Coatings: All workers on-site, including sub trades, using wet applied paints and coatings inside the building envelope are required to provide the following for each product to the construction manager to be reviewed by the LEED Consultant.
    1. A LMDF (LEED Material Declaration Form) included in Section 01 35 21 LEED Requirements with the following information:
      1. Manufacturer Name
      2. Product Name/Model/Number
      3. Surface Area of product applied on-site
      4. Volume of product applied on-site
      5. VOC content in g/L
      6. Verification that VOC General Emissions Testing following testing standard CDPH-1.2-2017 is available for the product.
    2. Submit product data/MSDS sheets for VOC emitting materials that clearly identifies the VOC content in g/L by product type as per SCAQMD Rule 1113. A table of LEED compliant VOC limits can be found in Appendix D of Section 01 35 21 LEED Requirements.
    3. Submit 3rd-party testing documentation for general emissions of applicable materials that clearly identifies the TVOC emissions for compliance with LEED. (e.g.: SCS Indoor Advantage Gold, Greenguard Gold, or the Collaborative for High Performance Schools (CHPS).)
  4. EPDs & Material Ingredient Reports: Where indicated in individual specification sections or available for submitted products provided LEED documentation using the LMDF (LEED Material Declaration Form) included in Section 01 35 21 LEED Requirements as part of the product's technical submittal.

1. Environmental Product Declarations (EPDs): where available for products in this section provide compliant EPDs as per Section 01 35 21 LEED Requirements and Procedures.
2. Material Ingredient Reporting: where available for products in this section provide compliant documentation as per Section 01 35 21 LEED Requirements and Procedures. (e.g.: HPDs, Cradle to Cradle, Declare Label, REACH Optimization.)
5. Coordinate commissioning with the project's third-party commissioning agent to achieve LEED compliance.

**1.36. PROJECT PHASING AND HOURS OF WORK**

1. Refer to Instructions to Bidders for information pertaining to project phasing and hours of work. Work within occupied spaces and work causing a disruption to operations will be performed outside regular business hours as determined by the Owner.

\*\*\*\*\*END OF SECTION\*\*\*\*\*

## **1. General**

### **1.1. GENERAL**

1. The Executed Agreement including General Conditions and Supplementary Conditions, applicable sections of Division 00 and Division 01, Section 26 05 00 - Common Work Results for Electrical, Section 26 05 01 - Electrical Submittals and Section 26 05 02 - Electrical Contract Closeouts, applicable drawings and amendments are part of and to be read in conjunction with this Section.

### **1.2. ELECTRICAL PERMITS AND RCDD CERTIFICATES**

1. Prior to submitting the first progress claim, provide the following permits and certificates:
  1. As per Section 26 05 00 - Common Work Results for Electrical provide copies of the following electrical permits:
    1. Electrical Wiring Permits.

### **1.3. HOURLY LABOUR RATE**

1. Submit the proposed hourly labour rate for review in a timely manner after contract award.

### **1.4. EQUIPMENT IDENTIFICATION**

1. As per Section 26 05 03 - Electrical Identification submit proposed nomenclature for all Lamicoïd plates for engineer's approval.

### **1.5. SHOP DRAWINGS**

1. Sections as follows:
  1. All DIVISION 26 & 28 Sections.

### **1.6. OPERATING AND MAINTENANCE MANUAL**

1. Operation and maintenance manual to be approved by, and final copies deposited with the Consultant before final inspection.
2. Operation data to include:
  1. Schematics for each system.
  2. Description of each system and its controls.
  3. Description of operation of each system.
  4. Operation instruction for each system and each component.
  5. Description of actions to be taken in event of equipment failure.
  6. Colour coding chart.
3. Maintenance data shall include:

1. Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
2. Data to include schedules of tasks, frequency, tools required and task time.
4. Performance data to include:
  1. Equipment manufacturer's performance data sheets with point of operation as left after system verification is complete.
  2. Equipment performance verification test results.
  3. Insulation resistance testing and panelboard phase current measurement records.
  4. Special performance data as specified elsewhere.
5. Approvals:
  1. Submit two (2) copies of draft Operation and Maintenance Manual to Consultant for approval. Submission of individual data will not be accepted unless so directed by the Consultant.
  2. Make changes as required and re-submit as directed by the Consultant.
6. Provide maintenance data for the following:
  1. All DIVISION 26 & 28 Sections.
7. Provide one (1) copy of all approved shop drawings for each maintenance manual.

### **1.7. RECORD DRAWINGS**

1. Site records:
  1. Provide sets of white prints as required for each phase of the work. Mark thereon all changes as work progresses and as changes occur. This shall include change orders, site instructions and changes to electrical systems.
  2. Make available for reference purposes and inspection at all times.
  3. Produce record drawings in accordance with Division 1.
2. Where products are specified by manufacturer and/or model, update AutoCAD file to show installed manufacturer and model.
3. Record Drawings:
  1. Prior to start of Testing and System verification finalize production of as-built drawings.
  2. Identify each drawing in lower right-hand corner in letters at least ½" (13 mm) high as follows: - "RECORD DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW ELECTRICAL SYSTEMS AS INSTALLED" (DATE).
  3. Submit to Consultant for approval and make corrections as directed.

\*\*\*\*\*END OF SECTION\*\*\*\*\*

## **1. General**

### **1.1. GENERAL**

1. The Executed Agreement including General Conditions and Supplementary Conditions, applicable sections of Division 00 and Division 01, Section 26 05 00 - Common Work Results for Electrical, Section 26 05 01 - Electrical Submittals and Section 26 05 02 - Electrical Contract Closeouts, applicable drawings and amendments are part of and to be read in conjunction with this Section.

### **1.2. FUNCTIONAL PERFORMANCE TESTING (FPT)**

1. Refer to Section 26 91 13 - Testing and Verification.
2. The correction of all electrical deficiencies identified throughout the project associated with the Work shall be a condition of Substantial Performance and shall be corrected prior to achieving Substantial Performance.
3. Deficiencies discovered during the FPT process are to be immediately rectified by the Electrical Contractor. A condition of Substantial Performance shall be the correction of all electrical deficiencies identified throughout the project associated with this work.
4. The contractor shall return copies of the deficiency lists to Owner via the Engineer with all corrected items signed off.
5. The FPT Deficiency list will form part of the Substantial Performance Inspection list specified in Division 01.

### **1.3. CLOSEOUT DOCUMENTATION**

1. Section 26 05 00: Common Work Results for Electrical.
  1. Copy of electrical permits from Utility.
  2. Single line electrical diagrams.
  3. Final Inspection certificate(s) from Inspection Authority.
2. Section 26 05 01: Electrical Submittals.
  1. Shop drawing and product data.
  2. Operating and Maintenance Manual.
  3. Spare parts.
  4. Record drawings.
3. Section 26 05 03: Electrical Identification.
  1. Submission of proposed equipment identification Lamicoid plates for approval.
4. Section 26 27 26: Wiring Devices.
  1. Written confirmation of receptacle polarity check.

5. Section 26 52 00: Unit Equipment for Emergency Lighting.
  1. Written Guarantee.
6. Section 26 91 13: Testing and Verification.
  1. Verification and Test Forms.

#### **1.4. DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS**

1. Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, troubleshooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
2. Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.
3. Following the completion of each training and demonstration session, the contractor is to obtain an attendance sheet signed off by those personnel who have received training.
4. Where deemed necessary, Owner may record these demonstrations on video tape for future reference.

**2. Products N/A**

**3. Execution N/A**

**\*\*\*\*\*END OF SECTION\*\*\*\*\***

## 1. General

### 1.1. GENERAL

1. The Executed Agreement including General Conditions and Supplementary Conditions, applicable sections of Division 00 and Division 01, Section 26 05 00 - Common Work Results for Electrical, Section 26 05 01 - Electrical Submittals and Section 26 05 02 - Electrical Contract Closeouts, applicable drawings and amendments are part of and to be read in conjunction with this Section.

### 1.2. IDENTIFICATION REQUIREMENTS

1. All electrical equipment shall be identified by the use of Lamicoid plates.
2. All enclosures receiving connections to the building power distribution system shall have their panel and circuit number identified by the use of Lamicoid plates. This includes equipment supplied by the electrical contractor and all other Divisions.
3. All electrical junction, pull boxes and splitters shall be colour coded inside and out with appropriate coloured paint. **All paint is to be applied prior to installation and not within the confines of the building.**
4. All conduit couplings shall be colour coded with appropriate coloured paint. All paint is to be applied prior to installation and not within the confines of the building.
5. All junction boxes shall have the panel and circuit numbers contained within, identified on the coverplate.
6. All wiring shall be identified through the use of self-laminating labels.
7. All electrical devices, junction boxes and equipment in concealed ceiling spaces shall be identified with two (2) Lamicoid plates, one on the device, junction box and equipment and one on the ceiling below.

## 2. Products

### 2.1. IDENTIFICATION NAMEPLATES

1. Lamicoid identification plates.
  1. Lamicoid 3 mm thick plastic engraving sheet for all electrical systems. Lamicoid characteristics are to be as follows, unless noted otherwise:
    1. Fire alarm systems to have red face with white core Lamicoid plates.
    2. Electrical equipment enclosures to have black face with white core Lamicoid plates.
    3. All ceiling mounted plates to have white face with black core.

2. Nameplate sizes:

- Size 1 10 mm x 50 mm (3/8" x 2") 1 line 5 mm (0.2") high letters
- Size 2 13 mm x 75 mm (1/2" x 3") 1 line 6 mm (0.25") high letters
- Size 3 16 mm x 75 mm (3/4" x 3") 2 line 5 mm (0.2") high letters
- Size 4 19 mm x 90 mm (3/4" x 3.5") 1 line 10 mm (3/8") high letters
- Size 5 38 mm x 90 mm (1.5" x 3.5") 2 line 13 mm (1/2") high letters
- Size 6 25 mm x 100 mm (1" x 4") 1 line 13 mm (1/2") high letters
- Size 7 25 mm x 100 mm (1" x 4") 2 line 6 mm (1/4") high letters
- Size 8 50 mm x 150 mm (2" x 6") 2 line 13 mm (1/2") high letters
- Size 9 75 mm x 150 mm (3" x 6") 3 line 13 mm (1/2") high letters

3. Identification to be in English.

## 2.2. COLOUR CODING OF ELECTRICAL BOXES

1. The colour coding of splitters, junction boxes, pull boxes and outlet boxes will follow the schedule as listed:

1. Colour coding of system as per the following:

System	3/4" DISC	1/4" DISC
0 to 50 volts	Violet	
51 to 240 volts	Yellow	
Ground or Bond	Green	
Energy Management	Red	White

2. All various systems junction and/or pull boxes etc., where located above grid system, shall have location identified on underside or room side of t-bar spline, with (19 mm) or (6 mm on 19 mm) self-adhering colour coded circular shaped discs, affixed directly to spline in close proximity to where concealed box is located. The same type of discs to be installed on ceiling or wall access cover plates.

- 1. 6 mm (1/4") discs are all white in colour.
- 2. 19 mm (3/4") discs are coloured as indicated.

3. 6 mm (1/4") to be affixed to center or middle of 19 mm (3/4") discs as system colours dictates.

4. All junction boxes and/or pull boxes, (and respective covers), complete with their respective cover plates as per the following:

- 1. Inside and out where one colour is required, with coverplate painted completely.

5. All junction boxes and/or pull boxes, where not concealed, are to have discs fastened to the outside of the box when architectural painting is complete.

## 2.3. WIRING IDENTIFICATION

1. Wiring Labels:

- 1. Write on self-laminating labels.

2. Panduit No's PLD-1, PLD-2.

### 3. Execution

#### 3.1. EQUIPMENT IDENTIFICATION

1. Submit description of proposed equipment identification plates for engineer's approval.
2. Do not manufacture Lamicoid plates prior to receiving written approval from the engineer.
3. Lamicoid nameplate fastening method shall be as follows:
  1. Concrete or concrete block.
    1. Contact type cement (Note: Peel off type not acceptable).
    2. Plasterboard.
      1. Contact type cement (Note: Peel off type not acceptable).
4. Equipment enclosures.
  1. Pop rivets. (Note: Screws not acceptable).
5. Ceiling and T-Bar spline.
  1. Contact type cement (Note: Peel off type not acceptable).

#### 3.2. IDENTIFICATION OF JUNCTION BOXES, PULL BOXES, SPLITTER TROUGHS AND OUTLET BOXES

1. Colour Coding
  1. Identification of electrical junction boxes, pull boxes, splitter troughs.
    1. Colour code as per 2.2.
    2. Apply colour coding prior to pulling conductors into boxes.
    3. Where primary colour only is indicated:
      1. Colour inside and outside of box.
      2. Colour all cover plates.
2. Voltage and Originating Source Identification
  1. Identification of electrical junction boxes, pull boxes, splitter troughs: smaller than 150 mm x 150 mm.
    1. Identify on the coverplate, using permanent indelible black marker the panel and circuit numbers contained with.
  2. Identification of electrical junction boxes, pull boxes, splitter troughs: 150 mm x 150 mm and larger.
    1. Provide Lamicoid plate fastened to coverplate, indicating:
      1. Voltage and phase.
      2. Originating panel.
      3. Size 6.
      4. Example: "120/208V, 3Ø, 4W, Panel 'A'."

2. Using permanent indelible black marker, identify the circuits contained within.

### **3.3. IDENTIFICATION OF SYSTEM CONTROL PANELS**

1. Provide Lamicoid plate fastened to equipment enclosure indicating:
  1. System name.
  2. Size 6.
  3. Example: "EMCS Control Panel".

### **3.4. IDENTIFICATION OF WIRING**

1. Identification of wiring:
  1. Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
  2. Labeling of all branch circuit wiring including phase conductors, neutral, ground and/or bonding conductors to be done on both ends of all circuit wires plus in any junction and/or pull boxes located in between using approved product (refer to 2.3). These labels are to be installed in a 'flagged' manner around individual conductors.
  3. Indicate panel and circuit number i.e.: Panel '1101', cct. #10.

\*\*\*\*\*END OF SECTION\*\*\*\*\*

## 1. General

### 1.1. GENERAL

1. The Executed Agreement including General Conditions and Supplementary Conditions, applicable sections of Division 00 and Division 01, Section 26 05 00 - Common Work Results for Electrical, Section 26 05 01 - Electrical Submittals and Section 26 05 02 - Electrical Contract Closeouts, applicable drawings and amendments are part of and to be read in conjunction with this Section.

### 1.2. REFERENCE STANDARDS

1. Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

### 1.3. REFERENCES

1. Test Requirements: ULC-S115-M or CAN4-S115-M, “Standard Method of Fire Tests of Through Penetration Fire Stops”.
2. Underwriters Laboratories of Canada (ULC) of Scarborough runs CAN4-S115-M under their designation of ULC-S115-M and publishes the results in their “FIRE RESISTANCE RATINGS DIRECTORY” that is updated annually.
3. Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL 1479 and publishes the results in their “FIRE RESISTANCE DIRECTORY” that is updated annually. UL tests that meet the requirements of ULC-S115-M are given a cUL listing and are published by UL in their “Products Certified for Canada (cUL) Directory”.
4. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments.
5. CAN/ULC-S102-M, Standard Test Method for Surface Burning Characteristics of Building Materials.
6. National Building Code of Canada.
7. CSA C22.1 latest edition, Canadian Electrical Code, Part 1 Safety Standard for Electrical Installations.

### 1.4. SUBMITTALS

1. Submit Product Data: Manufacturer’s specifications and technical data for **each material specifically** used on this project including the composition and limitations, documentation of ULC or cUL firestop systems to be used and manufacturer’s installation instructions to comply with Division 1.

2. Manufacturer's engineering judgment identification number and drawing details when no ULC or cUL system is available for an application. Engineer judgment must include both project name and contractor's name who will install firestop system as described in drawing.
3. Submit material safety data sheets provided with product delivered to job site. Submit product data in accordance with Section 26 05 01 - Electrical Submittals.
4. Shop drawings submission to include:
  1. Layout of equipment.
  2. Complete **PROJECT SPECIFIC** Wiring Diagrams and documentation. Include fire stopping methods specifically used on this project.
  3. Provide PDF copy of an operational and maintenance manual for all products being supplied.
5. Submit close out documents in accordance with Section 26 05 02 - Electrical Contract Closeouts.
6. Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual. Operation and maintenance data to include:
  1. Operation instructions.
  2. Description of system operation.
  3. Description of each subsystem operation.
  4. List showing each piece of equipment in system or subsystem by its original manufacturer name and model number.
  5. Part list showing parts used in equipment by identification numbers that are standard to electronics industry.

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

1. Deliver, store and handle materials in accordance with manufacturer's written instructions.
2. Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
3. Storage and Handling Requirements:
  1. Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  2. Store and protect public address systems from nicks, scratches, and blemishes.
  3. Replace defective or damaged materials with new.
4. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and ULC or cUL label where applicable.
5. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job site.

6. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.
7. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.
8. Do not use damaged or expired materials.

#### **1.6. WASTE MANAGEMENT AND DISPOSAL**

1. Separate and recycle waste materials.
2. Remove from site and dispose of packaging materials at appropriate recycling facilities.
3. Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
4. Divert unused metal and wiring materials from landfill to metal recycling facility.

#### **1.7. GENERAL DESCRIPTION OF THE WORK OF THIS SECTION**

1. Definition of Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.
2. Only tested firestop systems shall be used for penetrations for the passage of cables, conduit and other electrical equipment through the following:
  1. Fire-rated vertical barriers (walls and partitions).
  2. Horizontal barriers (floor/ceiling assemblies).
  3. Vertical service shaft walls and partitions.

## **2. Products**

### **2.1. FIRESTOPPING, GENERAL**

1. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
2. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

3. Firestopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
4. Primers: to manufacturer's recommendation for specific material, substrate, and end use.
5. Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

## 2.2. ACCEPTABLE MANUFACTURERS

1. Subject to compliance with through penetration firestop systems listed in U.L.C Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory, provide products of the following manufacturers as identified below:
  1. Hilti (Canada) Limited, Mississauga, Ontario 1-800-363-4458.
  2. Other manufacturers listed in the U.L.C Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.

## 2.3. MATERIALS

1. Use only firestop products that have been ULC or cUL tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
2. Sealants or caulking materials for use with non-combustible items including rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:
  1. Hilti FS-ONE Intumescent Firestop Sealant.
  2. Hilti CP 620 Fire Foam.
  3. Equivalent products listed in the U.L.C Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.

## 2.4. PENETRATIONS THROUGH A FIRE SEPARATION WALL

1. For penetrations through a Fire Separation wall provide a firestop system with a "F" Rating as determined by ULC or cUL as indicated below:

<b>Fire Resistance Rating of Separation</b>	<b>Required ULC or cUL "F" Rating of Firestopping Assembly</b>
30 minutes	20 minutes
45 minutes	45 minutes
1 hour	45 minutes
1.5 hours	1 hour
2 hours	1.5 hours
3 hours	2 hours
4 hours	3 hours

## **2.5. PENETRATIONS THROUGH A FIRE WALL OR HORIZONTAL FIRE SEPARATION**

1. For penetrations through a Fire Wall or horizontal Fire Separation provide a firestop system with a “FT” Rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.

## **3. Execution**

### **3.1. INSTALLER QUALIFICATIONS**

1. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer’s products per specified requirements. A manufacturer’s willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

### **3.2. PROJECT CONDITIONS**

1. Do not use materials that contain flammable solvents.
2. Scheduling:
  1. Schedule installation of CAST IN PLACE firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.
  2. Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.
3. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
4. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer’s recommended limitations for installation printed on product label and product data sheet.
5. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

### **3.3. PREPARATION**

1. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
  1. Verify penetrations are properly sized and in suitable condition for application of materials.
  2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.

3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
5. Do not proceed until unsatisfactory conditions have been corrected.

### **3.4. COORDINATION**

1. Coordinate location and proper selection of cast-in-place Firestop Devices. Ensure device is installed before placement of concrete.
2. Provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

### **3.5. INSTALLATION**

1. Regulatory Requirements: Install firestop materials in accordance with ULC Fire Resistance Directory or UL Products Certified for Canada (cUL) Directory.
2. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration joint materials.
  1. Seal all holes or voids made by penetrations to ensure an air and water-resistant seal.
  2. Protect materials from damage on surfaces subjected to traffic.

### **3.6. QUALITY ASSURANCE**

1. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.
2. Firestop System installation must meet requirements of CAN4-S115-M or ULC S-115-M tested assemblies that provide a fire rating as shown in Section 2. "Penetrations through a Fire Separation Wall" and "Penetrations through a Fire Wall or Horizontal Fire Separation" below.
3. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.
4. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.
5. For those firestop applications that exist for which no ULC or cUL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar ULC or cUL system designs or other tests will be submitted to local authorities

having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirements set forth by the International Firestop Council (September 7, 1994).

6. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
7. Keep areas of work accessible until inspection by applicable code authorities.
8. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.
9. Install a warning card that is clearly visible adjacent to all large and medium openings that may be re-penetrated. This card should contain the following information:
  1. Warning that the opening has being fire stop protected.
  2. Indicate the fire stop system used (ULC or cUL).
  3. F rating or FT rating.
  4. Firestop product(s) used.
  5. Person to contact and phone number in case of modification or new penetration of fire stop system.

### **3.7. ADJUSTING AND CLEANING**

1. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
2. Remove temporary dams after initial set of fire stopping and smoke seal materials.
3. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

### **3.8. COMMISSIONING**

1. Carry out the commissioning in conformance with Section 26 91 13 - Testing and Verification.

\*\*\*\*\*END OF SECTION\*\*\*\*\*

## 1. General

### 1.1. GENERAL

1. The Executed Agreement including General Conditions and Supplementary Conditions, applicable sections of Division 00 and Division 01, Section 26 05 00 - Common Work Results for Electrical, Section 26 05 01 - Electrical Submittals and Section 26 05 02 - Electrical Contract Closeouts, applicable drawings and amendments are part of and to be read in conjunction with this Section.

### 1.2. RELATED SECTIONS

1. Section 26 05 21 - Wires and Cables 0-1000V
2. Section 26 05 29 - Hangers and Supports
3. Section 26 05 31 - Splitter, Junction, Pull Boxes and Cabinets
4. Section 26 27 26 - Wiring Devices
5. Section 26 29 01 - Contactors
6. Section 27 05 28.01 - Pathways for Communications Systems

### 1.3. REFERENCES

1. CSA C22.2 No.65-18 Wire Connectors.

### 1.4. SUBMITTALS

1. Submit product data in accordance with Section 26 05 01 - Electrical Submittals.
2. Shop drawings submission to include:
  1. Layout of equipment.
  2. Complete **PROJECT SPECIFIC** Wiring Diagrams and documentation.
  3. Provide PDF copy of an operational and maintenance manual for all products being supplied.
3. Submit close out documents in accordance with Section 26 05 02 - Electrical Contract Closeouts.
4. Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual. Operation and maintenance data to include:
  1. Operation instructions.
  2. Description of system operation.
  3. Description of each subsystem operation.

4. List showing each piece of equipment in system or subsystem by its original manufacturer name and model number.
5. Part list showing parts used in equipment by identification numbers that are standard to electronics industry.

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

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

### **1.6. WASTE MANAGEMENT AND DISPOSAL**

1. Separate and recycle waste materials.
2. Remove from site and dispose of packaging materials at appropriate recycling facilities.
3. Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
4. Divert unused metal and wiring materials from landfill to metal recycling facility.

## **2. Products**

### **2.1. MATERIALS**

1. Use T & B 3310 AC90 type connectors for all branch circuit wiring sized #10 AWG AC90 and smaller. Current carrying parts are to be made of copper or copper alloy and be complete with an appropriate size insulating cap. Cap is to completely fit, or cover all enclosed conductors as required, with current carrying parts of sized to fit conductors as required.

## **3. Execution**

### **3.1. INSTALLATION**

1. Remove insulation carefully from ends of conductors.

2. All wire connectors are to be “plier-tightened”. Finger tight is not acceptable.
3. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.
4. Use T & B 3310 AC90 wire connectors for all branch circuit wiring sized #10 AWG AC90 and smaller. Current carry parts are to be made of copper or copper alloy and be c/w an appropriately sized insulating cap. Cap is to be completely fit, or cover all enclosed conductors as required.
5. Bushing stud connectors are not acceptable.
6. All wire connectors are to be plier-tightened. Finger-tight is not acceptable.

### **3.2. COMMISSIONING**

1. Carry out the commissioning in conformance with Section 26 91 13 - Testing and Verification.

**\*\*\*\*\*END OF SECTION\*\*\*\*\***

## 1. General

### 1.1. GENERAL

1. The Executed Agreement including General Conditions and Supplementary Conditions, applicable sections of Division 00 and Division 01, Section 26 05 00 - Common Work Results for Electrical, Section 26 05 01 - Electrical Submittals and Section 26 05 02 - Electrical Contract Closeouts, applicable drawings and amendments are part of and to be read in conjunction with this Section.

### 1.2. RELATED SECTIONS

1. Section 26 24 16 - Panel Boards Breaker Types.

### 1.3. REFERENCES

1. Canadian Standards Association (CSA International).
  1. CSA-C22.2 No.38-18 Thermoset-insulated wires and cables (Trinational standard with UL 44 and ANCE NMX-J-451)
  2. CSA-C22.2 No.51-20 Armoured Cables

### 1.4. SUBMITTALS

1. Submit product data in accordance with Section 26 05 01 - Electrical Submittals.
2. Shop drawings submission to include:
  1. Layout of equipment.
  2. Complete **PROJECT SPECIFIC** documentation.
  3. Provide PDF copy of an operational and maintenance manual for all products being supplied.
3. Submit close out documents in accordance with Section 26 05 02 - Electrical Contract Closeouts.
4. Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual. Operation and maintenance data to include:
  1. Operation instructions.
  2. Description of system operation.
  3. Description of each subsystem operation.
  4. List showing each piece of equipment in system or subsystem by its original manufacturer name and model number.
  5. Part list showing parts used in equipment by identification numbers that are standard to electronics industry.

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

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

### **1.6. WASTE MANAGEMENT AND DISPOSAL**

1. Separate and recycle waste materials.
2. Remove from site and dispose of packaging materials at appropriate recycling facilities.
3. Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
4. Divert unused metal and wiring materials from landfill to metal recycling facility.

## **2. Products**

### **2.1. BUILDING WIRES**

1. Unless otherwise noted, all conductors (phase, neutral, bond, isolated ground) installed on this project shall be stranded, soft drawn copper, of 98% conductivity rated at 600 volts, with RW90 XLPE insulation rated for a minimum of 600 VAC. The minimum wire size will be #12 AWG.
2. Existing conductors shall be reused if in good condition and tested for shorts.
3. Unless noted otherwise, phase colour coding as per C.E.C. rule 4-032, will apply.
4. All phase conductors sized from #12 AWG up to and including #2 AWG to have appropriate coloured insulation (red, black & blue).
5. All neutral, grounds and/or bond conductors sized #12 AWG up to and including #3/0 AWG to have appropriate coloured insulation (white or green).
6. Feeders fed from an overcurrent device rated up to and including 100A are to utilize copper conductors. Feeders fed from an overcurrent device rated above 100A may utilize

aluminum conductor material (ACM). Ensure the use of the of a wire brush, joint compound, and proper torque wrench.

7. Current carrying and neutral conductors for all systems rated 600 volts and less, shall have RW90-XLPE type insulation rated accordingly.
  1. The supply and installation of 1000 volt rated conductors shall be considered only where equipment manufactures or other applications warrants same.
8. Grounding and bonding conductors sized up to and including #10 AWG, are to have green coloured RW90 X-link insulation. Type TW75 c/w green coloured insulation is acceptable for all sizes #8 AWG and larger.
9. The tye-wrapping of the neutral conductor with its respective phase conductors is to be made at the closest point of entry “within” all panelboards, pull boxes, junction boxes, outlet boxes, etc.
10. All branch circuits which do not have neutral conductors, are to have their respective phase conductors tye-wrapped together in accordance with previously described methods.
11. The use of NMD-90 is prohibited unless prior approval is granted by the engineer and/or facility owner.

### **3. Execution**

#### **3.1. 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.
  2. All stranded conductors, (neutrals, bonds and phase conductors) prior to terminating under device bolts to be twisted together so as to form a single conductor.
  3. All cables are to be secured to concrete, concrete block, brick, metal decking/sliding, with nylon type inserts c/w self-tapping metal screws.
  4. Pliable type cables are to be secured to building structure at 4’ intervals, and tye-wrapped together at mid-point between each structure support.
  5. All branch circuit phase and/or neutral conductors are to be “Megger” tested for insulation resistance utilizing the following type meter:
    1. 500-volt meter for conductor insulation rating up to 500 volts.
    2. 1000-volt meter for conductor insulations rated above 500 volts.

#### **3.2. VOLTAGE DROP**

1. The contractor shall run all branch circuits so that the voltage drop in no instance exceeds 3% of the line voltage. The following table is to include both vertical and horizontal lengths of conductor runs. Minimum size of branch circuit neutral where phase sharing

occurs, shall not be smaller than #10 AWG. Minimum size of branch circuit neutral where dedicated to its own branch circuit phase conductor shall not be less than #12 AWG. Note that minimum size #10 AWG bond conductors to accompany #8 branch circuit conductors.

2. THE FOLLOWING TABLE SHALL BE STRICTLY ADHERED TO:

<b>Branch Circuit Length of Run</b>	<b>Phase Wire Size</b>	<b>Dedicated Neutral</b>	<b>Shared Neutral Size</b>	<b>Bond Wire Mm (feet)</b>
Up to 24,384 (80)	#12	#12	#10	#12
Up to 38,100 (125)	#10	#10	#8	#12
Up to 56,390 (185)	#8	#8	#6	#10

3. Oversized #10 AWG branch circuit wiring conductors to be extended to outlet box of device they feed (including switch legs). Oversized #8 AWG branch circuit wiring conductors to be extended from panelboard to junction box located on wall or ceiling directly above wall light switches and/or receptacles. #8 AWG wire to be reduced to #10 AWG for vertical portion of drop only.

**3.3. CONTROL CIRCUIT WIRING 50 VOLTS AND LESS**

1. The installation of surface wiring on walls or open type ceiling, shall be in EMT type conduit c/w associated “steel” type connectors and couplings.
2. EMT conduits are to be extended to within 30” of all various control devices associated with the operation of any given piece of mechanical equipment or device they might feed.
3. Unless specifically indicated otherwise, liquid tight flexible metal conduit c/w matching liquid tight connectors are to be used for final connections between end of EMT conduit and applicable control device. A junction or pull box may also be utilized to make the transition.
4. EMT type conduit “wall-stub” c/w flush installed device box shall be located in all partitions to accommodate wiring between the device and the associated ceiling space.
5. EMT connectors c/w nylon insulated throat or threaded type bushing shall be installed on end of EMT stub where it protrudes through wall “above”, and within finish accessible type ceiling. EMT plastic end cap bushing that are CSA approved may also be used.
6. All EMT conduit stubs are to be bonded to ground as required by CEC.

### **3.4. TESTING**

1. After all electrical wiring has been completed by the electrical subcontractor, they are to test the grounded electrical distribution system to ensure there are no grounds, shorts, and capacitive leakage in the system.
  1. All feeders or branch circuits which do not have neutral conductors are to have their respective phase conductors tye-wrapped together in accordance with the methods described previously.
  2. Megger feeders, circuits and neutrals.

### **3.5. COMMISSIONING**

1. Carry out the commissioning in conformance with Section 26 91 13 - Testing and Verification.

**\*\*\*\*\*END OF SECTION\*\*\*\*\***

## 1. General

### 1.1. GENERAL

1. The Executed Agreement including General Conditions and Supplementary Conditions, applicable sections of Division 00 and Division 01, Section 26 05 00 - Common Work Results for Electrical, Section 26 05 01 - Electrical Submittals and Section 26 05 02 - Electrical Contract Closeouts, applicable drawings and amendments are part of and to be read in conjunction with this Section.

### 1.2. RELATED SECTIONS

1. Section 26 05 27 - Grounding – Primary
2. Section 26 05 31 - Splitter, Junction, Pull Boxes and Cabinets
3. Section 26 05 31 - Outlet Boxes, Conduit Boxes and Fittings
4. Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings
5. Section 26 24 16 - Panel Boards Breaker Types
6. Sections 26 28 23 - Disconnect Switches – Fused and Non-fused
7. Section 26 32 13 - Power Generation Diesel
8. Section 26 36 23 - Automatic Load Transfer Equipment
9. Section 26 50 00 - Lighting Equipment
10. Section 27 05 28.01 - Pathways for Communications Systems

### 1.3. REFERENCES

1. CSA 22.2 No. 41:22 Grounding and bonding equipment (Trinational standard with NMX-J-590- ANCE and UL 467)

### 1.4. SUBMITTALS

1. Submit product data in accordance with Section 26 05 01 - Electrical Submittals.
2. Shop drawings submission to include:
  1. Layout of equipment.
  2. Complete **PROJECT SPECIFIC** Wiring Diagrams and documentation.
  3. Provide PDF copy of an operational and maintenance manual for all products being supplied.

3. Submit close out documents in accordance with Section 26 05 02 - Electrical Contract Closeouts.
4. Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual. Operation and maintenance data to include:
  1. Operation instructions.
  2. Description of system operation.
  3. Description of each subsystem operation.
  4. List showing each piece of equipment in system or subsystem by its original manufacturer name and model number.
  5. Part list showing parts used in equipment by identification numbers that are standard to electronics industry.

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

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

### **1.6. WASTE MANAGEMENT AND DISPOSAL**

1. Separate and recycle waste materials.
2. Remove from site and dispose of packaging materials at appropriate recycling facilities.
3. Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
4. Divert unused metal and wiring materials from landfill to metal recycling facility.

## **2. Products**

### **2.1. GROUND WIRING AND CONNECTORS**

1. All ground wiring indicated to be green in colour shall meet the CSA C22.2 No.38 Thermoset-insulated wiring and cables standard and CSA C22.2 No. 42:22 Grounding and bonding equipment (Trinational standard with NMX-J-590- ANCE and UL 467). Conductor sizing shall be sized at minimum to meet CSA C22.1-21 Table 16.

2. Bare ground wiring shall meet CSA C22.2 No. 42:22 Grounding and bonding equipment (Trinational standard with NMX-J-590- ANCE and UL 467).
3. All wire connectors, fitting and clamps shall be provided to complete electrical grounding of all electrical system and subsystems for the building, type, size, material as indicated, including but not necessarily limited to:
  1. Grounding and bonding bushings.
  2. Protective type clamps.
  3. Bolted type conductor connectors.
  4. Thermit welded type conductor connectors.
  5. Bonding jumpers, straps.
  6. Pressure wire connectors.

## 2.2. GROUND BARS

1. Ground Busbars: ¼” electro-tinplated copper, complete with insulators, stainless steel wall brackets and fasteners.
2. Main Electrical Room:
  1. ¼” thick by 4” wide by 24” long.
  2. Predrilled hole pattern as per Type NN
  3. Erico # EGBC14424NN
3. All Secondary Ground Bars:
  1. ¼” thick by 4” wide by 24” long.
  2. Complete with 33 pairs of 5/16” diameter and 5 pairs of 7/16” pre-drilled holes.
  3. Erico # TMGBA24L33PT.
4. Acceptable manufactures:
  1. Cooper B-Line
  2. Burndy.
  3. IlSCO.

## 2.3. COMPRESSION PASS THROUGH CONNECTORS FOR GROUND BARS

1. Where pass through connectors are required throughout this specification, the contractor can choose one of two options:
  1. Option One: Exothermic welding.
  2. Option Two: High conductivity, wrought copper alloy, bus bar connector.
2. Where Option Two is the chosen method, the following product is to be used:
  1. High conductivity wrought copper alloy, bus bar connector. Conductor and busbar grooves filled with Penetrox for better conductivity. cUL listed and stamped.
  2. Standard of Acceptance: Burndy Type YG14BTC28.
  3. Acceptable manufactures:
    1. IlSCO

2. Hubbell

**3. Execution**

**3.1. INSTALLATION GENERAL**

1. All grounding and bonding requirements shall be in accordance with all applicable CSA C22.1 latest edition and standard describe in tender documentation, whichever is more stringent.
2. Install complete permanent, continuous bonding system including, conductors, connectors, accessories. Where EMT is used, install bonding conductor in each and every conduit.
3. Install connectors in accordance with manufacturer's instructions.
4. Protect exposed grounding conductors from mechanical injury.
5. Use mechanical connectors for grounding connections to equipment provided with lugs.
6. Soldered joints not permitted.
7. All conduit for all electrical systems is to contain a minimum #12 AWG copper bond wire. Bonding jumpers are permitted for conduit stubbed into a T-bar ceiling. All metallic conduit stubs shall be bonded regardless of length.
8. Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw.
9. Make grounding connections in radial configuration only. Avoid loop connections.
10. All electrical services sized 200A and larger, install one minimum size ¼" x 2" x 24" copper ground bus bar, on main electrical room wall unless specifically indicated otherwise, c/w approved cone shaped insulators for securing bus directly to same.
11. The main "incoming ground" conductor is to run unbroken to the main electrical service entrance overcurrent device ground bus and then to the wall mounted ground bus.
12. All other various systems' electrical ground connectors are take place on the ground bus with "compression" type lugs. Lugs are to be as follows.
  1. Copper, one hole, long barrel (single crimp) type lugs are to be used for all wire size up to, and including #6 AWG.
  2. Copper, two-hole, long barrel (dual crimp) type lugs are to be used for all wire sizes #4 AWG and larger.
  3. To be bolted to bus bar utilizing concave, or combination of flat and locking type washers c/w accompanying hardware as may be required.

4. Use approved “bronze or copper” type ground connectors (as required) for terminating main incoming service entrance ground conductor directly to wall ground bus.
13. All cables, feeders and branch circuit conductors installed in conduit are to be c/w a separate minimum size #12 (solid) AWG copper bond/ground wire as follows:
  1. Where bond wires sizes larger than #12 AWG are required, they are to be increased as required by CSA C22.1 latest edition table 16, or as otherwise noted.
  2. No. 12 AWG and larger size ground or bond conductors shall be of soft drawn stranded copper of 98% conductivity, and of full size and AWG gauge.
  3. Size of bond conductor is to be based upon Table 16 of CSA C22.1 latest edition.
  4. Size of ground conductor is to be minimum #6 AWG.
  5. Minimum size #12 AWG solid ground insulated conductors are acceptable for bonding purposes associated with various other systems rated at 50 volts or less.
14. The feed bonding conductor shall be secured (wrapped around unbroken) to the grounding screw of each outlet/device box, before connecting to the other ground conductors, and/or providing a “pig-tail” lead for device terminations.
15. All ground wires are to be twisted together with a screw-on type wire connector, and then placed in rear of outlet box in such manner as to minimize obstructions.

### **3.2. COMMISSIONING**

1. Carry out the commissioning in conformance with Section 26 91 13 - Testing and Verification.

**\*\*\*\*\*END OF SECTION\*\*\*\*\***

## 1. General

### 1.1. GENERAL

1. The Executed Agreement including General Conditions and Supplementary Conditions, applicable sections of Division 00 and Division 01, Section 26 05 00 - Common Work Results for Electrical, Section 26 05 01 - Electrical Submittals and Section 26 05 02 - Electrical Contract Closeouts, applicable drawings and amendments are part of and to be read in conjunction with this Section.

### 1.2. RELATED SECTIONS

1. Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
2. Section 27 05 28.01 - Pathways for Communications Systems.

### 1.3. REFERENCES

1. Canadian Standards Association (CSA International).
  1. CSA-C22.2 No. 18.4:15(R2019) Hardware for the support of conduit, tubing, and cable (Bi-national standard with UL 2239)

### 1.4. SUBMITTALS

1. Submit product data in accordance with Section 26 05 01 - Electrical Submittals.
2. Shop drawings submission to include:
  1. Layout of equipment.
  2. Complete **PROJECT SPECIFIC** Wiring Diagrams and documentation.
  3. Provide PDF copy of an operational and maintenance manual for all products being supplied.
3. Submit close out documents in accordance with Section 26 05 02 - Electrical Contract Closeouts.
4. Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual. Operation and maintenance data to include:
  1. Operation instructions.
  2. Description of system operation.
  3. Description of each subsystem operation.
  4. List showing each piece of equipment in system or subsystem by its original manufacturer name and model number.
  5. Part list showing parts used in equipment by identification numbers that are standard to electronics industry.

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

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

### **1.6. WASTE MANAGEMENT AND DISPOSAL**

1. Separate and recycle waste materials.
2. Remove from site and dispose of packaging materials at appropriate recycling facilities.
3. Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
4. Divert unused metal and wiring materials from landfill to metal recycling facility.

## **2. Product**

### **2.1. SUPPORT CHANNELS**

1. U shape, size 45 mm x 45 mm, 3 mm thick, surface mounted as required.

### **2.2. BEAM CLAMPS**

1. Beam clamp for 10 mm threaded rod to be malleable iron, complete with hardened steel cup point set screw. Rated for a minimum of 227 Kg (400 pounds).
2. Taylor Pipe Support, Wide Mouth Top Beam Clamp #407, or equal.
3. Push-on type conduit clips are not to be used on this project.

### **2.3. ATTACHMENT FOR THREADED RODS TO METAL DECK**

1. Threaded fastener with expandable sleeve with ULC listed for direct attachment of threaded rod in metal deck (22-16 gauge).
2. Standard of acceptance to be Sammy Xpress

3. Threaded rod anchors such as Hangermate type are not to be used on this project

#### **2.4. ARMOURED CABLE STRAPS**

1. Aluminum alloy with cUL listed for armoured cable application.
2. Standard of acceptance to be Iberville cat# C10/C15 with equal by:
  1. Hubbell
3. Push-on type cable clips are not to be used on this project

### **3. Execution**

#### **3.1. INSTALLATION**

1. Secure equipment to hollow and solid masonry, tile and plaster surfaces with lead anchors.
2. Secure equipment to poured concrete with expandable inserts.
3. Support equipment, conduit or cables using clips, spring-loaded bolts, cable clamps designed as accessories to basic channel members.
4. Fasten exposed conduit or cables to building construction or support system using straps.
  1. One-hole steel straps to secure surface conduits and cables 35 mm (1 ¼ inch) and smaller.
  2. Two-hole steel straps for conduits and cables 41 mm (1 ½ inch) and larger.
  3. Beam clamps to secure conduit to exposed steelwork.
5. Suspended supports systems.
  1. Support single or multiple cables or conduits on a common steel support channel system supported by 10 mm (3/8") diameter threaded rod hangers, washers and nuts where direct fastening to building construction is impractical. Channel is to be sandwiched between nuts and washers located on both upper and underside portions of channels.
  2. Do not support a single conduit using a threaded rod and a conduit clip. This is not an acceptable means of installation as no lateral support is provided.
6. For surface mounting of single and multiple conduits use channels. Channels are to be securely attached to hangers with the maximum spacing not greater than:
  1. Conduits of one size only:
    1. 16 mm to 21 mm (½" to ¾") conduit 1524 mm (60")
    2. 27 mm & 35 mm (1" to 1 ¼") conduit 1980 mm (78")
    3. 41 mm (1 ½") & larger conduit 3050 mm (120")
  2. Conduits of mixed size:

1. Arrange supports so that maximum spacing of supports conforms to above, based on smallest conduit diameter.
7. All suspended types of junction and pull boxes are to be supported using a minimum of 10 mm (3/8") threaded rod c/w nuts and flat washers. Secure threaded rods to boxes using one flat washer and nut installed on both sides of box. Provide as follows:
  1. One rod required for all types of boxes sized 150 x 150 mm (6 x 6 inches) or smaller.
  2. Two rods required for all types of boxes larger than 150 x 150 mm (6 x 6 inches) but less than 304 x 304 mm (12 x 12 inches)
  3. Four rods required for all types of boxes 304 x 304 mm (12 x 12 inches) and larger.
8. All excess rod is to be cut-off within 13 mm (1/2") of channel bottom.
9. Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
10. Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
11. Do not use wire lashing or perforated strap to support or secure raceways or cables.
12. Do not use supports or equipment installed by other trade contractors for conduit or cable support except with permission of other trade and approval of Engineer.
13. Do not attach electrical conduit to supports installed as part of a suspended ceiling installation (gypsum board or T-Bar for example).
14. Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.
15. Various suspended types of outlet, pull and/or junction boxes including conduits, are to be supported with minimum size 3/8" threaded rod, nuts and flat washers. Threaded rods are to be secured to boxes with one flat washer and nut installed on both sides of box.
  1. One rod required for all types of boxes sized 6" x 6" ... 36 sq. inches and smaller.
  2. Two rods required for all types of boxes sized larger than 36 sq. inches, up to, and including those sized 12" x 12" ... 144 sq. inches.
  3. Minimum of four rods required for all boxes sized larger than 144 sq. inches.
16. EMT shall be securely fastened in place within 1m of each outlet box, junction box, pull box, cabinet or conduit fitting, with spacing between supports as per the C.E.C. Securing of surface and concealed conduits to structure for sizes up to and including 1 1/4" diameter may be done utilizing one-hole steel straps. Two-hole steel straps for all sizes 1 1/2" and larger. Grouped or singularly suspended conduits of all sizes to be supported with minimum sized 3/8" threaded rods and concrete shields. Where possible, two or more suspended type conduits shall be secured to a common steel support channel system and

are to be suspended utilizing minimum size 3/8" threaded rods, washers and nuts. Channel is to be sandwiched between nuts and washers located on both upper and underside portions of channels.

17. All excess rod is to be cut-off within 1/2" of channel bottom. In addition to CSA C22.1 latest edition minimum conduit spacing requirements, all suspended conduit runs containing horizontal or vertical elbows are to have one additional support rod installed not greater than 12" from midpoint of "all" 90E bends. Maximum spacing between conduit support channels shall be as dictated by smallest size conduit(s) being supported and/or secured to same.
18. The use of tye-wraps for "supporting" purposes, is strictly prohibited and will be strictly enforced. They may "only" be utilized to secure various systems wiring "in-place," but in no instance are they to be used as a substitute for approved type metal straps, clamps, etc.

### **3.2. COMMISSIONING**

1. Carry out the commissioning in conformance with Section 26 91 13 - Testing and Verification.

**\*\*\*\*\*END OF SECTION\*\*\*\*\***

## **1. General**

### **1.1. GENERAL**

1. The Executed Agreement including General Conditions and Supplementary Conditions, applicable sections of Division 00 and Division 01, Section 26 05 00 - Common Work Results for Electrical, Section 26 05 01 - Electrical Submittals and Section 26 05 02 - Electrical Contract Closeouts, applicable drawings and amendments are part of and to be read in conjunction with this Section.

### **1.2. SHOP DRAWINGS AND PRODUCT DATA**

1. Submit shop drawings and product data for cabinets in accordance with Division 01.

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

1. Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.
2. Remove from site and dispose of packaging materials at appropriate recycling facilities.
3. Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
4. Divert unused metal and wiring materials from landfill to metal recycling facility.

## **2. Products**

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

1. Welded steel construction with screw-on flat covers for surface mounting.
2. Covers with 25 mm (1 inch) minimum extension all around, for flush-mounted pull and junction boxes.
3. Junction boxes larger than 120 mm (4-11/16) to have a bonding terminal strip installed.

### **2.2. CABINETS**

1. Type D: 1.6 mm steel cabinet, built for surface or flush mounting. Flush cover lip 25 mm all around. Finish - ASA-61 grey enamel. Complete with screw on cover. Complete with bonding terminal strip.
2. Type E: 1.6 mm steel cabinet, surface mount. Formed steel hinge with pull ring catch. Finish ASA-61 grey enamel. Complete with bonding terminal strip.

3. Type T: 1.6 mm steel cabinet, 1.9 mm cover, latch lock, 2 keys. Finish - ASA - 61 grey enamel. Complete with bonding terminal strip.

### 3. Execution

#### 3.1. JUNCTION, PULL BOXES AND CABINETS INSTALLATION

1. Install all raceways in conformance with CEC, Section 12.
2. Install pull boxes in inconspicuous but accessible locations. Box cover to be hinged on the side. Do not install boxes with hinge on top.
3. Install pull boxes so as not to exceed 27 m (90 feet) of conduit run between pull boxes. Each run of raceway shall not have more than the equivalent of four 90-degree bends installed, including the bends located at an outlet or fitting.
4. Terminate all bonding conductors on bonding terminal strip installed inside junction box.
5. Where junction and or pull boxes are required to be 150 mm x 150 mm (6 inches x 6 inches) or larger Type E cabinets shall be used.
6. Type T cabinets shall be used when equipment is required to be housed in a lockable enclosure.
7. Location of junctions and/or pull boxes in suspended ceiling spaces, i.e. gyprock, T-bar, etc., are not to be greater than 760 mm (30 inch) above finish ceiling.
8. All suspended types of junction and pull boxes are to be supported using a minimum of 10 mm (3/8 inch) threaded rod c/w nuts and flat washers. Secure threaded rods to boxes using one flat washer and nut installed on both sides of box. Provide as follows:
  - .1 One rod required for all types of boxes sized 150 x 150 mm (6 x 6 inches) or smaller.
  - .2 Two rods required for all types of boxes larger than 150 x 150 mm (6 x 6 inches) but less than 304 x 304 mm (12 x 12 inches).
  - .3 Four rods required for all types of boxes 304 x 304 mm (12 x 12 inches) and larger.
9. Where junction boxes and pull boxes are secured to building structural components, they shall be mounted and secured in such a manner so as not to be “cantilevered” (i.e. only supported on one side of the box). In rare instances where site constraints dictate the installation of a “cantilevered” box, threaded rods shall be installed to provide additional support on the opposite end.
10. Colour Coding: All electrical junction, pull boxes splitters and cabinets shall be colour coded inside and out with appropriate coloured paint. **All paint is to be applied prior to**

**installation and not within the confines of the building.**

**\*\*\*\*\*END OF SECTION\*\*\*\*\***

## **1. General**

### **1.1. GENERAL**

1. The Executed Agreement including General Conditions and Supplementary Conditions, applicable sections of Division 00 and Division 01, Section 26 05 00 - Common Work Results for Electrical, Section 26 05 01 - Electrical Submittals and Section 26 05 02 - Electrical Contract Closeouts, applicable drawings and amendments are part of and to be read in conjunction with this Section.

### **1.2. RELATED WORK:**

1. Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

## **2. Products**

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

1. Size boxes in accordance with CSA C22.1 latest edition.
2. 100 mm (4 inch) square or larger outlet boxes as required for special devices.
3. Multi-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 or voltage are grouped.
6. Where tile rings are installed on this project, they must be the welded type with square corners (Rounded corners will not be acceptable). For single device installations use Iberville # BC52-C-49XX or approved equal. For two device installations use Iberville # 52-C-52-XX or approved equal. Select appropriate depth of tile ring to suit application.
7. Adjustable type tile rings of any type are not permitted on this project.
8. Sectional type boxes are not to be used with rigid galvanized steel conduit, "thickwall" type PVC, or "thickwall" EMT conduit. Sectional type boxes are only to be used with flexible conduit, AC-90, and/or other types of pliable cables, including those associated with other systems rated less than 50 volts.
9. Boxes connected to AC90 cables are to be specifically made for this purpose. Dual rated boxes (AC90/NMD90, etc.) are not acceptable.

## **2.2. SHEET STEEL DEVICE BOXES**

1. One or Two Device, Flush Installation, Suitable for Conduit Entry:
  1. Electro-galvanized steel single, flush device boxes for use in dry flush installation, shall be pressed steel, minimum size 100 mm (4 inch) square x 54 mm (2.125 inch) deep, minimum volume of 490 cubic centimetres (30 cu.in.), (similar to Iberville # 52171-K or approved equal). Provide single device square cornered tile cover (similar to Iberville # BC52-C-49XX or approved equal) or two device square cornered tile covers (similar to Iberville # 52-C-52-XX or approved equal).

## **2.3. MASONRY BOXES**

1. Electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls, minimum volume of 343 cubic centimetres (21 cu.in), 89 mm (3.5 in.) deep, to be Iberville #MBD or approved equal.

## **2.4. SURFACE MOUNT CONDUIT BOXES**

1. Cast FS aluminum boxes with factory-threaded hubs and mounting feet for surface wiring devices installed lower than 8' AFF.
2. Metal type "FS" device plates to be used on all type "FS" boxes unless noted otherwise. Covers are to be specifically made for boxes and to utilize 4-point fastening.
3. Surface boxes intended to be used for housing 347-volt lighting switches are to cast steel, type FS or FD, and "stamped" by manufacturer as being suitable for this particular voltage. Matching FS steel devices plate is to also have 347 volt stamped into face of same. Where installed higher than 8' A.F.F., metal type 1110-HV boxes c/w matching orange coloured metal switch plates may be used.
4. Tile type extension rings are not to be used on boxes that are surface mounted.

## **2.5. FLUSH MOUNT CONDUIT BOXES**

1. When installing flush boxes in metal drywall partition where the grouping of multiple device boxes is required, support the box between the studs with a box mounting bracket. Caddy RBS series box mounting brackets or Caddy SGB series box brackets or equal are approved for this application. Where a single flush box is installed, this box may be supported by the wall stud without any additional support required.
2. Flush installed 4" square, or a 4-11/16" square box being used as a junction or pull box that requires a blank metal coverplate, is have an appropriate sized, square welded one or two gang "tile ring" installed on same. This permits the use of a standard, one or two gang blank finish metal coverplate to be used, and avoids the necessity of acquiring an oversized, custom made coverplate.

## **2.6. FITTINGS - GENERAL**

1. Knock-out fillers to prevent entry of foreign materials.
2. Double locknuts and insulated bushings on sheet metal boxes.
3. Conduit fittings “LB, LL, LR” and their respective covers/plates are to be painted with appropriate colour coding and where concealed, have their locations identified with appropriate colour coded self-adhering discs applied to T-Bar splines and/or access opening frames in same manner as required for identifying concealed junction and/or pull boxes.
4. The use of either, corner pulling “Ells” or corner pulling “Elbows” in lieu of acceptable “conduit” fittings is strictly prohibited.

## **2.7. COLOUR CODING**

1. Colour coding of system as per Section 26 05 03 - Electrical Identification.

## **3. Execution**

### **3.1. INSTALLATION**

1. Support boxes independently of connecting conduits.
2. Fill boxes with paper, sponges or foam or similar approved material to prevent entry of construction material.
3. For flush installations mount outlets flush with finished wall using tile rings to permit wall finish to come within 6 mm (1/4”) of opening.
4. The front edges of boxes, cabinets and fittings installed in noncombustible walls or ceilings shall not be set in more than 6 mm (1/4”).
5. The front edges of boxes, cabinets and fittings installed in combustible walls (i.e. millwork) shall be flush with surface.
6. Provide correct size of openings in boxes for conduit, mineral insulated and armored cable connections. Reducing washers not to be used.
7. Install multi-gang boxes where more than one device is required. Sectional (gangable) boxes are not to be used on this project.

\*\*\*\*\*END OF SECTION\*\*\*\*\*

## **1. General**

### **1.1. REFERENCES**

1. The Executed Agreement including General Conditions and Supplementary Conditions, applicable sections of Division 00 and Division 01, Section 26 05 00 - Common Work Results for Electrical, Section 26 05 01 - Electrical Submittals and Section 26 05 02 - Electrical Contract Closeouts, applicable drawings and amendments are part of and to be read in conjunction with this Section.

### **1.2. PRODUCT DATA**

1. Submit product data in accordance with Division 01.
2. Indicate types of raceways with terminology similar to that used in this Section.

## **2. Products**

### **2.1. SURFACE RACEWAY SYSTEM**

1. Steel: to CSA C22.2 No. 62, one piece, free of sharp edges.
2. Corners, pull boxes, elbows, tees, two-piece assembly to facilitate site wiring.
3. Finish: Powder coat, white.
4. Necessary receptacles, communications and extension boxes, adapters and utility fittings required for complete installation.
5. Single channel raceway with base and cover.

### **2.2. FITTINGS**

1. Elbows, tees, couplings and hanger fittings: to CSA C22.2 No. 62, manufactured as accessories to raceway supplied.

### **2.3. STANDARD OF ACCEPTANCE**

1. Wiremold 500 Series Surface Metal Raceway, color by Architect, c/w:
  1. Elbows, ground clamps, entrance fittings, supporting clips, etc.
  2. Single and double gang device boxes.

### **2.4. ACCEPTABLE MANUFACTURER**

1. Hubbell

### **3. Execution**

#### **3.1. INSTALLATION**

1. All wiring and conduit are to be concealed, unless noted otherwise. Where this is not possible due to existing construction, metal surface mounted raceways are to be used.
2. Device locations are approximate only. Provide supports, elbows, tees, connectors, fittings, bushings, adaptors as required to accommodate final location of devices.
3. Install Surface Metal Raceways before installation of wiring. Install covers for raceways and fittings after installation or wiring.
4. Install supports, elbows, tees, connectors, fittings, bushings, adaptors as required.
5. Keep number of elbows, offsets, connections to minimum.

**\*\*\*\*\*END OF SECTION\*\*\*\*\***

## 1. General

### 1.1. GENERAL

1. The Executed Agreement including General Conditions and Supplementary Conditions, applicable sections of Division 00 and Division 01, Section 26 05 00 - Common Work Results for Electrical, Section 26 05 01 - Electrical Submittals and Section 26 05 02 - Electrical Contract Closeouts, applicable drawings and amendments are part of and to be read in conjunction with this Section.

### 1.2. RELATED SECTIONS

1. Section 26 05 28 - Grounding and Bonding
2. Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings

### 1.3. REFERENCES

1. Canadian Standards Association
  1. CAN/CSA C22.2 No. 18-98 (R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
  2. CSA C22.2 No. 45-M1981 (R2003), Rigid Metal Conduit.
  3. CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
  4. CSA C22.2 No. 83-M1985 (R2003), Electrical Metallic Tubing.
  5. CSA C22.2 No. 211.2-M1984 (R2003), Rigid PVC (Unplasticized) Conduit.
  6. CAN/CSA C22.2 No. 227.3-05, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).

### 1.4. SUBMITTALS

1. Submit product data in accordance with Section 26 05 01 - Electrical Submittals.
2. Shop drawings submission to include:
  1. Layout of equipment.
  2. Complete **PROJECT SPECIFIC** Wiring Diagrams and documentation
  3. Provide PDF copy of an operational and maintenance manual for all products being supplied.
3. Submit close out documents in accordance with Section 26 05 02 - Electrical Contract Closeouts.
4. Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual. Operation and maintenance data to include:
  1. Operation instructions.
  2. Description of system operation.
  3. Description of each subsystem operation.

4. List showing each piece of equipment in system or subsystem by its original manufacturer name and model number.
5. Part list showing parts used in equipment by identification numbers that are standard to electronics industry.

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

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

### **1.6. WASTE MANAGEMENT AND DISPOSAL**

1. Separate and recycle waste materials.
2. Remove from site and dispose of packaging materials at appropriate recycling facilities.
3. Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
4. Divert unused metal and wiring materials from landfill to metal recycling facility.

## **2. Products**

### **2.1. CONDUITS**

1. Rigid galvanized steel threaded conduit: size as indicated.
2. Electrical metallic tubing (EMT): with couplings, size as indicated.
3. Liquid-tight flexible metal conduit: size as indicated.
4. ENT conduit is not permitted for use on this project.

### **2.2. CONDUIT FASTENINGS**

1. Fasten conduit to building construction or support system using straps, as follows:

1. One-hole steel straps to secure surface conduits and cables 35 mm (1 ¼ inch) and smaller.
2. Two-hole steel straps for conduits and cables 41 mm (1 ½ inch) and larger.
2. Beam clamps to secure conduits to exposed steelwork.
3. Channel type supports for one or more conduits.
4. 10 mm (3/8 inch) diameter threaded rods to support suspended channels.

### **2.3. CONDUIT FITTINGS**

1. Fittings: manufactured for use with conduit specified. Coating same as conduit.
2. Unless otherwise noted, steel set screw type fittings shall be use on EMT. Rigid conduit fitting bodies made of alloys or malleable types of metals or not to be used.
3. Conduits exiting equipment enclosures equipped with sprinkler hoods shall be installed with rain tight EMT connectors. These connectors will be equipped with a rubber “O” Ring gasket. In addition, any conduit couplings in the vertical portion of the conduit run over equipment enclosures equipped with sprinkler hoods shall be rain tight.
4. Connectors for thin wall type EMT conduits shall be set screw, galvanized steel, c/w case hardened steel locknuts. Insulated throats are to be provided on connectors up to and including 27 mm (1 inch). Metal thread on bushings to be installed on all EMT connectors sized 35 mm (1 ¼ inch) or larger.
5. Flexible metal conduit connectors shall be nylon insulated, steel or malleable iron type similar to T & B Tite-Bite #3115 thru 3124 or approved equal. Provide insulating bushings (anti-shorts) for flexible metal conduit connectors. Plastic thread on bushings to be installed on all flexible metal conduit connectors sized 35 mm (1 ¼ inch) or larger.
6. Liquid-tight flexible metal conduit fittings:
  1. Specifically listed for liquid tight flexible metal conduit.
  2. Steel type, to match conduit size.
  3. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening.
  4. Safe edge ground type.
  5. Connectors shall have insulated throats.
  6. T & B #5300 series or approved equal.

### **2.4. FISH CORD**

1. Polypropylene.

### 3. Execution

#### 3.1. LOCATION OF CONDUIT

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

#### 3.2. INSTALLATION

1. Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
2. Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.
3. Where construction consists of metal Q deck and steel joists, conduits are to be installed in such a manner that the conduit system including fittings is not less than 38mm (1.5 inch) from the nearest surface of the metal roof deck.
4. Use rigid galvanized steel threaded conduit where subject to injury.
5. Use electrical metallic tubing (EMT) for the following:
  1. All exposed wiring.
  2. Where noted elsewhere in the contract documents.
6. EMT shall be installed as a complete system and shall be securely fastened in place within 300 mm (12 inch) of each outlet box, junction box, cabinet, couplings, fittings and changes in direction and the spacing between supports as follows:
  1. Not greater than 1500 mm (five feet) for 16 mm ( $\frac{1}{2}$  inch) and 21 mm ( $\frac{3}{4}$  inch) EMT.
  2. Not greater than 1800 mm (six feet) for 27 mm (1 inch) and 35 mm (1  $\frac{1}{4}$  inch) EMT.
  3. Not greater than 3050 mm (ten feet) for 41 mm (1  $\frac{1}{2}$  inch) EMT or larger.
7. All conduit runs shall be a maximum of 30 meters (100 feet) in length with a maximum of four (4) 90-degree bends between pull points. A pull box shall be placed in conduit runs where the sum of the bends exceeds 360 degrees, where the overall run exceeds 30 meters (100 feet) or there is a reverse bend in the run.
8. Pull boxes shall be placed in straight sections of conduit run and shall not be used in lieu of a bend.
9. The use of corner pulling ELLs or corner pulling elbows (conduit fittings [LL, LB, LR]) in lieu of pull boxes is not permitted.
10. Conduits shall be installed in a neat and ordered manner. When installed in a group, conduits shall be parallel and evenly spaced apart.

11. Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
12. Mechanically bend steel conduit over 19 mm (¾ inch) diameter.
13. Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
14. Install fish cord in empty conduits.
15. Where conduits become blocked, remove and replace blocked section.
16. Dry conduits out before installing wire.
17. The installation of conduits above the structure, directly below roof insulation is strictly prohibited.
18. All conduits to be complete with minimum #12 green insulated bond conductor.
19. Ensure all metal raceways are bonded to ground, including those used for communication systems, fire alarm systems. Where a separate bonding conductor is run to a bonding bushing on an open end of a metal raceway, a #6 green RW90 shall be used.
20. Liquid seal flexible conduit, not smaller than 3/8" inside diameter, up to a maximum length of 15' with bond and bushing, shall be used for final connections to all vibrating and/or mechanical equipment, including various systems controls and related devices, sprinkler system devices, etc.
21. Steel type connectors are to be used on flexible type conduits. Malleable type connectors are not permitted.
22. EMT conduit stub is to be off-set out of wall into accessible ceiling space of room containing flush installed device box, and have steel EMT connector complete with plastic or grounding type bushings "screwed" on same. EMT plastic end cap bushings that are CSA approved may also be used.
23. All EMT conduit wall stubs and associated boxes are to be adequately bonded to ground as per CEC requirements.

### **3.3. SURFACE AND CONCEALED CONDUITS**

1. Run parallel or perpendicular to building lines.
2. Run conduits in flanged portion of structural steel.
3. Group conduits wherever possible.
4. Do not pass conduits through structural members except as indicated.

5. Do not locate conduits closer than 75 mm (3 inch) parallel to hot water lines with a minimum of 25 mm (1 inch) at crossovers.
6. Support of electrical systems raceway shall be independent of any type of suspended ceiling support rods, wires, etc. Toggle bolts shall not be used in Gypsum board construction.
7. EMT conduit to be used for installation in unfinished areas.
8. Use aesthetic type surface raceway in finished areas where it is impossible to conceal conduits.
9. Wall mounted conduit/raceway is secured directly to, or directly on, exposed walls.
10. AC90 and/or other types of system pliable cabling are not to be installed on exposed walls and/or ceiling without the benefit of conduit/raceway.
11. Ceiling mounted conduit/raceway is to be secured directly to overhead structure and/or related structural steel as high as possible in the ceiling space, and as close as practicable to the underside of the deck.

#### **3.4. CONCEALED CONDUITS**

1. Do not install horizontal runs in masonry walls.
2. Do not install conduits in terrazzo or concrete toppings.
3. Vertically installed EMT conduit stubs from flush installed device boxes are to be provided in all block or concrete block walls.

#### **3.5. COMMISSIONING**

1. Carry out the commissioning in conformance with Section 26 91 13 - Testing and Verification.

\*\*\*\*\*END OF SECTION\*\*\*\*\*

## 1. General

### 1.1. GENERAL

1. The Executed Agreement including General Conditions and Supplementary Conditions, applicable sections of Division 00 and Division 01, Section 26 05 00 - Common Work Results for Electrical, Section 26 05 01 - Electrical Submittals and Section 26 05 02 - Electrical Contract Closeouts, applicable drawings and amendments are part of and to be read in conjunction with this Section.

### 1.2. REFERENCES

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

### 1.3. SUBMITTALS

1. Submit product data in accordance with Section 26 05 01 - Electrical Submittals.
2. Shop drawings submission to include:
  1. Layout of equipment.
  2. Complete **PROJECT SPECIFIC** Wiring Diagrams and documentation. Submit product data sheets for baseboard convectors to include:
    1. Product characteristics.
    2. Performance criteria.
    3. Mounting methods.
    4. Physical size.
    5. kW rating, voltage, phase.
    6. Cabinet material thicknesses.
    7. Limitations.
    8. Colour and finish.
3. Manufacturer's Instructions. Provide to indicate special handling criteria, installation sequence and cleaning procedures.
4. Submit close out documents in accordance with Section 26 05 02 - Electrical Contract Closeouts.
5. Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual. Operation and maintenance data to include:
  1. Operation instructions.
  2. Description of system operation.
  3. Description of each subsystem operation.
  4. List showing each piece of equipment in system or subsystem by its original

manufacturer name and model number.

5. Part list showing parts used in equipment by identification numbers that are standard to electronics industry.

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

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

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

1. Separate and recycle waste materials.
2. Remove from site and dispose of packaging materials at appropriate recycling facilities.
3. Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
4. Divert unused metal and wiring materials from landfill to metal recycling facility.

## **2. Products**

### **2.1. MANUFACTURERS**

1. Acceptable manufacturers:
  1. Ouellet (RBH Series)
  2. Dimplex (LC Series)
  3. Stelpro (B Series)

### **2.2. BASEBOARD CONVECTORS**

1. Heaters: to CSA C22.2 No. 46 standard wattage density as indicated with connection box both ends.
  1. Element through-type fitted with aluminum convactor vanes and resistor wire enclosed in mineral insulation in aluminum sheath.

2. Element locked to cabinet and supported with non-metallic supports to allow for expansion.
3. Cabinet: steel 1 mm thick finished in baked enamel two (2) coats, colour ivory with integral air deflector for diffusion.
4. Approved wiring channel for interconnection of heaters and components.
5. Knock-outs for 19 mm diameter conduit connection.
6. Additional accessories as indicated:
  1. Inside and outside corners.
  2. Splice plates.

### **2.3. CONTROLS**

1. Heaters are to be controlled by electronic type line voltage thermostats.
2. Thermostats to be Ouellet cat # OTH-500 or equal.

## **3. Execution**

### **3.1. INSTALLATION**

1. Attach baseboard heaters to wall with expanded shields.
2. For corner extension use inside and outside corners.
3. Make power and control connections.

### **3.2. COMMISSIONING**

1. Perform tests in accordance with Section 26 05 01 - Electrical Submittals.
2. Ensure that heaters and thermostatic controls operate correctly.
3. Provide written reports in accordance with Commissioning requirements of Section 26 05 01 - Electrical Submittals.
4. Carry out the commissioning in conformance with Section 26 91 13 - Testing and Verification.

\*\*\*\*\*END OF SECTION\*\*\*\*\*

## **1. General**

### **1.1. GENERAL**

1. The Executed Agreement including General Conditions and Supplementary Conditions, applicable sections of Division 00 and Division 01, Section 26 05 00 - Common Work Results for Electrical, Section 26 05 01 - Electrical Submittals and Section 26 05 02 - Electrical Contract Closeouts, applicable drawings and amendments are part of and to be read in conjunction with this Section.

### **1.2. RELATED WORK**

1. Electrical Contractor will provide all plywood backboards required for mounting electrical equipment.

### **1.3. RELATED SECTIONS**

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

### **1.4. SUBMITTALS**

1. Submit product data in accordance with Section 26 05 01 - Electrical Submittals.
2. Shop drawings submission to include:
  1. Layout of equipment.
  2. Complete **PROJECT SPECIFIC** Wiring Diagrams and documentation.
  3. Provide PDF copy of an operational and maintenance manual for all products being supplied.
3. Submit close out documents in accordance with Section 26 05 02 - Electrical Contract Closeouts.
4. Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual. Operation and maintenance data to include:
  1. Operation instructions.
  2. Description of system operation.
  3. Description of each subsystem operation.
  4. List showing each piece of equipment in system or subsystem by its original manufacturer name and model number.
  5. Part list showing parts used in equipment by identification numbers that are standard to electronics industry.

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

1. Deliver, store and handle materials in accordance with manufacturer's written instructions.

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

## **1.6. WASTE MANAGEMENT AND DISPOSAL**

1. Separate and recycle waste materials.
2. Remove from site and dispose of packaging materials at appropriate recycling facilities.
3. Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
4. Divert unused metal and wiring materials from landfill to metal recycling facility

## **2. Products**

### **2.1. LIGHTING & BRANCH CIRCUIT PANEL BOARDS**

1. Panel boards: as indicated on drawings.
2. Interrupting Ratings:
  1. All panel boards must be rated to withstand the available fault current calculations at the installed location.
  2. Unless otherwise noted, all panel board assemblies are to be rated for a symmetrical fault current of not less than 10 KA @ 240V.
3. Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
4. Panel boards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
5. Two keys for each panel board and key panel boards alike.
6. Bus Bars:
  1. Lugs to be rated for CU/AL.
  2. Tin-plated copper.
  3. Neutral to have same ampacity rating as main bus, unless noted otherwise.
7. Mains: suitable for bolt-on breakers.

8. All feeder conductors (phase, neutral and bonds) are to be terminated in factory provided multi-barrel lugs (Each conductor is to be provided with an individual, suitably sized connection point) with a single connection point to the bus bar.
9. Provide trim and doors on all panel boards.
10. Trim and door finish: grey enamel.
11. All panel boards to have factory installed bonding terminal strip.
12. Panel tubs to be a minimum of 508 mm (20 in.) wide, 146 mm (6 in.) deep for ampacity up to 225 amperes, unless noted otherwise. For panels above 225 amps, tubs to be minimum 965 mm (38 in.) wide, 287 mm (11.3 in.) deep.

## **2.2. DISTRIBUTION PANELBOARDS (DP)**

1. Distribution panelboards: as indicated on drawings.
2. Interrupting Ratings:
  1. All panel boards must be rated to withstand the available fault current calculations at the installed location.
  2. Unless otherwise noted, all panel board assemblies are to be rated for a symmetrical fault current of not less than 25 KA @ 240V.
3. Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
4. Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
5. Bus Bars:
  1. Lugs to be rated for CU/AL.
  2. Tin-plated copper, unless noted otherwise.
  3. Neutral busbar ampacity to have double the ampacity rating as main bus, unless noted otherwise. Refer to electrical system riser drawings.
6. Mains: suitable for bolt-on breakers.
7. All feeder conductors (phase, neutral and bonds) are to be terminated in factory provided multi-barrel lugs (Each conductor is to be provided with an individual, suitably sized connection point) with a single connection point to the bus bar.
8. All panelboards to have factory installed bonding terminal strip.
9. Panel tubs to be a minimum of 965 mm (38 in.) wide, 287 mm (11.3 in.) deep.

10. Provide drip hoods on all Distribution panelboards.

### **2.3. BREAKERS**

1. Breakers with thermal magnetic tripping in panel boards, unless noted otherwise.

### **2.4. EQUIPMENT IDENTIFICATION**

1. Provide equipment identification in accordance with Section 26 05 03 - Electrical Identification.
2. Complete circuit directory with typewritten legend indicating location and load of each circuit. All branch circuits such as lighting, receptacle, etc. to be identified by the room they terminate in. Panel directory is to be formatted so that odd numbered circuits appear on left of card; even numbered circuits appear on right. Identify all spare breakers.
3. Provide Lamicoid identification plates for all breakers in Distribution Panel Boards.
4. CSA Z462:21 warning label listing incident energy, arc flash boundary, and hazard risk category shall be applied. Date of power study the above information is based on shall also be included on the label.

### **2.5. STANDARD OF ACCEPTANCE**

1. Lighting and branch circuit panel boards:
  1. Cutler-Hammer.
    1. POW-R-LINE 1 &2.
2. Distribution panelboard
  1. Cutler-Hammer.
    1. POW-R-LINE 4.

### **2.6. ACCEPTABLE MANUFACTURERS TO THE REQUIREMENTS ABOVE**

1. Square D
2. Siemens.

## **3. Execution**

### **3.1. INSTALLATION**

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

2. Mount panel boards to height specified in Section 26 05 00 - Common Work Results for Electrical or as indicated. Ensure that the operating handle of the top mounted device is within two metres of the finished floor.
3. Raceways entering into wall mounted panel boards shall be mechanically secured to the tub and shall be mechanically continuous throughout the run. Where panel boards are designated as free-standing units, other methods for raceway entry will be considered on a case-by-case basis only. Requests for a variance must be submitted in writing to the consultant.
4. Connect loads to circuits as indicated.
5. Connect neutral conductors to common neutral bus.
6. Connect bonding conductors to common bonding bar.
7. Provide separate neutral conductors for all circuits feeding lighting equipment from lighting panel boards.
8. CSA Z462:21 warning label listing incident energy, arc flash boundary, and hazard risk category shall be applied.

### **3.2. PANEL BOARD START-UP, VERIFICATION AND PERFORMANCE TESTING**

1. Start-Up
  1. Perform start-up checks paying particular attention to:
    1. Name plate complete.
    2. Proper grounding.
    3. Drip hood in place.
    4. Clean equipment.
    5. Condition of insulation and insulators.
    6. Evidence of moisture damage.
    7. Cable lugs torqued to manufacturer's recommendation.
    8. Bus bolts torqued to manufacturer's recommendation.
    9. Doors and covers in place.
    10. Code required clearances around equipment.
    11. Exterior and paint finish.
    12. Insulation Megger tests.
  2. Provide a written start-up report.
    1. Verification
      - .1 Perform verification checks paying particular attention to:
        1. Manufacturer
        2. Voltage
        3. Main Bus Rating
        4. Copper Busing
        5. Copper Ground Bus

6. Phase Rotation Test
  7. Feeder Breakers
2. Provide a written verification report.
  3. Performance
    1. Carry out performance checks:
      1. Test Feeder Breakers and Trip Units.
      2. Provide a written performance report.

### **3.3. COMMISSIONING**

1. Carry out the commissioning in conformance with Section 26 91 13 - Testing and Verification.

**\*\*\*\*\*END OF SECTION\*\*\*\*\***

## 1. General

### 1.1. GENERAL

1. The Executed Agreement including General Conditions and Supplementary Conditions, applicable sections of Division 00 and Division 01, Section 26 05 00 - Common Work Results for Electrical, Section 26 05 01 - Electrical Submittals and Section 26 05 02 - Electrical Contract Closeouts, applicable drawings and amendments are part of and to be read in conjunction with this Section.

### 1.2. RELATED SECTIONS

1. Section 01 33 00 - Submittal Procedures.
2. Section 26 05 00 - Common Work Results Electrical.
3. Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

### 1.3. REFERENCES

1. Canadian Standards Association (CSA International)
  1. CSA-C22.2 No.42-99 (R2002), General Use Receptacles, Attachment Plugs and Similar Devices.
  2. CSA-C22.2 No.42.1-00, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
  3. CSA-C22.2 No.55-M1986 (July 2001), Special Use Switches.
  4. CSA-C22.2 No.111-00, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

### 1.4. SUBMITTALS

1. Submit product data in accordance with Section 26 05 01 - Electrical Submittals.
2. Shop drawings submission to include:
  1. Layout of equipment.
  2. Complete **PROJECT SPECIFIC** Wiring Diagrams and documentation.
  3. Provide PDF copy of an operational and maintenance manual for all products being supplied.
3. Submit close out documents in accordance with Section 26 05 02 - Electrical Contract Closeouts.
4. Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual. Operation and maintenance data to include:
  1. Operation instructions.
  2. Description of system operation.
  3. Description of each subsystem operation.

4. List showing each piece of equipment in system or subsystem by its original manufacturer name and model number.
5. Part list showing parts used in equipment by identification numbers that are standard to electronics industry.

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

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

### **1.6. WASTE MANAGEMENT AND DISPOSAL**

1. Separate and recycle waste materials.
2. Remove from site and dispose of packaging materials at appropriate recycling facilities.
3. Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
4. Divert unused metal and wiring materials from landfill to metal recycling facility

## **2. Products**

### **2.1. SWITCHES**

1. 20A, 120V, single pole, double pole, three-way, four-way switches (CSA approved).
2. Manually operated general purpose AC switches with following features:
  1. Terminal holes approved for No. 10 AWG wire.
  2. Silver alloy contacts.
  3. Nylon molding for parts subject to carbon tracking.
  4. Suitable for back and side wiring.
  5. Ivory toggle.
3. Toggle operated locking fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

4. Switches of one manufacturer throughout project.
5. Line voltage switches shall be best quality, Specification Grade, toggle type, flush mounted and CSA approved as general purpose alternating current switches. Switch handles shall be white; coverplates No. 301 stainless steel in all areas. Switches shall be side wired only. Rear or back wiring is not permitted. Thermoplastic plates shall not be used. Approved manufacturers are:  
  
120V-single pole      - Hubbell Cat. #1221-WH  
                                 - Bryant Cat. #4901-WH  
                                 - P & S Cat. #20AC1-WH  
                                 - Arrow Hart Cat. #1991-WH  
                                 - Leviton Cat. #1221-2W  
  
120V-three way      - Hubbell Cat. #1223-WH  
                                 - Bryant Cat. #4903-WH  
                                 - P & S Cat. #20AC3-WH  
                                 - Arrow Hart Cat. #1993-WH  
                                 - Leviton Cat. #1223-2WH  
  
120V-four way      - Hubbell Cat. #1224-WH  
                                 - Bryant Cat. #6901-WH  
                                 - P & S Cat. #20AC-W  
                                 - Arrow Hart Cat. #1994-WH  
                                 - Leviton Cat. #1224-2W
6. Single gang adjustable “box extension” is an approved accessory for extending single gang box opening a maximum of 7/8”. Their use is acceptable in non-combustible type walls where front edges of boxes have not been installed greater than 1-1/8” or 1-1/4” from finished wall.
7. Device “leveler and retainer” is an approved accessory for securing devices to flush installed boxes. This is particularly practical where an enlarged opening around a box has been made preventing device ears from coming into contact with finished wall.

## 2.2. RECEPTACLES

1. Unless specified otherwise, heavy duty duplex receptacles, CSA type 5-15 R, 125V, 15A, U ground, specification grade, with the following features:
  - .1 Reinforced thermoplastic base and deep nylon body.
  - .2 Impact resistant nylon face, complete with finder grooves.
  - .3 One-piece brass mounting strap with integral ground contacts.
  - .4 Suitable for No. 10 AWG for back and side wiring.
  - .5 Break-off links for use as split receptacles.
  - .6 Eight back wired entrances, four side wiring screws.
  - .7 Double wipe contacts.
  - .8 White in colour.

- .9 Standard of Acceptance: Hubbell No. 5262W.
- .10 Acceptable Manufacturers:
  - .1 Leviton #5262.
  - .2 Pass and Seymour #PS5262
- 2. Duplex receptacles where indicated: CSA 5-20R, 125V, 20A U ground as above, except Hubbell No. HBL5362W.
- 3. Duplex receptacles, ground fault where indicated: CSA 5-15R, 125V, 15A U ground as above, except Hubbell No. GFR5262SGW.
- 4. Receptacles of one manufacturer throughout project.
- 5. Acceptable manufacturers: Leviton, Pass & Seymour.

### 2.3. EXTERIOR RECEPTACLES

- 1. Located on roof:
  - 1. Locate in recessed weatherproof enclosure incorporating a recessed backbox.
  - 2. Heavy cast aluminum cover plate and lockable enclosure.
  - 3. Provide four keys to Owner.
  - 4. Acceptable Manufacturer: Hubbell #WP826.

## 3. Execution

### 3.1. INSTALLATION

- 1. Exterior Receptacles:
  - 1. Located on roof:
    - 1. Mount back box, recessed in wall at height as indicated.
    - 2. Wire and connect device and install assembly in adapter, install with U-ground up.
    - 3. Apply caulking compound to back of cover to provide waterproof seal.
    - 4. All receptacles to be polarity tested.
  - 2. Cover plates:
    - 1. Exterior cover plates to be heavy cast aluminum, c/w lockable feature.
  - 3. Identification:
    - 1. Identify all receptacles as per Section 26 05 03 - Electrical Identification.

### **3.2. COMMISSIONING**

1. Carry out the commissioning in conformance with Section 26 91 13 - Testing and Verification.

**\*\*\*\*\*END OF SECTION\*\*\*\*\***

## 1. General

### 1.1. GENERAL

1. The Executed Agreement including General Conditions and Supplementary Conditions, applicable sections of Division 00 and Division 01, Section 26 05 00 - Common Work Results for Electrical, Section 26 05 01 - Electrical Submittals and Section 26 05 02 - Electrical Contract Closeouts, applicable drawings and amendments are part of and to be read in conjunction with this Section.

### 1.2. RELATED SECTIONS

1. Section 26 28 23 - Disconnect Switches – Fused and Non-Fused.

### 1.3. REFERENCES

1. Canadian Standards Association (CSA International).
  1. CSA-C22.2 No. 248.8:11 (R2020), Low-voltage fuses - Part 8: Class J fuses (Tri-national standard, with UL 248-8 and NMX-J-009/248/8-ANCE).

### 1.4. SUBMITTALS

1. Submit product data in accordance with Section 26 05 01 - Electrical Submittals.
2. Shop drawings submission to include:
  1. Layout of equipment.
  2. Complete **PROJECT SPECIFIC** Wiring Diagrams and documentation.
  3. Provide PDF copy of an operational and maintenance manual for all products being supplied.
3. Submit close out documents in accordance with Section 26 05 02 - Electrical Contract Closeouts.
4. Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual. Operation and maintenance data to include:
  1. Operation instructions.
  2. Description of system operation.
  3. Description of each subsystem operation.
  4. List showing each piece of equipment in system or subsystem by its original manufacturer name and model number.
  5. Part list showing parts used in equipment by identification numbers that are standard to electronics industry.

### 1.5. DELIVERY, STORAGE AND HANDLING

1. Deliver, store and handle materials in accordance with manufacturer's written instructions.

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

## **1.6. WASTE MANAGEMENT AND DISPOSAL**

1. Separate and recycle waste materials.
2. Remove from site and dispose of packaging materials at appropriate recycling facilities.
3. Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
4. Divert unused metal and wiring materials from landfill to metal recycling facility.

## **2. Products**

### **2.1. FUSES GENERAL**

1. Low voltages, current limiting, HRC fuses, types as specified below and shall be CSA certified.
2. Fuses shall meet the following parameters:
  1. Fast Acting
    1. Rating: 1 – 600 amps.
      1. CSA certified to Standard C22.2 No. 248.8.
      2. 200 KAIR.
      3. Class J.
      4. Ferraz Shawmut A4J.
    2. Time Delay
      1. Rating: 1 – 600 amps.
        1. CSA certified to Standard C22.2 No. 248.8.
        2. 200 KAIR.
        3. Class J.
        4. Ferraz Shawmut AJT.
  3. Fuses shall be so selected as to provide a fully coordinated system for both overload and short circuit fault conditions.

## **2.2. STANDARD OF ACCEPTANCE**

1. Ferraz Shawmut.

## **2.3. ACCEPTABLE MANUFACTURERS**

1. Bussmann.
2. English Electric.

## **3. Execution**

### **3.1. INSTALLATION**

1. Install fast acting or time delay fuses, as indicated.
2. Install fuses in mounting devices immediately before energizing circuit.
3. All fusible equipment rated 600 amps or less shall be supplied with fuse clips to accept Class J fuses.
4. Ensure correct fuses are fitted to physically match mounting devices.
5. Ensure correct fuses fitted to assigned electrical circuit.

### **3.2. COMMISSIONING**

1. Carry out the commissioning in conformance with Section 26 91 13 - Testing and Verification.

**\*\*\*\*\*END OF SECTION\*\*\*\*\***

## **1. General**

### **1.1. GENERAL**

1. The Executed Agreement including General Conditions and Supplementary Conditions, applicable sections of Division 00 and Division 01, Section 26 05 00 - Common Work Results for Electrical, Section 26 05 01 - Electrical Submittals and Section 26 05 02 - Electrical Contract Closeouts, applicable drawings and amendments are part of and to be read in conjunction with this Section.

### **1.2. RELATED SECTIONS**

1. Section 26 26 13.01 - Fuses.

### **1.3. REFERENCES**

1. Canadian Standards Association (CSA International).
  1. CSA-C22.2 No. 4-16 (R2020), Enclosed and dead-front switches (Tri-national standard with NMX-J-162-ANCE-2016 and UL 98).

### **1.4. SUBMITTALS**

1. Submit product data in accordance with Section 26 05 010 - Electrical Submittals.
2. Shop drawings submission to include:
  1. Layout of equipment.
  2. Complete **PROJECT SPECIFIC** Wiring Diagrams and documentation.
  3. Provide PDF copy of an operational and maintenance manual for all products being supplied.
3. Submit close out documents in accordance with Section 26 05 02 - Electrical Contract Closeouts.
4. Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual. Operation and maintenance data to include:
  1. Operation instructions.
  2. Description of system operation.
  3. Description of each subsystem operation.
  4. List showing each piece of equipment in system or subsystem by its original manufacturer name and model number.
  5. Part list showing parts used in equipment by identification numbers that are standard to electronics industry.

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

1. Deliver, store and handle materials in accordance with manufacturer's written instructions.

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

## **1.6. WASTE MANAGEMENT AND DISPOSAL**

1. Separate and recycle waste materials.
2. Remove from site and dispose of packaging materials at appropriate recycling facilities.
3. Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
4. Divert unused metal and wiring materials from landfill to metal recycling facility.

## **2. Products**

### **2.1. DISCONNECT SWITCHES**

1. Non-fusible and fusible disconnect switch in CSA Enclosure as indicated.
2. Provision for padlocking in on-off switch position.
3. Mechanically interlocked doors to prevent opening when handle in ON position.
4. Quick-make, quick-break action.
5. ON-OFF switch position indication on switch enclosure cover.
6. Fuse clips to accommodate Class J only.
7. Supply HRC-I-J fuses for all fused disconnect switches, unless indicated otherwise.

### **2.2. EQUIPMENT IDENTIFICATION**

1. Provide equipment identification in accordance with Section 26 05 03 - Electrical Identification.

### **2.3. MANUFACTURERS**

1. Standard of Acceptance:
  1. Cutler-Hammer.
  2. Acceptable Manufacturer:
    1. Square D.
    2. Siemens.

## **3. Execution**

### **3.1. EXAMINATION**

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

### **3.2. INSTALLATION**

1. Install disconnect switches as indicated.
2. Install fuses in disconnect switches.
3. CSA Z462:21 warning label listing incident energy, arc flash boundary, and hazard risk category shall be applied to all switches rated at 600V line to line or greater.

### **3.3. COMMISSIONING**

1. Carry out the commissioning in conformance with Section 26 91 13 - Testing and Verification.

\*\*\*\*\*END OF SECTION\*\*\*\*\*

## **1. General**

### **1.1. SECTION INCLUDES**

1. Materials and supply for one (1) diesel generating units.

### **1.2. RELATED SECTIONS**

1. Section 26 36 23 - Automatic Load Transfer Equipment.

### **1.3. REFERENCES**

1. Canadian Standards Association
  1. CSA C22.2
2. International Organization for Standardization (ISO)
  1. ISO 3046-1-2002, Reciprocating internal combustion engines - Performance - Part I: Declarations of power, fuel and lubricating oil consumptions, and test methods - Additional requirements for engines for general use.
  2. ISO 3046-4-1997, Reciprocating internal combustion engines - Performance - Part 4: Speed governing.
3. National Electrical Manufacturers Association (NEMA)
  1. NEMA MG 1-22, & 33 Motors and Generators.
4. The Society of Automotive Engineers (SAE).

### **1.4. DESCRIPTION**

1. Provide an automatic, unattended, emergency power supply system consisting of:
  1. Radiator cooled low voltage diesel electric generating unit with control panel.
  2. Accessories and equipment specified in this specification.

### **1.5. LONG TERM SERVICEABILITY**

1. The equipment packager must be the same manufacturer of the engine to insure long term product support and longevity of the complete package.
2. The equipment supplier must have a parts and service depot within 250 km of the project site.
  1. The facility must be a reliable and longstanding business with at least 20 years experience in the industry.
  2. It must maintain a parts warehouse and service personnel.
3. The equipment supplier must have its own in-house oil analysis lab. This lab must be capable of analysing the engine fluids to determine if abnormal wear patterns occur. A report of findings must be produced and available for the owner.

## 1.6. DESIGN REQUIREMENTS

1. Design equipment suitable to meet the following requirements:
  1. Antigonish County Municipal Building:
    1. Total Load: 80kW, 4-cylinder diesel engine
    2. Voltage: 208/120V, 3Ø, 4W
    3. Frequency: 60 Hz
    4. 30-Hour Fuel Tank (733 L)
    5. Power Factor: 0.8 lag
    6. Maximum Rotational Speed: 1800 rpm
    7. Duty Rating: Standby power in accordance with ISO8528 and based on #2 diesel fuel with 35° API gravity.
    8. Ambient Temperature: 40°C
    9. Regulator
    10. Main breaker shall be rated 200A
    11. Battery: 1-12V, 950 CCA lead acid
    12. Standard of Acceptance: Caterpillar D80-6
  2. Design each unit capable of starting, attaining settled voltage and frequency limits and accepting full rated load within 10 seconds.

## 1.7. SUBMITTALS

1. Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
  1. Dimensions for the complete package generating set in metric and imperial units.
  2. Engine: make, model and rating.
  3. Generator: make, model and rating, motor starting curve, decrement curve, reactances and time constants.
  4. Voltage Regulator: make, model, type.
  5. Engine Electronic Control Module specifications.
  6. Battery: make, type, voltage, capacity.
  7. Charger: make, model, input and output rating.
  8. Generator package control panel specifications.
  9. Schematic and wiring diagrams of engine, generator and control panel.

## 1.8. CLOSEOUT SUBMITTALS

1. Provide operation and maintenance manual in electronic or paper format. Include maintenance schedules.
2. Provide following in English for incorporation into instruction manuals:
  1. Site test data for generator set including:
    1. 4-hour load test form as completed.
    2. Block loading data in graph format showing kW load, Amps, Volts and Hz.
    3. Letter indicating acceptance or deficiencies.

3. Forward an electronic version of data to contractor after completion of commissioning.

### **1.9. WARRANTY**

1. Provide 24-month warranty to cover the complete package generator set.
2. Provide also Platinum level Extended Service Coverage for a total of 60 months with no deductible. The manufacturer shall provide a 5-year warranty on all parts and labour as well as a 5-year service contract with annual service dates.

### **1.10. MAINTENANCE - EXTRA MATERIALS**

1. Provide generator unit with standard set of engine manufacturer's spare parts for the first service interval. Spares to include:
  1. Two fuel filter elements.
  2. Two fuel water separator elements.
  3. Two lubricating oil filter elements.
  4. Two sets of fuses.
  5. One spare oil sample extraction container complete with pre-paid mailer, pre-addressed to the supplier's oil analysis lab.

## **2. Products**

### **2.1. ASSEMBLY**

1. Provide following items plus such other items as necessary to make unit complete.
  1. Diesel Engine.
  2. Diesel Engine Accessories.
  3. Double walled fuel tank base.
  4. Outdoor sound attenuated enclosure.
  5. Vibration isolators.
  6. Electronic engine control.
  7. Engine Exhaust Silencer and Flex Connector.
  8. Engine Cooling System.
  9. Batteries and Rack.
  10. Battery Charger.
  11. Generator and Exciter.
  12. Voltage Regulator and Accessories.

### **2.2. MOUNTING**

1. Complete engine generator package shall be mounted on a common tank base.

### **2.3. DIESEL ENGINE**

1. The heavy-duty diesel engine shall be a product of the same manufacturer as the complete generator set package. The manufacturer shall have a record of at least 10 years in the electric power business. The engine shall have at a minimum:
  1. Certified to EPA Emergency Standby emission level. (Previous Tier 2 and Tier 3 levels.)
  2. Liquid cooled.
  3. After cooler and cooling radiator skid mounted with blower fan.
  4. Control panel mounted on the common skid.
2. Engine with auxiliary starting aids (e.g., glow plug assist start) are not acceptable.
3. Equip engine air intake with dry type heavy duty air cleaners located close to inlet manifold.
  1. Cleaner element: directly replaceable with elements that are readily available from the manufacturer's distributor.
4. Provide engine wiring for AC and DC services.
  1. Use stranded, minimum No.16 AWG with ink marked numbered circuits.
  2. Terminate wiring with coded terminals.
5. Provide personnel safety guards for exposed moving parts and exhaust manifolds.
6. The generator set manufacturer will use an engine of its own manufacture that is commonly used in other machines and applications to insure long term parts availability and serviceability. Engines from a third party will not be allowed.

### **2.4. OUTDOOR SOUND ATTENUATED ENCLOSURE**

1. The complete diesel engine generator set, including generator control panel, engine starting batteries and fuel oil tank, shall be enclosed in a factory assembled, sound attenuated enclosure mounted on the fuel tank base.
2. A weather resistant, sound attenuated enclosure of aluminum with electrostatically applied powder coated baked polyester paint. It shall consist of a roof, side walls, and end walls. Fasteners shall be either zinc plated or stainless steel.
3. Enclosure Sound Attenuation: The enclosure shall have a resulting sound level of 75 dba at a distance of seven (7) meters with the genset running under full load. Acoustical foam shall be provided between all supports and inside doors and sound baffles on air intake and air discharge.
4. Enclosure doors shall open to allow for convenient access to all serviceable components and controls.
5. Cooling air intakes shall be on the sides with air outlet in the roof.

6. The exhaust system shall be completely contained within the enclosure.

## **2.5. LUBRICATION SYSTEM**

1. Provide full pressure lubricating system complete with engine oil sump, oil filters, oil cooler and oil level gauge.
  1. Filter elements to be directly replaceable with elements that are provided by the local engine distributor.
2. Equip engine oil sump with an oil drain plumbed outside the package to permit complete oil drainage in convenient manner.
  1. Provide an oil drain shut off valve at the oil sump to prevent accidental oil draining.

## **2.6. FUEL SYSTEM**

1. Provide complete fuel system including fuel lift pump and filters.
2. Diesel Fuel System:
  1. The fuel system shall be integral with the engine. It shall consist of fuel water separator, high efficiency fuel filter and transfer pump.
  2. The transfer pump shall deliver fuel under low pressure to injection pump.
  3. Fuel injection and timing shall be achieved used hydraulically actuated unit injectors. The engine ECM shall control the fuel timing and volume.
3. Fuel/Water Separator:
  1. The fuel system shall include a primary fuel water separator filter between the fuel tank and transfer pump to screen large contaminants and water.
4. Primary Fuel Filter:
  1. A high efficiency, 2-micron fuel filter shall protect the fuel system from contaminates.
5. Fuel Priming Pump:
  1. A manual fuel-priming pump shall facilitate priming and bleeding air from the system.
6. Fuel System Maintenance:
  1. Filter elements to be directly replaceable with elements that are provided by the local engine distributor.

## **2.7. FUEL SUB BASE TANK**

1. Provide a fuel tank base of designated liter capacity for minimum 30 hours operation at full load, mounted under the generator set skid.
  1. It shall be double wall constructed to ULC-S601.

2. It shall be contained in a rupture basin with 110% capacity.
3. The filler shall be lockable with access from within the enclosure.
4. Include a mechanical reading fuel level gauge, vent and 1 spare connection.
5. Provide low fuel level alarm contact, connected to the genset control system to cause an alarm if the tank level falls below  $\frac{1}{2}$ .
6. Provide fuel leak alarm contact, connected to the genset control system to cause an alarm should the inner tank leak.

## **2.8. EXHAUST SYSTEM**

1. The engine exhaust system shall be installed to discharge combustion gases quickly and silently with minimum restriction. System including silencer shall be designed for minimum restriction, and in no case shall backpressure exceed 6.7 kPa (27 in H<sub>2</sub>O).
2. The exhaust system shall be completely contained within the genset enclosure.

## **2.9. SPEED GOVERNOR**

1. The engine shall be fully electronically control by an electronic engine control module.
  1. Governing system: in accordance with ISO 3046-4.
2. Governor with following features:
  1. Speed adjustable from 59.8 Hz to 60.2 Hz using the genset mounted control panel.
  2. Speed regulation, steady state, no-load to full load and vice versa: +/-0.2 Hz.
  3. Transient peak, no-load to full-load and vice versa: +/-20%.
  4. Recovery time to steady state condition on application of 80% from no load not to exceed three (3) seconds.

## **2.10. STARTING SYSTEM**

1. Provide complete starting system including cranking starting motor, batteries, heavy-duty battery cables and battery charger.
2. Provide positive engaging type cranking motor.
3. Provide 1 or 2 - 12 volt, 950 CCA lead acid batteries as noted. Batteries shall be connected in series and able to crank through 9 consecutive crank cycles.
4. Provide battery rack on the genset package to support batteries.
5. Provide battery charger with 120V AC input and 24 VDC output.
  1. Output shall be 10 amps minimum.
  2. Output voltage ripple: shall be 3% or less.
  3. Battery charger shall have an ammeter.
  4. Charger: CSA approved.

## 2.11. GENERATOR

1. Provide generator, drip proof to IP23, single bearing and close coupled to engine with flex plate coupling.
  1. Generator: full amortisseur winding, direct connected brushless exciter with easily removable bolt-on diodes with surge protection.
2. Maximum deviation of open circuit terminal voltage waveform not to exceed 0.25%.
3. Provide excitation system capable of sustaining short circuit output not less than 2.4 times rated current for 10 seconds.
4. Generator winding insulation: Class H; winding temperature rise not to exceed 150°C as measured by resistance in ambient temperature of 40°C.
5. Provide digital voltage regulation system integrated into genset control system.
  1. The digital voltage regulator shall be microprocessor based with fully programmable operating and protection characteristics. The regulator shall maintain generator output voltage within +/- 0.25% for any constant load between no load and full load. The regulator shall be capable of sensing true RMS in three phases of alternator output voltage, or operating in single phase sensing mode. The voltage regulator shall include a VAR/Pf control feature as standard. The regulator shall provide an adjustable dual slope regulation characteristic in order to optimize voltage and frequency response for site conditions. The voltage regulator shall include standard the capability to provide generator paralleling with reactive droop compensation and reactive differential compensation.
  2. The voltage regulation system shall be integrated into the Generator Control Panel with generator voltage adjustments made via the controller keypad. Additionally, the controller shall allow system parameter setup and monitoring, and provide fault alarm and shutdown information through the controller. A PC-based user interface shall be available to allow viewing and modifying operating parameters in a Windows compatible environment.
6. Provide main generator output circuit breaker.
  1. The circuit breaker shall be isolated from generator set vibration and connected to the generator output.
  2. It shall be 3-pole with and have a solid neutral connection point in the enclosure.
  3. It shall have an interrupting capacity above that of the generator output capacity.
  4. The breaker shall have an electronic trip unit with LS/I functions.
  5. The breaker shall have an interrupting capacity above that of the output society.
  6. The circuit breaker shall have a load side single lug arrangement accepting cable up to 400 MCM. (This varies with breaker size and generator type.)

## 2.12. CONTROL PANEL

1. Provide a fully solid-state, microprocessor based, generator set control. The control panel shall be designed and built by the engine manufacturer. The control shall provide all operating, monitoring, and control functions for the generator set. The control panel shall provide real time digital communications to all engine and regulator controls via SAE J1939. The panels shall be installed in electrical rooms.
2. The following functionality shall be integral to the control panel.
  1. The control shall include a minimum 33 x 132 pixel, 24mm x 95mm, positive image, transfective LCD display with text-based alarm/event descriptions.
  2. Audible horn for alarm and shutdown with horn silence switch
  3. Remote start/stop control
  4. Control function for Run/Off/Auto control integral to system microprocessor
  5. Cooldown timer
  6. Speed adjust
  7. Lamp test
  8. Emergency stop push button
  9. Voltage adjust
  10. Voltage regulator V/Hz slope – adjustable
  11. Password protected system programming
3. The controls shall provide the following digital readouts for the engine and generator. All readings shall be indicated in either metric or English units
  1. Engine oil pressure
  2. Engine coolant temperature
  3. Engine RPM
  4. Battery volts
  5. Engine hours
  6. Engine crank attempt counter
  7. Engine successful start counter
  8. Service maintenance interval
  9. Real time clock
  10. Generator AC volts (Line to Line, Line to Neutral and Average)
  11. Generator AC current (Avg and Per Phase)
  12. Generator AC Frequency
  13. Generator kW (Total and Per Phase)
  14. Generator kVA (Total and Per Phase)
  15. Generator kVAR (Total and Per Phase)
  16. Power Factor (Avg and Per Phase)
  17. Total kW-hr
  18. Total kVAR-hr
  19. % kW
  20. % kVA
  21. % kVAR
  22. Excitation voltage
  23. Excitation current

### **2.13. ENGINE - GENERATOR CONTROLLER**

1. The control shall monitor and provide alarm indication and subsequent shutdown for the following conditions. All alarms and shutdowns are accompanied by a time, date, and engine hour stamp that are stored by the control panel for first and last occurrence:
  1. Low oil pressure alarm/shutdown
  2. High coolant temperature alarm/shutdown
  3. Loss of coolant shutdown
  4. Overspeed shutdown
  5. Overcrank shutdown
  6. Emergency stop shutdown
  7. Low coolant temperature alarm
  8. Low battery voltage alarm
  9. High battery voltage alarm
  10. Control switch not in auto position alarm
  11. Generator over voltage
  12. Generator under voltage
  13. Generator over frequency
  14. Generator under frequency
  15. Generator overcurrent
  16. Loss of excitation alarm/shutdown
  17. Instantaneous over excitation alarm/shutdown
  18. Time over excitation alarm/shutdown
  19. Rotating diode failure
  20. Loss of sensing

### **2.14. INPUTS AND OUTPUTS**

1. Programmable Digital Inputs:
  1. The Controller shall include the ability to accept programmable digital input signals. The signals may be programmed for either high or low activation using programmable Normally Open or Normally Closed contacts.
2. Programmable Relay Outputs:
  1. The control shall include the ability to operate programmable relay output signals, integral to the controller. The output relays shall be rated for 2A @ 30VDC and consist of 2 Form A (Normally Open) contacts.
3. Programmable Discrete Outputs:
  1. The control shall include the ability to operate two (2) discrete outputs, integral to the controller, which are capable of sinking up to 300mA.

**2.15. MAINTENANCE**

1. All engine, voltage regulator, control panel and accessory units shall be accessible through a single electronic service tool. The following maintenance functionality shall be integral to the generator set control
  1. Engine running hours display
  2. Service maintenance interval (running hours or calendar days)
  3. Engine crank attempt counter
  4. Engine successful starts counter
  5. 40 events are stored in control panel memory

**2.16. REMOTE COMMUNICATIONS**

1. Required as indicated in Part 1.7.

**2.17. STANDARD OF ACCEPTANCE**

1. Acceptable manufacturers are Caterpillar, Kohler and Generac. Alternate equipment suppliers will be responsible for any design alterations and their associated costs.
2. Any alternate shall be submitted for approval to the Consulting Engineer at least five (5) working days prior to bid closing.

**2.18. START-UP AND TESTING**

1. Coordinate all start-up and testing activities with the Engineer and Owner. After installation is complete and normal power is available, the manufacturer's local dealer shall perform the following tests without subject the equipment to abnormal conditions.
2. Protection and control; demonstrate the following:
  1. Overheat protection.
  2. Low oil pressure protection.
  3. Cranking cut out.
  4. Overcrank protection (3 tries).
  5. Overspeed protection.
3. Site specific testing.
  1. With generator set control in Auto, remove normal power and record time from normal power off to emergency power on.
  2. Restore normal power and record re-transfer and cool down times.
  3. Load test generator set at full load for 4 continuous hours using a resistive loadbank. Record the following parameters at 30-minute intervals:
    1. Generator voltage on phases A to B, B to C and C to A.
    2. Generator output current on phases A, B and C.
    3. Generator frequency.
    4. Generator output kW.
    5. Engine speed.

6. Engine oil pressure.
7. Engine coolant temperature.
4. Using the manufacturers service tool in its data recording mode, provide colored graphs showing voltage and frequency transient and steady state limits for full load to no load, 3/4 load to no load, 1/2 load to no load, 1/4 load to no load and vice versa.
5. Record battery voltage drop during cranking.
4. After the completion of the load testing, remove a sample of oil from the engine and have it analysed at the generator set supplier's lab. Include the oil sample report with the other test reports to form a baseline of engine ware condition.

### **2.19. TRAINING**

1. Provide on-site training to instruct the owner's personnel in the proper operation and maintenance of the equipment. Review operation and maintenance manuals, parts manuals, and emergency service procedures.

## **3. Execution**

### **3.1. DESCRIPTION**

1. Install diesel/generator package on site and hook up power and control wiring as per drawing.
2. Supply fuel for testing and commissioning. On completion of verification of operation of the emergency power system the fuel tank shall be filled with diesel fuel.
3. Provide to the engineer start-up, commissioning and certification report.

\*\*\*\*\*END OF SECTION\*\*\*\*\*

## **1. General**

### **1.1. GENERAL**

1. The Executed Agreement including General Conditions and Supplementary Conditions, applicable sections of Division 0 and Division 1, Section 26 05 00 - Common Work Results for Electrical, Section 26 05 01 - Electrical Submittals and Section 26 05 02 - Electrical Contract Closeouts, applicable drawings and amendments are part of and to be read in conjunction with this Section

### **1.2. RELATED REQUIREMENTS**

1. Section 26 32 13 - Power Generation Diesel.

### **1.3. REFERENCES**

1. CAN3-C13-M83, Instrument Transformers.
2. CAN3-C17-M84, Alternating-Current Electricity Metering.
3. ANSI/NEMA ICS 2-1988, Industrial Control Devices, Controllers, and Assemblies.

### **1.4. SYSTEM DESCRIPTION**

1. Automatic load transfer equipment to:
  1. Monitor voltage on all phases of normal power supply.
  2. Initiate cranking of standby generator unit on normal power failure or abnormal voltage on any one phase below pre-set adjustable limits for adjustable period of time.
  3. Transfer load from normal supply to standby unit when standby unit reaches rated frequency and voltage pre-set adjustable limits.
  4. Transfer load from standby unit to normal power supply when normal power restored, confirmed by sensing of voltage on all phases above adjustable pre-set limit for adjustable time period.
  5. Shut down standby unit after running unloaded to cool down using adjustable time delay relay.
2. Automatic transfer switch shall be as follows:
  1. 208/120V 3φ 4W 600A ATS shall be ASCO 7000 open Transition and Accessory 48 (Front Entry) or Equal by Kohler, Caterpillar CTG Series or MTU.

### **1.5. SHOP DRAWINGS**

1. Submit shop drawings for the ATS.
2. Submit shop drawings which shall include:

1. Make, model and type.
2. Load classification.
3. Single line diagram showing controls and relays.
4. Description of equipment operation including:
  1. Automatic starting and transfer to standby unit and back to normal power.
  2. Test control.
  3. Manual control.
  4. Automatic shutdown.

#### **1.6. OPERATION AND MAINTENANCE DATA**

1. Provide operation and maintenance data for automatic load transfer equipment for incorporation into Operation and Maintenance Manuals.
2. Detailed instructions to permit effective operation, maintenance and repair.
3. Technical data:
  1. Schematic diagram of components, controls and relays.
  2. Illustrated parts lists with parts catalogue numbers.
  3. Certified copy of factory test results.

#### **1.7. SUBMITTALS**

1. The contractor in this project shall obtain show drawings from Samson Equipment of the generator being supplied for this project and submit as shop drawings to demonstrate coordination of installation, commissioning, testing and verification.

#### **1.8. CLOSEOUT SUBMITTALS**

1. Provide operation and maintenance manual in electronic or paper format. Include maintenance schedules.
2. Provide following in English for incorporation into instruction manuals:
  1. Site test data for generator set including:
    1. 4-hour load test form as completed.
    2. Block loading data in graph format showing kW load, Amps, Volts and Hz.
    3. Letter indicating acceptance or deficiencies.
3. Forward an electronic version of data to contractor after completion of commissioning.

#### **1.9. CODES AND STANDARDS**

1. The automatic transfer switches and controls shall conform to the requirements of:
  1. UL 1008 - Standard for Transfer Switch Equipment.

2. IEC 947-6-1 Low-voltage Switchgear and Control gear; Multifunction equipment; Automatic Transfer Switching Equipment.
3. CSA C22.1-2018 - Canadian Electrical Code.
4. NFPA 110 - Emergency and Standby Power Systems.
5. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
6. NEMA Standard ICS10-1993 (formerly ICS2-447) - AC Automatic Transfer Switches.
7. UL 508 Industrial Control Equipment.
8. National Building Code of Canada (2015) seismic requirements for a post disaster building.

#### **1.10. ACCEPTABLE MANUFACTURERS**

1. Automatic transfer & bypass – isolation shall be ASCO 7000 Series or Equal by Kohler Model KGS. Request for Alternates shall be submitted for approval to the consulting Engineer in accordance with Division 00 – Instruction to bidders.

## **2. Products**

### **2.1. MECHANICALLY HELD TRANSFER SWITCH**

1. The transfer switch shall be electrically operated and mechanically held. The electrical operator shall be a momentarily energized, single-solenoid mechanism. Main operators which include overcurrent disconnect devices, linear motors or gears shall not be acceptable. The switch shall be mechanically interlocked to ensure only two possible positions, normal or emergency.
2. All transfer switch sizes shall use only one type of main operator for ease of maintenance and commonality of parts.
3. The switch shall be positively locked and unaffected by momentary outages, so that contact pressure is maintained at a constant value and contact temperature rise is minimized for maximum reliability and operating life.
4. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction for high withstand and close-on capability and be protected by separate arcing contacts.
5. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. Switches rated 600 amps and higher shall have front removable and replaceable contacts. All stationary and moveable contacts shall be replaceable without removing power conductors and/or bus bars.

6. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof, which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.
7. Where neutral conductors must be switched, the AS shall be provided with fully rated overlapping neutral transfer contacts. The neutrals of the normal and emergency power sources shall be connected together only during the transfer and retransfer operation and remain connected together until power source contacts close on the source to which the transfer is being made. The overlapping neutral contacts shall not overlap for a period greater than 100 milliseconds. Neutral switching contacts which do not overlap are not acceptable.
8. Where neutral conductors are to be solidly connected, a neutral conductor plate with fully rated AL-CU pressure connectors shall be provided.
9. Seismic support to be built-in to frame of unit.

## 2.2. MICROPROCESSOR CONTROLLER

1. The controller's sensing and logic shall be provided by a single built-in microprocessor for maximum reliability, minimum maintenance, and the ability to communicate serially through an optional serial communication module.
2. A single controller shall provide twelve selectable nominal voltages for maximum application flexibility and minimal spare part requirements. Voltage sensing shall be true RMS type and shall be accurate to  $\pm 1\%$  of nominal voltage. Frequency sensing shall be accurate to  $\pm 0.2\%$ . The panel shall be capable of operating over a temperature range of -20 to +60 degrees C and storage from -55 to +85 degrees C.
3. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance. Sensing and control logic shall be provided on multilayer printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers. The panel shall be enclosed with a protective cover and be mounted separately from the transfer switch unit for safety and ease of maintenance. The protective cover shall include a built-in pocket for storage of the operator's manuals.
4. All customer connections shall be wired to a common terminal block to simplify field-wiring connections.
5. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:
  1. EN 55011:1991 Emission standard - Group 1, Class A
  2. EN 50082-2:1995 Generic immunity standard, from which:
    1. EN 61000-4-2:1995 Electrostatic discharge (ESD) immunity
    2. ENV 50140:1993 Radiated Electro-Magnetic field immunity

3. EN 61000-4-4:1995 Electrical fast transient (EFT) immunity
4. EN 61000-4-5:1995 Surge transient immunity
5. EN 61000-4-6:1996 Conducted Radio-Frequency field immunity
3. IEEE472 (ANSI C37.90A) Ring Wave Test.

### 2.3. ENCLOSURE

1. The ATS/BPS shall be furnished in a Type 1 enclosure unless otherwise shown on the plans. The ATS shall have conduit and cables enter from the side.
2. All standard and optional door-mounted switches and pilot lights shall be 16-mm industrial grade type or equivalent for easy viewing & replacement. Door controls shall be provided on a separate removable plate, which can be supplied loose for open type units.
3. Enclosure shall have bracing and mounting points that meet the Seismic requirements for a National Building Code of Canada (2015) post disaster building designation.

## 3. Operation

### 3.1. CONTROLLER DISPLAY AND KEYPAD

1. A four line, 20-character LCD display and keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through the serial communications input port. The following parameters shall only be adjustable via DIP switches on the controller:
  1. Nominal line voltage and frequency
  2. Single or three phase sensing
  3. Operating parameter protection
  4. Transfer operating mode configuration (Open transition, Closed transition or Delayed transition)
2. All instructions and controller settings shall be easily accessible, readable and accomplished without the use of codes, calculations, or instruction manuals.

### 3.2. VOLTAGE, FREQUENCY AND PHASE ROTATION SENSING

1. Voltage and frequency on both the normal and emergency sources (as noted below) shall be continuously monitored, with the following pickup, dropout and trip setting capabilities (values shown as % of nominal unless otherwise specified):

<u>Parameter</u>	<u>Sources</u>	<u>Dropout/Trip</u>	<u>Pickup/Reset</u>
Undervoltage	N&E,3f	70 to 98%	85 to 100%

Overvoltage	N&E, 3f102 to 115%	2% below trip underfrequency	N&E	85 to 98%	90 to 100%
Overfrequency	N&E	102 to 110%		2% below trip	
Voltage unbalance	N&E	5 to 20%		1% below dropout	

2. Repetitive accuracy of all settings shall be within  $\pm 0.5\%$  over an operating temperature range of  $-20^{\circ}\text{C}$  to  $60^{\circ}\text{C}$ .
3. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via serial communications port access.
4. The controller shall be capable (when activated by the keypad or through the serial port) of sensing the phase rotation of both the normal and emergency sources. The source shall be considered unacceptable if the phase rotation is not the preferred rotation selected (ABC or CBA).
5. Source status screens shall be provided for both normal & emergency to provide digital readout of voltage on all 3 phases, frequency, and phase rotation.

### 3.3. TIME DELAYS

1. An adjustable time delay of 0 to 6 seconds shall be provided to override momentary normal source outages and delay all transfer and engine starting signals. Capability shall be provided to extend this time delay to 60 minutes by providing an external 24 VDC power supply.
2. A time delay shall be provided on transfer to emergency, adjustable from 0 to 60 minutes, for controlled timing of transfer of loads to emergency.
3. Two time-delay modes (which are independently adjustable) shall be provided on re-transfer to normal. One time-delay shall be for actual normal power failures and the other for the test mode function. The time delays shall be adjustable from 0 to 60 minutes. Time delay shall be automatically bypassed if the emergency source fails and the normal source is acceptable.
4. A time delay shall be provided on shut down of engine generator for cool down, adjustable from 0 to 60 minutes.
5. A time delay activated output signal shall also be provided to drive an external relay(s) for selective load disconnect control. The controller shall have the ability to activate an adjustable 0 to 5-minute time delay in any of the following modes:
  1. Prior to transfer only.
  2. Prior to and after transfer.
  3. Normal to emergency only.

4. Emergency to normal only.
  5. Normal to emergency and emergency to normal.
  6. All transfer conditions or only when both sources are available.
6. The controller shall also include the following built-in time delays for optional Closed Transition and Delayed Transition operation:
    1. 1 to 5-minute time delay on failure to synchronize normal and emergency sources prior to closed transition transfer.
    2. 0.1 to 9.99 second time delay on an extended parallel condition of both power sources during closed transition operation.
    3. 0 to 5-minute time delay for the load disconnect position for delayed transition operation.
  7. All time delays shall be adjustable in 1 second increments, except the extended parallel time, which shall be adjustable in .01 second increments.
  8. All time delays shall be adjustable by using the LCD display and keypad or with a remote device connected to the serial communications port.

#### **3.4. WITHSTAND AND CLOSING RATINGS**

1. The ATS/BPS shall be rated to close on and withstand the available RMS symmetrical short-circuit current at the ATS/BPS terminals with the type of overcurrent protection shown on the plans.
2. The ATS/BPS shall be UL listed in accordance with UL 1008 and be labeled in accordance with that standard's 1½ and 3 cycle, long-time ratings. ATS/BPSs which are not tested and labeled with 1½ and 3 cycle (any breaker) ratings and have series, or specific breaker ratings only, are not acceptable.

#### **3.5. ADDITIONAL FEATURES**

1. A three-position momentary-type test switch shall be provided for the *test / automatic / reset* modes. The test position will simulate a normal source failure. The reset position shall bypass the time delays on either transfer to emergency or retransfer to normal.
2. A SPDT contact, rated 5 amps at 30 VDC, shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred.
3. Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of one contact, closed when the ATS is connected to the normal source and one contact closed, when the ATS is connected to the emergency source.

4. LED indicating lights (16 mm industrial grade, type 12) shall be provided; one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red).
5. LED indicating lights (16 mm industrial grade, type 12) shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal and emergency sources, as determined by the voltage sensing trip and reset settings for each source.

**The following features shall be built-in to the controller, but capable of being activated through keypad programming or the serial port only when required by the user:**

1. Provide the ability to select “commit/no commit to transfer” to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.
2. Terminals shall be provided for a remote contact which opens to signal the ATS to transfer to emergency and for remote contacts which open to inhibit transfer to emergency and/or retransfer to normal. Both of these inhibit signals can be activated through the keypad or serial port.
3. An Inphase monitor shall be provided in the controller. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The Inphase monitor shall be specifically designed for and be the product of the ATS manufacturer. The Inphase monitor shall be equal to ASCO Feature 27.
4. The controller shall be capable of accepting a normally open contact that will allow the transfer switch to function in a non-automatic mode using an external control device.
5. **Engine Exerciser** - The controller shall provide an internal engine exerciser. The engine exerciser shall allow the user to program up to seven different exercise routines. For each routine, the user shall be able to:
  1. Enable or disable the routine.
  2. Enable or disable transfer of the load during routine.
  3. Set the start time:
    - time of day
    - day of week
    - week of month (1st, 2nd, 3rd, 4th, alternate or every)
  4. Set the duration of the run.

At the end of the specified duration the switch shall transfer the load back to normal and run the generator for the specified cool down period. A 10-year life battery that supplies power to the real time clock in the event of a power loss will maintain all time and date information.

6. **System Status** - The controller LCD display shall include a “System Status” screen which shall be readily accessible from any point in the menu by depressing the “ESC” key a maximum of two times. This screen shall display a clear description of the active operating sequence and switch position. For example:

***Normal Failed  
Load on Normal  
TD Normal to Emerg  
2min15s***

Controllers that require multiple screens to determine system status or display “coded” system status messages, which must be explained by references in the operator’s manual, are not permissible.

7. **Self Diagnostics** - The controller shall contain a diagnostic screen for the purpose of detecting system errors. This screen shall provide information on the status input signals to the controller which may be preventing load transfer commands from being completed.

#### **4. Additional Requirements**

##### **4.1. WARRANTY**

1. The manufacturer shall provide a 5-year/2000-hour warranty on all parts and labour on the automatic transfer switch as well as travel to the site. A standard 5-year service contract shall be provided.
2. Provide a standard five-year service contract, the cost of this contract is to be included with the supply and installation of this equipment. The service contract shall include (but not be limited to) the semi-annual, annual and five-year inspection test and maintenance requirements of the CSA C282.

##### **4.2. TESTS AND CERTIFICATION**

1. The contractor is responsible for all fees and the scope of work to obtain a third-party commissioning agent for the purposes of compliance with the ULC S1001 standard for integrated systems testing of fire protection and life safety systems.
2. The complete ATS/BPS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.
3. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.
4. The ATS/BPS manufacturer shall be certified to ISO 9001 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation and servicing in accordance with ISO 9001.

#### **4.3. SERVICE REPRESENTATION**

1. The ATS/BPS manufacturer shall maintain a national service organization of company-employed personnel located throughout the contiguous Canada. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.
2. The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years.

### **5. Optional Features (Included)**

#### **5.1. DATA MONITOR**

1. Furnish data monitors at locations shown to monitor all functions specified below.
2. The Data Monitors shall be listed to UL 3111-1, CSA, CE Mark, and industrially rated for an operating temperature range of -20°C to 60°C.
3. The Data Monitor shall be accurate to 1% measured, 2% computed values and display resolution to .1%. Voltage and current for all phases shall be sampled simultaneously to assure high accuracy in conditions of low power factor or large waveform distortions (harmonics).
4. The Data Monitor shall be capable of operating without modification at nominal frequencies of 45 to 66 Hz and over a control power input range of 20 – 32VDC.
5. Each Data Monitor shall be capable of interfacing with an optional communication module to permit information to be sent to central location for display, analysis, and logging.
6. The Data Monitor shall accept inputs from industry standard instrument trans-formers (120 VAC secondary PT's and 5A secondary CTS.) Direct phase voltage connections, 600 VAC and under, shall be possible without the use of PT's.
7. The Data Monitor shall be applied in single, 3-phase, or three & four wire circuits. A fourth CT input shall be available to measure neutral or ground current.
8. All setup parameters required by the Data Monitors shall be stored in non-volatile memory and retained in the event of a control power interruption.
9. The following metered readings shall be communicated by the Data Monitor, via serial communication, when equipped with optional serial communications module:
  1. Currents and voltage for metered readings information:
    1. Current, per phase RMS and neutral (if applicable)
    2. Current Unbalance %

3. Voltage, phase-to-phase and phase-to-neutral
  4. Voltage Unbalance %
  5. Real power (KW), per phase and 3-phase total
  6. Apparent power (KVA), per phase and 3-phase total
  7. Reactive power (KVAR), per phase and 3-phase total
  8. Power factor, 3-phase total & per phase
  9. Frequency
  10. Accumulated Energy, (MWH, MVAH, and MVARH)
2. The following energy readings shall be communicated by the Data Monitor:
    1. Accumulated real energy KWH
    2. Accumulated reactive energy KVAH
    3. Accumulated apparent energy KVARH

NOTE: For real and reactive energy reported values, separate total for energy flow from each source shall be stored, including the arithmetic sum.

10. Data Monitor Input/Output Options.
  1. Data Monitors shall be equipped with the following I/O:
    1. Provide (8) solid state status inputs.
    2. Provide four (4) relay output contacts

\*\*\*\*\*END OF SECTION\*\*\*\*\*

## 1. General

### 1.1. GENERAL

1. The Executed Agreement including General Conditions and Supplementary Conditions, applicable sections of Division 00 and Division 01, Section 26 05 00 - Common Work Results for Electrical, Section 26 05 01 - Electrical Submittals and Section 26 05 02 - Electrical Contract Closeouts, applicable drawings and amendments are part of and to be read in conjunction with this Section.

### 1.2. REFERENCES

1. American National Standards Institute (ANSI)
  1. American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
    1. ANSI/IEEE C62.41-1991, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
2. Canadian Standards Association (CSA International)
3. Underwriters' Laboratories of Canada (ULC).
4. Illuminating Engineering Society (IES).
  1. The Lighting Handbook Tenth Edition
  2. IES TM-21-11, Projecting Long Term Lumen Maintenance of LED Light Sources
  3. IES LM-79-08, Approved Methods: Electrical and Photometric Measurements of Solid-State Lighting Products
  4. IES-LM-80-08, Approved Methods: Measuring Lumen Maintenance of LED Light Sources

### 1.3. SUBMITTALS

1. Submit product data in accordance with Section 26 05 01 - Electrical Submittals.
2. Shop drawings submission to include:
  1. Layout of equipment.
  2. Complete **PROJECT SPECIFIC** Wiring Diagrams and documentation. Include the following as part of the shop drawings:
    1. Provide manufacturer's product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations in the digital PDF format.
    2. Provide complete photometric data prepared by independent testing laboratory for luminaires where specified.
  3. Provide PDF copy of an operational and maintenance manual for all products being supplied.

3. Submit close out documents in accordance with Section 26 05 02 - Electrical Contract Closeouts.
4. Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual. Operation and maintenance data to include:
  1. Operation instructions.
  2. Description of system operation.
  3. Description of each subsystem operation.
  4. List showing each piece of equipment in system or subsystem by its original manufacturer name and model number.
  5. Part list showing parts used in equipment by identification numbers that are standard to electronics industry.

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

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

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

1. Separate and recycle waste materials.
2. Remove from site and dispose of packaging materials at appropriate recycling facilities.
3. Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
4. Divert unused metal and wiring materials from landfill to metal recycling facility

## **2. Products**

### **2.1. LUMINAIRES**

1. Manufactured specifically for LED light source, unless noted otherwise.
2. Hinged, latched steel door frame c/w mechanical light leak seals or gaskets.

3. Minimum lens thickness of 3.17 mm (0.125 inch) at thinnest part of lens.
4. Provided with high performance drivers and lamps, as recognized by DLC.
5. The complete luminaire assembly shall have a maximum lumen depreciation of 70% of initial lumens over 50,000 hours based under IES TM-21-11 testing conditions at an ambient temperature of 25 degrees Celsius.
6. Refer to electrical legend.

## **2.2. CHIP AND BOARD ASSEMBLY**

1. LED Chip.
  1. LED chips are to be binned to a maximum of 4 step MacAdam ellipse.
  2. Wattage Lumens Life (hrs.)
2. LED Chip and Board Manufacture
  1. Provide RoHS compliant components. Supply test results from a recognized environmental lab with the shop drawings for the luminaires.
  2. Extended life lamps for all linear lamps.
  3. Standard of Acceptance:
    1. LED chips shall be manufactured by Cree as follows:
3. Acceptable manufactures, to the requirements listed above:
  1. Nichia
  2. Osram
  3. Philips

## **2.3. DRIVER**

1. LED drivers (Dimming): CSA and CBM certified, small can energy efficient electronic type, as follows:
  1. Rating: 120 V or 347 V, 60 Hz, instant start type as directed on the accompanying documentation.
  2. Totally encased and designed for 40°C ambient temperature.
  3. Input watts: as per drawings
  4. Total Harmonic Distortion: less than 15%.
  5. Minimum Starting Temperature: -10 degrees C, unless noted otherwise.
2. Mounting: integral with luminaire.
  1. Acceptable manufactures, to the requirements listed above:
    1. Lutron
    2. EldoLED
    3. Philips
    4. Osram
    5. Universal

## 2.4. FINISHES

1. Polyester powder finish:
  1. Conditioning of metal before painting:
    1. For corrosion resistance conversion coating to CGSB 31-GP-103Ma.
    2. For paint base, conversion coating to CGSB 31-GP-105 Ma, CGSB 31-GP-106M.
  2. Metal surfaces of luminaire housing and reflectors finished with baked white polyester powder enamel to give smooth, uniform appearance, free from pinholes or defects.
  3. Surfaces finished as follows:
    1. White, minimum reflection factor 90%.
    2. Colour fastness: yellowness factor not above 0.02 and after 250 h exposure in Atlas fade-ometer not to exceed 0.05.
    3. Film thickness, not less than 0.03 mm average and in no areas less than 0.025 mm.
    4. Gloss not less than 80 units as measured with Gardner 60° gloss meter.
    5. Flexibility: withstand bending over 12 mm mandrel without showing signs of cracking or flaking under 10 times magnification.
    6. Adhesion: 24 mm square lattice made of 3 mm squares cut through film to metal with sharp razor blade. Adhesive cellulose tape applied over lattice and pulled. Adhesion satisfactory if no coating removed.
2. Alzak finish:
  1. Aluminum sheet fabricated from special aluminum alloys and chemically brightened, subsequently anodically treated to specifications established by Alcoa, to produce:
    1. Finish for mild commercial service, minimum density of coating 7.8 g/m<sup>2</sup>, minimum reflectivity 83% for specular, 80.5% for semi-specular and 75% for diffuse.
    2. Finish for regular industrial service, minimum density of coating 14.8 g/m<sup>2</sup>, minimum reflectivity 82% for specular and 73% for diffuse.
    3. Finish for heavy duty service, minimum density of coating 21.8 g/m<sup>2</sup>, minimum reflectivity 85% for specular, 65% for diffuse.

## 3. Execution

### 3.1. INSTALLATION

1. Locate and install luminaires as indicated.

### 3.2. WIRING

1. Connect luminaries to lighting circuits.

2. Install separate #12 RW90 bonding conductor in fixture raceways when fixtures are continuously mounted in rows.
3. Provide a separate neutral conductor for all lighting circuits.

### **3.3. LUMINAIRE SUPPORT**

1. For suspended ceiling installations support luminaires from ceiling grid. Additional ceiling suspension hangers are to be supplied and installed by Division 9. Hangers are to be installed within 150 mm of each corner of the fixture.

### **3.4. LUMINAIRE ALIGNMENT**

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

### **3.5. WARRANTY**

1. All luminaires are required to be supplied with a complete assembly certified for use in Canada by a certifying agent approved by the authority having jurisdiction.
  1. The manufacturer shall warrant the complete assembly including chips, boards, drivers, housing and len(s) as follows:
    1. All components are to be RoHS compliant and free from defects in material and workmanship and to operate from the date of Substantial Performance for a minimum period of 36 months. If the components fail within this time frame, the manufacturer shall supply a replacement component, at no charge.
    2. Driver to be RoHS compliant and free from defects in material and workmanship and to operate from the date of Substantial Performance for a period of 60 months. If the ballast fails within this time frame, the manufacturer shall supply replacement ballast, at no charge.

### **3.6. COMMISSIONING**

1. Carry out the commissioning in conformance with Section 26 91 13 - Testing and Verification.
2. The project's third-party commissioning agent will commence a Functional Performance Testing Program independent of other processes specified, upon receipt of written verification from the General Contractor for the purposes of LEED compliance.

\*\*\*\*\*END OF SECTION\*\*\*\*\*

## **1. General**

### **1.1. GENERAL**

1. The Executed Agreement including General Conditions and Supplementary Conditions, applicable sections of Division 00 and Division 01, Section 26 05 00 - Common Work Results for Electrical, Section 26 05 01 - Electrical Submittals and Section 26 05 02 - Electrical Contract Closeouts, applicable drawings and amendments are part of and to be read in conjunction with this Section.

### **1.2. RELATED SECTIONS**

1. Section 26 50 00 - Lighting Equipment.

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

1. Separate and recycle waste materials.
2. Remove from site and dispose of packaging materials at appropriate recycling facilities.
3. Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
4. Divert unused metal and wiring materials from landfill to metal recycling facility.

### **1.4. REFERENCES**

1. Canadian Standards Association CSA C22.2 No. 141.

### **1.5. SUBMITTALS**

1. Submit product data in accordance with Section 26 05 01 - Electrical Submittals.

## **2. Products**

### **2.1. EQUIPMENT**

1. Supply voltage: 120 VAC, as indicated.
2. Output voltage: 12 VDC.
3. Operating time as indicated, but in no case less than 30 min.
4. Battery: sealed, lead acid, maintenance free.

5. Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations.
6. Solid state transfer circuit.
7. Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.
8. Signal lights: solid state, for 'AC Power ON'.
9. Lamp Type: 4 Watt LED.
10. Heavy duty steel housing, c/w corrosion resistant undercoating.
11. Automatic self-diagnostic circuitry and test feature, c/w the following features:
  1. Microprocessor based.
  2. Monitors lamps, battery and circuitry.
  3. Internally simulated weekly functionality test.
  4. Multicolour LED visual display (Red, Yellow & Green).
12. Auxiliary equipment:
  1. Test switch.
13. Remote heads to be 12-volt, 4-Watt LED, unless indicated otherwise.

## **2.2. WIRING OF REMOTE HEADS**

1. Conductors: RW90 type to Section 26 05 21 - Wires and Cables 0-1000 V.
2. Conduit: type EMT, to Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

## **2.3. EQUIPMENT IDENTIFICATION**

1. Provide equipment identification in accordance with Section 26 05 03 - Electrical Identification.

## **2.4. STANDARD OF ACCEPTANCE**

1. Stanpro "SLA" Series Cat #SLA-12-036-25-4LR-AT for surface mount units, SLSOR Series for T-bar mount, each c/w 4-Watt LED lamps and wire guards where indicated.
2. Stanpro "N" Series Cat #N2-12-2LED-06V-4W NEMA 1 c/w two 4-Watt LED lamps for remote heads for surface mounting.

## **2.5. ACCEPTABLE MANUFACTURERS TO THE REQUIREMENTS ABOVE**

1. Emergilite
2. 1 Lite
3. Stanpro
4. Aimlite
5. Beghelli

## **3. Execution**

### **3.1. INSTALLATION**

1. Ceiling mount units where indicated.
2. Provide individual fixture chain supports on both ends of each ceiling mounted battery unit. The weight of each battery unit is not to be supported by the ceiling grid.
3. Install remote heads in suspended ceilings using bar hangers. Provide additional support such that the remote heads are rigidly held in place and cannot be moved or turned.
4. Install unit equipment and remote mounted fixtures.
5. Direct heads.
6. Where multiple DC feeds originate from a battery pack, install one feed from the battery pack to a suitably sized junction box. Feed multiple feeds from the junction box.
7. Provide and post instructions for the operation and care of the emergency battery units and testing interval, in conformance with CEC Rule 46-102.
8. Provide identification as per Section 26 05 03 - Electrical Identification.

### **3.2. WARRANTY**

1. For batteries, the 12-month warranty period is extended to 10 years.

### **3.3. COMMISSIONING**

1. Carry out the commissioning in conformance with Section 26 91 13 - Testing and Verification.

2. The contactor is responsible for all fees and the scope of work to obtain a third-party commissioning agent for the purposes of compliance with the ULC S1001 standard for integrated systems testing of fire protection and life safety systems.

**\*\*\*\*\*END OF SECTION\*\*\*\*\***

## **1. General**

### **1.1. GENERAL**

1. The Executed Agreement including General Conditions and Supplementary Conditions, applicable sections of Division 00 and Division 01, Section 26 05 00 - Common Work Results for Electrical, Section 26 05 01 - Electrical Submittals and Section 26 05 02 - Electrical Contract Closeouts, applicable drawings and amendments are part of and to be read in conjunction with this Section
2. The verification of all electrical systems installed on this project is the responsibility of the Electrical Contractor. Manufactured systems or components shall be commissioned by factory trained technicians representing the manufacturer, in the presence of the Owner's designated representatives, and under the direction of the electrical contractor.
3. The electrical contractor will aid the Owner's representatives and ensure that the manufacturer's representative is on site during functional performance testing (FPT).
4. Tests shall be performed by qualified electricians or technicians as required by the nature and complexity of the test.
5. The correction of all electrical deficiencies identified throughout the project associated with this work shall be a condition of Substantial Performance and shall be corrected prior to achieving Substantial Performance.
6. The contractor is responsible for all fees and the scope of work to obtain a third-party commissioning agent for the purposes of compliance with the ULC S1001 standard for integrated systems testing of fire protection and life safety systems.

### **1.2. RELATED WORK**

1. General requirements: Division 01.

### **1.3. SCOPE**

1. Systems verifications are called for throughout the individual specifications, however, this does not relieve this section from providing all testing and verification necessary to ensure that systems and equipment operate as required and that they interface with other systems and equipment as required.

### **1.4. QUALITY ASSURANCE**

1. The Electrical Contractor is responsible for quality assurance and whenever necessary, to ensure compliance with operating requirements, CSA, these contract documents, the Authority having Jurisdiction and other requirements and codes as applicable.

### **1.5. CONTRACTOR'S RESPONSIBILITIES**

1. Prepare each system for testing and verification.
2. Coordinate the efforts of testing and verification.
3. Provide personnel, operate systems at designated times, and under conditions required for proper testing and adjusting.
4. Provide all necessary test and calibration equipment, temporary facilities, meters, sensors, load banks, etc. necessary to simulate and verify correct operating conditions.
5. Coordinate and pay for all costs associated with testing and verification, including but not limited to costs for: travel, labour, equipment, testing agencies, manufacturers, testing and any other costs incurred to test and verify equipment and systems.
6. Make test instruments available to Engineer to facilitate spot checks during testing.
7. Retain possession of test instruments and remove at completion of services.
8. Verify system installation is complete and in continuous operation.
9. Where systems or equipment do not operate as required, make the necessary corrections or modifications, re-test and re-commission.

### **1.6. SUBMITTALS**

1. The Contractor shall submit the following documentation prior to FPT:
  1. Record drawings.
  2. Operations and maintenance manuals.
  3. A letter of acceptance from the local inspection authority. A copy is to be included in the operations and maintenance manuals.
  4. A letter of guarantee. A copy is to be included in the operations and maintenance manuals.
  5. Copies of the following test results (A copy is to be included in the operations and maintenance manuals):
    1. Insulation/megger tests.
    2. Commissioning and/or Certification Report from the manufacturer for the following systems (A copy is to be included in the operations and maintenance manuals).
    3. Completed verification forms included with this section. When there are multiples of referenced equipment, devices or systems, electrical contractor is responsible for obtaining a suitable number of forms to complete the verification process for the entire project.

### **1.7. INSTRUCTION OF OWNER'S STAFF**

1. Provide the following:
  1. Necessary instruction of equipment and systems operation to Owner's staff.
    1. At least 72 hours' advance notifications in writing.
    2. Provision of factory trained technicians where necessary.
    3. Provision of presentation with the use of as-built drawings and data books required in other sections of these specifications.
  2. Conduct presentation on project premises.

### **1.8. FUNCTIONAL PERFORMANCE TESTING (FPT)**

1. The project's third-party commissioning agent will commence a Functional Performance Testing Program independent of other processes specified, upon receipt of written verification from the General Contractor for the purposes of LEED compliance. During this program, for a period of not more than 4 working days, a project's third-party commissioning agent team will verify the operation of all LEED related systems. The FPT process may involve real or simulated conditions to determine the systems full operational capabilities. Copies of all specified reports and documents are to be made available to the site during the period. During the FPT process, the Electrical Contractor will provide within 48 hours' notice, the following:
  1. An onsite representative familiar with all aspects of the work to assist with coordination of trades during FPT as needed.
  2. A full time onsite senior electrical or technical representative for each building system to assist with the FPT of systems and equipment.
  3. Equipment manufacturer's technical representatives shall be available for onsite and telephone consultation from time to time as required throughout the FPT.
  4. All tools and test equipment required to operate the systems in real or simulated mode.
2. The contractor is responsible for all fees and the scope of work to obtain a third-party commissioning agent for the purposes of compliance with the ULC S1001 standard for integrated systems testing of fire protection and life safety systems. This contractor's third-party commissioning agent shall test all fire protections and life safety system for coordination and onsite compliance.
3. Beyond the LEED and ULC S1001 compliance FTP process the contractor is responsible for completing system specific onsite functional performance testing to ensure the following:
  1. All systems are complete and operational in all respects.
  2. All specified reports and documents have been submitted and approved.
  3. All tests, commissioning and start-up processes described elsewhere in the specification are complete.
  4. All demonstrations have been completed and documented.
  5. All defects and deficiencies identified during the commissioning of all electrical systems have been corrected.

6. Provide documentation to be included in the O&M manual to demonstrate the functional status of each system at the time of the projects Substantial Completion.
4. FPT shall be performed on all electrical systems referenced in the contract documents, which may include, but not be limited to, the following:
  1. Power Distribution System.
  2. Emergency Power Generation
  3. Lighting and Lighting Control System
  4. Emergency and Exit Lighting System
  5. Structured Cabling and Communications Systems
  6. Public Address and Mass Notification System
  7. Door Entry System
  8. Situational Awareness Response Assistant System
  9. CCTV Video Surveillance System
  10. Fire Alarm System
5. Deficiencies or discrepancies discovered during the FPT process are to be immediately rectified by the Electrical Contractor. A condition of Substantial Performance shall be the correction of all electrical deficiencies identified throughout the project associated with this work. The Electrical Contractor shall also provide exceptional arrangements for labor and materials required to correct deficiencies which prevent the satisfactory completion of the FPT process.

## **1.9. FINAL REPORT**

1. Assemble all testing data and verification reports and submit them to the Engineer.
2. Each form shall bear signature of recorder, date of test, and all relevant information in clear and legible form.
3. Identify each instrument used, and latest date of calibration of each.
4. Include written confirmation by Owner's representatives that all verification, testing, instruction, and demonstrations have been completed to the Owner's satisfaction.

## **2. Products N/A**

## **3. Execution**

### **3.1. INSULATION RESISTANCE TESTING**

1. Megger circuits, feeders, and equipment up to 350V with a 500V instrument.
2. Check resistance to ground before terminating cables and wires.

### **3.2. VERIFICATION TESTS AND FORMS**

1. Perform tests as required to properly complete the verification forms included in this section.
2. Deficiencies or discrepancies discovered during this process are to be immediately rectified by the Electrical Contractor. The Electrical Contractor shall provide exceptional arrangements for labor and materials as may be required to correct these deficiencies.

**\*\*\*\*\*END OF SECTION\*\*\*\*\***

## 1. General

### 1.1. GENERAL

1. The Executed Agreement, including all Bidding and Contract Requirements, Sections, Division 01, Specification Sections, applicable Drawings and Amendments are part of, and to be read in conjunction with this Section.

### 1.2. SUMMARY

1. This specification provides the functional requirements for the addition of new fire alarm devices to existing fire alarm system.
2. The Contractor shall furnish all labor, services and materials necessary to provide and install a complete, functional life safety fire system. The System shall comply in respects with all pertinent codes, rules, regulations and laws of the local Authority Having Jurisdiction. The System shall comply in all respects with the requirements of these specifications, manufacturer's recommendations and Underwriters Laboratories Canada (ULC) listings.
3. This Fire Alarm System Specification must be conformed to, in its entirety to ensure that the installed and programmed Life Safety System will function as designed and will accommodate the future requirements and operations required by the building owner. All specified operational features must be met without exception.
4. It is further intended that upon completion of this work, the Owner be provided with: Complete information and drawings describing and depicting the entire system(s) as installed, including all information necessary for maintaining, troubleshooting, and/or expanding the system at a future date.
5. The system shall include, but not be limited to:
  1. Addition of new fire alarm devices to existing system.
  2. Tie in of new emergency generator to existing fire alarm system.
6. Related Sections:
  1. Division 26 - Electrical.

### 1.3. REFERENCES

1. The equipment and installation shall comply with the current provisions of the following standards and codes:
  1. Underwriters Laboratories Inc. Standards:
    1. ULC shall list the system and all components for use in fire protective signaling systems. The ULC Label shall be considered as evidence of compliance with this requirement. The equipment shall be listed by ULC under the following standards as applicable:
      1. CAN/ULC-S527 Control Units for Fire Alarm Systems.

2. CAN/ULC-S525 Audible Signal Appliances for Fire Alarm Systems.
  3. CAN/ULC-S536 Inspection and Testing of Fire Alarm Systems.
  4. CAN/ULC-S524 Installation of Fire Alarm Systems.
  5. CAN/ULC-S537 Verification of Fire Alarm Systems.
  2. Any equipment not bearing a ULC Label shall be removed and replaced with compatible ULC labeled equipment at the contractor's expense.
2. Canadian Electrical Code (CEC).
  3. National, Provincial and Local Building Codes.
  4. International Standards Organization.
  5. The system and all components will be manufactured to ISO 9001 international Quality Management and Quality Assurance Standards.
  6. In the case of any discrepancy between these specifications, the project drawings, and any applicable local codes, the installed Fire Alarm shall comply with the most stringent requirement.

#### **1.4. DEFINITIONS/ABBREVIATIONS**

1. AFF: Above Finished Floor.
2. AHJ: Authority Having Jurisdiction.
3. Approved: Unless otherwise stated, materials, equipment or submittals approved by the Authority or AHJ.
4. Circuit: Wire path from a group of devices or appliances to a control panel or transponder.
5. Class A Circuit: (Return Loop Circuit) – A circuit having one continuous path connecting all components on the circuit and terminating through an alternate connection path in the source enclosure.
6. Class B Circuit: (Terminated Circuit) – A circuit having one continuous path connecting all devices on the circuit and terminating at an end-of-line device.
7. CPU: The central computer of a multiplex fire alarm or voice command control system.
8. Data Communications Link (DCL): The data channel between the control units, annunciators, active field devices and supporting field devices of a distributed type system.

9. FACP: Fire Alarm Control Panel.
10. HVAC: Heating Ventilating and Air Conditioning.
11. IDC: Initiating Device Circuit.
12. LED: Light Emitting Diode.
13. LCD: Liquid Crystal Display.
14. NAC: Notification Appliance (Signal) Circuit.
15. ULC: Underwriters Laboratories of Canada
16. ULC Listed: Materials or equipment listed and included in the most recent edition of the ULC Fire Protection Equipment Directory.
17. Zone: Combination of one or more circuits or devices in a defined building area, i.e. 3 circuits on a floor combined to form a single zone.

## **1.5. SYSTEM DESCRIPTION**

1. Design requirements:
  1. Remove or relocate fire alarm devices as indicated on the drawings. Have component operation verified on site.
  2. Install new devices as indicated on drawings, complete with wiring.
2. All Fire alarm equipment shall be arranged and programmed to provide a system for the early detection of fire, the notification of building occupants.

## **2. Products**

### **2.1. MANUFACTURER**

1. The Contractor shall supply system components as required to be compatible with existing Honeywell Fire-Lite addressable fire alarm panel.

### **2.2. GENERAL**

1. All equipment furnished for this project shall match existing system. All equipment, materials, accessories, devices, and other facilities covered by this specification or noted on contract drawings and installation specifications shall be the best suited for the intended use and shall be the product of a single manufacturer.

### **2.3. SYSTEM OVERVIEW**

1. The Fire Alarm System is a multiplex microprocessor-based system designed specifically for smoke and fire detection applications.

## **3. Execution**

### **3.1. INSTALLATION**

1. The entire system shall be installed in accordance with the latest edition of CAN/ULC-S524 and the approved manufacturers manuals and wiring diagrams. The contractor shall furnish all labor, conduit, wiring, outlet boxes, junction boxes, and similar devices necessary for a complete, functional life safety fire alarm system. Provide all necessary equipment to be installed in accordance with the manufacturer's wiring diagrams and the requirements of the Canadian Electrical Code and the Inspection Authority.
2. All cutting, patching and re-painting shall be by this contractor.
3. Wall device boxes are to be supported from structure.

### **3.2. TESTING AND INSPECTION**

1. Once the installation is complete, the Contractor shall have the system tested and verified. The manufacturer's representative shall perform testing and verification of the fire alarm equipment, including those components necessary to the direct operation of the system such as Piezos, power supply and controls, whether or not manufactured by the manufacturer. The verification shall comprise an examination and test of such equipment for the following:
  1. That the type of equipment installed is that designated by the specifications.
  2. That the wiring connections to all equipment components show that the installer undertook to have observed ULC requirements.
  3. That all products have been properly calibrated, and adjustments set correctly.
  4. That the representative's equipment has been installed in accordance with the manufacturer's recommendations.
  5. That the supervisory wiring of all devices connected to a supervised circuit is operating and that the wiring, having been met to the satisfaction of the inspecting officials.
  6. Testing to be done in the presence of the local building inspector and the local Fire Marshall.
  7. Fire alarm system shall be verified as per the latest issue of CAN-ULCS537 Verification of Fire Alarm Systems standard.
  8. A complete report indicating all tests shall be provided to the Consultant.

\*\*\*\*\*END OF SECTION\*\*\*\*\*