

DIVISION 26

ELECTRICAL

Part 1 General

1.1 GENERAL CONDITIONS

- .1 All Sections of General Conditions form a part of this Specification. They shall be read and fully adhered to exactly as if repeated here in full.
- .2 Refer to all other Sections of the Specifications and these Documents to determine their effect upon the work of this Section.

1.2 SCOPE

- .1 A brief but not necessarily all inclusive list of work to be performed under this contract is given herein.
- .2 The Contractor shall supply all labor, material, equipment, transportation, services and facilities necessary to make, test and place into operation a complete electrical installation as shown on the drawings and/or as specified herein.
- .3 Where the term "provide" is used herein, it shall mean "supply, install, adjust, test and place into operation".
- .4 All systems shall be completely assembled, adjusted, tested and demonstrated to be ready for operation to the satisfaction of the Contract Administrator.
- .5 The Contractor shall carefully examine the drawings and specifications and shall fully inform himself as to all existing conditions and limitations, including all laws, ordinances and regulations affecting the contract and the work and shall include in his tender all items implied or required to complete the work of this contract.
- .6 The Contractor shall satisfy himself as to working space, storage space, access facilities and all other conditions pertaining to the site, relating to the conduct of his operations, by the inspection of the site and examination of the drawings.
- .7 Provide all labor and materials as necessary to install, wire, connect and put into satisfactory operation the following control panels and mechanical equipment indicated under Divisions 11, 22, 23, 25, 28, and 40:
 - .1 Electric motors and actuated valves
 - .2 Motor starters, contactors, and interlocks where specified as components of "packaged" equipment.
 - .3 Miscellaneous plumbing and HVAC equipment including fans, hot water tank, snow melt, etc.
 - .4 Miscellaneous controllers and devices including access gates, security cameras, etc.

- .8 The Contractor shall re-tag all equipment in Hauled Wastewater Building 2. The equipment is presently tagged with an "X" functional area code identifying it as being Leachate equipment. After the changes in this scope of work the building will be a Hauled Wastewater function area and requires a "Y" functional area code.
 - .1 In addition to the functional area, tag numbering will also be revised, to prevent multiple pieces of equipment from having the same tag.
 - .2 Update tags for terminal blocks and wiring.
 - .3 Update tags in programming, displays, HMIs, DCS.
 - .4 The Contract Administrator shall provide a list of existing equipment and tags with proposed new tag numbers.
 - .5 The Contractor shall review the list on site to confirm existing tags and to add tags for any equipment that is not on the list.

1.3 EXTENT OF WORK

- .1 This work shall consist of furnishing of all labor, material, equipment and all incidentals required for the electrical works shown in the Contract Documents.
- .2 Wire to and make connections to, all electrical power and control items required, including motors, controls, etc.

1.4 EXAMINATION OF DRAWINGS

- .1 The electrical drawings do not show all architectural, mechanical and structural details. All electrical schematics are shown diagrammatically unless otherwise noted. The Contractor shall review the mechanical and structural drawings to obtain building dimensions and details. Verify dimensions accurately by measurements.
- .2 To change the location of electrical equipment, submit a request in writing to the Contract Administrator for approval. If approved, such changes are to be made at no additional cost to the City.
- .3 No extra will be allowed for any additional labor or materials required for relocation of equipment due to interference with equipment of other trades, beams, joists, walls, etc., unless the conflict has been submitted to the Contract Administrator.

1.5 APPROVED DESIGN AND INSTALLATION

- .1 Equipment and material to be of approved design and manufactured in accordance with all governing regulations such as "Canadian Standards Association", "Canadian Electrical Code", "Provincial Department of Labor", "Underwriters Laboratory", etc. Equipment and material must bear applicable acceptance labels of all associations and governing bodies recognized by the municipal, provincial and federal authorities.
- .2 Install equipment in strict accordance with manufacturer's recommendations and governing rules, regulations and codes.

- .3 Where requirement conflict occurs, install all materials in accordance with the most severe requirements.
- .4 Material installed under this Section to be new and of uniform construction.
- .5 All installation to ensure maximum headroom, minimum interference with free use of surrounding areas, and best access to equipment.
- .6 To deviate major service runs from the location shown on the drawings, submit to the Contract Administrator suitable drawings showing such deviations together with reasons for deviations and obtain approval from the Contract Administrator before proceeding with the installation.

1.6 CODES AND STANDARDS

- .1 Do complete installation in accordance with the latest edition of the Canadian Electrical Code, Provincial, Municipal, and other codes, rules and regulations and requirements of local authorities having jurisdiction.
- .2 Perform all work in accordance with drawings, specifications, applicable municipal and provincial regulations, and any pertinent inspection bulletins issued by the electrical inspection authority having jurisdiction over the installation. In no instance shall the standard established by the drawings and specifications be reduced.
- .3 Provide a copy of all standards referred to in this Section for use on site.

1.7 PERMITS, FEES AND INSPECTION

- .1 Submit to City of Winnipeg the necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Pay associated fees.
- .3 Notify Contract Administrator of changes required by Electrical Inspection Department prior to making changes.
- .4 Furnish Certificates of Acceptance from authorities having jurisdiction on completion of work to Contract Administrator.

1.8 ABBREVIATIONS

- .1 Abbreviations for electrical terms shall be to CSA Z85 1983.
- .2 Names used throughout these specifications are:
 - .1 EEMAC: Electrical & Electronic Manufacturers Association of Canada (formerly CEMA)
 - .2 CSA: Canadian Standards Association
 - .3 FM: Factory Mutual

- .4 NEMA: National Electrical Manufacturers Association (U.S.)
- .5 JIC: Joint Industry Conference
- .6 IPCEA: Insulated Power Cable Engineers Association
- .7 ISA: Instrument Society of America
- .8 CEC: Canadian Electrical Code
- .9 IEEE: Institute of Electrical and Electronic Engineers
- .10 IES: Illuminating Engineering Society
- .11 NBC: National Building Code
- .12 ANSI: American National Standards Institute

1.9 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures for all equipment as indicated with the exception of conduit, standard conduit fittings and low voltage wiring.
- .2 Indicate on shop drawings details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.
- .3 Where applicable, include wiring, single line and schematic diagrams.
- .4 Wiring drawings showing interconnection with work or other sections are required.
- .5 Indicate the number or letter used as an identification symbol on product data for panelboards, lighting fixtures and other equipment.

1.10 OPERATION AND MAINTENANCE MANUALS

- .1 Include in the manuals information based on Section 01 78 00 - Close-Out Submittals, and the following requirements:
 - .1 Operation and maintenance instructions to be sufficiently detailed with respect to design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.
 - .2 Technical data to be in form of approved shop drawings, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists.
 - .3 Advertising or sales literature is not acceptable.
 - .4 Provide wiring and schematic diagrams and performance curves.
 - .5 Include names and addresses of local suppliers for all items included in the operation and maintenance manuals.
- .2 Submit six (6) complete copies of manuals and "as-constructed" drawings to the Contract Administrator for review. Revise initial manual as required by the Contract Administrator prior to final submission.

1.11 RECORD DRAWINGS

- .1 Submit record drawings in accordance with Section 01 78 00 - Closeout Submittals.
- .2 The Contractor shall record all changes made during construction and provide record drawings to the City upon completion of the work.
- .3 At the completion of the project, the Contractor shall submit one (1) set of record drawings on disk, accurately recording all changes, deviations and relocations necessitated by job conditions and equipment approved shop drawings all done on AutoCAD.
- .4 Include with the record drawings a list for each motor indicating motor or equipment number and name, nameplate voltage, horsepower and current, the size of overload and breaker or fuse protection provided.

1.12 SINGLE LINE DIAGRAM

- .1 At the completion of the project, the Contractor shall submit one (1) copy of revised plant single line diagram on disk, accurately recording all changes, deviations and relocations necessitated by job conditions done on AutoCAD.

1.13 PROCESS & INSTRUMENTATION DIAGRAM

- .1 At the completion of the project, the Contractor shall submit one (1) copy of revised plant process and instrumentation diagram on disk, accurately recording all changes, deviations and relocations necessitated by job conditions done on AutoCAD.

1.14 DEFINITIONS

- .1 The following are definitions of terms and expressions used in the specification:
 - .1 "Inspection Authority" means agent of any authority having jurisdiction over construction and safety standards associated with any part of electrical work on site.
 - .2 "Supply Authority" means electrical power company or commission responsible for delivery of electrical power to project.
 - .3 "Electrical Code" means Canadian Electrical Code C22.1 or code in force at project location.
 - .4 "Indicated" means as shown on contract drawings or noted in contract documents.
- .2 Refer to CSA C22.2 No.0 for "Definitions and General Requirements".

1.15 COOPERATION AND COORDINATION

- .1 Schedule expediting of all materials and execution of work with associated work specified in other Sections.

- .2 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete shall be schedule 40 galvanized steel pipe, sized for free passage of conduit, and protruding 50 mm (2").
- .3 Cables, conduits and fittings to be embedded or plastered over neatly and close to building structure so furring can be kept to a minimum.
- .4 Arrange for holes through exterior walls and roof to be flashed and made weatherproof.

1.16 SOURCE QUALITY CONTROL

- .1 Arrange for a plant inspection by Contract Administrator where specified.
- .2 Inform Contract Administrator of manufacturing progress and arrange inspections at appropriate times.
- .3 Action required by factory inspection shall not be construed as final acceptance.
- .4 Obtain a Certificate of Acceptance from the inspection authority on completion of work and hand it to the Contract Administrator.
- .5 The Contract Administrator may carry out inspections and prepare deficiency lists for action by the Contractor, during and on completion of project.

1.17 CARE, OPERATION AND START-UP

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

1.18 APPROVAL OF ALTERNATE MATERIALS

- .1 Bid Opportunity shall be based on the materials, products, and manufacturers specified.
- .2 Alternates to materials, products, and manufacturers specified shall be in accordance with Bid Opp section B7.
- .3 Supply and install all motor power wiring and conduit, all control wiring and conduit, all local and remote control devices, and all motor starters and contactors except where specified as components of "packaged" equipment.

Part 2 Products

2.1 GENERAL

- .1 All materials shall be fully approved by the Canadian Standards Association (CSA) for use as installed and meet the requirements of this specification in all respects.
- .2 Where there is no alternative to supplying equipment which does not have CSA approval, submit such equipment to Provincial Hydro Inspection Authorities for special inspection and obtain approval. Pay all associated fees.
- .3 Materials and equipment shall be of Canadian manufacture except where specified otherwise or where Canadian made materials or equipment do not exist.
- .4 Where two or more units of the same class or type of equipment are required, the units shall be the product of a single manufacturer, although components of equipment need not be products of the same manufacturer.
- .5 Use material and equipment available from regular production of manufacturer.
- .6 Control panels and component assemblies to be shop manufactured.

2.2 FINISH

- .1 Finish metal enclosure surfaces by removing rust and scale, cleaning, and applying rust resistant primer inside and outside with at least two coats of finish enamel.
- .2 Paint all switchgear and distribution enclosures "light grey" to ASA 61 grey.
- .3 Clean, prime and paint exposed hangers, racks, fastenings, etc., to prevent rusting.

2.3 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 in above standard without damage to equipment.

2.4 MATERIALS AND EQUIPMENT

- .1 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.
- .2 Factory assemble control panels and component assemblies.

2.5 WIRING

- .1 Lugs, terminals, screws used for termination of wiring must be suitable for copper conductors.

2.6 ENCLOSURES

- .1 Minimum enclosure type to be used is NEMA 12 gasketed nonventilated for ordinary environments, NEMA 4X for corrosive environments or NEMA 3R for outdoor installations unless otherwise specified.

2.7 MANUFACTURERS AND CSA LABELS

- .1 Manufacturers' nameplates and CSA labels are to be visible and legible after equipment is installed.

2.8 WARNING SIGNS

- .1 Provide warning signs with suitable background color and lettering as required to meet requirements of inspection authorities and Contract Administrator. Use decal signs, minimum size 178 mm x 250 mm.

2.9 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Provide wiring and controls for motors and motorized equipment.

2.10 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates as follows:

- .2 Nameplates:

- .1 Lamacoid 3 mm thick plastic engraving sheet, black face, white core, mechanically attached with self tapping screws.

NAMEPLATE SIZES

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

- .3 Allow for average of twenty-five (25) letters per nameplate.
- .4 Identification to be English.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

- .6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .7 Terminal cabinets and pull boxes: indicate system and voltage.
- .8 Transformers: indicate capacity, primary and secondary voltages.

2.11 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, either numbered or colored plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and color coding throughout.
- .3 Color code: to CSA C22.1.
- .4 Use color coded wires in communication cables, matched throughout system.

2.12 LOCATION OF OUTLETS

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

2.13 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
 - .1 Local switches: 1400 mm.
 - .2 Wall receptacles:
 - .1 General: 1200 mm.
 - .3 Panelboards: as required by Code or as indicated.
 - .4 Voice and data communication outlets: same height as nearest receptacle.

2.14 LOAD BALANCE

- .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

- .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

2.15 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: plastic, sized for free passage of conduit, and protruding 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

2.16 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 The work of this section to be carried out by a contractor who holds a valid Master Electrical contractor license as issued by the Province that the work is being constructed.
- .3 Conduct and pay for following tests:
 - .1 Power distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting and its control.
 - .4 Emergency lighting.
 - .5 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .6 Systems: fire alarm system, access control.
- .4 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
- .5 Insulation resistance testing.
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing.

- .6 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .7 Submit test results for Contract Administrator's review.

2.17 ARC FLASH SAFETY LABELING

- .1 Provide arc flash safety labeling on electrical equipment in accordance with CSA - Z462.

Part 3 Execution

3.1 WORKMANSHIP

- .1 All work to be carried out by qualified journeymen of the related trades.
- .2 Where sheet metal enclosures are not provided with knockouts, Greenlee punches shall be used in all cases. Cutting torches shall not be used for making holes.

3.2 INSTALLATION

- .1 Determine manufacturers' recommendations regarding storage and installation of equipment and adhere to these recommendations.
- .2 Check all factory joints and tighten where necessary to ensure continuity.
- .3 Coordinate the work of this Section with the installation of the equipment specified in the relevant Sections of Division 11 - Parking Control, Division 22 - Plumbing, Division 23 - HVAC, Division 25 - Automation, Division 28 - Electronic Safety and Security, and shown on the Mechanical and Electrical drawings.
- .4 Perform all work in compliance with the relevant sections of this Section.

3.3 SPECIAL PROTECTION

- .1 Accept the responsibility to protect those working on the project from any physical danger due to exposed electrically energized equipment such as panel mains, outlet wiring, etc. Shield and mark all live parts "LIVE 600 VOLTS" or with the appropriate voltage.
- .2 Arrange for the installation of temporary doors, barriers, etc., for all electrical equipment. Keep these doors locked at all times except when under direct supervision.

3.4 FIREPROOFING

- .1 Where sleeves or openings are installed in walls, floors, roof or partitions to accommodate raceways, cables or bus duct, provide all necessary seals, fittings, barriers and fire resistant materials to restore the installation to its original fire rating to the satisfaction of the Contract Administrator.

3.5 TOUCH-UP PAINTING

- .1 Be responsible for field touch up painting of all shop painted electrical equipment installed in this Contract.
- .2 All surfaces to be painted shall be dry, clean, and free from dust, dirt, grease, frost, rust, loose crystals or extraneous matter, tool and machine marks. Feather out edges of scratch marks to make patch inconspicuous.
- .3 Apply one or more coats of paint until the damaged surface has been restored to original finish condition. Do not apply succeeding coats until preceding coat is dry and hard. Sand lightly between coats with No. 00 sandpaper.
- .4 Be responsible for obtaining the necessary touch up paint of the original type and quality from the equipment manufacturer.
- .5 Supervise priming and finish painting of all electrical equipment and material not shop painted.

3.6 SLEEVES AND OPENINGS

- .1 Provide sleeves and openings for exposed conduits, busways, and wireways, where they pass through walls or floors conforming to relevant fire codes where applicable.
- .2 Sleeves for individual conduits shall be galvanized steel in ordinary areas or stainless steel in corrosive environments.
- .3 Pack or fill sleeves and openings after the completed work is in place. Filling shall provide a waterproof seal to prevent leakage of water or other liquids through the sleeve or opening.
- .4 Sleeves and openings shall not displace reinforcing steel, and shall receive approval of the Contract Administrator prior to placement.

3.7 CUTTING AND PATCHING

- .1 Do all drilling, cutting, fitting and patching necessary for the running and securing of conduits, wireways, and other electrical equipment.
- .2 Provide supports necessary for same.
- .3 Provide bracing and anchorage of work subject to Contract Administrator's approval.
- .4 No cutting of the structural members or of the fireproofing shall be done without the written consent of the Contract Administrator.
- .5 Caulk and flash all conduits passing through walls, roofs or other surfaces exposed to weather or as indicated on the drawings to prevent the passage of water and/or sewer gases.

3.8 HANGERS AND SUPPORTS

- .1 Provide hangers, angles, channels, and other supports necessitated by field conditions to install all items of electrical equipment. Design of supports and methods of fastening to building structures shall be subject to the Contract Administrator's approval.
- .2 All local motor control devices are to be grouped and mounted on a free-standing frame of stainless steel construction easily accessible and as close to the motor as possible.
- .3 Provide weight-distribution facilities, where required, so as not to exceed the load-bearing capacities of floors or walls that bear the weight of, or support, electrical items.
- .4 Support material and fasteners shall be stainless steel.
- .5 Equipment shall not be held in place by its own weight. Provide base anchor fasteners in each case.

3.9 PROTECTION OF EQUIPMENT

- .1 Protect conduit and wireway openings against the entrance of foreign matter by means of plugs or caps.
- .2 Fixtures, materials, equipment, or devices damaged prior to final acceptance of the work shall be restored to their original condition or replaced by the Contractor.

3.10 TESTING OF ELECTRICAL SYSTEMS GENERAL

- .1 Prior to the Contract Administrator's acceptance, all electrical equipment, materials and systems installed shall be subject to an inspection and applicable performance tests supervised by the Contract Administrator to ensure that the operation of the system and components satisfy the requirements of the Specifications.
- .2 Ensure that the system and its components are ready prior to the inspection and test for acceptance.
- .3 All testing shall be conducted by fully qualified personnel only. Tests requiring initial power energization of a system shall not be made without notification of the Contract Administrator. Tests, checks and the like carried out by or on behalf of the Contractor shall be documented and certified at no additional cost to the City. Submit six copies of the test certificates to the Contract Administrator. Carefully check wiring for each system and/or part of a system to ensure that the system will function properly as indicated by wiring and schematic diagrams, description of operation, etc.
- .4 Carefully check wiring for each system and/or part of a system to ensure that the system will function properly as indicated by wiring and schematic diagrams, description of operation, etc.
- .5 Manually operate alarms and control devices to check whether their operation during normal and abnormal operating conditions causes the proper effect.

- .6 In addition to tests on purely electrical systems, supply the necessary labor and equipment for operational tests required by other Sections where electrical services are involved and make final adjustments to the electrical controls at no additional cost to the City.
- .7 Perform tests on auxiliary or specialized systems with the assistance of the manufacturer's representative. Upon successful conclusion of the tests, obtain a certificate from the manufacturer stating that the system has been installed to their satisfaction and that it is in good working order.
- .8 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to values and settings as indicated.
- .9 Supply all instruments, meters and personnel required for the tests.

3.11 CABLE AND WIRE 1000 VOLT AND BELOW

- .1 Tests on cables in this voltage range shall be limited to insulation resistance measurements using a 500V megger for systems up to 350V and a 1000V megger for 351 600V systems.
- .2 Record all test results in a log book and submit to the Contract Administrator for reference. Replace or repair all circuits, which do not meet minimum requirements specified in the CEC, Table 24. Insulation resistance of the following circuits shall be measured:
 - .1 Power, lighting and motor feeders (with equipment disconnected): phase to phase, phase to neutral and phase to ground.
 - .2 Control circuits: measure to ground only.
 - .3 Do not perform megger tests on control circuits containing transistorized or solid state components.
 - .4 Where power factor correction equipment is installed, it may be necessary to disconnect the capacitors from the system prior to testing to avoid overvoltage.

3.12 GROUNDING SYSTEM

- .1 Test the grounding system efficacy for compliance with CSA Standard C22.1 and Supply Authority requirements. Verify that the ohmic resistance values specified therein are not exceeded.
- .2 Notify Contract Administrator that they may be present to witness Contractor testing.

3.13 TRAINING

- .1 Provide for the training of the Contract Administrator in the operation, maintenance and testing of all systems and equipment including the provision of qualified manufacturer's technical representatives for specialized systems.
- .2 Provide these services for such period, and for as many visits as necessary to put installation in working order, and to ensure that operating personnel are conversant with all aspects of its care and operation.

3.14 DELIVERY AND STORAGE

- .1 Ship and store floor mounted equipment in upright position.
- .2 Ship channel bases and anchor stencils in advance of equipment.
- .3 Keep equipment doors locked. Protect equipment from damage and dust.
- .4 Block moving parts when necessary to prevent damage during movement and shipment of equipment. Instructions to remove blocking before putting equipment in service to be clearly and conspicuously displayed.
- .5 Store all electrical equipment indoors. Temperature sensitive equipment to be stored in heated spaces.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for wire and box connectors.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2No.18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
 - .2 CSA C22.2No.65, Wire Connectors.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
- .3 National Electrical Manufacturers Association (NEMA)

Part 2 Products

2.1 MATERIALS

- .1 Pressure type wire connectors to: CSA C22.2No.65, with current carrying parts of suitable material sized to fit conductors as required.
- .2 Fixture type splicing connectors to: CSA C22.2No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Clamps or connectors as required to: CAN/CSA-C22.2No.18.

Part 3 Execution

3.1 INSTALLATION

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

- .1 CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.
- .2 CAN/CSA-C22.2 No. 131, Type TECK 90 Cable.

Part 2 Products

2.1 BUILDING WIRES

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

2.2 TECK CABLE

- .1 Cable: to CAN/CSA-C22.2 No. 131.
- .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
- .3 Insulation:
 - .1 Type: ethylene propylene rubber.
 - .2 Chemically cross-linked thermosetting polyethylene rated type RW90, 600 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking aluminum.
- .6 Overall covering: polyvinyl chloride material.
- .7 Fastenings:
 - .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
 - .2 Channel type supports for two or more cables.
 - .3 Threaded rods: 6 mm dia. to support suspended channels.
- .8 Connectors:

- .1 Watertight, approved for TECK cable.

2.3 ALUMINUM SHEATHED CABLE

- .1 Conductors: copper, size as indicated.
- .2 Insulation: type RA90 rated 600 V.
- .3 Sheath: aluminum applied to form continuous corrugated sheath.
- .4 Outer jacket of PVC applied over sheath.
- .5 Fastenings for aluminum sheathed cable:
 - .1 One hole steel straps to secure surface cables 25 mm and smaller. Two hole steel straps for cables larger than 25 mm.
 - .2 Channel type supports for two or more cables.
 - .3 Threaded rods: 6 mm dia. to support suspended channels.

2.4 FIBRE OPTIC CABLE AND TERMINATIONS

- .1 Multimode fibre cable.
- .2 Construction:
 - .1 Central strength member: Dielectric epoxy glass rod.
 - .2 Fibres: 250µm diameter buffer
 - .3 Buffer tubes: Polymer loose tubes c/w super absorbent polymer.
 - .4 Cable core: components cabled around a central strength member.
 - .5 Core separator: super absorbent tape between cable core and outer strength member.
 - .6 Outer strength member: torque balanced contra helical aramid yarn.
 - .7 Cable jacket: black, flame retardant, UV and moisture resistant polymer c/w ripcord applied under the jacket.
 - .8 Armour: aluminum interlocking armour.
 - .9 Armour jacket: flame retardant riser rated PVC.
- .3 Fibre connectors to be LC type.
- .4 Panduit Buffer Tube fan-out Kit
 - .1 Panduit Opticom Fiber Wall Mount Enclosure (Sealed Enclosure). FWME4 w/ Two (2) 6-port LC panel (Panduit FAP6WSTZ). Include 2 panel blanks.
 - .2 One fanout kit located in the Hauled Wastewater Building #2, and one fanout kit located in the Leachate Building.
- .5 LC Field-Installable connectors as required
- .6 LC-LC fiber patch cords as required

2.5 WIRING ACCESSORIES

- .1 Wire markers, black letters on white background, shall be heat shrink type as manufactured by Critchley.
- .2 Cable markers for cables or conductors greater than 13 mm diameter, shall be strap on type, rigid PVC, black letters on white background, with PVC covered aluminum straps, as manufactured by Electrovert Cat. No. 510.
- .3 Terminal blocks shall be minimum 600 volt rated, modular, sized to accommodate conductor size used, as manufactured by Weidmuller, Phoenix, Allen-Bradley.
- .4 Where screw type terminals are provided on equipment, field wiring shall be terminated with insulated fork tongue terminals, as manufactured by Thomas & Betts, Sta Kon.
- .5 Splice connectors for wire sizes #14 10 AWG inclusive, shall be of the compression spring type, as manufactured by Ideal Waterproof Type DP.
- .6 Splice connectors for wire sizes #8 AWG and larger shall be split bolt type, sized to suit number and size of conductors, as manufactured by Burndy Servit Type KS.
- .7 Cable ties shall be nylon, one piece, self locking type, as manufactured by Thomas & Betts, Burndy, Electrovert.
- .8 Electrical insulating tape as manufactured by 3M Scotch 88.
- .9 Cable grips shall be provided for all vertical and catenary cable suspension installations to reduce cable tension at connectors or at cable bends. The cable grips shall be selected to accommodate the type and geometry of cable supported and shall be of the single wave, variable mesh design, as manufactured by Kellems, Arrow-Hart.
- .10 Cable pulling lubricant shall be compatible with cable covering and shall not cause damage and corrosion to conduits or ducts.

Part 3 Execution

3.1 INSTALLATION – GENERAL

- .1 Install all wire according to the drawings with a minimum size of #12 AWG unless indicated otherwise.
- .2 Pull wire into ducts and conduits in accordance with the manufacturer's recommendations, using patented wire grips suitable for the type of wire or using pulling eyes to be installed directly onto the conductors.
- .3 Limit pulling tensions to those recommended by the manufacturer to avoid overstressing wire.
- .4 Utilize adequate lubricant when pulling wires through ducts and conduits to minimize wear on cable jackets.

- .5 Make connections to equipment "pig tails" with mechanical, insulated, screw on connectors for wire sizes #14 10 AWG. For wire sizes #8 AWG and larger utilize split bolt connectors, taped with three layers minimum of insulating tape. For all terminations, wire through the conductor, apply joint compound anti-oxidant, and torque to lug manufacturer's recommended torque levels.
- .6 No splices shall be permitted in cable or wiring runs without the written permission of the Contract administrator, and shall only be permitted in junction boxes.
- .7 Neutral conductors shall be identified. Paint or other means of colouring the insulation shall not be used.
- .8 Unless otherwise specified, make all wiring taps, splices and terminations with identified compression screw type terminal blocks, securely fastened to avoid loosening under vibration or normal strain. Make connections for interior and exterior lighting circuits and 120 volt, 15 amp convenience receptacle circuits using screw on or split bolt connectors and insulating tape.
- .9 Determine the exact length of cable required to avoid splices.
- .10 Identify each conductor by specified markers at each termination indicating the circuit designation or wire number.
- .11 Identify each cable by attaching a suitable marker, stamped or indelibly marked with the cable number, at each end of the cable and in all junction boxes and pull boxes.

3.2 INSTALLATION OF TECK CABLE 0 -1000 V

- .1 Install cables.
 - .1 Group cables wherever possible on channels.
- .2 Install cable in trenches in accordance with trench details.
- .3 Terminate cables in accordance with Section 26 05 20- Wire and Box Connectors - 0 - 1000 V.

3.3 INSTALLATION OF ALUMINUM SHEATHED CABLE

- .1 Group cables wherever possible on channels.
 - .1 Install cable in trenches in accordance with trench details.
- .2 Terminate cables in accordance with Section 26 05 20- Wire and Box Connectors - 0-1000 V.

3.4 INSTALLATION OF FIBRE OPTIC CABLE

- .1 Redundant fibre runs with each fibre in its own path as much as possible.
- .2 New construction will have each fibre in separate conduit. Sharing fibre conduit with low voltage wiring shall be acceptable.

- .3 Fibre quantities per cable shall be as follows:
 - .1 Two (2) fibres for transmit and receive for networking to the industrial PC.
 - .2 Four (4) fibres for camera signals.
 - .3 Six (6) spare fibres reserved for future networking.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

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

Part 2 Products

2.1 EQUIPMENT

- .1 Grounding conductors: bare stranded copper, soft annealed, sized to suit system amperage.
- .2 Non-corroding accessories necessary for grounding system, type, size, material to suit equipment, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Thermit welded type conductor connectors.
 - .5 Bonding jumpers, straps.
 - .6 Pressure wire connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

- .1 Install complete permanent, continuous grounding system including conductors, connectors, and accessories. Tie to station grounding grid.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections and connections to electrodes, using permanent mechanical connectors or inspectable wrought copper compression connectors to ANSI/IEEE 837.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.

- .7 Install bonding wire for flexible conduit, connected at one end to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .8 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .9 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.

3.2 SYSTEM AND CIRCUIT GROUNDING

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

3.3 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.

3.4 COMMUNICATION SYSTEMS

- .1 Install grounding connections for voice/data communication, fire alarm, and security systems in accordance with CEC and specific equipment manufacturer's recommendations.

3.5 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Contract administrator and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator (where present) during tests.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 Refer to Section 26 05 01 for project electrical extent of work.
- .2 Furnish all labour, materials, equipment and services specified, indicated or requested to install the electrical boxes specified herein and on the drawings.

Part 2 Products

2.1 SPLITTERS

- .1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3 At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2 JUNCTION AND PULL BOXES

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

2.3 CABINETS

- .1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.
- .2 Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing 19 mm plywood backboard for surface mounting.

Part 3 Execution

3.1 SPLITTER INSTALLATION

- .1 Install splitters and mount plumb, true and square to the building lines.
- .2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.

- .2 Mount cabinets with top not higher than 2 m above finished floor.
- .3 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.3 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Install size 2 identification labels indicating system name voltage and phase.

END OF SECTION

Part 1 General

1.1 REFERENCES

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

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

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

2.2 SHEET STEEL OUTLET BOXES

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

2.3 MASONRY BOXES

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

2.4 CONCRETE BOXES

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

2.5 FLOOR BOXES

- .1 Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with brushed aluminum faceplate. Device mounting plate to accommodate

short or long ear duplex receptacles. Minimum depth: 28 mm for receptacles; 73 mm for communication equipment.

2.6 CONDUIT BOXES

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

2.7 FITTINGS - GENERAL

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

Part 3 Execution

3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 Furnish all labour, materials, supervision, equipment and services specified, indicated or requested to install a complete conduit raceway system. The raceway systems shall be comprised of the supply and installation of all conduits, fittings, supports, hangers and miscellaneous support materials and hardware required.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
 - .2 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .3 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.

1.3 LOCATION OF CONDUIT

- .1 The drawings do not show every specific conduit run. All wiring shall be surface unless otherwise indicated in the specifications and/or shown on the drawings. All devices shall be surface mounted type except as shown.

Part 2 Products

2.1 CONDUITS

- .1 Conduit in ordinary areas and humid corrosive environments shall be Rigid P.V.C. Minimum size to be 19 mm.
- .2 Conduit in hazardous areas shall be threaded rigid aluminium epoxy coated conduit with zinc coating and corrosion resistant epoxy finish inside and outside. Minimum size to be 12 mm.
- .3 Liquid-tight flexible metal conduit for motor and equipment connections.
- .4 EMT conduit shall not be utilized anywhere in the installation.

2.2 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits.

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

2.3 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory "ells" where 90E bends are required for 25 mm and larger conduits.

2.4 EXPANSION FITTINGS FOR CONDUIT

- .1 All conduits entering outlet boxes and devices that are located in walls subject to movement shall be terminated by means of liquid-tight flexible conduit, approximately 450 mm in length between the conduit and the outlet box or device which is being supplied. All conduits, bus duct, wireways, etc., passing through or across expansion joints of the building shall be installed with the use of approved expansion fittings.

2.5 FISH CORD

- .1 Polypropylene.

Part 3 Execution

3.1 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.
- .3 Use rigid pvc conduit unless otherwise noted.
- .4 Use rigid pvc conduit underground and in cast concrete.
- .5 Use flexible metal conduit for connection to motors.
- .6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .7 Minimum conduit size: 19 mm.
- .8 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .9 Mechanically bend steel conduit over 19 mm dia.
- .10 Install fish cord in empty conduits.
- .11 Run 2-50 mm spare conduits up to ceiling space and 2-50 mm spare conduits down to crawlspace from each flush panel. Terminate these conduits in 152 x 152 x 102 mm

junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.

- .12 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .13 Dry conduits out before installing wire.

3.2 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended channels.
- .5 Do not pass conduits through structural members except as permitted by the Contract Administrator
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.3 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.

3.4 CONDUITS IN CAST-IN-PLACE CONCRETE

- .1 Conduit is not to be run in concrete slabs but may pass through slabs.
- .2 Locate to suit reinforcing steel.
- .3 Protect conduits from damage where they stub out of concrete.
- .4 Install sleeves where conduits pass through slab or wall.
- .5 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.

3.5 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and components for dry type transformers up to 600 V primary, equipment identification and transformer installation.

1.2 RELATED SECTIONS

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

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2 No.47, Air-Cooled Transformers (Dry Type).
 - .2 CSA C9, Dry-Type Transformers.
- .2 National Electrical Manufacturers Association (NEMA)

1.4 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures. At a minimum shop drawings to include:
 - .1 Voltage ranges and taps
 - .2 KVA rating
 - .3 Mounting configurations
 - .4 Weight
 - .5 Cable terminal sizes
 - .6 Nameplate data.
- .2 Include transformer literature in electrical O&M manuals in accordance with Section 01 78 00 - Close-out Submittals and Section 26 05 01 - Common Work Results - Electrical.

Part 2 Products

2.1 TRANSFORMERS

- .1 Use transformers of one manufacturer throughout project.
- .2 Design.
 - .1 Type: Epoxy encapsulated
 - .2 Three phase, 600V delta connected primary, 120/208V wye connected secondary
 - .3 kVA rating as indicated on drawings
 - .4 Operating frequency of 60 Hz
 - .5 Winding insulation of 1000 V class, 115 degree temperature rise

- .6 Maximum impedance of 5%
- .7 Sound rating of 40 dB
- .8 Basic Impulse Level (BIL) is standard
- .9 Hipot is standard
- .10 Taps 4 - 2 1/2 percent FCAN, FCBN
- .11 Termination at bottom of transformer
- .12 Finish: in accordance with Section 26 05 01 - Common Work Results - Electrical.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Label size: 7.

2.3 MANUFACTURERS

- .1 Acceptable manufacturer is Hammond, Square "D", Bemag.

Part 3 Execution

3.1 INSTALLATION

- .1 Mount dry type transformers as indicated.
- .2 Ensure adequate clearance around transformer for ventilation.
- .3 Install transformers in level upright position.
- .4 Remove shipping supports only after transformer is installed and just before putting into service.
- .5 Loosen isolation pad bolts until no compression is visible.
- .6 Make primary and secondary connections in accordance with wiring diagram.
- .7 Energize transformers after installation is complete.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for standard and custom breaker type panelboards.

1.2 RELATED SECTIONS

- .1 Section 26 05 01 - Common Work Results - Electrical.
- .2 Section 26 28 21 - Moulded Case Circuit Breakers.

1.3 REFERENCES

- .1 All equipment to CSA Standard C22.2 No. 29 M1989.
- .2 Fault current ratings to be indicated on nameplates.

1.4 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures. Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.
- .2 Include panelboard literature in electrical O&M manuals in accordance with Section 26 05 01 – Common Work Results – Electrical. Submit in accordance with Section 01 78 00 - Close-out Submittals

Part 2 Products

2.1 PANELBOARDS

- .1 Panelboards: to CSA C22.2No.29 and product of one manufacturer.
 - .1 Install circuit breakers in panelboards before shipment.
 - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .2 250 and 600 V panelboards: bus rated for 25,000 A (symmetrical) bracing.
- .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 Provide all necessary connectors and mounting hardware in every space to facilitate installation of future breakers. Provide blank fillers for all spaces.

- .6 Concealed hinges and concealed trim mounting screws, hinged locking door with flush catch.
- .7 Panelboards to have flush doors. (Gasketed where required).
- .8 Two keys for each panelboard and key panelboards alike.
- .9 NEMA 12 gasketed nonventilated.
- .10 Provide "sprinkler-proof" design in areas where sprinkler fire protection is installed. In any event, all surface mounted enclosures to be complete with sprinkler drip cover.
- .11 Copper bus with neutral of same ampere rating as mains.
- .12 Mains: suitable for bolt-on breakers.
- .13 Trim with concealed front bolts and hinges.
- .14 Trim and door finish: baked grey enamel.

2.2 BREAKERS

- .1 Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers.
- .2 All breakers to be bolt on type, moulded case, non adjustable and non interchangeable trip, single, two and three pole, 120/208 (240)V or 347/600V and with trip free position separate from "On" or "Off" positions.
- .3 Two and three pole breakers to have common simultaneous trip and able to be located in any circuit position within the panelboard. Minimum interrupting rating of breakers to be as follows:
 - .1 347/600V panelboards - 14,000 Amps at 347 volts.
 - .2 120/208V panelboards - 10,000 Amps at 250 volts.
- .4 Main breaker to be separately mounted at top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .5 Provide circuit breakers with indicated trip ratings as shown in the panelboard schedules.
- .6 Provide spare 15 Amp single pole breakers for unused circuits, or other spare breakers where so indicated.
- .7 Provide GFI type breakers as indicated.
- .8 Provide Lock-on devices as indicated and in any event for Fire Alarm circuits, Security equipment circuits, EXIT sign circuits and Emergency Battery equipment circuits.

2.3 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

- .2 Nameplate for each panelboard size 4 engraved.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit.
- .5 Complete circuit directory with typewritten card(s) located in slide-in plastic pocket(s) fixed to the back of the related door. Directory card to indicate the panel designation, mains size, voltage/phase and the location and load controlled of each circuit. Include a "letter sized" paper copy of each directory in the project maintenance manual.
- .6 Provide a plasticized typewritten information card fixed to the back of the each panel door. Information card to indicate the panel designation and location, feeder type and size and locations of any controlling contactors and feeder pullboxes. Include a "letter sized" paper copy of each information card in the project maintenance manual.

2.4 STANDARD OF ACCEPTANCE

- .1 Cutler Hammer, Type PRL. Door within door trim where indicated.
- .2 Schneider, Type NQOD. Door within door trim where indicated.

Part 3 Execution

3.1 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Panelboards located in service rooms, mechanical rooms, and electrical rooms to be mounted on unistrut supports.
- .3 Mount panelboards to height specified in Section 26 05 01 - Common Work Results - Electrical or as indicated.
- .4 Connect loads to circuits as indicated.
- .5 Connect neutral conductors to common neutral bus with respective neutral identified.
- .6 Install 4x27 mm [1"] empty conduits (or equivalent) from each flush mounted panelboard single tub to ceiling space above and 2x27 mm [1"] empty conduits (or equivalent) from each flush mounted panelboard single tub down to ceiling or space below where space exists. Refer also to Section 26 05 34 "Conduits, Conduits Fastenings And Conduit Fittings"

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Switches, receptacles, wiring devices, cover plates and their installation.

1.2 RELATED SECTIONS

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

1.3 REFERENCES

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

1.4 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Include wiring devices literature in electrical O&M manuals in accordance with Section 26 05 01 – Common Work Results - Electrical. Submit in accordance with Section 01 78 00 - Close-out Submittals.

Part 2 Products

2.1 SWITCHES

- .1 Extra heavy duty specification grade.
- .2 20 A, 120 V or 347 V, single pole, double pole, three-way, four-way switches as indicated.
- .3 Manually-operated general purpose ac switches as indicated and with following features:
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea or melamine moulding for parts subject to carbon tracking.
 - .4 Suitable for back and side wiring.
 - .5 White toggle (red toggle for emergency power circuits).

- .4 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.
- .5 Switches of one manufacturer throughout project.
- .6 Standard of acceptance:
 - .1 Hubbell HBL.1221 20A series
 - .2 Leviton 1221-20A 120V series – 18221 347V
 - .3 Pass & Seymour PS20AC1 120V series – PS37201(3)0 347V
 - .4 Wet location rated in wet locations, Hubbell Bell Series or equivalent equal in accordance with B7.

2.2 RECEPTACLES - GENERAL

- .1 Extra heavy duty specification grade.
- .2 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:
 - .1 White nylon molded housing (red for emergency power circuits)
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Eight back wired entrances, four side wiring screws.
 - .5 Triple wipe contacts and rivetted grounding contacts.
- .3 Other receptacles with ampacity and voltage as indicated.
- .4 Receptacles of one manufacturer throughout project.
- .5 Standard of acceptance:
 - .1 Hubbell 5252 heavy duty, construction series
 - .2 Leviton 5262 series
 - .3 Pass & Seymour 5262 series

2.3 RECEPTACLES – PARTICULAR APPLICATION

- .1 Ground Fault Interrupter type to be 15 Amp, 125 volt duplex receptacles to be 2 pole, 3 wire hospital grade, white face, parallel blade, U ground, impact resistant nylon face, complete with breaker and reset button. ~~Equal to:~~
 - .1 Hubbell GF8200A series
 - .2 Leviton 7599HG series
 - .3 Pass & Seymour HG1595 series (Décor)
- .2 All other single outlet and special purpose receptacles to be similar to the grade and series indicated above. Confirm ampacity, voltage and pin configuration prior to installation.

2.4 COVER PLATES

- .1 Stainless steel: Type 302 or 304, No. 4 finish, 1mm thick, accurately die cut, protective cover for shipping. For general interior flush mounted wiring devices and surface type FS or FD type boxes. Cover plates from one manufacturer throughout project.
- .2 Nylon plates: Heavy duty, unbreakable and flush. All nylon plates to match wiring device color.
- .3 Steel: sheet steel hot dip galvanized with rolled edges for surface mounted utility boxes.
- .4 Wall plates to be flush mounting with "positive bow" feature to ensure that all edges of plate are flush with wall or surface box when installed.
- .5 All plates to be bevelled type with smooth rolled outer edge and smooth face. Exposed sharp edges are not acceptable.
- .6 Cast metal: die cast profile, ribbed for strength, flash removed, primed with grey enamel finish and complete with four mounting screws to box for special purpose wiring devices.
- .7 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for wiring devices as indicated. Double doors for standard duplex receptacles. Coverplates to fasten to box by four screws. Utilize outdoors and in wet locations. provide while-in-use covers to Code.
- .8 Gaskets: resilient rubber or close cell foam urethane.
- .9 Cover plates for all wiring devices to be from one manufacturer throughout project.

Part 3 Execution

3.1 INSTALLATION

- .1 Switches:
 - .1 Install single throw switches with handle in "UP" position when switch closed.
 - .2 Install switches in gang type outlet box when more than one switch is required in one location.
 - .3 Mount toggle switches at height in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
 - .2 Ground fault interrupter duplex receptacles to be used, adjacent sinks or water sources.

- .3 Mount receptacles at height in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .3 Cover plates:
 - .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
 - .2 Install suitable common cover plates where wiring devices are grouped.
 - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 24 17 – Panelboards Breaker Type.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA-C22.2 No. 5, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.3 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures. Include time-current characteristic curves for breakers.
- .2 Include circuit breaker literature in electrical O&M manuals in accordance with Section 26 05 01 – Common Work Results - Electrical. Submit in accordance with Section 01 78 00 - Close-out Submittals.

Part 2 Products

2.1 BREAKERS GENERAL

- .1 Moulded-case circuit breakers: to CSA C22.2 No. 5
- .2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation.
- .3 Common-trip breakers: with single handle for multi-pole applications.
- .4 Circuit breakers to have minimum interrupting capacity rating as indicated.

2.2 THERMAL MAGNETIC BREAKERS

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.
- .2 Series rated breakers to be manufacturer tested and listed. Breakers to be applied following manufacturer's guidelines and accepted best practice.

Part 3 Execution

3.1 INSTALLATION

- .1 Install circuit breakers as indicated.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CAN/CSA C22.2 No.4, Enclosed Switches.
 - .2 CSA C22.2 No.39, Fuseholder Assemblies.

1.3 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Include circuit breaker literature in electrical O&M manuals in accordance with Section 26 05 01 – Common Work Results – Electrical. Submit in accordance with Section 01 78 00 - Close-out Submittals.

Part 2 Products

2.1 DISCONNECT SWITCHES

- .1 “Heavy Duty” class, enclosed manual air break switches in non-hazardous locations: to CSA C22.2 No.4
- .2 Fuseholder assemblies to CSA C22.2 No.39.
- .3 Fusible and non-fusible disconnect switch in CSA enclosure.
- .4 Provision for padlocking in off switch position.
- .5 Fuses as indicated. Allow for Class J or L for general circuits, Class RK5 for transformer, motor or other high inrush current circuits
- .6 Fuseholders in each switch suitable without adaptors, for type of fuse as indicated.
- .7 Quick-make, quick-break action.
- .8 ON-OFF switch position indication on switch enclosure cover.
- .9 NEMA 12 gasketed noventilated in ordinary areas. Weatherproof or wet location rated as required.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Indicate name of load controlled on size 4 nameplate.

2.3 STANDARD OF ACCEPTANCE

- .1 Cutler Hammer – Heavy Duty
- .2 Schneider - Heavy Duty
- .3 Siemens - Heavy Duty

Part 3 Execution

3.1 INSTALLATION

- .1 Install disconnect switches complete with fuses where indicated or required.
- .2 Provide and locate safety disconnect switches to isolate individual items of equipment in accordance with Canadian Electrical Code CSA 22.1 whether indicated on not on the contract drawings.

3.2 MOTOR PLUG/RECEPTACLE AND QUICK DISCONNECTS

- .1 Motor quick disconnects do not negate the requirement for a switched safety disconnect as specified in this Division. A separate disconnect is still required unless the Contract Administrator has given a special pre-approved circumstance.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 This section covers the supply and installation of all transient voltage surge suppressors.

1.2 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 Include:
 - .1 Unit dimensions, mass, installation instruction details and wiring configuration.
 - .2 Clamping voltage test data, in a graph form, for a Category B3 ringwave and a Category B3 combination wave, as defined by ANSI/IEEE C62.41 and tested in accordance with ANSI/IEEE C62.45.
 - .3 Insertion loss test data, in a graph form, over a frequency bandwidth from 0 to 100 MHz and tested in accordance with MIL-STD 220A.
 - .4 A nameplate showing the electrical ratings, including UL 1449 surge suppression ratings and the UL and CSA monograms, shall be permanently affixed to the unit.
- .2 Include surge suppressor literature in electrical O&M manuals in accordance with Section 26 05 01 – Common Work Results – Electrical. Submit in accordance with Section 01 78 00 - Close-out Submittals.

Part 2 Products

2.1 GENERAL PRODUCT

- .1 The transient voltage surge suppressors (TVSS) described by this specification are to be installed in the various panels as indicated.
- .2 All TVSS devices shall be listed under UL 1449 and certified by CSA.
- .3 TVSS device enclosure shall be rated EEMAC 12

2.2 SPECIFIC PRODUCT REQUIREMENTS

- .1 TVSS device installed on the MCC shall be suitable for a Category C3 environment in accordance with ANSI/IEEE C62.41.
- .2 TVSS device shall be wired in parallel into the electrical system.
- .3 TVSS device shall feature full-cycle tracking clamping profiles that follow the AC sine wave contour for uniform transient voltage surge suppression regardless of phase angle.

- .4 TVSS device circuit shall be a MOV-based, hybrid design; surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform shall be rated and internally fused to a minimum of 100kA in relation to available interrupting capacity (AIC) per phase and provide equal impedance paths to each matched MOV bank. TVSS device design shall not be based on components such as gas tubes, which may crowbar the system.
- .5 The maximum continuous operating voltage (MCOV) shall be greater than 115% of the nominal system operating voltage.
- .6 TVSS devices shall protect against surges between phase and neutral (L-N) and neutral and ground (N-G) in wye configured systems (four-mode TVSS device). TVSS devices for branch panels shall protect against surges between phase and neutral (L-N), phase and ground (L-G) and neutral and ground (N-G) in wye configured systems (seven-mode TVSS device). All delta configured systems shall be protected between phases (L-L) and phase to ground (L-G).
- .7 TVSS devices shall be capable of sustaining a single pulse transient current (based on a single pulse 8 x 20µs waveform specified in IEEE C62.45) of 150 kA in the L-N mode for wye configured systems, or L-L and L-G for delta configured systems, and 50kA in the N-G mode. TVSS devices for branch panels shall be capable of sustaining a single pulse transient current (based on a single pulse 8 x 20µs waveform specified in IEEE C62.45) of 90 kA in the L-N and L-G modes, or L-L and L-G for delta configured systems, and 50kA in the N-G mode.
- .8 Maximum let through voltage shall not exceed the following UL 1449 Classification, for Category B3 ring and combination waves:

Max. Let Through Voltage per Mode	L-N, N-G; L-G (when present)	L-L
120/240 VAC, 1φ	500	-
120Y/208 VAC	500	-
220 VAC Delta	-	500
220Y/380 VAC	800	-
240 VAC Delta	-	800
277Y/480 VAC	1000	-
347Y/600 VAC	1200	-
480 VAC Delta	-	1500
600 VAC Delta	-	2000

- .9 MI/RFI rejection, measured in accordance with the 50 ohms insertion loss procedures outlined in MIL-STD 220A, shall reflect a minimum noise attenuation of 10 db over a frequency bandwidth from 20 kHz to 10 MHz.
- .10 TVSS device endurance shall meet the UL Category C3 as an adjunct to its TVSS UL listing, consisting in the application of 1000 surges at 30-second intervals with 20 kV full peak voltage values for IEEE Category C3.

2.3 SAFETY AND DIAGNOSTIC MONITORING

- .1 TVSS device shall have visual indicators and an audible alarm to advise that the system is active and functioning properly or that TVSS protection has been lost or damaged and that device maintenance or replacement is necessary.
- .2 TVSS device shall include a set of 1 N.O. and 1 N.C. contacts for remote monitoring of device status and be capable of incorporating an optically-coupled sensing circuit option, which will permit monitoring of the TVSS device from a remote site.
- .3 TVSS device shall include a test and diagnostic circuit to ensure proper functioning of the monitoring circuit.

2.4 ACCEPTABLE MANUFACTURER

- .1 All TVSS devices shall be from the same manufacturer as distribution panelboards.
- .2 TVSS device manufacturer shall provide one year warranty from the date of substantial completion against any part failure when installed in compliance with the manufacturer's instructions and all applicable national and local electrical codes.
- .3 Acceptable manufacturer for the TVSS devices shall be Leviton or the same manufacturer as panelboards to be supplied.

Part 3 Execution

3.1 WIRING REQUIREMENTS

- .1 All TVSS devices shall be installed in accordance with the applicable sections of the C.E.C. Part I and following the manufacturer's recommended practice. Conductor lead lengths to the TVSS device shall be kept as short as possible, without unnecessary bends. Conductors shall be twisted and tightly bound together. Refer to manufacturer's instructions for required size of conductors.

3.2 EXTERNALLY MOUNTED TVSS

- .1 Provide a breaker sized in accordance with TVSS device manufacturer's instructions for connection of TVSS device into panel.

- .2 Maximum conductor lead length between breaker and TVSS device shall not exceed 350mm. Route in as short a path and as straight a path as practicable. Minimize number of bends and maximize bend radius.

3.3 INTEGRATED DISTRIBUTION PANEL INSTALLATION

- .1 TVSS devices shall be factory installed into the distribution panels and/or MCC as indicated.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI C82.1, Electric Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.
 - .2 ANSI C82.4, Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps.
- .2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE C62.41, Surge Voltages in Low-Voltage AC Power Circuits.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures. Include complete photometric data prepared by independent testing laboratory for luminaires as follows:
 - .1 Total input watts.
 - .2 5 plane candlepower summary.
 - .3 Polar plot candela distribution.
 - .4 Zonal lumen summary.
 - .5 Luminaire efficiency.
 - .6 CIE type.
 - .7 Coefficient of utilization.
 - .8 Lamp type and lumen rating in accordance with IESNA testing procedures.
 - .9 Lens and louvre type and finish.
 - .10 Spacing criterion.
- .2 Include lighting fixture literature in electrical O&M manuals in accordance with Section 26 05 01 – Common Work Results – Electrical. Submit in accordance with Section 01 78 00 - Close-out Submittals.

Part 2 Products

2.1 LAMPS

- .1 Include lamps for all fixtures.

2.2 BALLASTS

- .1 Fluorescent ballast: CBM and CSA certified, energy efficient type, IC electronic, dimmable where indicated.
 - .1 RFI/EMI suppression circuit to: FCC (CFR47) Part 18, sub-part C, Class A and Part 15, sub-part B, Class B.

- .2 Totally encased and designed for 40C ambient temperature.
- .3 Power factor: minimum 95 % with 95% of rated lamp lumens.
- .4 Crest factor: 1.5 maximum current, 2.0 maximum voltage.
- .5 Capacitor: thermally protected.
- .6 Harmonics: 10 % maximum THD, including 49th.
- .7 Operating frequency of electronic ballast: 21 khz minimum.
- .8 Ballast Factor: greater than 0.90.
- .9 Ballast: premium, not generic, PowerSmart.
- .10 Sound rated: Class A.
- .11 Mounting: integral with luminaire.

2.3 **FIXTURE TYPES**

- .1 Type A: 4 foot fluorescent, 2-F32T8/841, wet location listed, high impact acrylic lens, Lithonia DMW or ~~equivalent~~ equal in accordance with B7, premium ballast OS10ISX or ~~equivalent~~ equal in accordance with B7.
- .2 Type B: Exterior wallpack, LED, low glare, Lithonia OLWX1LED-40W-40K-MVOLT-PE with vandal guard.

2.4 **POLES**

- .1 Outdoor lighting poles
 - .1 9.14m height pole.
 - .2 Baseplate minimum A-36 plate.
 - .3 Hand hole c/w cover and mounting hardware.
 - .4 Ground stud, 3 leveling shims, 2-piece bolt together base cover.
 - .5 4 anchor rods c/w nut and washer. Threaded portion shall be hot dip galvanized.
 - .6 Pole finish shall be natural aluminum.
 - .7 Top tenon suitable for two fixture mounting spaced 180 degrees.
 - .8 Acceptable manufacturer shall be West Coast Engineering No. 5SQP24. Review existing on site for match prior to submission of shop drawings.
- .2 Outdoor camera pole
 - .1 6m height pole.
 - .2 Baseplate minimum A-36 plate.
 - .3 Hand hole c/w cover and mounting hardware.
 - .4 Ground stud, 3 leveling shims, 2-piece bolt together base cover.
 - .5 4 anchor rods c/w nut and washer. Threaded portion shall be hot dip galvanized.
 - .6 Pole finish shall be galvanized power coated, colour to match existing.
 - .7 Top tenon suitable for two fixture mounting spaced 180 degrees.
 - .8 Suitable for mounting of camera at 4.5m height.
 - .9 Acceptable manufacturer shall be West Coast Engineering No. 5SQP20. Review existing on site for match prior to submission of shop drawings.

Part 3 Execution

3.1 INSTALLATION

- .1 Locate and install luminaires as indicated on electrical site plan drawings.

3.2 WIRING

- .1 Connect luminaires to lighting circuits.

3.3 LUMINAIRE SUPPORTS

- .1 For suspended ceiling installations support luminaires from ceiling grid in accordance with local inspection requirements.

3.4 LUMINAIRE ALIGNMENT

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for emergency lighting systems.

1.2 RELATED SECTIONS

- .1 Section 26 05 21 - Wires and Cables (0-1000 V).
- .2 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.141, Unit Equipment for Emergency Lighting.

1.4 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
Include:
 - .1 System components.
 - .2 Mounting method.
 - .3 Source of power.
 - .4 Special attachments.
- .2 Include emergency lighting literature in electrical O&M manuals in accordance with Section 26 05 01 – Common Work Results – Electrical. Submit in accordance with Section 01 78 00 - Close-out Submittals.

Part 2 Products

2.1 EQUIPMENT

- .1 Emergency lighting equipment: to CSA C22.2 No.141.
- .2 Supply voltage: as indicated.
- .3 Output voltage: 12 V dc.
- .4 Operating time: 60 min or as indicated.
- .5 Battery: sealed, maintenance free.
- .6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01V for plus or minus 10% input variations.

- .7 Solid state transfer circuit.
- .8 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.
- .9 Signal lights: solid state.
- .10 Lamp heads: remote, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: LED 7W.
- .11 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries. Suitable for wet location.
- .12 Finish: white.
- .13 Provide combination exit sign where so indicated.
- .14 Auxiliary equipment:
 - .1 Test switch.
 - .2 Shelf or mounting bracket.
 - .3 Cord and plug connection for AC.

2.2 WIRING OF REMOTE HEADS

- .1 Conduit: in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .2 Conductors: in accordance with Section 26 05 21 - Wires and Cables 0-1000 V, sized in accordance with manufacturer's recommendations.

Part 3 Execution

3.1 INSTALLATION

- .1 Install unit equipment and remote mounted fixtures.
- .2 Direct heads.
- .3 Connect exit lights to unit equipment.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No.141, Unit Equipment for Emergency Lighting.
 - .2 CSA C860, Performance of Internally-Lighted Exit Signs.

1.2 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures. Product data sheets for exit lights to include:
 - .1 Performance criteria.
 - .2 Physical size / dimension drawings
 - .3 Equipment finish.
- .2 Include exit signs literature in electrical O&M manuals in accordance with Section 26 05 01 – Common Work Results – Electrical. Manufacturer’s Instructions to indicate special handling criteria, installation sequence, cleaning and maintenance procedures. Submit in accordance with Section 01 78 00 - Close-out Submittals.

Part 2 Products

2.1 STANDARD UNITS

- .1 Exit lights: to CSA C22.2 No.141 and CSA C860, packaged in accordance with the Canadian Code for Preferred Packaging guidelines.
- .2 Housing: suitable for wet location.
- .3 Lamps: LED.
- .4 Operation: designed for 100,000 hours of continuous operation without relamping.

Part 3 Execution

3.1 INSTALLATION

- .1 Install exit lights.
- .2 Connect fixtures to exit light and emergency circuits.
- .3 Ensure that exit light circuit breaker is locked in on position.

END OF SECTION