PART 1 General

1.1 SCOPE OF WORK

.1 The requirements herein are applicable to electrical division 26, 27 and 28

.2 The electrical contractor shall furnish all labour, materials, tools, appliances and equipment necessary to entirely complete and provide for the operation of the electrical systems indicated in these specifications and as shown on drawings.

1.2 DEFINITIONS

.1 Refer to TIA/EIA-598, Annex A for definitions of terms: optical-fiber interconnects distribution and breakout cables.

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

1.3 WORK INCLUDED IN DIV. 26, 27 AND 28

.1 The overall intention is to provide a finished piece of work complete in all aspects, and all items reasonably inferable as called for by the plans and specifications, and by normally accepted good practice, notwithstanding that every item necessarily required may not be specifically mentioned. This contractor shall fulfill his obligation and not take advantage of any unintentional errors or omissions should such exist, to the detriment of the owners' interest. Generally the work includes, but is not limited to the following:

.1 Electrical:

.1 Coordination with utilities, all associated fees to extend utility to building shall be borne by Owner/User;

.2 Coordination, supply and installation of conduits and wiring from new NB Power transformer bank pole to two new building service entrance;

.3 Supply and installation of exterior luminaires and their controls;

.4 Supply and installation of electrical distribution system as indicated;

.5 Wiring of equipment supplied by others including mechanical systems and building service equipment;

.6 Supply and installation of wiring devices;

.7 Supply and installation of interior luminaires and their controls;

.8 Supply and installation of emergency lights;

.9 Supply and installation of conduit and wiring;

.10 Supply and installation of electric heating and associated controls;

.11 Supply and installation of the following Communication systems:

.1 Data/Voice system;

.12 Supply and installation of the following Safety and Security systems:

.1 Intrusion Detection and Alarm system;

.2 Camera Surveillance (CCTV) system;

.3 P.A system;

.13 Supply and installation of Grounding system;

.14 Supply, installation and programming of controls as indicated;

.15 Supply and installation of wiring for baseball lighting system (system and lights supplied by owner). Contractor must also be present for commissioning. Commissioning agent will be hired by owner.

.16 Testing of systems for acceptance by inspection authority;

.17 Supply of temporary lighting and power;

.18 Mark-up “Records Drawings” in red on print provide to Consultant.

1.4 WORK NOT INCLUDED IN DIV. 26, 27 AND 28

.1 Excavation and backfill work shall be the responsibly of the General Contractor.

.2 Supply and installation of mechanical equipment shall be the responsibility of mechanical division.

.3 All architectural finishes, core drilling, cutting, and patching shall be the responsibility of the general contractor.

.4 Any required trenching of floors or removal of existing T-bar ceilings for the running of conduit or cables shall be the responsibility of the General Contractor.

.5 Firestopping of penetrations through walls and floors shall be the responsibility of the general contractor in accordance with Section 26 00 10 – Electrical Installations General Requirements.

PART 2 Products

2.1 NOT USED

PART 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This Contractor shall be responsible to coordinate the enclosed applicable sections of these specifications with the following:

- .1 Section 01 11 10 – General Requirements
- .2 Section 07 84 00 – Fire Stopping.
- .3 Section 01 23 10 – Alternates.
- .4 Section 01 61 00 – Common Product Requirements
- .5 Section 01 35 29 – Health and Safety Requirements.
- .6 Section 01 78 00 – Closeout Submittals.
- .7 Section 01 45 00 – Quality Control.
- .8 Section 02 81 01 – Hazardous Materials.
- .9 Section 01 74 11 – Cleaning
- .10 Section 01 33 00 – Submittal Procedures.
- .11 Section 31 23 33 – Excavating, Trenching and Backfilling

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

- .1 CSA C22.1, latest revision, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
- .2 CAN/CSA-C22.3 No. 1-, latest revision, Overhead Systems.
- .3 CAN/CSA-C22.3 No. 7-, latest revision, Underground Systems.
- .4 CAN3-C235, latest revision, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
- .5 CAN/CSA Z462-latest revision, Workplace Electrical Safety.
- .6 CAN/ULC-S1001-latest revision, Standard for Integrated Systems Testing of Fire Protection and Life Safety Systems.

.2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)

- .1 EEMAC 2Y-1, latest revision, Light Gray Colour for Indoor Switch Gear.

.3 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

- .1 IEEE SP1122, latest revision, The Authoritative Dictionary of IEEE Standards Terms.

.4 Canadian Commission on Building and Fire Codes National Research Council of Canada

- .1 National Building Code of Canada – Latest revision.
- .2 National Fire Code of Canada – Latest revision.

1.3 DEFINITIONS

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

1.4 GENERAL REQUIREMENTS

.1 This Section covers items common to Sections of Division 26. This section supplements the requirements of Division 1 and Mechanical.

.2 All wiring and conduit are shown in diagrammatic form only. See architectural drawings for exact location of all walls and openings.

.3 Contractor shall be familiar with building ceiling spaces. Most conduit runs shown as straight runs will consist of several offsets due to service equipment. Contractor may propose alternate paths to achieve similar aims after detailed review of site conditions.

.4 Schedule all electrical work with general contractor and user. All work shall be performed in such a manner as to affect minimal disruption to the occupants. Any disruptive work shall be scheduled during the night or on weekends.

.5 Coordinate any power shut down with owner/user 72 hours in advance.

.6 Contractor shall coordinate inspection date with Consultant and shall provide labour for access to all equipment for inspection to confirm work method. Such access shall include removal of panel covers and opening of disconnect switches, junction/pull boxes, starters and luminaries.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Action and informational submittals: in accordance with Division 01. All inquires, shop drawings, request for substitutions and similar items shall be submitted to the Consultant.

.2 Product Data: submit WHMIS MSDS

.3 Submit to Technical Inspection Services, Department of Public Safety, necessary number of drawings and specifications for examination and approval prior to commencement of work. Pay all associated fees.

.4 Submit for review single line electrical diagrams. Final diagrams are to be provided under plexiglass and be securely mounted to wall in the following locations:

.1 Electrical distribution system in main electrical room.

.2 Electrical power generation and distribution systems in power plant rooms.

.5 Shop drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in province having jurisdiction.

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

.3 Part numbers for submitted products and equipment to be clearly highlighted, boxed or arrowed with all required accessories and components indicated.

.4 Submitted information must be specific, detailed and relevant to the project. Bulk, generic information is not acceptable.

.5 Indicate details of construction, dimensions, capacities, and electrical performance characteristics of equipment or material.

.6 Where applicable, include wiring, single line and schematic diagrams.

.7 Include wiring drawings or diagrams showing interconnection with work of other Sections.

.8 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.

.9 Identify circuit terminals on wiring diagrams and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.10 Indicate on drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.11 Faxes are not acceptable for shop drawings. If sent by fax, they will not be reviewed.

.12 Electronic PDF shall be acceptable for preliminary review of shop drawings. Official shop drawings shall be sent as per Section 01 33 00 – Submittal Procedures.

.13 Do not begin fabrication until shop drawings have been reviewed by Consultant. Allow ten (10) working days for Consultant review.

.14 Consultant review of shop drawings does not relieve the contractor of the responsibility for co-ordination of field measurements required to complete the work.

.15 Div. 26 Contractor and General Contractor shall approve all shop drawings by signing and dating them prior to submitting to Consultant. Failure to comply will result in automatic rejection of shop drawings. When non-compliance results in extra costs due to construction delays, the contractor shall bear these costs.

.16 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.6 Electronic shop drawings:

.1 Where the use of electronic shop drawings has been agreed to by the Engineer-Architect, the following electronic submittal requirements are to be followed:

.1 Shop drawings to be submitted in PDF format, legible and clear.

.2 Shop drawings to be grouped by specification section, with one PDF file per specification section. The file name to indicate the section number and name, i.e. “26 50 00 Lighting Rev0.PDF” with resubmissions appended Rev1, Rev2, etc.

.3 Supplemental information not previously submitted to be identified as follows: “26 50 00 Lighting Supplement 1.PDF”, Supplement 2, etc.

.4 A cover sheet is to be incorporated into each PDF submission and indicate the project name and number, specification section number and name, the contractor’s name, supplier’s name, date submitted,

contractor's stamp and signature identifying that the contractor has reviewed the information prior to submission for correctness and completeness. Sufficient white space (minimum of ¼ page) is to be left for the Engineer-Architect's stamp and comments.

.5 Part numbers for submitted products and equipment to be clearly highlighted, boxed or arrowed with all required accessories and components indicated.

.6 Submitted information must be specific, detailed and relevant to the project. Bulk, generic information is not acceptable.

.7 Electronic shop drawing transmittal forms, where provided, must be submitted as separate PDF files and not bound in with the shop drawings.

.7 Certificates:

.1 Provide CSA certified equipment and material.

.2 Where CSA certified equipment and material is not available, submit such equipment and material to inspection authorities for special approval before delivery to site.

.3 Submit test results of installed electrical systems and instrumentation.

.4 Permits and fees: in accordance with General Conditions of contract.

.5 Submit, upon completion of Work, load balance report as described in PART 3 – FIELD QUALITY CONTROL.

.8 Permits, fees and inspections

.1 Submit in accordance with Division 01 – General Requirements.

.2 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

.3 Pay associated fees.

.4 Consultant will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost (only for service entrance with ampacity lower than the limits set for plan review requirements).

.5 Notify Consultant of changes required by Electrical Inspection Department prior to making changes.

.6 Obtain wiring permit prior to commencing work.

.7 Advise Consultant 72 hours in advance for all inspections required. This includes, but is not limited to, open ceiling, open wall, substantial, final and additional inspections as requested in following technical sections.

.8 Manufacturer's Field Reports: submit manufacturer's written report to Engineer-Architect within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

1.6 SYSTEM STARTUP

.1 Instruct Consultant-Architect and operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

1.7 OPERATING INSTRUCTIONS

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Operating instructions to include the following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating, lubrication, and shutdown procedure.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Print or engrave operating instructions in laminated plastic.

.4 For operating instructions exposed to weather, provide weather-resistance materials or weatherproof enclosure.

.5 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

1.8 SITE VISIT

.1 Prior to tender submission, visit the site and become familiar with the job and all conditions which may affect the costs. Ignorance of existing conditions will not be considered as basis for extra claims.

1.9 PRIOR APPROVAL OF PRODUCTS

.1 Manufacturers products that are not named in the specifications must receive approval from Architect/Consultant prior to the tender closing date.

.2 Schedule and model numbers found on drawings shall be considered as being integral part of these specifications. Model number identified is the basis of design. Any model number not found shall only be considered as equal if it meets quality and performance.

.3 Any and all extra work that may result from an approved equal that is of different dimensions or requirements than the basis of design shall be the responsibility of this contractor.

1.10 WASTE MANAGEMENT AND DISPOSAL

.1 Separate, recycle and dispose of waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Collect and separate for disposal: paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with waste management plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility.

.5 Fold-up metal bending, flatten and place in designated area for recycling.

1.11 GUARANTEE

.1 Provide, in supplement of other system guarantee, in writing, a guarantee covering all labor and material for a period of one year from final acceptance of work, and agree to repair and make good all defects during that time.

.2 When the project is completed a documentation file is to be given to the Department of Transportation and Infrastructure – Buildings Division. The file should contain all warranty information.

.2 Prior to expiration of the construction contract warranty, the owner will carry out functional performance testing (FPT). The Contractor will cooperate fully with the Department of Transportation and Infrastructure – Buildings Division request for warranty service and pay for all associated costs.

.3 From the date of issuance of a 'Certificate of Substantial Performance', all equipment, materials and workmanship must be unconditionally warranted for a period of one (1) years, or such longer periods as may be provided in the warranty of the manufacturer of individual components, whichever is longer.

.4 Defects and deficiencies which originate or become evident during the warranty period must be repaired or replaced, at no additional cost. All work relating to said deficiencies must be carried out at a time, during or after normal working hours, which is acceptable to the occupant.

1.12 CODES AND STANDARDS

.1 Do complete installation in accordance with CSA C22.1, latest revision, except where specified otherwise.

.2 Do overhead and underground systems in accordance with CSA C22.3 No.1 and No.7, latest revisions except where specified otherwise.

.3 Abbreviations for electrical terms: to CSA Z85-1983, latest revision.

.4 Electrical system to conform to latest revision of Model National Energy Code of Canada for Buildings

1.13 CARE, OPERATION AND START-UP

.1 Instruct Consultant and operating personnel in the operation, care and maintenance of system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service representative 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.

1.14 VOLTAGE RATINGS

.1 Operating voltages: to CAN3-C235-83, latest revision.

.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.

1.15 ADDENDA AND REVISIONS

.1 All addenda, instructions and revisions issued during the tendering period shall become part of the Contract Documents and shall be included in the Tender, and shall take precedence over previous instructions.

.2 The Consultant reserves the right to make revisions to the drawings during the period of construction and these revisions shall take precedence over previously issued drawings. All revisions to work shall be executed by duly authorized change orders, with the amount of addition or deduction to the contract amount approved by the Owner before the execution of any work entailed in the revisions.

1.16 EXAMINATION OF DRAWINGS AND EXISTING CONDITIONS

.1 The Electrical Contractor shall become completely familiar with drawings and specifications, as well as construction methods of other trades related to the work, in order to avoid possible conflicts on the project. Should drastic changes be necessary to resolve such conflicts, the Contractor shall notify the Consultant and secure written approval and agreement on necessary adjustments before the installation is started.

.2 Prior to close of tender, the Contractor shall visit the site and become familiar with site conditions, availability of storage space and all other factors that might influence the tender. No allowance shall be made for problems arising due to lack of knowledge of existing conditions that could reasonably have been ascertained by a careful inspection.

1.17 DISCREPANCIES

.1 If, during the preparing their tender, Bidders find any errors, omissions, or discrepancies in the plans, specifications or other documents or having any doubt regarding the intent

or meaning of any part thereof, shall immediately notify the Consultant, who will send written instructions or clarification to all bidders. Where such discrepancies exist and it is evident that the Contractor could not have properly tendered without clarification, and where such clarification was not requested, no changes to the contract shall be considered in order to have the installation completed correctly. The Owner and Consultant shall not be responsible for oral instructions.

1.18 SUBSTITUTIONS

.1 It is the intent of these specifications to establish the required quality of materials. Where manufacturer's name and catalogue reference data are used, it is done in order to establish the required quality, style, size or function. The decision as to suitability shall rest with the Consultant.

.2 Refer to Section 01 61 00 – Common Product Requirements.

.3 All materials not meeting the standards as set down by these specifications shall not be allowed on the job site.

.4 Substitutions affecting the design will not be permitted. Additional costs to any other trade or to Consultant as a result of a change or substitution by this Contractor shall be borne by this Contractor.

.5 The listing of a manufacturer as acceptable does not imply acceptance of all products of that manufacturer or only products of that manufacturer. Only products meeting the standards as set out in the specifications will be accepted.

.6 All requests for alternates shall be submitted before award of contract.

.7 Faxes are <u>not</u> acceptable for request for alternates. If sent by fax, they will not be reviewed.

1.19 OPERATION AND MAINTENANCE MANUALS

.1 The Electrical Contractor shall provide three (3) copies of Operation and Maintenance Manuals in accordance with Section 01 78 00- Closeout Submittals. The manuals shall consist of a hard cover three ring binder with removable pages, indexed and tabbed as to content. A copy of all electronic files shall be included on a USB stick.

.2 Include in Operation and Maintenance Manuals:

- .1 Copy of all approved shop drawings.
- .2 Details of design elements, construction features, component function and maintenance requirements to permit the effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of the installation.
- .3 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature unacceptable.
- .4 Wiring and schematic diagrams and performance curves.
- .5 Name and addresses of electrical contractor.

.6 Names and addresses of local suppliers.

.7 Copy of all test certificates including but not limited to:

- .1 Insulation / Megger tests,
- .2 Load balance tests on all transformers, the main switchboard and distribution panels.
- .3 Voltage regulation / tap tests on all transformers.
- .4 Load tests on all electric motors.
- .5 Work report c/w dates from Electrical Inspection Department including electrical permit associated with the project.
- .6 Security system testing and verification with approval from Authority having Jurisdiction.

.8 Copy of all final panelboard schedules including existing where modified by this contract.

.9 Copy of signed transmittal verifying all maintenance materials turned over to the owner/user.

.10 Copy of divisions 26, 27 and 28 specifications.

.11 Copy of electrical permit associated with the project.

.12 A letter of warranty.

.13 Other documents as specified within various sections of these specifications.

1.20 RECORD DRAWINGS

.1 Provide “Record Drawings” in accordance with Section 01 78 00 - Closeout Submittals.

.2 After award of Contract, Consultant will provide 2 sets of white print drawings for purpose of maintaining record drawings. Using Red Ink, accurately and neatly record deviations from Contract Documents caused by site conditions and changes ordered by Consultant. Electronic (CAD) files shall be acceptable for record drawings. When using electronic files, Contractor shall have all modifications clearly shown on a separate layer and using a red color font.

.3 Record locations of concealed components of electrical services.

.4 As-built drawings to include the final layout and location of all electrical equipment devices, outlets and pull boxes installed.

.5 As-built drawings to include routing of all electrical services such as feeders, and branch wiring for all electrical systems as noted in Division 26, 27 and 28 contract documents.

.6 As-built drawings from the contractor shall be signed by the contractor.

.7 A complete and separate set of white prints is to be kept on the site at all times.

.8 These prints to be marked up to record clearly, neatly, accurately and promptly, all locations of Electrical work, deviations from and changes to the "Issued for Construction" Documents.

.9 The accurate locations, depth, size and type of each underground utility and service line to be recorded before concealment, to ensure accurate and future direct access to these buried services. Dimensioning on 'record' drawings shall refer to the building or other permanent fixtures for future reference.

.10 The Record Drawings will be reviewed at regular intervals by the Engineer-Architect and will be taken into consideration when reviewing the monthly applications for progress payment.

.11 Identify drawings as "Project Record Copy". Maintain in new condition and make available to Consultant for inspection on-site and at all job meetings.

.12 On completion of Work and prior to final inspection, submit record documents to Consultant for preparation of "Record Drawings" transparencies.

1.21 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Section 01 61 00 – Common Product Requirements.

.2 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.

.3 Control panels and component assemblies shall be factory assembled.

.4 Where electrical equipment rooms are sprinklered in accordance with the National Building Code of Canada, the electrical equipment contained in such rooms is to have enclosures which comply with Canadia Electrical Code Rule 26-008.

.5 All equipment must fit into the space and configuration allocated. The Contractor to be responsible for resolving any increase in space requirements or configuration difficulties, due to non-conformity of said condition.

.6 The Contractor to ensure that all carried products, are completely physically and electrically compatible.

1.22 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

.2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 25 and shown on mechanical drawings.

.3 Review Mechanical drawings; coordinate final electrical connection to all mechanical equipment and controls with mechanical drawings.

.4 Coordinate location of equipment in elevator machine room & pit with supplier.

1.23 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1, latest revision.

.2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1, latest revision.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

1.24 LOCATION OF DEVICES AND EQUIPMENT

.1 Locate outlets as shown on drawings and as indicated below.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of devices, zone boxes, terminal panels, equipment and connections at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors. Locate disconnect devices in mechanical, boiler and elevator machine rooms on latch side of door.

.5 Leave space clear and install equipment to accommodate future materials and/or equipment as indicated or specified, or to accommodate equipment and/or materials supplied by other trades.

.6 Verify that the spaces in which the equipment is to be installed is sufficient and install all equipment to maintain head room and clearances, to conserve space, comply with codes, and to ensure adequate space for future servicing.

.7 Locate outlets at casework and in typical rooms as per architectural casework details and wall elevations

.8 Install polyethylene vapor barrier box on all exterior wall outlets to maintain vapor barrier integrity.

1.25 ACCESS DOORS

.1 Access doors for furred ceilings or spaces for servicing equipment and accessories or for inspection of safety, operating or fire devices for installation under section erecting the walls or ceilings. Provide general contractor with number, type, size and locations prior to tender close.

.2 Access doors shall be flush mounted (600 x 600) mm for body entry and (300 x 300) mm for hand entry unless otherwise noted. Doors shall open 180 degrees, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps. Steel shall be prime coated. Doors shall be of approved manufacturer with published literature. Door flanges to have prepunched holes so that drywall compound will conceal flange and only steel door is visible.

.3 Access doors to be supplied and installed by General Contractor.

1.26 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 and sensors: 1200 mm.
- .2 Wall receptacles:
  - .1 General: 455 mm.
  - .2 Above top of continuous baseboard heater: 200 mm.
  - .3 Above top of counters: 150 mm
  - .4 Above top of counter splash backs: 150 mm.
  - .5 In mechanical rooms: 1400 mm.
  - .6 In utility rooms: 1400 mm.
  - .7 In washrooms and janitor closets: 1400 mm.
  - .8 Exterior: 600mm above level 1 slab.
- .3 Panelboards: 1500mm or as required by Code or as indicated.
- .4 Thermostats: 1500 mm.
- .5 Telephone and interphone outlets: 450 mm.
- .6 Intrusion alarm detectors: 2400 mm
- .7 Door operator pushbuttons: refer to architectural
- .8 Exit lights: 150 mm above door frame (or equivalent where no door is present).
- .9 Emergency lights: 3000 mm or at ceiling where ceiling is lower. Coordinate device heights with architectural room and casework elevations.

.4 Coordinate device heights with architectural room and casework elevations.

.5 Generally, masonry outlet boxes are to be installed in bottom of concrete boxes to approximate heights indicated.

.6 Refer to all detail drawings and confirm mounting of devices prior to roughing-in.

.7 In renovated areas, mounting height shall be match those of existing devices.

1.27 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe, 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, conduit and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

.4 All core drilling patching and firestopping of penetrations through walls and floors shall be the responsibility of the General Contractor.

.5 Core drill through walls and floor, as required. Submit exact locations and sizes to Consultant for approval prior to drilling.

.6 Any required trenching of floors, or removal of existing T-bar ceilings for the running of conduit or cables shall be the responsibility of the General Contractor, unless stated otherwise on drawings.

.7 Install cables in cable tray per CSA C22.1, latest revisions.

.8 Seal all conduits which enter air handling units, cooler or freezers in accordance with CEC rule 22-302.

1.28 VOLTAGE DROP

.1 All conductors shall be sized for a maximum voltage drop of 3% cable run and a total of 5% from Utility supply service to device. Contractor shall use connected load for directly connected equipment otherwise the voltage drop shall be calculated based on 80% of the rating of the overload or overcurrent device protecting the circuit or feeder. Loads indicated in the panel schedule are only used to calculate the demand load and shall <u>not</u> be used for determining the voltage drop.

.2 Following table identifies the maximum wire run allowed based on wire gauge. Contractor shall apply this table and used the identified wire gauge. For other types of receptacles, voltage drop shall be calculated using 80% of the overcurrent protection device.

Minimum wire gauge for 5-15R receptacles			
Distance (meters)			*Conductor Phase/Neutral/Bond (AWG)*
0m	to	19m	#12/#12/#12
20m	to	34m	#10/#10/#10
35m	to	54m	#8/#8/#8

55m	to	85m	#6/#6/#6
Minimum wire gauge for 5-20R receptacles			
Distance (meters)			*Conductor Phase/Neutral/Bond (AWG)*
0m	to	14m	#12/#12/#12
15m	to	24m	#10/#10/#10
25m	to	39m	#8/#8/#8
40m	to	64m	#6/#6/#6
65m	to	99m	#4/#4/#4

.3 Receptacles requiring wire gauge greater than #10 AWG shall have a junction box install in the nearest readily accessible ceiling reducing cable gauge to #10 for connection to receptacle terminals.

1.29 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 in maintenance manual.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 At completion of work, include in the maintenance manual, a report listing phase and neutral currents on: panelboards, dry-core transformers and motor control centers, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

1.30 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 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 associated controls.

.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.5 Fire pump and all motor load tests.

.6 Uninterruptable Power Supply (UPS) tests.

.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 Insulation resistance testing for main feeder installations.

.1 Test for cable insulation resistance shall be made by qualified field technician; name and certification shall be submitted for approval to Consultant if requested.

.2 Perform Megger tests on all wire insulations as per manufacturer instructions prior to energizing.

.3 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument and Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument. For other equipment, consult manufacturer for proper equipment.

.4 Take readings using the Time Resistance Method (successive reading for a period of 10 minutes). A good insulated device will show a continual increase in resistance.

.5 Wear appropriate personal protective equipment (PPE).

.6 All tests shall be recorded on a form sheet signed by the person performing the test and dated. A copy shall be submitted to the Consultant and another copy placed in the Operation and Maintenance Manual.

.7 Check resistance to ground before energizing.

.8 Inform Consultant of proposed corrective action if cable fails visual and/or insulation testing.

.5 Carry out tests in presence of Consultant.

.6 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.7 Submit test results for Consultant's review.

1.31 CO-ORDINATION OF PROTECTIVE DEVICES

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

1.32 AUTHENTIC MANUFACTURER

.1 Only authentic manufacturer equipment purchased through an authorized distributor shall be accepted. Refurbished or used equipment are not acceptable and if found will be replaced by authentic parts at contractor expense.

1.33 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Consultant with schedule within 2 weeks after award of Contract.

1.34 SCHEDULE

.1 Note that the Owner intends to carry on business as usual and work activities must be coordinated to maintain electrical services in occupied areas. Provide any required temporary work.

.2 Work activities which disrupt occupants of the building, such as excessive noise caused by drilling of walls, floors or ceilings must be approved and scheduled in writing with the building maintenance superintendent at least 48 hours in advance, and done outside normal working hours.

.3 All power shutdowns which affect building occupants or building operation must have prior approval of Owner and must be scheduled in writing at least 7 days in advance with the building maintenance superintendent.

.4 Overtime work and work outside normal work hours deemed necessary to accomplish scheduling are the responsibility of the Contractor and must meet the requirements of the Department of Post-Secondary Education, Training and Labour. All costs resulting from such Overtime work must be included in the Contractor's total tender price.

.5 Engineer-Architect may require work to be done in phases. Refer to Division 01 – General Requirements for additional information and requirements. All costs associated with phasing must be included in the Contractor's total tender price.

.6 If required by Engineer or Architect, contractor shall supply man hours related to each task identified in the construction schedule. [*only for large project requesting a detailed construction schedule*]

1.35 PROJECT COORDINATION

.1 The Electrical Contractor shall totally review all architectural, structural and mechanical drawings and specifications to coordinate and determine work associated with electrical work prior to submitting tender price. Also, review all Addendums associated with all trades.

.2 After review of all documents associated with other trades, forward any questions and obtain answers by Addendum, prior to tender submission.

.3 Submission of tender by Electrical Contractor acknowledges coordination with other trades as part of these contract documents.

.4 Whenever differences occur between plans and diagrams or schematics, and between specifications and diagrams, the maximum condition shall govern and the tender shall be based on whichever is the greater amount.

Part 2 Products

2.1 PRIOR APPROVAL OF PRODUCTS

.1 The use of any product not listed by name in the specification must be approved prior to tender submission. Refer to Section 00 21 14 – Instructions to Bidders.

.2 By using pre-approved product substitutions, the Contractor accepts the responsibility and associated costs for all required modifications to circuitry, devices and wiring. The Contractor shall submit complete engineered shop drawings (including power wiring) with deviations from the original design highlighted in an alternate colour to the Engineer-Architect for review and approval prior to rough-in.

.3 To meet design constraints there will be no alternates accepted for inverters or battery storage components.

2.2 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.3 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.4 Language operating requirements: provide identification nameplates and labels for control items in English.

2.3 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Division 01 – General Requirements.

.2 Material and equipment to be CSA certified. Where CSA certified material and equipment is not available, obtain special approval from inspection authorities before delivery to site and submit such approval as described in PART 1 – ACTION AND INFORMATIONAL SUBMITTALS.

.3 Factory assemble control panels and component assemblies.

.4 Where electrical equipment rooms are sprinklered in accordance with the National Building Code of Canada, the electrical equipment contained in such rooms is to have enclosures which comply with Canadian Electrical Code Rule 26-008.

.5 All equipment must fit into the space and configuration allocated. The Contractor to be responsible for resolving any increase in space requirements or configuration difficulties, due to non-conformity of said condition.

.6 The Contractor to ensure that all carried products, are completely physically and electrically compatible.

2.4 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and coordination responsibilities related to motors, equipment and controls, as indicated. Verify size, location and wiring requirements of all equipment with appropriate trade, reviewed shop drawings and site conditions prior to rough-in.

.2 Provide control wiring and conduit, except for conduit, wiring and connections below 50V which are related to control systems specified in mechanical sections and shown only on mechanical drawings.

.3 security areas and key latches provided where tampering is a concern. Steel to be prime coated. Access doors to be from an approved manufacturer with published literature.

2.5 WIRING TERMINATIONS

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

Part 3 Execution

3.1 WORKMANSHIP

.1 All connections and terminations shall be securely tightened so that heat cycling over the life of the equipment does not result in loose or overheated connections. Lugs, terminals, and wire shall be compatible materials not subject to electrolytic corrosion.

.2 All panels, equipment, conduit, and wiring shall be installed to avoid interferences with other equipment or working spaces. Layout all work in consultation with other trades and suppliers. Adhere to manufacturers shop drawings to locate conduits and terminations. Keep equipment and wiring clear of high temperature areas, where possible.

.3 When handling equipment, ensure that only proper lifting lugs or jacking pads are used, and that slings are clear of equipment.

.4 All equipment shall be properly leveled, plumbed, shimmed, secured in place, and grouted where necessary. Equipment shipped in pieces shall be securely assembled using all bolt holes provided.

.5 Where applicable, equipment shall be mounted so as to permit access by operations or maintenance personnel.

.6 Contractor shall provide watertight weather protection to seal all openings to the exterior required by this contract.

.7 Contractor shall provide watertight weather protection to seal all openings of sprinkler and rainthight equipment required by this contract.

3.2 CLEANING

.1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 26 00 10 - Electrical Installations General Requirements.

1.2 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:

.2 Nameplates:

.1 Lamicoid 3 mm thick plastic engraving sheet, white face, black core for non-essential power equipment, red face, white core for equipment on essential power, 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 Labels:

.1 Embossed plastic labels with 6 mm high letters unless specified otherwise.

.4 Wording on nameplates and labels to be approved by Consultant prior to manufacture.

.5 Allow for average of twenty-five (25) letters per nameplate and label.

.6 Identification to be English.

.7 Use one nameplate or label for both languages.

.8 All panels, disconnect switches, transformers, control panels, starters and other electrical equipment enclosures shall be provided with lamicoid nameplates. Nameplates shall be mechanically attached to all metal surfaces with metal type “pop-rivets” where possible.

.9 Nameplates that are attached to building exterior surfaces shall use nylon inserts and self tapping screws unless noted otherwise.

.10 Nameplates to other surfaces shall be affixed with contact type cement. Contact type cement shall be applied to complete back side of plate, as opposed to several points or locations on same.

.11 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics branch circuit breaker number. Label both box and cover.

.12 Nameplates for control panels, disconnects, starters and contactors: indicate equipment being controlled and voltage, phase, no. of wires, designated power source, branch circuit breaker numbers and HP or KW rating where applicable.

Example

Motor M-1 – 10HP 600V – 3PH – 3W Fed from MCC-1-2B

.13 Pull boxes: indicate system and voltage.

.14 Terminal cabinets and pull boxes: indicate system and voltage.

.15 Transformers: indicate capacity, primary and secondary voltages.

.16 Distribution panelboards, MCC's and splitters:

.1 Designated name of equipment,

.2 Overcurrent protection device rating,

.3 Voltage, phase, no. of wires and bus capacity,

.4 Designation of power source.

Example

MCC-1 – 600A 347/600V – 3PH – 4W Fed from Panel DPA-X4

.17 Panelboards: indicate voltage, current and panel number. Install additional lamicoid nameplate to indicate breakers which have been designed for, and incorporate an interrupting capacity sized larger than 10 KAIC.

.18 All wiring devices, including but not limited to receptacles and switches, shall have a transparent circuit identification permanently installed on coverplate indicating panelboard and circuit. Acceptable labelling product: Panduit #LS5 c/w LS5-530 tape or equivalent.

.19 All wiring devices, including but not limited to receptacles and switches, shall be labeled to identify panelboard and circuit with lamicoid nameplate mechanically fixed to wall above coverplates. Lamicoid shall be white face with black lettering for non essential power and red face with white lettering for essential power.

Example

EFG-36

.20 Cabinets: label as indicated.

.21 An additional lamicoid nameplate shall be installed on any piece of electrical equipment that has been designed to contain overcurrent protection devices having an interrupting capacity larger than 10 KAIC. Confirm such equipment with electrical drawings.

Example

Minimum interrupting capacity of breakers installed in this panel shall be no less than 22KAIC

1.3 WIRING IDENTIFICATION

.1 Identify wiring (including neutral conductors) with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring including in all junction boxes/ pull boxes located between.

.2 Markings shall indicate panel and circuit number; i.e., A1-27. Normal ground circuits to have ground, neutral and phase wires identified with black on white background tape or insulation.

.3 Tape to be vinyl, self-adhesive Electrovert Type Z Markers or equivalent.

.4 Use coloured plastic tapes to identify feeders on both ends of phase conductors and at junction and pull boxes of conductor insulation colours are other than red, black, blue, white and green.

.5 Maintain phase sequence and colour coding throughout.

.6 Colour code: to CSA C22.1.

.7 Use colour coded wires in communication cables, matched throughout system.

.8 Use colour coded wires in communication cables, matched throughout system. When category 6 communication cables are used, the following colour standard shall be followed:

Wireless Access Point	**Yellow**
HVAC	**Green**
Cameras	**Purple**
Uplink	**Red**
Specialty	**Black**
Standard Data	**White**
Telephone	**Blue**

1.4 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	**Auxiliary**
50V to 249V Normal	Green	
50V to 249V Emergency	Orange	
250V to 749V Normal	Blue	
250V to 749V Emergency	Yellow	
Low Voltage (ex. Lighting controls)	White	Pink
Telephone (Wired and Wireless)	White	
Data (includes Fiber, Multimedia)	White	Yellow
Public Address	White	Green
Nurse Call	White	Red
Intercom	White	Blue
Clock	White	Orange
Dictation	White	Brown
Intrusion	Red	Blue
CCTV	Red	Green
Door Access	Red	Orange
Fire Alarm	Red	
Fire Alarm Voice	Red	Black
Medical Gas Alarms	Red	Yellow
Patient Monitoring	Orange	Black
Controls (ex. HVAC)	Brown	Orange

.4 Contractor shall coordinate colors with existing building color coding, if any, and modify accordingly. All modifications shall be registered in Operation and Maintenance Manuals.

.5 All electrical and communication conduits shall be color coded as per Health Centre requirements.

1.5 WIRING TERMINATIONS

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

1.6 MANUFACTURERS AND CSA LABELS

.1 Visible and legible, after equipment is installed.

1.7 WARNING SIGNS

.1 As specified and to meet requirements of Electrical Inspection Department and Consultant.

.2 Porcelain enamel signs, minimum size 175 x 250 mm.

.3 All warning signs shall be in accordance with Occupational Safety and Health Administration (OSHA) regulations and shall be suitable for exterior use. The warning sighs shall be fastened with round head, type 316 stainless steel screws or bolts, located and mounted in a manner acceptable to the Engineer and be bilingual.

.4 Mount on back and front, approximately 1,500mm above grade, clearly lettered “HIGH VOLTAGE” sign for warning personnel.

.5 High voltage warning signs shall be as follow:

.1 Colored red with white lettering.

.2 178mm high by 254mm wide on a 1.6mm thick plastic or similar acceptable material.

.3 Text shall read:

1.8 SINGLE LINE ELECTRICAL DIAGRAMS

.1 Supply single line electrical diagrams under Plexiglas as follows:

.1 Electrical distribution system: locate in main electrical room.

.2 Drawings: 600 x 600 mm minimum size.

PART 2 Products

2.1 NOT USED

PART 3 Execusion

3.1 FIELD QUALITY CONTROL

.1 Contractor shall submit wording for all labels, nameplates and lamicoids to Consultant for review and approval. Failure to comply shall result in the replacement of all nameplates, labels and lamicoids at the contractor cost.

.2 Contractor shall submit all single line diagrams to Consultant for review and approval. Failure to comply shall result in the replacement of all single lines.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA InternationalCAN/CSA-C22.2 No.18, latest revision, Outlet Boxes, Conduit Boxes and Fittings.

.1 CAN/CSA-C22.2 No.65, latest revision, Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y-2, latest revision, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 26 00 10 – Electrical Installations General Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wire and box connectors from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan and/or Waste Reduction Workplan related to Work of this Section and in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.5 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan and/or Waste Reduction Workplan in accordance with Section 26 00 10 – Electrical Installations General Requirements.

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Crimp style wire connectors, nylon insulated, with current carrying parts of copper alloy, for conductors #16 AWG and smaller.

.4 Fork tongue, nylon insulated, crimp style terminals for connecting conductors #16 AWG and smaller to screw down terminals.

.5 Crimp style wire connectors, nylon insulated with current carrying parts of copper alloy, for connecting solid to stranded conductors.

.6 Compression type connectors or terminal blocks in suitable enclosure for connecting #6 AWG conductors and larger, unless indicated otherwise. Compression type connectors to have a temperature rating of 90 deg. C.

.7 Bushing stud connectors: to EEMAC 1Y-2 to consist of:

- .1 Connector body and stud clamp for round copper conductors.
- .2 Clamp for stranded copper conductors.
- .3 Clamp for stranded aluminum conductors .
- .4 Stud clamp bolts.
- .5 Bolts for copper bar.
- .6 Bolts for aluminum bar.
- .7 Sized for conductors, bars as indicated.

.8 Clamps or connectors for armoured cable, TECK cable aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2 No.18.

.9 Connection to motors shall be done using a dielectric insulation silicone gel as per Raychem GelCap motor connection kit or equivalent.

.10 Waterproof gel filled twist-on type wire connectors to: CAN/CSA-C22.2 No.65 and UL486D, with current carrying parts of copper alloy sized to fit copper conductors as required.

.1 Suitable for use in damp, wet, raintight and submersible locations.

.2 Temperature rating: 105 deg. C.

.3 Silicone sealant temperature: -43 deg. C to 204 deg. C.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connectors installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Remove insulation carefully from ends of conductors and cables 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 CAN/CSA-C22.2 No.65.

.3 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.

.4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

.2 Use gel filled connectors for splices in damp or wet locations such as in exterior light fixtures and receptacles.

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

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.3 Waste Management: separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 05 20 – Wire Box and Connectors (0 – 1000V).

.2 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

.3 Section 26 05 36 –Cable Trays for Electrical Systems.

.4 Section 26 05 43.01 – Installation of Cables in Trenches and Ducts.

1.2 REFERENCES

.1 Canadian Standard Association (CSA)

.1 CSA C22.2 No. 0.3, latest revision, Test Method for Electrical Wires and Cables.

1.3 PRODUCT DATA

.1 Provide product data in accordance with Section 26 00 10 – Electrical Installations General Requirements.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: remove for reuse and return of pallets, crates, padding and packaging materials in accordance with Section 26 00 10 – Electrical Installations General Requirements.

Part 2 Products

2.1 BUILDING WIRES

.1 Conductors:

.1 Solid for 10 AWG and smaller, stranded for 8 AWG and larger.

.2 Minimum size: 12 AWG for branch circuits, 12 AWG for bonding, 14 AWG for control circuits.

.2 Copper conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, Jacketted.

.3 Aluminum Conductor Material (ACM): sized in accordance with Canadian Electrical Code, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, non-jacketted. Minimum size permissible: #1/0 AWG.

.4 Conductor sizes on drawings are based on copper conductors. If ACM conductors are used, size must be adjusted to have equivalent ampacity.

.5 Note that copper conductors must be used where connected to 100% rated molded circuit breakers.

.6 Equivalent sized aluminum conductors shall be permitted for feeders fed from overcurrent devices rated 100A and above. Refer to electrical single line diagram cable list on drawings. Contractor shall provide credit if aluminium conductors are used. Even more, if aluminum conductors are used, the contractor is responsible to size the wires and conduits according to the CEC and shall ensure that the equipment can physical accept the bigger conduit/wires. No extra will be permitted for changes required for using aluminium conductors. Note that copper conductors must be used where connected to 100% rated molded circuit breakers.

2.2 TECK 90 CABLE

.1 Cable: in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Cable: to CAN/CSA C22.2 No. 131-M89 (R1994), Type TECK 90 Cable.

.3 Conductors:

.1 Grounding conductor: copper unless indicated otherwise.

.2 Circuit conductors: copper unless indicated otherwise on drawings, size as indicated.

.4 Insulation:

.1 Ethylene propylene rubber EP.

.2 Cross-linked polyethylene XLPE.

.3 Rating: 600V.

.5 Inner jacket: polyvinyl chloride material.

.6 Armour: interlocking aluminum.

.7 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project FT6.

.8 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 1500 mm centers.

.3 Threaded rods: 6 mm minimum diameter to support suspended channels.

.9 Connectors:

.1 Watertight, approved for TECK cable.

.2 Explosion proof approved for TECK cable where indicated.

.10 Termination kits: [field installed] [factory installed] approved for MI cable

2.3 NON-METALLIC SHEATHED CABLE

.1 Non-metallic sheathed copper cable type: NMD90XLPE size as indicated.

Part 3 Execution

3.1 GENERAL CABLE INSTALLATION

.1 All work to be concealed in finished areas.

.2 Service: building wire in conduit, copper or ACM conductors.

.3 Panel Feeders:

.1 Feeders fed from an overcurrent device rated up to and including 100A to utilize copper conductors in conduit.

.2 Feeders fed from an overcurrent device rated above 100A may utilize copper or ACM conductors in conduit.

.4 Branch circuit work:

.1 Concealed work in wall partitions: NMD 90.

.2 Horizontal work above accessible ceilings: NMD 90.

.3 Surface work: building wire in conduit.

.5 Mechanical equipment: NMD 90 or Teck cable, maximum length 1500 mm.

.6 Drops to light fixtures, rotating and vibrating equipment: building wire in flexible conduit or armoured cable, maximum length 1500 mm.

.7 Install cable in trenches in accordance with Section 26 05 43.01 – Installation of Cables in Trenches and in Ducts.

.8 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).

.9 Cable Colour Coding: to Section 26 00 53 – Identifications for Electrical Systems.

.10 Conductor length for parallel feeders to be identical.

.11 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.12 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.13 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

.14 When pulling cable, precaution must be taken to avoid exceeding cable maximum pull tension and minimum bending radius.

.15 Wiring for outdoor to use building wire in PVC conduit with liquid tight for drops to lights and equipments.

3.2 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 In underground ducts in accordance with Section 26 05 43.01 – Installation of Cables on Trenches and in Ducts.

3.3 INSTALLATION OF TECK90 CABLE (0 -1000 V)

.1 Group cables wherever possible on channels.

.2 Install cable exposed, securely supported by straps.

.3 Fasten in place at 1500 mm intervals and 300 mm from terminations.

.4 Use VFD cable between drive and motor where distance exceeds 10 m.

3.4 INSTALLATION OF NON-METALLIC SHEATHED CABLE

.1 Install cables.

.2 Install straps and box connectors to cables as required.

3.5 RESTRICTIONS

.1 Splices in wire and cable #6 AWG and larger are not permitted.

.2 Wiring and cabling installed directly in ceiling cavities must be run parallel and perpendicular to building lines. Wherever possible, wiring and cabling is to follow a common pathway.

.3 Flexible conduit or armoured cable drops to light fixtures to be installed from junction box to fixture. Loops between fixtures are not acceptable.

.4 Maximum exposed length of armoured cable from junction box to wall partition to be 3000 mm.

.5 All wiring for services within the building must be installed on the warm side of the vapour barrier unless prior approval is obtained from the Engineer-Architect to run on the cold side.

.6 Refer to Section 26 05 29 – Hangers and Supports for Electrical Systems, for acceptable support methods.

.7 Do not install cables, raceways and boxes directly to underside of roof decking. Support cables, raceways and boxes so that their nearest outside surface is not less than 38 mm from bottom of roof decking.

.8 RW90 wire in EMT conduit must be used where exposed.

3.6 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Perform tests using method appropriate to site conditions and to approval of Consultant and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

END OF SECTION

Part 1 General

1.1 REFERENCES

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

.1 ANSI/IEEE 837, latest revision, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

.2 CSA International

.1 CSA C22.2 No.41, latest revision, Grounding and Bonding Equipment (Bi-National Standard with UL 467).

.2 CSA Z32, latest revision, Electrical Safety and Essential Electrical Systems in Health Care Facilities.

.3 NB Power.

.1 Standard Construction Practices.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Operation and Maintenance Data: submit operation and maintenance data for grounding equipment for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 26 00 10 – Electrical Installations General Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect grounding equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan and/or Waste Reduction Workplan related to Work of this Section and in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.5 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan and/or Waste Reduction Workplan in accordance with Section 26 00 10 – Electrical Installations General Requirements.

Part 2 Products

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.

.2 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, tinned, soft annealed, size as required.

.3 Rod electrodes: copper clad steel 19 mm diameter by minimum 3 m long.

.4 Plate electrodes: copper, surface area 0.2 m^2, minimum 1.6 mm thick.

.5 Grounding conductors: bare stranded copper, tinned, soft annealed, size as indicated.

.6 Insulated grounding conductors: green, copper conductors, size as indicated.

.7 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.

.8 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.
.2 Protective type clamps.
.3 Bolted type conductor connectors.
.4 Thermit welded type conductor connectors.
.5 Bonding jumpers, straps.
.6 Pressure wire connectors.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for grounding equipment installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION GENERAL

.1 Electric power utility equipment including bollards if applicable, must be grounded in accordance with utility Standard Construction Practices.

.2 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run green insulated bonding conductor in all conduit.

.3 Install connectors in accordance with manufacturer's instructions.

.4 Protect exposed grounding conductors from mechanical injury.

.5 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process, permanent mechanical connectors or inspectable wrought copper compression connectors to ANSI/IEEE 837 as indicated.

.6 Use mechanical connectors for grounding connections to equipment provided with lugs.

.7 Soldered joints not permitted.

.8 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.9 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.10 Install separate ground conductor to outdoor lighting standards.

.11 Connect building structural steel and metal siding to ground by welding copper to steel.

.12 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.

.13 Ground secondary service pedestals.

3.3 ELECTRODES

.1 Make ground connections to continuously conductive underground water pipe on street side of water meter.

.2 Install water meter shunt.

.3 Install concrete encased electrodes in building foundation footings, with terminal connected to grounding network.

.4 Install rod electrodes and make grounding connections as indicated.

.5 Bond separate, multiple electrodes together.

.6 Use size 2/0 AWG copper conductors for connections between electrodes.

.7 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.4 EQUIPMENT GROUNDING

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

3.5 GROUNDING BUS

.1 Install copper grounding bus mounted on insulated supports on wall of electrical room and communication equipment room.

.2 Ground items of electrical equipment in electrical room and IT equipment in communication equipment room to ground bus with individual bare stranded copper connections size 2/0AWG.

3.6 COMMUNICATION SYSTEMS

.1 Install grounding connections for telephone, data, sound, fire alarm, security systems, intercommunication systems as follows:

.1 Telephones: make telephone grounding system in accordance with telephone company's requirements.

.2 Data: make data grounding system in accordance with ANSI J-STD-607-A and data installer’s requirements.

.3 Sound, fire alarm, security systems, intercommunication systems as indicated.

3.7 PERMAFROST

.1 Bond non-current carrying metal parts together with size #6 AWG copper equipotential conductor. Run conductor from separate lug or service neutral bar to, but not necessarily limited to, following indoor systems and equipment:

.1 Hot water heating system.

.2 Main water pipe.

.3 Main building drain.

.4 Telephone, radio/tv, emergency and fire alarm lead-in or service conduits, near panels.

.5 Make connections to pipes on building side of main valves and tanks. Connect jumpers across boilers to supply and return hot water heating pipes.

.2 Drive three -19 mm diameter x 3 m copper clad ground rods at least 1.8 m apart in original undisturbed ground. If rods will not penetrate permafrost, drive at angle not more than 60 degrees from vertical, and in same direction. Rods must be driven, not trenched.

.3 Install ground wire from service neutral bar to rods and where buried use bare copper not smaller than size 1 AWG strand or size 4 AWG solid, and at least 640 mm below ground. Bond ground conductor, or short tap from it, to outside metal sheathing of building close to power service conduit. Use lug or cast clamp, with bronze or plated bolt, nut and washers (not sheet metal screw or wood screw). Remove paint from sheathing for good contact. Conduit is required only on outside wall of building. Indoors, run bare and fasten as specified for equipotential bonding wire.

.4 Install electrode interconnections where metal parts, circuits or grounding conductors and/or electrodes are in proximity to lightning rod conductors.

3.8 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Consultant and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

3.9 CLEANING

.1 Progress Cleaning: clean in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.3 Waste Management: separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 00 10 – Electrical Installations General Requirements.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: remove for reuse and return of pallets, crates, padding and packaging materials in accordance with Section 26 00 10 – Electrical Installations General Requirements.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, pre-galvanized steel, [stainless steel 304] surface mounted or suspended as required.

2.2 SPECIFIC PURPOSE SUPPORTS

.1 Specific purpose heat treated, spring steel fasteners to support boxes, conduit and cable from main structure, channels, metal studs and T-bar ceilings.

.2 Acceptable manufacturer or approved equal:

.1 B-Line.

.2 Thomas & Betts.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to hollow masonry, tile and plaster surfaces with lead anchors or nylon shields.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Secure surface mounted equipment to inverted T bar ceilings with bar type box hangers fastened to grid. Ensure that T-bars and box hangers are adequately supported to carry weight of equipment specified before installation. Box hangers to be connected to building structure with independent hanger wire.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.7 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers (trapeze system) where direct fastening to building construction is impractical. Threaded rods to be attached the ceiling structure.

.8 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.

.9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.11 Do not use wire lashing, perforated strap, nylon or plastic self locking cable ties (Ty-raps) to support or secure raceways or cables.

.12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Consultant.

.13 Do not use T-bar ceiling hanger wires to support conduit and cable.

.14 Do not install cables, raceways and boxes directly to underside of roof decking. Support cables, raceways and boxes so that their nearest outside surface is not less than 38 mm from bottom of roof decking.

.15 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

3.2 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, latest revision, Canadian Electrical Code, Part 1.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Provide shop drawings: in accordance with Section 26 00 10 – Electrical Installations General Requirements.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installations General Requirements.

Part 2 Products

2.1 JUNCTION AND PULL BOXES

.1 Construction: welded steel enclosure.

.2 Covers Flush Mounted: 25 mm minimum extension all around.

.3 Covers Surface Mounted: screw-on flat covers.

Part 3 Execution

3.1 JUNCTION AND PULL BOXES

.1 Install junction boxes and pull boxes in inconspicuous but readily accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.

.3 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1. Provide pull boxes so as not to exceed 30 m of conduit run between pull boxes.

.4 Size and install junction and pull boxes to CSA C22.1.

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

3.2 IDENTIFICATION

.1 Equipment Identification: to Section 26 00 53 – Identification for Electrical Systems.

.2 Identification Labels: size 2 indicating system name, voltage and phase or as indicated.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, latest revision, Canadian Electrical Code, Part 1.

.2 CSA C22.2 No. 45, latest revision, Rigid Metal Conduit.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Submit samples for floor box covers in accordance with Section 26 00 10 – Electrical Installations General Requirements.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installations General Requirements.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 347 V outlet boxes for 347 V switching devices.

.6 Combination boxes with barriers where outlets for more than one system are grouped.

.7 The wiring from the essential power system shall be kept separate from other wiring.

2.2 GALVANIZED STEEL OUTLET BOXES

.1 One-piece electro-galvanized construction.

.2 Single and multi-gang flush device boxes for flush installation, minimum size 76 x 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. keep smaller jobs

.3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.5 Extension and plaster rings for flush mounting devices in finished plaster and/or tile walls.

.6 Round type plaster rings to be used in plaster construction only.

.7 Extension rings for flush mounting devices in manufactured casework as required.

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 CONDUIT BOXES

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

2.6 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

.1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63 mm with two double clamps to take non-metallic sheathed cables.

2.7 FITTINGS - GENERAL

.1 Set-screw type steel couplings and connectors for EMT. Connectors to have nylon insulated throats for conduits 27 mm and larger.

.2 Steel connectors, nylon insulated for flexible conduit.

.3 Bushing and connectors with nylon insulated throats.

.4 Knock-out fillers to prevent entry of debris.

.5 Conduit outlet bodies for conduit up to 35mm and pull boxes for larger conduits.

.6 All fittings entering sprinkler proof or rain tight equipment shall be of watertight protection type.

.7 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 Outlet boxes installed in steel stud partition walls to be supported with steel screw gun box brackets installed between studs.

.4 The use of surface mounted conduit boxes is to be minimized, limited to unfinished areas and is subject to the prior approval of the Consutlant.

.5 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.6 Refer to architectural details for boxes to be mounted in or behind casework and ensure box comes within 6 mm of opening. Install box extensions as required.

.7 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.

.8 Vacuum clean interior of outlet boxes before installation of wiring devices.

.9 Identify systems for outlet boxes as required in accordance with Section 26 00 53 – Identification for Electrical System.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.2 No. 18, latest revision, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.

.2 CSA C22.2 No. 45, latest revision, Rigid Metal Conduit.

.3 CSA C22.2 No. 56, latest revision, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.4 CSA C22.2 No. 83, latest revision, Electrical Metallic Tubing.

.5 CSA C22.2 No. 211.2, latest revision, Rigid PVC (Unplasticized) Conduit.

.6 CAN/CSA C22.2 No. 227.3, latest revision, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Product data: submit manufacturer's printed product literature, specifications and datasheets.

.1 Submit cable manufacturing data.

.3 Quality assurance submittals:

.1 Test reports: submit certified test reports.

.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Instructions: submit manufacturer's installation instructions.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

1.4 LOCATION OF CONDUITS

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

1.5 CONDUIT SIZE

.1 Conduit sizing, where indicated, is based on copper conductors and rigid steel conduit. Where aluminum conductor material (ACM) is used or where conduit type requires an additional bond wire, adjust conduit size to suit.

Part 2 Products

2.1 CABLES AND REELS

2.2 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel threaded.

.2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.

.3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with steel set-screw coupling and connectors.

.4 Rigid pvc conduit: to CSA C22.2 No. 211.2.

.5 Flexible metal conduit: to CSA C22.2 No. 56, steel.

.6 Flexible pvc conduit: to CAN/CSA-C22.2 No. 227.3.

2.3 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller.

.1 Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 1.5 m on centre.

.4 Threaded rods, 6 mm diameter, to support suspended channels.

2.4 CONDUIT FITTINGS

.1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.

.3 Steel Set-screws connectors for EMT.

.4 Watertight connectors with O-ring gasket for all sprinkler environment installation.

.1 Set-screws are not acceptable.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 200 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 FISH CORD

.1 Polypropylene.

2.7 SEALANT

.1 Low VOC mastic compound.

.1 Acceptable manufacturer or approved equal:

.1 Flex Grip.

.2 Kingco 11-600.

.3 Uni-mastic 181.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 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.

.3 Install conduit parallel or perpendicular to building lines.

.4 Use epoxy coated conduit in corrosive areas.

.5 Use electrical metallic tubing (EMT) except in cast concrete, above 2.4 m not subject to mechanical injury.

.6 Use rigid PVC for exterior branch circuit work.

.7 Use rigid PVC conduit for feeders and branch circuit work under ground floor slab and in poured concrete unless indicated otherwise. Where the use of underground duct is indicated, use duct to rigid PVC conduit transition for conduit extending above finished grade unless indicated otherwise. Apply cleaning and solvent compounds to

manufacturer's recommendations and make joints watertight. Install a separate integral bond wire sized in accordance with CEC in all rigid PVC conduit. Restrictions for use:

.1 Do not use in hazardous locations.

.2 Do not use where exposed.

.3 Must terminate at first flush outlet box in uninsulated wall (maximum allowable length from floor stub out to first outlet box is 1500 mm).

.4 Must be installed minimum of 50 mm below slab.

.5 Must contain an integral bond wire sized in accordance with CEC.

.6 Feeds from building exterior must make transition to EMT upon entering building.

.8 Use flexible metal conduit for connection to motors in dry areas

.9 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.10 Use rigid galvanize conduit in explosion proof environments.

.11 Use explosion proof flexible connection for connection to explosion proof motors.

.12 Install conduit sealing fittings in hazardous areas.

.1 Fill with compound.

.13 Minimum conduit size for lighting and power circuits: 21 mm.

.14 Holes for conduit through drywall partitions to be drilled neatly and as small as possible. After installation of conduit through holes, all remaining space surrounding the conduit is to be sealed with acoustical caulking or approved fire stopping material in the case of a rated partition. Penetrations through drywall partitions to be sealed on both sides of the partition.

.1 conduit from junction box to outlet boxes for each computer in sub-floor.

.15 Bend conduit cold:

.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.16 Mechanically bend steel conduit over 21 mm diameter.

.17 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.18 Install fish cord in empty conduits.

.19 Run 2-27 mm spare conduits up to ceiling space and 2-27 mm spare conduits down to ceiling space from each flush panel.

.1 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.

.20 Remove and replace blocked conduit sections.

.1 Do not use liquids to clean out conduits.

.21 Dry conduits out before installing wire.

.22 Conduits shall not be run horizontally in closed wall.

3.3 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 or surface channels.

.5 Do not pass conduits through structural members except as indicated.

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

3.4 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.

3.5 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel.

.1 Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed.

.1 Use cold mastic between sleeve and conduit.

.5 Conduits in slabs: minimum slab thickness 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

3.6 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

.1 Run conduits 27 mm and larger below slab and encase in 75 mm concrete envelope.

.1 Provide 50 mm of sand over concrete envelope below floor slab.

3.7 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

3.8 CONDUIT SEALANT

.1 All conduits entering buildings from underground or penetrating the building vapour barrier must be internally sealed immediately inside the building after installation of wires to prevent the entrance of water and condensation.

.2 Seal conduit using mastic compound.

.3 Install in accordance with manufacturer's recommendations.

3.9 CLEANING

.1 Proceed in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 00 10 – Electrical Installation General Requirements.

.2 Section 31 23 33.01 – Excavating, Trenching and Backfilling.

1.2 REFERENCES

.1 CSA International

.1 CAN/CSA-Z809, latest revision, Sustainable Forest Management.

.2 Forest Stewardship Council (FSC)

.1 FSC-STD-01-001, latest revision, FSC Principle and Criteria for Forest Stewardship.

.3 Insulated Cable Engineers Association, Inc. (ICEA)

.4 Sustainable Forestry Initiative (SFI)

.1 SFI – Standard, latest revision.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for cables and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 26 00 10 – Electrical Installation General Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect cables from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan and/or Waste Reduction Workplan related to Work of this Section and in accordance with Section 26 00 10 – Electrical Installation General Requirements.

.5 Packaging Waste Management: remove for reuse and/or return of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan and/or Waste Reduction Workplan in accordance with Section 26 00 10 – Electrical Installation General Requirements.

Part 2 Products

2.1 CABLE PROTECTION

.1 38 x 140 mm cedar planks.

2.2 MARKERS

.1 Nameplate: aluminum anodized 89 x 125 mm, 1.5 mm thick mounted on wall mylar label 0.125 mm thick with words Cable or Conduit Entry with depth to indicate building entry point.

.2 Marker tape:

.1 Metal detectable polyethylene marker tape: 75 mm wide for direct burial.

.2 Marker tape to be red in colour with the following words printed in large black block letters: CAUTION CAUTION CAUTION ELECTRIC LINE BURIED BELOW.

2.3 SEALANT

.1 Low VOC mastic compound.

.1 Acceptable manufacturer or approved equal:

.1 Flex Grip.

.2 Kingco 11-600.

.3 Uni-mastic 181.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for cable installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 DIRECT BURIAL OF CABLES

.1 After sand bed in accordance with Section 26 00 10 – Electrical Installation General Requirements, is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable.

.1 Do not pull cable into trench.

.2 Include offsets for thermal action and minor earth movements.

.1 Offset cables 150 mm minimum for each 60 m run, maintaining minimum cable separation and bending radius requirements.

.3 Make termination and splice only as indicated leaving 0.6 m minimum of surplus cable in each direction.

.1 Make splices and terminations in accordance with manufacturer's written recommendations using approved splicing kits.

.4 Underground cable splices not acceptable.

.5 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable or in accordance with manufacturer's written recommendations; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.

.6 Cable separation:

.1 Maintain 75 mm minimum separation between cables of different circuits.

.2 Maintain 300 mm minimum horizontal separation between low and high voltage cables.

.3 When low voltage cables cross high voltage cables maintain 300 mm vertical separation with low voltage cables in upper position.

.4 At crossover, maintain 75 mm minimum vertical separation between low voltage cables and 150 mm between high voltage cables.

.5 Maintain 300 mm minimum lateral and vertical separation for fire alarm and control cables when crossing other cables, with fire alarm and control cables in upper position.

.6 Install treated planks on lower cables 0.6 m minimum in each direction at crossings.

.7 After sand protective cover specified in Section 26 00 10 – Electrical Installation General Requirements, is in place, install continuous row of overlapping 38 x 140 mm cedar planks as indicated to cover length of run.

3.3 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated in ducts.

.2 Do not pull spliced cables inside ducts.

.3 Install multiple cables in duct simultaneously.

.4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.5 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.

.6 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.

.7 After installation of cables, seal duct ends with duct sealing compound.

.8 Install in each empty duct a pull rope continuous throughout each duct run with 3 m spare rope at each end.

3.4 MARKERS

.1 Install wall mounted type markers where underground conduits and/or cables enters a building.

.2 Install marker tape 300 mm below grade and as indicated, continuous over full length of cable ducts.

3.5 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 00 10 – Electrical Installation General Requirements.

.2 Perform tests using qualified personnel.

.1 Include necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds.

.1 Ensure resistance to ground of circuits is not less than 50 megohms.

.5 Pre-acceptance tests:

.1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000V megger on each phase conductor.

.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.6 Acceptance Tests:

.1 Ensure that terminations and accessory equipment are disconnected.

.2 Ground shields, ground wires, metallic armour and conductors not under test.

.3 High Potential (Hipot) Testing.

.1 Conduct hipot testing in accordance with manufacturer's recommendations.

.4 Leakage Current Testing:

.1 Raise voltage in steps from zero to maximum values as specified by manufacturer for type of cable being tested.

.2 Hold maximum voltage for specified time period by manufacturer.

.3 Record leakage current at each step.

.7 Provide Consultant with list of test results showing location at which each test was made, circuit tested and result of each test.

.8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 26 00 10 – Electrical Installation General Requirements.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 26 00 10 – Electrical Installation General Requirements.

.3 Waste Management: separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installation General Requirements.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 PROTECTION

.1 Repair damage to adjacent materials caused by cables installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CAN/CSA-C22.2 No.47-M90, latest revision, Air-Cooled Transformers (Dry Type).

.2 CSA C9-02, latest revision, Dry-Type Transformers.

.3 NRCan 2019 CAN/CSA-C802.2, latest revision, Minimum Efficiency Values for Dry Type Transformers.

.2 National Electrical Manufacturers Association (NEMA)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Operation and Maintenance Data: submit operation and maintenance data for dry type transformers for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 26 00 10 – Electrical Installations General Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect dry type transformers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan and/or Waste Reduction Workplan related to Work of this Section and in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.5 Packaging Waste Management: remove for reuse and/or return of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan and/or Waste Reduction Workplan in accordance with Section 26 00 10 – Electrical Installations General Requirements.

Part 2 Products

2.1 DESIGN DESCRIPTION

.1 Transformers to be in accordance with CSA C9 and CAN/CSA C22.2 No.47.

.2 Load and no-load efficiencies and losses to be in accordance with CAN/CSA C802.2.

.3 Use transformers from one manufacturer throughout project.

.4 Transformer design to meet equipment space allowance indicated on drawings.

- .1 Type: ANN.
- .2 3 phase, kVA, V input and V output as shown on drawings, 60 Hz.
- .3 Voltage taps: standard.
- .4 Insulation: Class 1 220 with epoxy impregnation insulation system, 150 degrees C temperature rise.
- .5 Basic Impulse Level (BIL): standard.
- .6 Hipot: standard.
- .7 Average sound level: standard.
- .8 Impedance at 17 degrees C: standard.
- .9 Enclosure: CSA, air ventilated, sprinkler proof, removable metal front panel.
- .10 Mounting: wall as indicated.
- .11 Finish: in accordance with Section 26 00 10 – Electrical Installations General Requirements.
- .12 Copper windings.
- .13 Winding configuration to be as noted on drawings.
- .14 Voltage Regulation to be 4% or better.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Label size: 7.

.3 Nameplate wording shall include equipment identification, KVA rating and fed from information.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for dry type transformers installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Mount dry type transformers up to 75 kVA as indicated. Mount dry type transformers above 75 kVA on floor on housekeeping pad.

.2 Ensure adequate clearance around transformer for ventilation.

.3 Transformer rated greater then 50kVA shall have a minimum horizontal working space of 1m on the sides that provide access to the conductor connections. Refer to CEC-2-312.

.4 Install transformers in level upright position.

.5 Remove shipping supports only after transformer is installed and just before putting into service.

.6 Loosen isolation pad bolts until no compression is visible.

.7 Make primary and secondary connections in accordance with wiring diagram.

.8 Energize transformers after installation is complete.

.9 Make conduit entry into bottom 1/3 of transformer enclosure.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.3 Waste Management: separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by dry type transformers installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CSA C22.2 No.29, latest revision, Panelboards and Enclosed Panelboards.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for panelboards and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Include on drawings:

.1 Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Operation and Maintenance Data: submit operation and maintenance data for panelboards for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 26 00 10 – Electrical Installations General Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect panelboards from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan and/or Waste Reduction Workplan related to Work of this Section and in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.5 Packaging Waste Management: remove for reuse and/or return of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan and/or Waste Reduction Workplan in accordance with Section 26 00 10 – Electrical Installations General Requirements.

Part 2 Products

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2 No.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 V panelboards: bus and breakers rated for 25 kA (symmetrical) interrupting capacity or as indicated on drawing.

.3 600 V panelboards: bus and breakers rated for 25 kA (symmetrical) interrupting capacity or as indicated on drawing.

.4 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

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

.6 Minimum of 2 flush locks for each panel board.

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

.8 Aluminum bus with neutral of same ampere rating of mains.

.9 Mains: suitable for bolt-on breakers.

.10 Trim with concealed front bolts and hinges.

.11 Trim and door finish: baked enamel.

.12 Isolated ground bus.

.13 Include grounding busbar with 3 of terminals for bonding conductor equal to breaker capacity of the panel board.

2.2 BREAKERS

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

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

.3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.4 Lock-on devices for 10% of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to Owner.

.5 Lock-on devices for fire alarm, door supervisory, intercom, exit and night light circuits.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.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, mounted in plastic envelope at inside of panel door.

.5 Circuits supplying Patient Care Areas must be entered in circuit directory with Bold Font.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for panelboards installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

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

.2 Install surface mounted panelboards on plywood backboards (painted with fire rated paint) in accordance with Section 26 00 10 – Electrical Installations General Requirements. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height specified in Section 26 00 10 – Electrical Installations General Requirements or as indicated.

.4 Connect loads to circuits.

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

.6 Where panels of different systems (i.e. Standard and Vital Power) supply a common patient care area, ground busses in panels to be interconnect with a minimum #6 AWG ground conductor.

.7 Run 2-27 mm spare conduits up to ceiling space and 2-27 mm spare conduits down to ceiling space from each flush/recessed panelboards.

.1 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.

.8 Breaker locking devices shall be provided as necessary for circuits supplying safety equipment.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.3 Waste Management: separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by panelboards installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CSA C22.2 No.42, latest revision, General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CAN/CSA C22.2 No.42.1, latest revision, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA C22.2 No.55, latest revision, Special Use Switches.

.4 CSA C22.2 No.111, latest revision, General-Use Snap Switches (Bi-national standard, with UL 20).

.5 CAN/CSA C22.2 No. 144.1-06 (R2011), Ground Fault Circuit Interrupters (Tri-national standard, with UL 943 and NMX-J-520-ANCE)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations and General Requirements.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings as per Section 26 00 10 – Electrical Installations and General Requirements

.1 Indicate on drawings:

.1 Rating

.2 NEMA configuration

.3 Connection method

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations and General Requirements.

.2 Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 26 00 10 – Electrical Installations and General Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wiring devices from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan and/or Waste Reduction Workplan related to Work of this Section and in accordance with Section 26 00 10 – Electrical Installations and General Requirements

.5 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, and packaging materials as specified in 26 00 10 – Electrical Installations and General Requirements.

Part 2 Products

2.1 SWITCHES

.1 15A, voltage as indicated, single pole, double pole, three-way, four-way switches to: CSA C22.2 No.55 and CSA C22.2 No.111.

.2 Manually-operated general purpose AC switches with following features:

.1 Terminal holes approved for No. 10 AWG wire.

.2 Silver alloy contacts.

.3 Urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 white toggle.

.3 Toggle operated locking fully rated for up to 80% of rated capacity of motor loads and/or heating loads with pilot light.

.4 Commercial specification grade must be used.

.5 Switches of one manufacturer throughout project.

.6 Acceptable Manufacturer:

.1 120V Toggle:

.1 Hubbell

.2 Leviton

.3 Pass & Seymour

.2 120V, Lock Type:

.1 Hubbell

.2 Leviton

.3 Pass & Seymour

.3 120V, 3 Way Toggle:

.1 Hubbell

.2 Leviton

.3 Pass & Seymour

.4 120V, 4 Way Toggle

.1 Hubbell

.2 Leviton

.3 Pass & Seymour

.5 120V, occupancy sensor type as per Lithonia Sensor Switch # WSX Series or approved equal.

.6 120V, occupancy sensor with dimming type as per Lithonia Sensor Switch # WSX D Series or approved equal.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features:

.1 White urea molded housing.

.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.

.6 Commercial specification grade must be used.

.7 Acceptable manufacturer:

.1 Hubbell

.2 Leviton

.3 Pass & Seymour

.2 Duplex receptacles CSA type 5-15R, 120VAC, 15A, closed sensitivity of 5mA with following features:

.1 White urea molded housing.

.2 Suitable for No. 10 AWG for side wiring.

.3 Four side wiring screws.

.4 Reset button to rearm GFCI after tripping.

.5 Test button to test trip GFCI for operability.

.6 Commercial specification grade must be used.Acceptable materials:

.1 Hubbell

.2 Leviton

.3 Pass & Seymour

.3 Duplex receptacles CSA type 5-20RA, 125V, 20A, U ground with the following features:

.1 White area molded housing.

.2 Suitable for No. 10AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Four side wiring screws.

.5 Commercial specification grade must be used.

.6 Acceptable materials:

.1 Hubbell

.2 Leviton

.3 Pass & Seymour

.4 Duplex receptacles CSA type 5-20R, 120VAC, 20A, closed sensitivity of 5mA with following features:

.1 White urea molded housing.

.2 Suitable for No. 10 AWG for side wiring.

.3 Four side wiring screws.

.4 Reset button to rearm GFCI after tripping.

.5 Test button to test trip GFCI for operability.

.6 Commercial specification grade must be used.

.7 Acceptable materials:

.1 Hubbell

.2 Leviton

.3 Pass & Seymour

.5 TVSS receptacle such as Hubell HBL5260SA or approved equal.

.6 USB receptacle such as Hubell SNAP8200UACW or approved equal.

.7 Commercial specification grade must be used.

.8 Receptacles of one manufacturer throughout project.

2.3 COVER PLATES

.1 Cover plates for wiring devices to: CSA C22.2 No.42.1.

.2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.3 White thick cover plates for wiring devices mounted in flush-mounted outlet box.

2.4 SOURCE QUALITY CONTROL

.1 Cover plates from one manufacturer throughout project.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wiring devices installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 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 00 10 – Electrical Installations General Requirements unless indicated otherwise.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 All receptacle mounted horizontally shall have the ground contact on the left and all receptacles mounted vertically shall have the ground contact at the top.

.3 Mount receptacles at height in accordance with Section 26 00 10 – Electrical Installations General Requirements unless indicated otherwise.

.4 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.5 Install GFR type receptacles when 20A or 15A receptacle are installed within 1.5 meter of a sink, bathtub or shower stall. Additionally, install GFR type receptacles as indicated on the drawings.

.3 Cover plates:

.1 Install suitable common cover plates where wiring devices are grouped.

.2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.3 Waste Management: separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.3 Repair damage to adjacent materials caused by wiring device installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CSA C22.2 No. 5, latest revision, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Include time-current characteristic curves for breakers with ampacity of 100 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

.4 Certificates:

.1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit 3 copies of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.

.1 Production certificate of origin must be submitted to Consultant for approval.

.2 Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.

.3 Any work of manufacturing, assembly or installation to begin only after acceptance of production certificate of origin by Consultant. Unless complying with this requirement, Consultant reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.

.4 Production certificate of origin must contain:

.1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.

.2 Licensed dealer's name and address and person of distributor responsible for Contractor's account.

.3 Contractor's name and address and person responsible for project.

.4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.

.5 Name and address of building where circuit breakers will be installed:

.1 Project title.

.2 End user's reference number.

.3 List of circuit breakers.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 26 00 10 – Electrical Installations General Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store circuit breakers off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect circuit breakers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan and/or Waste Reduction Workplan related to Work of this Section and in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.5 Packaging Waste Management: remove for reuse and/or return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan and/or Waste Reduction Workplan in accordance with Section 26 00 10 – Electrical Installations General Requirements.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers, Circuit breakers, and ground-fault circuit-interrupters, fused circuit breakers, and accessory high-fault protectors: to CSA C22.2 No. 5

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.3 Common-trip breakers: with single handle for multi-pole applications.

.4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.5 Circuit breakers with interchangeable trips on units over 200A or as indicated.

.6 Circuit breakers to have minimum symmetrical rms interrupting capacity rating as indicated on single line diagram, minimum of 10kA for 250V and 14kA for 600V.

.7 Circuit breakers to be supplied by the same manufacturer as the panelboard or distribution board in which they are being installed.

.8 Mini circuit breakers, twin or tandem breakers are not acceptable.

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.

.1 .

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Install circuit breakers in electrical distribution equipment as indicated.

.2 Use thermal magnetic breakers unless indicated otherwise on drawings.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.3 Waste Management: separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA C22.2 No.4, latest revision, Enclosed Switches.

.2 CSA C22.2 No.39, latest revision, Fuseholder Assemblies.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 26 00 10 – Electrical Installation General Requirements.

1.3 HEALTH AND SAFETY

.1 Do construction occupational health and safety in accordance with Section 26 00 10 – Electrical Installation General Requirements.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installation General Requirements.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard and packaging material for recycling in accordance with Waste Management Plan.

.4 Separate for reuse and/or recycling and place in designated containers waste in accordance with Waste Management Plan.

.5 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Fusible or non-fusible, Heavy- Duty Nema 12 inside, Nema 3R outside or as indicated, horsepower rated disconnect switch in CSA Enclosure 1, to CAN/CSA C22.2 No.4 size as indicated.

.2 Provision for padlocking in off switch position by three locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuses: size as indicated, in accordance with Section 26 28 13.01 - Fuses - Low Voltage.

.5 Fuseholders: to CSA C22.2 No.39 relocatable and suitable without adaptors, for type and size of fuse indicated.

.6 Quick-make, quick-break action.

.7 ON-OFF switch position indication on switch enclosure cover.

2.2 HP RATED TOGGLE DISCONNECT

.1 Heavy- Duty, horsepower rated toggle disconnect switch in CSA Enclosure NEMA type 12

.2 Provision for padlocking in off switch position.

.3 Acceptable manufacturers:

1. Square D type K
2. Eaton
3. Siemens

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 00 53 – Identification for Electrical Systems.

.2 Indicate name of load controlled on size 4 nameplate.

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI C82.1, latest revision, Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.

.2 ANSI C82.4, latest revision, Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps Multi Supply Type.

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

.1 ANSI/IEEE C62.41, latest revision, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

.3 ASTM International Inc.

.1 ASTM F1137, latest revision, Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.2 ASTM A123/A123M, latest revision, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.3 ASTM A167, latest revision, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip

.4 ASTM A366/A366M, latest revision, Specification for Steel Sheet, Carbon, Cold-Rolled, Commercial Quality.

.4 Illuminating Engineering Society of North America (IESNA)

.1 IES Lighting Handbook, Reference and Application.

.5 Canadian Standards Association (CSA International)

.6 ICES-005, latest revision, Radio Frequency Lighting Devices.

.7 Underwriters' Laboratories of Canada (ULC)

.1 UL 94, latest revision, Test for Flammability of Plastic Materials for Parts in Devices and Appliances.

.2 UL 496, latest revision, Edison-Based Lampholders.

.3 UL 508, latest revision, Industrial Control Equipment.

.4 UL 542, latest revision, Fluorescent Lamp Starters.

.5 UL 595, latest revision, Marine-Type Electric Lighting Fixtures.

.6 UL 1029, latest revision, High-Intensity Discharge Lamp Ballasts.

.7 UL 1570, latest revision, Fluorescent Lighting Fixtures.

.8 UL 1571, latest revision, Incandescent Lighting Fixtures.

.9 UL 1572, latest revision, High Intensity Discharge Lighting Fixtures.

.10 UL 8750, latest revision, The Standard for Safety of Light Emitting Diode (LED) Equipment for use in Lighting Product.

.8 Consortium for Energy Efficiency (CEE).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide complete photometric data prepared by independent testing laboratory for luminaires where specified, for approval by Consultant.

.3 Photometric data to include: VCP Table where applicable.

.3 Quality assurance submittals: provide following in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.3 QUALITY ASSURANCE

.1 Provide mock-ups in accordance with Section 26 00 10 – Electrical Installations General Requirements.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse and return of pallets, crates, paddling and packaging materials in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.4 Divert unused metal materials from landfill to metal recycling facility.

.5 Disposal and recycling of fluorescent lamps as per local regulations.

.6 Disposal of old PCB filled ballasts.

Part 2 Products

2.1 LIGHT EMITTING DIODE (LED) LUMINAIRE

.1 The LED luminaire shall consist of a LED Luminaire Assembly, LED Driver and mounting hardware.

.2 LED Luminaire requirements shall be as described, but no limited to, below:

- .1 Voltage input as indicated in luminaire schedule (±10%), 60Hz.
- .2 Correlated Color Temperature (CCT) and Color Rendering Index (CRI) as indicated in luminaire schedule.
- .3 Conformance with UL 8750.

.3 LED Luminaire Assembly requirements shall be as described, but not limited to, below:

- .1 Definition: Luminaire Assembly is the LED assembly without the LED Driver.
- .2 Input voltage shall be 24VDC or 36VDC.
- .3 CCT, CRI, minimum life and UL shall be as described in luminaire schedule.

.4 LED Driver requirements shall be as described, but not limited, below:

- .1 Voltage operation as indicated on luminaire schedule (±10%).
- .2 Operating frequency 60Hz.
- .3 Operating temperature between -40°C to +50°C.
- .4 Minimum efficiency of 85%.
- .5 Self-protected including short circuit protection.
- .6 Power factor (PF) $\geq$ 0.90.

2.2 LIGHT POLES

.1 Supply type, configuration and dimensions as indicated on drawings and in luminaire schedule. Maximum deflection of the poles shall be 5% when fully loaded. Poles shall resist wind loads in accordance with the Canadian Building Code. Supply pole as indicated with handhole and flush cover with tamper proof screw and grounding stud, luminaire mounting tenon/bracket, base cover and mounting hardware including anchor bolts, nuts, washers and baseplate to permit accurate alignment and installation of pole and luminaire as indicated.

.2 Contractor shall be responsible to coordinate with general contractor for pouring of light pole concrete base for exact location and conduit rough-in.

2.3 FINISHES

.1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

2.4 OPTICAL CONTROL DEVICES

.1 As indicated in luminaire schedule.

2.5 LUMINAIRES

.1 As indicated in luminaire schedule.

.2 Approved equals from Signify, StandPro and Cooper Lighting will also be accepted.

2.6 DRYWALL FRAMING KITS

.1 Except where flanged luminaires are specified, drywall framing kits are to be provided where required to adapt grid trimmed luminaires to drywall ceilings. Frame finish to be baked white enamel. Refer to architectural drawings and finish schedule to determine where drywall framing kits are required.

Part 3 Execution

3.1 INSTALLATION

.1 Locate and install luminaires as indicated.

.2 Provide adequate support to suit ceiling system.

.3 Supply and install all materials and accessories as required for proper mounting of all luminaires.

.4 Install drywall framing kits to adapt grid trimmed luminaires to drywall ceilings as required.

3.2 WIRING

.1 Connect luminaires to lighting circuits:

.1 Install flexible or rigid conduit for luminaires as indicated.

3.3 LUMINAIRE SUPPORTS

.1 For suspended ceiling installations support luminaires independently of ceiling.

.2 Install safety cables for all suspended luminaires from the fixture housing to the building structure.

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 LIGHT POLES

.1 Install light poles as indicated and in accordance with the manufacturer’s recommendations. Light poles shall be grounded as indicated on drawings.

3.6 CLEANING

.1 Clean in accordance with Section 26 00 10 – Electrical Installation General Requirements.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installation General Requirements.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CSA C22.2 No.141, latest revision, Emergency Lighting Equipment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for emergency lighting and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Operation and Maintenance Data: submit operation and maintenance data for emergency lighting for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 26 00 10 – Electrical Installations General Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect emergency lighting from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan and/or Waste Reduction Workplan related to Work of this Section and in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.5 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, and packaging materials as specified in 26 00 10 – Electrical Installations General Requirements.

1.5 WARRANTY

.1 For batteries in this Section 26 52 00 - Emergency Lighting, 12 months warranty period is extended to 120 months.

Part 2 Products

2.1 EQUIPMENT

.1 Emergency lighting equipment: to CSA C22.2 No.141.

.2 Supply voltage: 120V, AC.

.3 Output voltage: 12V DC.

.4 Operating time: 30 minutes.

.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 0.01 V for plus or minus 10% input variations.

.7 Solid state transfer circuit.

.8 Auto diagnostics built-in.

.9 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

.10 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.

.11 Lamp heads: integral on unit, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: LED, 5.7 W, minimum 200 lumen minimum output.

.12 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. White finish.

.13 Wire guards where indicated.

.14 Acceptable manufacturers for battery pack fixtures as indicated on drawings.

.15 Acceptable manufacturers for remote head fixturesas indicated on drawings.

2.2 WIRING OF REMOTE HEADS

.1 Conduit: type EMT, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 Conductors: Building (RW90) type 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 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for emergency lighting installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Install unit equipment and remote mounted fixtures.

.2 Make normal and emergency power connections.

.3 Direct heads.

.4 Connect exit lights to unit equipment.

.5 Test each unit for 30 minutes on emergency.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.3 Waste Management: separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by emergency lighting installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.141, latest revision, Unit Equipment for Emergency Lighting.

.2 CSA C860, latest revision, Performance of Internally-Lighted Exit Signs.

.2 National Fire Protection Association (NFPA)

.1 NFPA 101, latest revision, Life Safety Code.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.4 Quality Assurance Submittals: submit following in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.1 Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and/or recycling in accordance with Section 26 00 10 – Electrical Installations General Requirements.

Part 2 Products

2.1 SELF-POWERED UNITS

.1 Exit lights: to CSA C22.2 No.141 and CSA C860.

.2 Housing: extruded aluminum housing, brush aluminum finish.

.3 Face and back plates: cast aluminum alloy.

.4 Lamps: LED-12W, 100,000 hours.

.5 Operation: designed for 100,000 hours LED lamps only, 100,000 hours of continuous operation without relamping.

.6 Pictogram: Dimension as per ISO and color green as per ISO 3854-1.

.7 Downlight: white glass in bottom of unit.

.8 Face plate to remain captive for relamping.

.9 Supply voltage: 120V ac.

.10 Output voltage: 12V dc.

.11 Operating time: 30 minute minimum.

.12 Recharge time: 12 hours

.13 Auto diagnostics built-in.

.14 Battery: sealed, maintenance free.

.15 Charger: solid state, voltage/current regulated, inverse temperature compensated, short circuit protected, with regulated output of plus or minus 0.01 V for plus or minus 10% V input variation.

.16 Solid state transfer circuit.

.17 Signal lights: solid state, for 'AC Power ON' and 'High Charge' condition.

.18 Mounting: suitable for universal mounting directly on junction box and c/w knockouts for conduit.

.1 Removable or hinged front panel for easy access to batteries.

.19 Wire guard as required.

.20 Acceptable material:

.1 Lumacell
.2 Aimlite
.3 Ready-Lite

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install exit lights to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.

.2 Install pictogram legends as required to direct traffic along path of egress.

.3 Connect exit signs to dedicated circuits as shown on drawings.

.4 Connect emergency battery transformer to circuit supplying luminaire in the affected area.

.5 Ensure that exit light circuit breaker is locked in on position.

3.3 CLEANING

.1 Proceed in accordance with Section 26 00 10 – Electrical Installations General Requirements.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION