PART 1 Specification List

DIVISION 26 – ELECTRICAL INSTALLATION

END OF SECTION

PART 1 General

1.1 SCOPE OF WORK

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

.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 AND 27

.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 Electrical demolition and relocation of PIL Booth #1 and PIL Booth #2, as indicated on drawings;
- .2 Wiring of equipment supplied by others including mechanical systems and building service equipment;
- .3 Supply and installation of wiring devices;
- .4 Supply and installation of interior luminaires, lamps and their controls;
- .5 Supply and installation of conduit, cable tray, and wiring;
- .6 Supply and installation of electric heating and associated controls;
- .7 Testing of systems for acceptance by inspection authority;
- .8 Supply of temporary lighting and power;
- .9 Mark-up "Records Drawings" in red on print provide to Consultant.

1.4 WORK NOT INCLUDED IN DIV. 26 AND 27

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

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

.3 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.

.4 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.

1.5 PRICE BREAKDOWN

.1 Furnish to Consultant within forty-eight (48) hours of tender closing a breakdown of tendered price into the following categories:

.1 Set-up, permits, and sleeving.

.2 Installation and supply of electrical equipment for PIL Booth #1 (including demolition).

.3 Installation and supply of electrical equipment for PIL Booth #2 (including demolition).

.4 Testing and commissioning.

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 10 10 – General Requirements

.2 Section 01 61 00 – Common Product Requirements

.3 Section 01 35 29-06 – Health and Safety Requirements.

.4 Section 01 35 35 – Fire Safety Requirements.

.5 Section 01 78 00 – Closeout Submittals.

.6 Section 01 45 00 – Quality Control.

.7 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.8 Section 01 33 00 – Submittal Procedures.

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 CAN3-C235, latest revision, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.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.

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 Division 25.

.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 Submittals: in accordance with Section 01 33 00 - Submittal Procedures. All inquires, shop drawings, request for substitutions and similar items shall be submitted to the Consultant.

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

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

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

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

.7 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.

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

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

.10 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.

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

.3 Permits, fees and inspections

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

.2 Pay associated fees.

.3 Consultant will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost.

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

.5 Obtain wiring permit prior to commencing work.

.6 Advise Consultant 72 hours in advance for all inspections required as per Section 26 06 01 - Electrical Systems Inspection Schedules.

1.6 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.

1.7 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.

1.8 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

.5 All work shall meet the requirements of the wiring guidelines for patient service areas in New-Brunswick Hospitals, as prepared by the Bioengineering Institute, UNB, latest edition, where applicable, as well as CAN/CSA-Z32.04, Electric Safety and Essential Systems in Health Care Facilities.

1.9 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.

1.10 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.

1.11 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.

1.12 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.

1.13 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.

1.14 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.

1.15 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 CD (compact disk).

.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:

.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.

.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 and 27 specifications.

.11 Copy of electrical permit associated with the project.

.12 A letter of guarantee.

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

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

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

1.17 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.

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

1.19 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.

1.20 LOCATION OF OUTLETS

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

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

1.21 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: 300 mm.

.2 Above top of continuous baseboard heater: 200 mm.

.3 Above top of counters or counter splash backs: 200 mm.

.4 In mechanical rooms: 1400 mm.

.5 In utility rooms: 1200 mm.

.6 In washrooms and janitor closets: 1200 mm.

.3 Panelboards: as required by Code or as indicated.

.4 Thermostats: 1500 mm.

.5 Clocks: 2100 mm.

.6 Telephone and interphone outlets: 300 mm.

.7 Wall mounted telephone and interphone outlets: 1400 mm.

.8 Fire alarm stations: 1400 mm.

.9 Fire alarm bells: 2100 mm.

.10 Television outlets: 300 mm.

.11 Door bell pushbuttons: 1400 mm.

.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.

1.22 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.

1.23 VOLTAGE DROP

.1 All conductors were sized for a maximum voltage drop of 3% per cable run and a total of 5% from Utility supply service to device. Contractor wishing to reduce cable sizes based on cable ampacity from CEC tables shall provide calculations showing that CEC rule 8-102 is respected

1.24 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.

1.25 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 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 Carry out tests in presence of Consultant.

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

.6 Submit test results for Consultant's review.

1.26 CO-ORDINATION OF PROTECTIVE DEVICES

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

1.27 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.

Part 2 Products

2.1 Not used

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.

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 DESCRIPTION OF WORK

.1 This section addresses the complete removal of electrical equipment that is obsolete, abandoned or made redundant by this Contract as specified. It also covers alteration of existing electrical services affected by renovations.

.2 Existing electrical services including conduit and wire shall be relocated / rerouted as required to allow for renovations and new construction. This includes relocating/rerouting to accommodate other trades.

.3 Work include, but is not limited to, the following:

- .1 Replacement of distribution equipment.
- .2 Lighting.
- .3 Wiring devices.
- .4 Intrusion system devices.
- .5 Removal of equipment and devices as indicated.
- .6 Removal of any temporary electrical equipment.
- .7 Testing of equipment and cleaning of site.

.4 Refer to Section 26 00 10 - Electrical Installations General Requirements.

1.2 SITE SURVEY

.1 Prior to tender submission, visit the site and survey and quantify the extent of the removals / alterations required for this contract and include for all costs in the total tendered price. Any existing conditions (demolition) information indicated on the drawings is for general guidance only.

.2 In conjunction with the site visit, review architectural, mechanical and electrical drawings and include all costs due to existing conditions in total tendered price.

1.3 REFERENCE STANDARDS

.1 All removal or modification work of electrical construction to be done in accordance with the safety standards outlined in the Canadian Electrical Code and Occupational Health and Safety Act.

1.4 PROTECTION

.1 The Contractor is responsible for any damages to existing structure as a result of the work.

1.5 SALVAGE MATERIAL

.1 Materials and equipment identified on the drawing to be reused are to be removed, stored, cleaned, and re-installed as required to allow for new construction.

.2 Prior to demolition, the Consultant shall be notified immediately of any damage to equipment or material intended for reuse.

1.6 DISPOSAL

.1 Prior to demolition, Owner will identify any items of electrical equipment which are to be set aside as directed for future use by Owner. All other material and equipment removed in accordance with this Section become the property of the Contractor for disposal off the property.

.2 Comply with all municipal, provincial and federal bylaws and standards when disposing of waste.

.3 Remove contaminated or dangerous materials as defined by Authorities having jurisdiction relating to environmental protection from site and dispose of in safe manner to minimize danger at site or during disposal.

PART 2 Products

2.1 NOT USED

PART 3 Execution

3.1 GENERAL REMOVALS

.1 Remove all obsolete or abandoned electrical services including wire and conduit, except those designated for reuse.

.2 Remove, relocate, extend and/or reinstall existing electrical services as required to accommodate other trades.

.3 Coordinate work of this Section with other trades.

.4 Schedule all removal work with the Owner and the General Contractor. Do not disrupt building operations except as permitted by the Schedule.

.5 Any conduit, wiring, boxes or equipment that is to remain in service is to be properly supported as required by the CEC. Any additional hangers, straps or fasteners required are to be supplied under this contract.

.6 Make alterations to existing electrical services as required and make good all circuits affected by the renovations.

.7 Any relocation of existing equipment and any rerouting of existing wire and conduit to accommodate new work shall be included in total tendered price.

.8 Perform all related shutdown work beforehand to keep down-time to a minimum. Once a shutdown is taken, work must progress continuously until power is restored.

.9 With the new mechanical services being routed through the existing building, existing conduits, boxes, etc. must be relocated as required to accommodate new duct work and piping. Accessibility must be retained.

.10 Coordinate all work with Utilities as required. Utility costs for work shall be borne by Owner/User.

3.2 CUTTING

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

3.3 CLEANING

.1 Reused existing equipment shall be cleaned in accordance with Section 26 00 10 – Electrical Installations General Requirements.

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 Bilingual: English and French.

.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 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.

.17 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

.18 Cabinets: label as indicated.

.19 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

.20 Supply and install a label on all electrical equipment subject to Arc Flash hazard as per CSA C22.2.

.21 Supply and install a label on all electrical equipment subject to Arc Flash hazard as per CSA Z462. Nameplate shall consist of, but not limited to, the following information:

.1 Arc Flash Boundaries.

.2 Arc Flash Categories.

.3 Required personnel protective equipment (PPE).

.4 Equipment identification information.

.5 Address, name and date of Arc Studying company.

Example

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.

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**
up to 250 V	Black	
up to 600 V	Yellow	
up to 5 kV	Yellow	
up to 15 kV	Yellow	
Power Emergency		Red
Clock	Pink	Blue
Low Voltage	White	
Fiber Optic	Orange	
Telephone	Blue	
Data	Yellow	
Public Address	Turquoise	
Nurse Call	Green	
CCTV	Purple	Pink
Fire Alarm	Red	
Intrusion	Pink	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.

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.

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 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.

.4 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.

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.

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.

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: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 1000 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, Jacketted.

.3 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.

2.2 ARMOURED CABLES

.1 Conductors: insulated, copper unless indicated otherwise on drawings, size as indicated.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from aluminum strip.

.4 Connectors: anti short connectors.

Part 3 Execution

3.1 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.

3.2 GENERAL CABLE INSTALLATION

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

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

.3 Conductor length for parallel feeders to be identical.

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

.5 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.

.6 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.

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

3.3 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

3.4 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible on channels.

.2 Terminate Cables in accordance with Section 26 05 20 – Wire Box and Connectors (0 – 1000V)

.3 Install anti-short, straps and connectors as required.

.4 Maximum length shall be 1500mm from junction box to luminaire and installed only where concealed. Loops between luminaires are not acceptable.

.5 Use only for drops from junction box in existing walls where installation of conduit is not possible, and for drops from junction box to luminaire. Maximum length of 3000mm for walls and 1500mm for luminaires. All wiring not respecting these conditions shall be replaced at contractor cost

3.5 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit.

.2 Ground control cable shield.

END OF SECTION

Part 1 General

1.1 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, surface mounted.

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 with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

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

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

- .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
- .2 Two-hole steel straps for conduits and cables larger than 50 mm.
- .3 Beam clamps to secure conduit to exposed steel work.

.7 Suspended support systems.

- .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
- .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.8 For surface mounting of two or more conduits use channels at 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 or perforated strap to support or secure raceways or cables.

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

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

END OF SECTION

Part 1 General

1.1 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, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

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.

2.2 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

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

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

.4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

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

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

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

.6 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.

Part 2 Products

2.1 CABLES AND REELS

.1 Provide cables on reels or coils.

- .1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.

.2 Each coil or reel of cable to contain only one continuous cable without splices.

.3 Identify cables for exclusively dc applications.

2.2 CONDUITS

.1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

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 3 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 Watertight connectors and couplings for EMT.

.1 Set-screws are not acceptable.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for [100] [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.

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

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

.5 Install EMT conduit from computer room branch circuit panel to outlet boxes located in sub floor.

.6 Install EMT conduit from computer room branch circuit panel to junction box in sub-floor immediately below panel.

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

.7 Bend conduit cold:

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

.8 Mechanically bend steel conduit over 21 mm diameter.

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

.10 Install fish cord in empty conduits.

.11 Remove and replace blocked conduit sections.

.1 Do not use liquids to clean out conduits.

.12 Dry conduits out before installing wire.

3.3 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.4 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 SECTIONS

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

1.2 INSPECTIONS

.1 Contractor shall arrange for the following inspection during work.

.1 Contractor shall arrange an inspection by Consultant before any closing of walls and ceilings for approval of work method.

.2 Final inspection shall be carried out by the Consultant upon termination of specified work to this Contractor.

.3 A separate inspection shall be carried out by the Consultant for more complex controlled systems such as VFD, lighting control, etc… or at the demand of the general contractors. Such inspection shall be done after commissioning and start-up of these systems.

.2 For all the above mentioned inspections, the Contractor shall arrange and pay to have the proper personnel present to open electrical equipments and explain the work method used during installation.

.3 Above listed inspection does not include inspections required for the work of Division 27. Contractor shall arrange to provide similar inspection, when applicable to those divisions.

.4 Contractor shall advise Consultant 72 hours in advance of the above mentioned inspections as specified in Section 26 00 10 – Electrical Installations General Requirements.

.5 Upon failure to submit to any of the above inspections or any additional inspection due to incomplete work, Contractor shall arrange and pay to make additional inspection possible.

.6 If walls or ceiling are closed without inspection, it shall be the responsibility of this contractor to pay any additional costs to open walls or ceilings and make good any damages.

PART 2 Products

2.1 NOT USED.

.1 Not used.

PART 3 Execution

3.1 NOT USED.

.1 Not used.

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).

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 15 A, 120 V, single pole, double pole, three-way and 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 for normal power, red toggle for emergency (Generator circuits).

.3 Toggle operated locking fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads and/or heating loads.

.4 Switches of one manufacturer throughout project.

.5 Acceptable materials:

.1 120V Toggle:

.1 Hubbell #HBL1201W/R

.2 Leviton #CSB1-15W/1201-2R

.3 Pass & Seymour #PS15AC1W/PS20AC1RED

.2 120V, 3 Way Toggle:

.1 Hubbell #HBL1203W/HBL1223R

.2 Leviton #CSB3-15W/1203-2R

.3 Pass & Seymour #PS20AC3W/PS20AC3RED

2.2 DIMMER SWITCH

.1 Full range dimmer designed to produce brightness control by means of a single slider and:
- .1 Fit single gang standard switch box.
- .2 Provides 0-10V sinking control for LED drivers.
- .3 Switch on to selected light level.
- .4 Light level select with slider.
- .5 Rated 0-10Vdc – 30mA, 24Vdc – 100mA.

.2 Dimmer switch and LED drivers shall be compatible.

.3 Red finish and coverplate.

.4 Acceptable manufacturers:
- .1 Lutron # NTSTV-DV-WH, NT-S-MFB-HT or approved equal.

2.3 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features:
- .1 Urea molded housing white for non-essential and red for emergency (Generator circuits).
- .2 Suitable for No. 10 AWG for back and side wiring.
- .3 Break-off links for use as split receptacles.
- .4 Eight back wired entrances, four side wiring screws.
- .5 Triple wipe contacts and rivetted grounding contacts.
- .6 Acceptable materials:
  - .1 Hubbell #5262W/R
  - .2 Leviton #M5262-SW/SR
  - .3 Cooper #AH5262W/RD

.2 Duplex receptacles CSA type 5-20R, 120VAC, 20A, closed sensitivity of 5mA with following features:
- .1 Urea molded housing white for non-essential and red for emergency (Generator circuits).
- .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 Acceptable materials:
  - .1 Hubbell #5362W/R
  - .2 Leviton #M5362-SW/SR
  - .3 Cooper #AH5362W/RD

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

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2.4 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 Plastic white/red cover plates, thickness 2.5 mm for wiring devices mounted in flush-mounted outlet box.

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

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

.4 Install GFR type receptacles as indicated.

.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 RELATED SECTIONS

.1 Section 26 00 10 – Electrical Installations General Requirements

1.2 MEASUREMENT FOR PAYEMENT

.1 All work and materials related to this section will not be measured for payment, but shall be considered as incidental to the electrical lump sum price.

1.3 PRODUCT DATA

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

PART 2 Products

2.1 BREAKERS GENERAL

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

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

.3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from [3-8] times current rating.

.4 Circuit breakers with interchangeable trips as indicated.

.5 Circuit breakers to have minimum of 10,000 A symmetrical rms interrupting capacity rating.

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.

PART 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

END OF SECTION

PART 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI C82.1-(latest revision), Electric Lamp Ballasts-Line Frequency Flourescent Lamp Ballast.

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

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

.1 ANSI/IEEE C62.41-(latest revision), Surge Voltages in Low-Voltage AC Power Circuits.

.3 American Society for Testing and Materials (ASTM)

.1 ASTM F1137-88 (latest revision), Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.4 United States of America, Federal Communications Commission (FCC)

.1 FCC (CFR47) EM and RF Interference Suppression.

.5 Canadian Standards Association,CSA

.1 CSA C22.1 (latest revision), Canadian Electrical Code

1.2 RELATED SECTIONS

.1 Section 26 00 10 – Electrical Installations General Requirements

.2 Section 26 05 33 – Conduits, Conduit Fastenings, and Conduit Fittings

1.3 SHOP DRAWINGS AND PRODUCT DATA

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

.2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for approval by Consultant.

.3 Photometric data to include: VCP Table.

1.4 MAINTENANCE MATERIALS

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

.2 Provide copy of receipts of maintenance materials in maintenance and operation manuals.

PART 2 Products

2.1 LAMPS

.1 Lamps are specified in fixture schedule.

2.2 DRIVERS

.1 Construction: Suitable for operating loads up to 50W

.2 23.0 V to 26.5 V DC output. 453 mA ± 18 mA

.3 0-10 V dimming standard (where applicable).

.4 Starting temperature is 0°C.

.5 Input voltage: 120-277 V, 50 Hz or 60 Hz.

.6 50,000-hour design life.

.7 Class 2 output UL recognized to UL and CSA requirements.

.8 Suitable for dry and damp locations.

.9 Class P, Type 1 outdoor acceptable.

.10 High frequency – operates LED at 250 kHz DC.

.11 High power factor: 0.9 minimum.

.12 Total harmonic distortion (THD) less than 20%.

.13 Short circuit and overload protection.

.14 Inherent thermal protection.

.15 Complies with ANSI C62.41 Category A for transient protection.

.16 Complies with ANSI C82.11.

.17 Complies with FCC part 15 non-consumer equipment EMC.1

.18 Driver shall be Underwriters Laboratory listed, Class P, Type 1, outdoor and CSA certified.

.19 Driver shall carry a five-year warranty.

.20 Acceptable materials: Lithonia or approved equal.

2.3 LUMINAIRES

.1 See schedule on drawings.

.2 Luminaires in schedule are intended to set a standard below which equipment will not be accepted.

.3 Luminaires with voltages exceeding 150V to ground shall be complete with an integral disconnect means as per CEC 30-308

.4 Acceptable Manufacturers:

.1 Linear LED: Lithonia or approved equal.

.2 Downlights: Lithonia or approved equal.

PART 3 Execution

3.1 INSTALLATION

.1 Locate and install luminaires as indicated on drawings.

3.2 WIRING

.1 Connect luminaires to lighting circuits through conduit as specified in Section 26 05 33 – Conduits, Conduit Fastenings and Conduit Fittings.

3.3 LUMINAIRE SUPPORTS

.1 For suspended ceiling installations support luminaires independently of ceiling.

.2 Support linear LED mounted in continuous rows once every 1.5m.

3.4 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

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

1.2 SHOP DRAWINGS AND PRODUCT DATA

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

.2 Submit product data sheets for infrared heater. Include:

- .1 Product characteristics.
- .2 Performance criteria.
- .3 Mounting methods.
- .4 Physical size.
- .5 kW rating, voltage, phase.
- .6 Cabinet material thicknesses.
- .7 Limitations.
- .8 Colour and finish.
- .9 Thermostat, transformer, controls where integral.

.3 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, cleaning procedures and operating instructions.

1.3 CLOSEOUT SUBMITTALS

.1 Submit operation and maintenance data for infrared heater in accordance with Section 01 78 00 - Closeout Submittals.

1.4 WASTE MANAGEMENT AND DISPOSAL

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

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

.3 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

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

.5 Collect, package and store existing convectors units for either reuse or recycling and return to recycler in accordance with Waste Management Plan.

PART 2 Products

2.1 MANUFACTURERS

.1 Acceptable manufacturers:

Ouellet # UFO-R or approved equal.

2.2 INFRARED HEATER

.1 Infrared heater provides instantaneous, focused infrared radiant heat. It warms people and objects. To use with remote control.

.2 120 V, 60 Hz, 1-phase 1700 W Heater.

.3 Constructed with 18-gauge aluminum extrusion casing, rigid plastic injection molded end caps, high strength metal protective grid, high quality aluminum optical reflector, pivoting mounting brackets included, high quality 8 ft. power cord.

.4 Needs to be plugged in a NEMA 5-15R plug.

.5 Patented flower shape filament inside a 23 mm Quartz tube heating element.

2.3 CONTROLS

.1 Buttons on the remote control and LCD screen supplied with infrared heater.

.2 5 intensity settings integrated.

PART 3 Execution

3.1 INSTALLATION

.1 Install infrared heaters and controls.

.2 Install infrared heater on wall as per manufacturer’s requirements.

3.2 FIELD QUALITY CONTROL

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

.2 Ensure that heaters and controls operate correctly.

END OF SECTION