

Part 1 General

1.1 REFERENCE

- .1 This Section supplements Division 01, and forms part of every Section of Division 26, 27 and 28.

1.2 ACCESS DOORS

- .1 Supply 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 Acceptable manufacturer or approved equal:
 - .1 Zurn
 - .2 Le Hage
 - .3 Buensod
 - .4 Acudor #DW-5040

1.3 AS-BUILT DRAWINGS

- .1 Provide As-Built drawings of the installation incorporating all changes from the contract drawings.
- .2 As-built drawings to include the final layout and location of all electrical equipment devices, outlets and pull boxes installed.
- .3 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.
- .4 A complete and separate set of white prints is to be kept on the site at all times.
- .5 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.
- .6 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.

- .7 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.

1.4 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 100mm.
- .2 Install cables, conduits and fittings to be embedded or plastered over neatly and close to building structure so furring can be kept to a minimum.

1.5 FIELD QUALITY CONTROL

- .1 Conduct and pay for tests of the following:
 - .1 Power distribution system, including phasing, voltage, grounding and load balancing;
 - .2 Circuits originating from branch distribution panels;
 - .3 Lighting and its control;
 - .4 Motors, heaters and associated control equipment, including sequenced operation of systems where applicable;
 - .5 Systems - fire alarm system, communications, intrusion alarm, etc.
- .2 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
- .3 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350V with a 500V instrument.
 - .2 Megger 350-600V circuits, feeders and equipment with a 1000V instrument.
 - .3 Check resistance to ground before energizing.
- .4 Advise Engineer-Architect prior to carrying out tests to ensure Engineer-Architect's presence is not required.
- .5 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .6 Submit test results for Engineer-Architect's review.

1.6 CORE DRILLING OF CONCRETE WALLS AND FLOORS

- .1 Refer to structural specifications and drawings for requirements of core drilling of concrete walls and floors. Openings 100mm and larger to be sleeved prior to concrete pour. Opening less than 100mm may be core drilled. Maximum conduit size run in slab to be 25mm.

1.7 COORDINATION OF PROTECTIVE DEVICES

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

1.8 SCHEDULE

- .1 Overtime work and work outside normal work hours as deemed necessary to accomplish scheduling are the responsibility of the Contractor and must meet the requirements of the Department of Public Safety. All costs resulting from such overtime must be included in the Contractor's Total Tender Price.

1.9 WARRANTY

- .1 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) year, or such longer periods as may be provided in the warranty of the manufacturer of individual components, whichever is longer.
- .2 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.

1.10 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.

1.11 CLEANING

- .1 Clean luminaire reflectors and lenses, lamps, and other surfaces that have been exposed to construction dust and dirt. Clean the insides and outsides of panelboards, splitters and other electrical equipment, and completely remove all debris and tools from the project.

1.12 CODES AND STANDARDS

- .1 Complete the installation of the work in accordance with latest editions of the National Building Code, Canadian Electrical Safety Code, C.S.A., U.L.C., N.F.P.A. or other Codes, as required.

- .2 Comply with Electrical and Building Code(s) Bulletins in force at time of Bid submission. While not identified and specified by number in this Division, they are to be considered as forming part of related Standards.
- .3 Abbreviations for electrical terms are as per C.S.A. Z85.

1.13 COMPLETION OF CONTRACT

- .1 All the equipment must be cleaned and tested, before final acceptance by the Engineer-Architect.
- .2 Replace, at no cost, all incandescent lamps burned out during a 30 (thirty) day period and all burned-out fluorescent and HID lamps for a period of 90 (ninety) days after date of issuance of "Substantial Completion" for the Contract for the building.
- .3 Defects and deficiencies which originate or become evident during the warranty period must be repaired or replaced, at no cost.
- .4 If, during the warranty period, transformers, ballasts or other noise and vibration producing equipment are considered by the Engineer-Architect to exceed acceptable standards, then these must be replaced without delay or additional cost to the Owner. All work relating to the replacement of defective items must be carried out after normal working hours and at a time which is acceptable to the Owner.
- .5 Contractor to be responsible for weekly cleaning and dusting of all Lan Rooms/Telecom Rooms. Just prior to the installation of any active equipment by the Owner/User into these rooms, the Contractor to conduct a thorough and complete environmental cleaning of the Lan Rooms/Telecom Rooms. Additionally, if the Contractor is still working in these rooms after the installation of any Owner/User's equipment, the Contractor must conduct a thorough daily cleaning including dusting, vacuuming and cleaning.

1.14 CONCRETE

- .1 It is the responsibility of the Electrical Contractor to advise the General Contractor of all required concrete and formwork for bases, curbs and ductbanks required for the work of this Division prior to tender closing.

1.15 CONCRETE BASES

- .1 All floor mounted equipment to be installed on a 100mm high concrete base by Division 03. Concrete base to extend 53mm on all sides with chamfered corners.
- .2 It is the responsibility of the Electrical Contractor to advise the General Contractor of the number, size and locations of all required pads (in electrical and mechanical rooms).

1.16 CONTRACT DRAWINGS

- .1 The Drawings for the Electrical work are diagrammatic performance Drawings only, intended to convey the scope of work and indicate the general arrangement and approximate location of apparatus and fixtures, and the approximate sizes and locations of

- equipment and outlets. The Drawings do not intend to show Architectural, Mechanical or Structural details.
- .2 Make, at no additional cost, any changes or additions to materials and equipment necessary to accommodate Structural conditions (offsets around beams, columns, etc.).
 - .3 Alter at no additional cost, the location of materials and/or equipment as directed, provided that the changes are made before installation, and do not necessitate additional materials.
 - .4 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.
 - .5 No claim for extra payment to be made for extra material or work made necessary by circumstances encountered due to conditions which were visible upon, or reasonably inferable from, such examinations of drawings, documents, premises and associated systems prior to submission of the response.
 - .6 Change location of outlets, zone boxes and termination panels at no extra cost providing cable length increase resulting from said relocation does not exceed 3 metres and information is given prior to installation of said outlet, cable or termination panel.
 - .7 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.
 - .8 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.
 - .9 Confirm at the site, the exact location of equipment, outlets, and fixtures, and the location of outlets for equipment supplied by other vendors and trades, before installation.
 - .10 Notify the Engineer-Architect of any discrepancies in the specifications and/or drawings. In the event of a discrepancy, the Contractor to be responsible for the condition of greatest value until the Engineer-Architect has an opportunity to review the discrepancy and issue an instruction.

1.17 DEFINITIONS

- .1 Wherever the words "install", "provide", or "supply and install", are used, it shall be understood to mean "provide and install, inclusive of all labour, materials, installation, testing, and connections" for the item to which referred.
- .2 "Concealed" is defined as "out of sight" in "normal" viewing conditions, and includes buried in concrete, above acoustic tile or gypsum board ceilings, within masonry or gypsum board constructed walls, within cable trays or below raised access floors.

1.18 EXISTING CONDITIONS

- .1 Visit the site and examine the existing conditions affecting the work of this Division. Ignorance of existing conditions will not be considered as bases for extra claims.

1.19 EXPEDITING

- .1 Continuously check and expedite delivery of all materials and equipment required for the successful execution of the work.
- .2 If requested by the Engineer-Architect, inspect at the source of manufacture, to confirm status, and submit an itemized flow chart of equipment order and delivery dates.
- .3 Continuously check and ensure that the necessary information is communicated to all parties involved.
- .4 Immediately inform the Engineer-Architect in writing of any anticipated delays.

1.20 FIELD SUPERVISION AND WORKMANSHIP

- .1 Workmanship throughout to conform with the highest standards applicable.
- .2 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 to be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks – the activities permitted to be determined based on the level of training attained and the demonstration of ability to perform specific duties.
- .3 The work of this division to be carried out by a contractor who holds a valid Master electrical contractor license as issued by the Province that the work is being constructed.

1.21 FINISHES

- .1 All shop finished metal equipment and enclosure surfaces, must be prepared by removal of rust and scale from the raw metal, degreasing, cleaning, application of rust resistant primer inside and outside, and at least two coats of finish enamel paint. Use factory standard colours unless otherwise specified. Colour reference numbers are Sico.
- .2 Paint outdoor electrical equipment “Equipment Green 10131”, finish to EEMAC Y1-1.
- .3 Paint exterior surfaces of indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1.
- .4 Clean and touch-up surfaces of shopfinished equipment that is scratched or marred during shipment or installation, so as to match original paint.
- .5 Turn over to the Owner, 1l. (0.22 gal.) of paint of each colour used, in the form of liquid or spray, to allow for future touch-up of damaged areas.
- .6 Paint recessed panelboards to match adjacent surfaces.

1.22 IDENTIFICATION

- .1 Identify all electrical and tele/data equipment and wiring.
- .2 Coordinate identification of mechanical equipment, with Mechanical Contractor to ensure identical names, and designations are used.
- .3 Wording on nameplates and labels to be approved by the Engineer-Architect to be in English.
- .4 Allow for an average of 25 (twenty-five) letters per nameplate and label.
- .5 Use nameplates for:

- .1 Panelboards, indicating designation, voltage, phase, number of wires and location of feed and circuit number.

- .2 Example:

<p style="text-align: center;">PANEL N - 150A 120/208V - 3PH - 4W FED FROM PNL CDP-A, CCT #1, 3, 5</p>

- .3 Transformers, indicating primary and secondary voltage, phase, and number of wires, designation and location of feed.
- .4 Lamicoid nameplates installed on combination starters, magnetic starters, manual starters and all various system controls, control panels, and disconnect switches shall contain the following information in the following order:
 - .1 Designated name of equipment.
 - .2 Voltage(s), number of phases and wires.
 - .3 Branch circuit breaker number(s).
- .5 Terminal cabinets, indicating system and voltage characteristics.
- .6 Tele/data, security and miscellaneous system and F.A. panels, fire alarm modules transfer switches and other equipment, indicating system and voltage. Refer to Division 27 for specific tele/data identification requirements.
- .6 Nameplates to be lamicoid, 3mm thick, plastic engraving sheet, black face and a contrasting white core.

Nameplate Sizes

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

- .7 Nameplates to be mechanically attached to equipment, by means of rivets or self tapping screws.

.8 Wiring Identification:

- .1 Identify branch circuit wiring including neutral conductors at both ends, including in all junction boxes located in between with permanent indelible identifying markings, indicating panel and circuit number (i.e. A1-25).
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour code: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

.9 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 15m intervals.
- .3 Colours: 25mm wide prime colour and 20mm wide auxiliary colour.

	<u>Prime</u>	<u>Auxiliary</u>
Up to 250V	Yellow	
Up to 600V	Yellow	Green
Up to 5 kV	Yellow	Blue
Up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication System	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

- .10 Use plastic self adhesive tape to identify incoming utility source lines, feeders, subfeeders and bus work in each switchboard and unit sub-station.

- .1 Unless otherwise specified, tape colour code to be as follows:

Red	-	Phase A
Black	-	Phase B
Blue	-	Phase C
White	-	Neutral
Green	-	Ground

- .11 Complete all panelboard directories with neat, type written list of circuit numbers and item controlled.
- .12 Identify the insulated ground conductors with green tape both at the outlet box and the junction box when using 3 conductor "BX" cable to insulated ground "IG" receptacles.
- .13 All light switches, lights, receptacles, starters, direct connected equipment, etc., are to have its panel and circuit identified with a lamicaid nameplate (or plastic nameplate neatly installed on coverplate and in corresponding box). Black letters on white background, 6mm high x 25mm long (ie. A-3 or A-2,4,6). Lamicaid nameplates to be properly secured to wall or equipment below coverplate.

- .14 All junction and/or pull boxes shall be marked with an indelible ink marker to designate the circuit number of enclosed wiring, the designated panel name and electrical characteristics where applicable.
- .15 Install an additional 'lamicoid' nameplate on all, or any piece of electrical equipment, or apparatus, ie. main switchboard, CDP panels, panelboards, motor control centres and fusible switches, etc. that may contain overcurrent devices, i.e. circuit breakers and/or fuses that have been designed for and incorporate an interrupting capacity sized 'larger' than 10 kAIC.

Examples:

Minimum interrupting capacity of breakers installed in this panel is to be not less than 22kAIC.

Minimum interrupting capacity of fuses installed in this MCC is to be not less than 100 kAIC.

1.23 INSERTS, HANGERS AND SLEEVES

- .1 Provide hangers, inserts, sleeves and supports as required.
- .2 Inserts are to be of lead shield type.
- .3 Hangers must not be welded to structural steel members and burning of holes in structural steel is prohibited.
- .4 Sleeves in new construction are to be of a type suitable for the application, and be sealed and made watertight. Sleeves through concrete to be sized for free passage of conduit, and installed flush with underside of concrete slab and extend 100mm above finished floor unless otherwise shown.
- .5 Be responsible for the installation of sleeves in accordance with the Construction Schedule.

1.24 INTENT

- .1 It is the intent of these drawings and specifications that the Contractor provide complete and operational systems as required.
- .2 Where differences occur, the maximum condition shall govern.
- .3 Any miscellaneous items, hardware, devices, wiring, etc., not specifically described, but required for the operation of the system, must be provided and included as part of the Tender.

1.25 LOCATION OF OUTLETS

- .1 Locate receptacle, telephone and data outlets from dimensional Architectural elevation drawings where applicable. Do not install outlets back-to-back in walls, but allow

minimum 150mm horizontal clearance between boxes. Coordinate all device locations with architectural wall finishes to ensure devices can be properly mounted where indicated. Notify Engineer-Architect of any site conflicts prior to rough-in.

- .2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3m and information is given before installation.
- .3 Locate light switches on latch side of doors, unless otherwise shown.
- .4 Locate disconnect devices in mechanical rooms and elevator machine rooms on latch side of door, unless otherwise shown.
- .5 Where devices are shown adjacent to one another in plan but occur at different elevations, they are to be vertically aligned.
- .6 Where receptacle, telephone, data or additional communications devices are shown adjacent to one another in plan, they are to share common backbox/coverplate with all required divider plates.

1.26 MATERIALS AND EQUIPMENT

- .1 Provide materials and equipment in accordance with Division 01. All materials and equipment to be new, C.S.A. certified, and manufactured to the Standards specified.
- .2 Where there is no alternative to supplying equipment which is not C.S.A. certified, obtain special approval from the local Inspection Department.
- .3 Factory assemble control panels and component assemblies.
- .4 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.
- .5 The Contractor to ensure that all carried products, are completely physically and electrically compatible.

1.27 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centre line of equipment unless specified or indicated otherwise. Where mounting heights vary from noted standard, seek clarification from Engineer-Architect.
- .2 If mounting height of equipment is not indicated, verify with Engineer-Architect before proceeding with installation.
- .3 Local switches: 1200mm
- .4 Wall receptacles: vertically
 - Above floors: 400mm
 - Above top of continuous baseboard heater: 200mm
 - Above top of counters or splash back: 200mm

- In mechanical rooms: 1400mm
- .5 Panelboards: 1500mm or as required by Code.
- .6 Telephone and data outlets above floor: 400mm vertically
- .7 Fire alarm pull stations: 1200mm
- .8 Fire alarm horn/strobes: 2440mm
- .9 Emergency lighting: 3000mm or at ceiling where ceiling is lower.
- .10 Wall mounted exit signs: 150mm above door frame (or equivalent where no door is present).
- .11 Thermostats/temperature sensors: 1200mm (coordinate with Mechanical Contractor).

1.28 NOISE AND VIBRATION

- .1 Electrical equipment is to operate without objectionable noise or vibration. If, in the opinion of the Engineer-Architect, the equipment operates with excessive noise or vibration, then the equipment must be replaced or noise or vibration eliminated.
- .2 Connections to noise-producing and vibrating equipment must be made with flexible conduit. This includes transformers (both power and distribution), dimming equipment racks and motors. Use a minimum of 1m of flexible cable at each device, formed into a 360 deg. loop.
- .3 Vibration isolators are to be provided where indicated or required. Transformers to be isolated from the structure, with spring and rubber isolators when wall mounted or suspended and 12mm high density neoprene sandwich pads (type MWP) when floor mounted.

1.29 OPERATION AND MAINTENANCE MANUALS

- .1 Provide operation and maintenance manuals.
- .2 Include the following information in the Operations and Maintenance manuals:
 - .1 Names and address of local suppliers for the items included.
 - .2 Details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of 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 is not acceptable.
 - .4 The Engineer-Architect reviewed shop drawings.
 - .5 Work report c/w dates from Electrical Inspection Department including electrical permit associated with the project.
 - .6 Fire alarm verification reports.
 - .7 Warranty letters from contractors and suppliers.

- .3 Review information provided in the maintenance instructions and manuals with the Owner's operating personnel to ensure a complete understanding of the electrical equipment and systems and their operation.

1.30 OWNER/USER SUPPLIED EQUIPMENT

- .1 Where specified install all equipment provided by the Owner/User.
- .2 Receive, store and install equipment, and accept full responsibility for it and its correct operation.

1.31 OWNER/USER'S INSTRUCTION AND TRIAL USAGE

- .1 Arrange and pay for the service of the manufacturers' factory service technician to instruct the Owner/User and operating personnel in the startup, operation, care and maintenance of all the equipment. All equipment to be tested and commissioned before instruction. Provide sheets for signatures of Owner/User and operating personnel present at each instruction period.
- .2 Arrange and pay for the service of the manufacturer's factory service technician to supervise the start-up of his equipment installation, and to check, adjust, balance and calibrate components.
- .3 Provide these services for such period, and for as many visits as necessary to ensure that the operating personnel are conversant with all aspects of its care and operation.
- .4 The operating personnel must be permitted to operate the systems under the contractor's supervision for a reasonable period of time prior to Substantial Completion of Contract. This use to not be misconstrued as acceptance of the equipment.

1.32 PERMITS AND FEES

- .1 Submit to the local Electrical Inspection Department and Local Utility the necessary number of Electrical Drawings and Specifications for examination, special inspection and/or approval, prior to the commencement of the work, and pay all costs and associated fees. If required, prepare any additional drawings/ documents required by the Authority.
- .2 The Engineer-Architect will provide upon request, the required quantity of drawings and specifications at no cost.
- .3 Notify Engineer-Architect of changes required by Electrical Inspection Department prior to making changes.
- .4 Arrange for the timely installation of the permanent electrical and telephone service, and comply with all of the Authorities requirements.

1.33 PLYWOOD

- .1 Supply and install all plywood backboards required for the work of this Division. Plywood to be highest quality fire retardant fir, 1200mm wide x 2400mm high, 19mm thick unless otherwise specified. Prime and paint backboards on both sides with fire retardant paint of

a colour to match the equipment and services mounted thereon as defined in "Finishes" above.

- .2 Plywood backboards are to be used for mounting the following surface wall mounted equipment thereon:

- Cabinets
- Contactors
- Tele/Data Equipment
- Disconnect Switches
- Fire Alarm Control Equipment
- GFI Equipment
- Junction Boxes 600mm square and larger
- Meter Cabinets
- Panelboards
- Pull Boxes
- Splitter
- Wall Mounted Switchgear

- .3 Where practical, group devices on a common backboard.

1.34 PROTECTION

- .1 Protect exposed live equipment during construction for personnel safety.
- .2 Shield and mark live parts 'LIVE 600 VOLTS', or with appropriate voltage.
- .3 Install doors for temporary storage rooms containing the Contractors non-installed electrical equipment. Keep these doors locked, except when under direct supervision of Electrician.
- .4 The Electrical Sub-Contractor's qualified Superintendent, to be present for all concrete pours in order to witness and accept responsibility for protection of equipment.

1.35 RESTRICTIONS

- .1 Tele/data rooms and closets are designed for tele/data, Sound Masking and Security DGP's and equipment only. Do not locate any other electrical equipment therein, nor use these rooms for risers or feeders for services except to voice and data equipment.

1.36 SINGLE LINE ELECTRICAL DIAGRAMS

- .1 Provide single line electrical diagrams under plexiglass as follows:
- .1 Electrical distribution system: locate in Electrical Room c/w metal frame.
 - .2 Provide updated fire alarm riser diagram, plan and zoning at fire alarm control panel.
 - .3 Drawings: 600 x 600mm size minimum.

1.37 SEALING

- .1 Where cables or conduits pass through non fire-rated floors, walls or roof, provide internal and external sealing thereto. The sealants shall be low VOC.
- .2 For non-fire rated locations, sealant to be silicone, that meets requirements of CGSB19-GP-23 for the size of the joint required, and the types of materials being bonded.
- .3 For fire rated locations, the fire stop shall meet the requirements of ULC with regards to the type of assembly and the fire separation.
- .4 Seal all empty conduits at both ends.
- .5 Refer to Division 07 for precise methods and requirements.
- .6 Electrical Contractor is responsible for verifying size and number of locations required for electrical systems and advising Division 07 Contractor.

1.38 SHOP DRAWINGS

- .1 Submitted shop drawings must indicate details of construction, dimensions, scale, capacities, weights and electrical performance characteristics of equipment or materials, as well as specification reference section number, and project name.
- .2 Shop drawings to be provided with sufficient space on the front for all Engineer-Architect's and Contractor's "review" stamps.
- .3 Where applicable, include wiring, single line and schematic design drawings, and diagrams showing interconnections with the work of other divisions.
- .4 Work affected by submittal shall not proceed until review is complete.
- .5 Review submittals prior to submission to Engineer-Architect. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with requirements of the work and Contract Documents and bears Stamp of Contractors.
- .6 Changes made to the Shop Drawings by the Engineer-Architect will not affect the Contract Price.
- .7 Submit Shop Drawings for all material and equipment referred to in contract document:
 - Emergency Battery System
 - Exit Lights
 - Fire Alarm System
 - Lighting Controls
 - Luminaires
 - Moulded Case Breakers
 - Panelboards
 - Power Cables
 - Sealants

Wiring Devices
Other Electrical Equipment

- .8 Submit shop drawings for the following equipment for general review of Electrical requirements only:

All mechanical equipment requiring individual electrical servicing

1.39 TEMPORARY SERVICE

- .1 Temporary electrical service to be provided by General Contractor - coordinate all requirements.
- .2 Provide extension cords, extension lighting and equipment required for the work of this trade. The cost of this work to be included in the Bid Price.

1.40 VOLTAGE RATINGS

- .1 Operating voltages to be as indicated in C.S.A. C235.
- .2 Motors, electric heating, control and distribution devices and equipment must operate satisfactorily at 60 Hz, and within the operating limits established by the above Code, without damage to equipment.
- .3 Motors supplied by all Divisions, up to and including 375W (1/2HP) to be 120V, 1ph, and 562W (3/4HP) and larger to be 600V, 3ph unless otherwise specified.

1.41 WARNING SIGNS

- .1 Provide warning signs, as specified to meet requirements of Inspection Department and Engineer-Architect.
- .2 Use decal signs, minimum 175mm x 250mm in size.

1.42 WIRE PULLING LUBRICANT

- .1 Lubricant to be non-corrosive and CSA approved for the type of cable used.
- .2 Lubricants to be soap or wax based, depending upon application. Use soap based for short runs and for semi-conducting insulated wires, and wax based for long runs.

1.43 MECHANICAL/ELECTRICAL RESPONSIBILITIES

- .1 The following is a list of mechanical and electrical responsibilities for the above mentioned project:
- .1 Electrical Contractor will be responsible for the complete supply, installation, and wiring of starters, except for equipment containing built-in starters and variable speed drives. Electrical Contractor will supply and install all feeders to the line side and load side of each starter. For equipment containing built-in starters, Electrical Contractor will provide power and connect the unit terminals.
- .2 Package units will have integral starters and only power feeders need be provided. The package unit starters will be by Mechanical Contractor.

- .3 Electrical Contractor to provide all remote disconnect switches.
- .4 All control wiring (including BAS) except fire alarm shall be by Mechanical Contractor, regardless of voltage.
- .5 Voltages for motors 3/4 HP and larger will be 208V, 3 phase. Anything smaller will be 120V single phase or 208V 1 or 3 phase.
- .6 All motors shall be provided by Mechanical Contractor.
- .7 No two-speed double winding motors are to be used unless Mechanical Contractor gives prior notice to Electrical Contractor.
 - .1 Mechanical Contractor to provide thermistor protection on motors 15 HP and larger using approved thermistors.
 - .2 Thermistors will be provided by Mechanical Contractor.
 - .3 Electrical Contractor to provide manual reset devices for motor starters for thermistor interface. (Only for starters that are provided by Electrical Contractor).
- .2 All fire alarm work to be done by Electrical Contractor. Electrical Contractor will provide all relays for interface to control wiring for fan shutdown, etc.
- .3 All electric heaters will be supplied and installed by Electrical Contractor.
- .4 Electrical Contractor shall provide 120V to locations indicated where power circuits are required for mechanical control systems, ie. BAS panels, etc.
- .5 Electrical power and control wiring for mechanical equipment and systems shall comply with the requirements set out in Division 26, 27 and 28 Specifications.

END OF SECTION

Part 1 General

1.1 DESCRIPTION OF WORK

- .1 In general, work of this Section consists of the complete removal of all obsolete and/or abandoned electrical equipment and materials where indicated. It also covers alteration of existing electrical services affected by the renovations.

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. Bidders are encouraged to assess the site conditions, including type of existing luminaires, access to ballast enclosures, elevation of stairway lighting, etc. **Extra cost will not be allowed due to existing site conditions.** Site conditions information indicated on the drawings is for general guidance only and does not include all the required work.

1.3 REFERENCE STANDARDS

- .1 All removal or alteration work of electrical construction to be done in accordance with the safety standards outlined in the Canadian Electrical Code.

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 in the contract as being reused are to be taken down, stored, cleaned, reinstalled, etc. as required to allow for the retrofit.
- .2 Identify any damaged equipment or materials intended for reuse prior to demolition and point out deficiencies to the Engineer at that time.

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

Part 2 Products

- .1 Not used.

Part 3 Execution

3.1 GENERAL REMOVALS

- .1 Remove all obsolete or abandoned electrical services in effected area, including exposed wire and conduit, except those designated for reuse.
- .2 Schedule all removal work with the Owner. Do not disrupt operations except as permitted by the Schedule.
- .3 Any existing conduit, wiring, boxes or equipment that is to remain in service is to be properly supported as required by the CEC. Any additional hangers, straps or fasteners required are to be supplied under this contract.
- .4 Make alterations to existing electrical services as required and make good all circuits affected by the renovations.

3.2 CUTTING

- .1 Cutting required for removals and alterations to be to the approval of the Engineer and performed by general contractor with appropriate power tools.

3.3 REMOVAL OF BALLASTS CONTAINING PCB'S

- .1 Fluorescent lighting ballasts containing PCB's shall be disposed of in accordance with the NB Department of Environment instructions and guidelines.
- .2 Contractor shall place ballasts containing PCB's in Owner supplied metal drums. Drums will be provided, and removed from site, by the Owner. A maximum of 130 ballasts are allowed in one barrel.
- .3 When leaking ballast containing PCB's are encountered, the Contractor shall implement the following procedure:
 - .1 Place vermiculite or similar absorbent material in a recycle barrel (drum) to a depth of 10 cm.
 - .2 Workers handling leaking ballasts and performing the fixture cleaning must wear protective latex gloves.
 - .3 Remove the ballast (s) from the fixture (s) and cut off the attached wires.
 - .4 Place the ballast in a plastic bag, tie the bag closed and place it in the barrel. Record the actual quantity in each barrel.
 - .5 Ensure adequate ventilation in the work area. Clean any oil or tar residue from the ballast enclosure. Use varsol as a solvent.
 - .6 Rags used for this clean-up, the detached wire pieces and any non-cleanable items must be bagged and placed in a separate recycle barrel (other than the barrel used for the ballasts).
 - .7 Ensure the barrels are placed in a locked room ready for shipping by the Owner.
- .4 Light fixture lens and housing shall be cleaned by the Contractor.

3.4 CLEANING

- .1 Reused existing equipment is to be cleaned in accordance with Section 01 00 01 and 26 05 00.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

- .1 Section 26 05 00 - Electrical General Requirements.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2No.18-98, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
 - .2 CSA C22.2No.65-93(R1999), Wire Connectors.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

Part 2 Products

2.1 MATERIALS

- .1 Pressure type wire connectors are to be manufactured to CSA C22.2 No. 65. Clamps and connectors are to be manufactured to CSA C22.2 No. 18. Use twist-on connectors for #14 to #8 wires.
- .2 Building Wire Connectors to be:
 - .1 For wire sizes up to #6 AWG - Ideal 'Wing Nut' or Gardner-Bender 'Wing Gard'.
 - .2 For wire sizes #6 AWG and larger:
 - .1 At studs and bus bars – Burndy long barrel compression lugs Cat. # YA-2N c/w inspection window for copper to copper connections.
 - .2 At studs and bus bars – Burndy long barrel compression lugs Cat. # YAA2 c/w inspection window for copper to aluminium connections.
- .3 Cable connectors to be:
 - .1 For armoured TECK cables, watertight type, with open compounded head - T&B series "Spin-on 2" with corrosion resistant boot.
 - .2 For armoured cables steel type with nylon insulated throat - T&B 'Tite-Bite'.

- .3 Clamps or connectors for armoured cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable.
- .4 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
 - .1 Connector body and stud clamp for conductors.
 - .2 Clamp for copper conductors.
 - .3 Clamp for ACSR conductors.
 - .4 Stud clamp bolts.
 - .5 Bolts for copper conductors.
 - .6 Sized for conductors as indicated.

Part 3 Execution

3.1 INSTALLATION

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

- .1 CSA C22.2 No .0.3-96, Test Methods for Electrical Wires and Cables.
- .2 CAN/CSA-C22.2 No. 131-M89(R1994), Type TECK 90 Cable.

1.3 PRODUCT DATA

- .1 Submit product data in accordance with Section 26 05 00.

1.4 ACCEPTABLE MATERIALS

- .1 Where materials are specified by the trade name within this Section, they are to establish an acceptable standard of quality. Alternates shall only be accepted upon approval prior to tender closing.

Part 2 Products

2.1 MATERIALS

- .1 Wire in Conduit:
 - .1 Conductor material to be annealed commercial grade, copper, 98 percent conductivity, up to #10 AWG solid, with RW90 insulation, #8 and larger, stranded, with RW90 insulation, unless noted otherwise, 600V rating. Minimum size #12 AWG (solid) for power and lighting loads, and for continuous loads over 10A, size #14 AWG for control.
 - .2 Colour Coding:
 - .1 Two conductor, 1 phase: 1 black, 1 white
 - .2 Three conductor, 1 phase: 1 red, 1 black, 1 white
 - .3 Three conductor, 3 phase: 1 red, 1 black, 1 blue
 - .4 Four conductor, 3 phase: 1 red, 1 black, 1 blue, 1 white
 - .5 Ground wires: green
 - .3 Feeders fed from an overcurrent device rated up to and including 100A are to utilize copper conductors. Feeders fed from an overcurrent device rated above 100A may utilize either copper or aluminum conductor material (ACM).
 - .4 All receptacle circuits within the building are to be fully rated. To avoid voltage drop and derating of circuits, the following maximum circuit lengths are to be followed in sizing cabling (120V circuits):

	#12	#10	#8
15A	24.6m	39m	62.1m
20A	18.3m	29.1m	46.2m

.2 TECK Cable:

.1 Conductors:

- .1 Grounding conductor: copper
- .2 Circuit conductors: copper size as indicated.

.2 Insulation:

- .1 Chemically cross-linked thermosetting polyethylene rated type RW90 1000V.

.3 Inner jacket: polyvinyl chloride material.

.4 Armour: flat interlocking aluminum.

.5 Overall covering: thermoplastic polyvinyl chloride material, FT4 rated.

.6 Fastenings:

- .1 One-hole steel straps to secure surface cables 50mm diameter and smaller. Two-hole steel straps for cables larger than 50mm diameter.
- .2 Channel type supports for two or more cables at 600mm centres.
- .3 Steel threaded rods: 6mm diameter to support suspended channels.

.7 Connectors:

- .1 Watertight, approved TECK cables.

.3 Armoured Cables:

- .1 Type to be AC-90, Multi-conductor, with solid, annealed commercial grade 98 percent conductivity tinned copper conductors and cross-linked polyethylene with R90 insulation, 600 volt rating, minimum size #12 AWG unless indicated otherwise.

.2 Colour Coding:

Two conductor, 1 phase: 1 black, 1 white

Three conductor, 1 phase: 1 black, 1 red, 1 white

- .3 Grounding to be uninsulated, solid copper, with impregnated paper separator.

.4 Mineral Insulated Cables:

- .1 Mineral-insulated cables to be manufactured to CSA C22.2 No. 124.
- .2 Conductors to be solid, bare, soft-annealed copper, sized as required.
- .3 Insulation to be compressed powdered magnesium oxide, to form compact homogeneous mass throughout entire length of cable.

- .4 Overall covering to be annealed seamless copper sheath, type LW MI, rated 600V, 250 deg.C.
- .5 P.V.C. outer jacket to be applied over sheath, for direct burial, wet locations and where corrosive agents exit. For installations above ground, P.V.C. jacket must meet requirements of Vertical Tray Fire Test of CSA C22.2 No. 0.3 with maximum flame travel of 1.2m.
- .5 Control cables:
 - .1 Type LVT: number of soft annealed copper conductors and sized as indicated, minimum with thermoplastic insulation, FT-4 rated outer covering of thermoplastic jacket, and armour of closely wound aluminum wire. Alternately, jacket to meet ULC, NBC and CSA requirements for installation in an air plenum.

2.2 BONDING & GROUNDING CONDUCTORS

- .1 Bonding and grounding conductors shall be copper with a green insulation covering.
- .2 All feeders and branch circuit conductors installed in conduits shall include a separate green bond wire, sized in accordance with the C.E.C., minimum size #14 (solid) AWG as follows:
 - .1 Where bond wire sizes larger than #14 AWG are required, they are to be increased as required by Table 16 of the C.E.C., or as otherwise noted.
 - .2 Minimum size #14 AWG (solid) green insulated conductors are acceptable for bonding purposes associated with various control systems rated at 50 volts or less.
 - .3 Bonding and grounding conductors up to and including #10 AWG shall have RW90 X-link insulation. For sizes of #8 AWG and larger, TW75 green insulation is acceptable.

2.3 ACCEPTABLE MATERIALS

- .1 Philips
- .2 Canada Wire
- .3 Pirelli
- .4 Alcan

Part 3 Execution

3.1 INSTALLATION

- .1 General:
 - .1 Wire to be installed in conduit, and sized for the connected load(s) and protection as required for all branch circuits in corridors, into rooms and in all open ceiling spaces and rooms, unless otherwise specified. Wire to receptacles must be in EMT conduit from end to end.

- .2 Wiring methods related to the installation of main feeders: unless specifically indicated otherwise, feeder conductors are to always be installed in conduit.
 - .3 Low voltage armoured feeder cables to be installed individually on channels, or grouped on cabletrough.
 - .4 Run separate neutral wire, same size as the current carrying wires, for each receptacle circuit.
 - .5 The current carrying capacity of the feeders, subfeeders and branch circuit conductors to be sized to equal or better than shown on the drawings. If wire or cable sizes with equivalent current carrying capacity other than that specified is used, ensure that the voltage drop to be less than 2%.
 - .6 The number of wires indicated for various systems is intended to show the general scheme only. The required number and type of wires to be installed in accordance with the manufacturer's diagrams.
 - .7 In rooms with dropped T-bar or accessible ceilings, main EMT branch circuits may be converted one meter inside room to AC90 for all drops to fixtures, etc. All wire shall be #12 minimum from panel to individual rooms; however, drops to fixtures may be #14. All wiring for power, receptacles in corridor and loads larger than 10 amps shall be #12 minimum. All cables above T-bar ceiling to be properly secured.
 - .8 All communications wiring, cables, etc. may be run in EMT or be FT-6 rated and run in j-hooks to cable tray system. Telephone and data cabling are each to be tied separately and all other communications systems are to be run separately. Sleeve all cable runs through walls and ceilings. Fire alarm cables must have armour jacket. All cables to be identified every 15 meters and be fastened every 1.5 meters.
 - .9 All cables and wiring should be installed on the warm side of the vapour barrier where possible with vapour barrier penetrations kept to a minimum.
 - .10 All cables are to be secured to concrete, concrete block, brick, and metal decking/siding; with inserts complete with self-tapping metal screws. Pliable type cables are to be secured to building structure at 1220mm intervals and tie-wrapped together at mid-point between each structure support.
- .2 Wire in Conduit:
- .1 Provide pigtails at all outlets for fixtures and wiring devices. All neutrals and branch circuits to be connected in each outlet box to avoid a break in the neutral or the circuit wire when fixture or wiring device is disconnected.
 - .2 At each junction, pull and outlet box make a 360 deg. loop of the stripped uncut ground conductor under the ground screws.
- .3 TECK Cable:
- .1 Do not directly bury in or below concrete slabs or walls.
 - .2 Do not encircle single conductor cable with ferrous metal.
 - .3 No splices will be permitted.

- .4 Single conductors of a three or four wire circuit to be run with uniform spacing of not less than one cable diameter throughout the feeder length.
- .5 Use wood throated cable clamps to ensure proper and uniform cable spacing.
- .6 Cable connections to all enclosures, boxes and panels by means of a watertight malleable aluminum connector.
- .4 Armoured Cables:
 - .1 These cables must be run concealed and may be used only for the following purposes:
 - .1 Final connection from a conduit ceiling box to outlets and receptacles in partitions only.
 - .2 Final connections to luminaires for maximum length of 1.5m. Loops between fixtures are not permitted - only from junction box to fixture.
 - .2 Use insulated throat connectors and anti-short sleeves at all dressed ends.
 - .3 All type of 'armoured' cables are to be installed concealed, parallel and perpendicular to building lines and shall be adequately secured to the building structure at not less than 1500mm intervals or as otherwise indicated, protecting cables from mechanical damage.
 - .4 Install independent supports for cabling in ceiling spaces, and do not use those of other trades. Cables not to be secured to mechanical systems piping, ducts or suspended ceiling support wires.
 - .5 The laying of 'unsupported' cables directly on top of ceiling grid system is prohibited.
 - .6 AC90 is not permitted in concrete walls.
- .5 Mineral Insulated Cables:
 - .1 Run cable exposed, securely supported by straps.
 - .2 Make cable terminations by using factory-made kits.
 - .3 At cable terminations use thermoplastic sleeving over bare conductors.
 - .4 Do not splice cable.
 - .5 MI cables to be used for emergency system feeders and branch circuits requiring a 1 (one) hour fire rating, where rating is not achievable by embedding in poured concrete or enclosing in fire rated spaces.
 - .6 MI cables must be rigidly supported at maximum spacing of 1m. Do not use aluminum products for support.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 00 - Electrical General Requirements.

Part 2 Products

2.1 SUPPORT CHANNELS

- .1 Unless otherwise noted, U shape pre-galvanized steel, size 41mm x 41mm x 2.2mm thick, for surface mounting, suspending, or inserting into poured concrete walls and ceilings as required.
- .2 All channel fittings to suit channel type.
- .3 All other fittings to suit equipment weight, location and surfaces as required.

Part 3 Execution

3.1 INSTALLATION

- .1 Secure plywood backboards, channels, luminaires, equipment and fittings to wood with wood screws to solid masonry, tile and plaster surfaces with lead anchors, to poured concrete with self-drilling expandable inserts, and to hollow masonry walls with toggle bolts.
- .2 Support ceiling mounted equipment from the ceiling support system.
 - .1 Ensure that the support system is adequate to carry weight of equipment specified before installation, or independently support from structure.
 - .2 Provide the Engineer-Architect and Local Electrical Inspection Department with a letter of approval from Division 09 contractor.
- .3 Support equipment, conduit or cable using clips, spring loaded bolts, or cable clamps designed as accessories to basic channel members.
- .4 Fasten exposed conduit or cables to building using:
 - .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.
- .5 For suspended support system:
 - .1 Support individual cable or conduit runs with 6mm diameter threaded rods and spring clips.

- .2 Support two or more cables or conduits on channels support by 6mm diameter threaded rod hangers where direct fastening to building construction is impractical.
- .6 For surface mounting of two or more conduits, use channels at 1500mm spacing.
- .7 Provide metal brackets, frames, hangers, clamps and related type of support structure where indicated or as required to support conduit and cable runs.
- .8 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .9 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .10 Do not use supports or equipment installed for other trades for conduit or cable support except with permission and approval of Engineer-Architect.
- .11 Install fastenings and supports as required for each type of equipment, cable and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data for cabinets in accordance with Section 26 05 00.

Part 2 Products

2.1 SPLITTER TROUGHS

- .1 Splitter trough construction is to be based on CSA C22.2 No. 76, junction and pull boxes construction is to be based on CSA C22.2 No. 40.
- .2 Sheet steel enclosure, with welded corners and formed hinged cover suitable for locking in closed position.
- .3 Connection bars are to match required size and number of incoming and outgoing conductors as indicated.
- .4 Provide at least three spare terminals on each set of lugs in splitter troughs less than 400A and feed through lugs where required.
- .5 Provide double lugs for neutrals where required.

2.2 JUNCTION AND PULL BOXES

- .1 Suitable for surface mounting and be of welded steel construction with screw-on flat covers.
- .2 For flush-mounted pull and junction boxes, provide covers with a 25mm minimum extension all around.
- .3 P.V.C. junction and pull boxes to be of a one piece moulded type.

2.3 GENERAL CABINETS

- .1 Type E: to be sheet steel, for surface mounting, complete with hinged door and return flange overlapping sides, handle and catch.
- .2 Type T to be sheet steel, for surface or flush mounting, complete with hinged door, latch, lock, 2 keys, containing 20 mm plywood backboard.

Part 3 Execution

3.1 SPLITTER INSTALLATION

- .1 Install splitter troughs where required. Mount plumb, true and square to the building lines.

- .2 Extend splitters for full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install junction and pull boxes in inconspicuous but accessible locations. Location must be coordinated with other trades.
- .2 Type T cabinets to be used for hard wired life safety system, and to be complete with required terminal blocks.
- .3 Only certain junction and pull boxes are indicated. Provide pull boxes so as not to exceed 30 m of conduit run between boxes, and after every 2 (two) 90 deg. bends.
- .4 Mount cabinets with top not higher than 2.0m above finished floor.

3.3 IDENTIFICATION

- .1 Install nameplates in accordance with Section 26 05 00.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CSA C22.1-1998, Canadian Electrical Code, Part 1.

1.2 ACCEPTABLE MATERIALS

- .1 Where materials are specified by the trade name within this Section, they are to establish an acceptable standard of quality. Alternates shall only be accepted upon approval prior to tender closing.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES - GENERAL

- .1 The construction of outlet boxes, conduit boxes and fittings is to be based on CSA C22.2 No. 18.
- .2 Size boxes in accordance with CSA C22.1.
- .3 Boxes to be suitable for the utilization voltage.
- .4 102mm square or larger outlet boxes as required for special devices.
- .5 Combination boxes to have barriers where outlets for more than one system are grouped.
- .6 Blank cover plates for boxes without wiring devices.
- .7 Recessed 100mm square or larger outlet boxes to be complete with single or ganged plaster rings to suit application.
- .8 Gang boxes where wiring devices are grouped.

2.2 SHEET STEEL OUTLET BOXES

- .1 Electro-galvanized steel single and multi-gang device boxes for flush installation, to be minimum size 75 mm x 50 mm x 37 mm unless otherwise specified or required. 100 mm square outlet boxes to be used when more than one conduit enters one side, with extension and plaster rings as required.
- .2 Boxes for door switches and push buttons to be sized as required.
- .3 Utility boxes for connection to surface mounted EMT conduit, to be minimum 100 x 54 x 48mm size.
- .4 Square or octagonal outlet boxes for lighting fixture outlets, to be minimum 100mm size.

- .5 Square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster or tile walls, to be minimum 100mm size.

2.3 MASONRY BOXES

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

2.4 CONCRETE BOXES

- .1 Electro-galvanized sheet steel concrete boxes to be used for flush mounting in concrete, with matching extension and plaster rings as required.

2.5 CONDUIT BOXES

- .1 Cast FS or FD feraloy boxes with factory-threaded hubs and mounting feet to be used for outlets connected to surface mounted rigid, EMT and PVC conduits.
- .2 Die cast aluminum boxes (single-gang and two-gang) with factory-threaded hubs and mounting feet to be used for all surface mounted GFI receptacles. Boxes will have powder coat finish (gray).
 - .1 Acceptable materials:
 - .1 Hubbell: RACO No. 5324 series (single gang) and 5341 series (two gang).

2.6 PVC BOXES

- .1 F Series and octagon boxes to be moulded type, with fastening ears and screw-secured covers as required, reinforced PVC suitable for use with Carlon Plus 80 PVC conduits.
- .2 Acceptable materials:
 - .1 Scepter
 - .2 Carlon

2.7 FITTINGS - GENERAL

- .1 Bushing and connectors to be with nylon insulated throats.
- .2 Provide knock-out fillers to prevent entry of foreign materials.
- .3 Use conduit outlet bodies for conduit up to and including 32mm and pull boxes for larger conduits.
- .4 Provide double locknuts and insulated bushings on sheet metal boxes.

2.8 RECESSED FLOOR BOXES

- .1 Concrete tight electro-galvanized sheet steel floor boxes, adjustable to suit floor finish with faceplate, suitable for floor required and be hinged with a positive action clip, such that walking thereon provides no movement or noise whatsoever. Provide slots in the lid,

for passage of cables when in closed position, natural aluminum finish to any exposed metal parts and provide device mounting plates to accommodate short or long ear receptacles. Minimum depth to be 28mm for receptacles, 75mm for communication equipment.

- .2 Complete with bottom openings drilled and tapped for 16 mm and 21 mm conduit and have a maximum depth to suit the thickness of concrete available.
- .3 Boxes to be suitable for the quantity of duplex receptacle and voice/data outlets as shown on drawings.
- .4 Acceptable Materials:
 - .1 Legrand/Wiremold
 - .2 Hubbell
 - .3 Condufloor

Part 3 Execution

3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, foam sponges or similar approved material to prevent entry of construction material. Remove upon completion of work.
- .3 Size box wiring chambers in accordance with Canadian Electrical Code.
- .4 Gang boxes together where wiring devices are grouped.
- .5 Provide matching blank cover plates for boxes without wiring devices.
- .6 Use combination boxes where outlets for more than one system or voltage are grouped.
- .7 For flush installations, mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .8 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.
- .9 Provide "FS" or "FD" feraloy boxes for all surface mounted devices, including fire alarm, security and auxiliary systems.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA C22.2 No. 18-98, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
 - .2 CSA C22.2 No. 45-M1981(R1992), Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56-1977(R1999), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83-M1985(R1999), Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2-M1984(R1999), Rigid PVC (Unplasticized) Conduit.
 - .6 CAN/CSA C22.2 No. 227.3-M91(R1999), Flexible Nonmetallic Tubing.

1.2 ACCEPTABLE MATERIALS

- .1 Where materials are specified by the trade name within this Section, they are to establish an acceptable standard of quality. Alternates shall only be accepted upon approval prior to tender closing.

1.3 LOCATION OF CONDUIT

- .1 Drawings do not show all conduits. Those shown are in diagrammatic form only.
- .2 All interior wiring generally shall be in EMT (except where prohibited by Code), including panel feeders, branch circuit power and lighting circuits, fire alarm, security and sound systems, communications (within walls) and control (within walls) wiring. All conduits and EMT shall be concealed except in electrical or mechanical rooms. Surface mounted and exposed conduits shall be run parallel and perpendicular to building lines.

Part 2 Products

2.1 CONDUITS

- .1 Rigid and epoxy coated conduit to be threaded, galvanized steel and to be manufactured to C.S.A. C22.2, No. 45.
- .2 Electrical metallic tube (EMT) conduit and couplings to be manufactured to C.S.A. C22.2, No. 83.
- .3 Rigid PVC conduit to be manufactured to C.S.A. C22.2, No. 211.2.
 - .1 Acceptable materials:
 - .1 Carlon Plus 40 or Septer Schedule 40 rigid PVC conduits.

.4 Flexible metal conduit and liquid-tight flexible metal conduit to be manufactured to C.S.A. C22.2, No. 56.

.5 Flexible PVC conduit to CAN/CSA-C22.2 No. 227.3.

2.2 CONDUIT FASTENINGS

.1 Conduit straps to be steel, single or double hole for rigid or EMT conduit, and heavy duty PVC, double hole for PVC conduit.

.2 Provide one-hole steel straps to secure surface conduits 53mm and smaller, and two-hole steel straps for conduits larger than 53mm.

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

.4 Use threaded rods, 6mm diameter, to support suspended channels.

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

2.3 CONDUIT FITTINGS

.1 Fittings for conduits to be manufactured to C.S.A. C22.2, No. 18.

.2 Fittings for rigid conduit to be steel threaded type, and for EMT conduit, to be steel set screw type and weatherproof connectors with "O" rings in sprinklered buildings.

.3 Fittings for PVC conduit to be rigid, extruded, solvent type, to match Carlon Plus 80 conduits.

.4 Fittings for flexible conduit and exposed conduit outdoors to be liquid-tight type, straight or angled threaded for rigid and compression for EMT conduit.

.5 Expansion fittings for rigid, EMT or PVC conduits to be of the watertight type, with an integral bonding assembly, suitable for deflection in all directions.

.6 Bushings and connectors to be c/w insulated throat.

.7 Factory "ELLS" where 90° bends are required for 40mm and larger conduits.

2.4 PULLING CABLES

.1 Pulling cables to be polypropylene and of a strength suitable for tension to be pulled.

2.5 WATERPROOF MEMBRANE

.1 Conduits penetrating waterproof membranes, to be PEM #6372.

2.6 EXPANSION FITTINGS FOR RIGID CONDUIT

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

- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19mm (3/4") deflection in all directions.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.7 LIQUID TIGHT NON-METALLIC FLEXIBLE CONDUIT

- .1 Smooth, black, PVC, equal to Thomas & Betts "XTRAFLEX" LTC Series.
- .2 Non-metallic liquid-tight fittings, equal to Thomas & Betts LT Series.

2.8 PVC DUCT JOINTS

- .1 Solvent cement for PVC duct joints shall have a VOC content of less than 510g/litre of coating, less water and less exempt compounds.

Part 3 Execution

3.1 INSTALLATION (GENERAL)

- .1 All installations on underside of deck must be mounted on structure and not fastened by clamps to underside of deck as required by Local Inspection Authority.
- .2 All conduits to be surface mounted (exposed) in mechanical and electrical service spaces and rooms and concealed elsewhere.
- .3 Provide connectors with waterproof bushings and "O" rings when entering or exiting from top or sides of electrical equipment.
- .4 Exposed conduits to be installed to conserve headroom and cause minimum interference in spaces through which they pass.
- .5 Use rigid galvanized steel threaded conduit for all service work unless specified otherwise.
- .6 Use rigid PVC conduits in all outdoor locations.
- .7 Use rigid PVC conduit underground and in exposed indoor corrosive areas.
- .8 Use rigid PVC conduit in poured concrete slabs on and above grade where able to embed in at least 50mm of poured concrete.
- .9 Use flexible metal conduit c/w anti-short insulators for short connections to motors and transformers in dry areas and connection to surface or recessed fluorescent fixtures, alternately use armoured cables.
- .10 Use liquid-tight flexible metal conduit c/w anti-short insulators for short connections to motors and transformers in damp locations, including electrical and mechanical rooms.
- .11 Use electrical metallic tubing (EMT) for branch circuit work except in poured concrete or underground unless indicated otherwise. When used for feeders, install a separate integral ground wire sized in accordance with the C.E.C.

- .12 Install conduit sealing fittings in hazardous areas, and fill conduit with compound.
- .13 Bend conduit without heating. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .14 Mechanically bend conduit over 20 mm diameter.
- .15 Field threads on rigid conduit must be of sufficient length to draw conduits tight.
- .16 Install pulling cables in all conduits that are to remain "empty".
- .17 Run 3 (three) 21 mm spare conduits up to ceiling space from each recessed panelboard.
- .18 Where conduits become blocked, remove and replace blocked section.
- .19 A maximum of 2 (two), 90 deg. bends, or equivalent up to 180 deg., will be permitted without installation of a pull box. Radius of bends must be no less than 10 (ten) times the conduit diameter.
- .20 Conduits must be dry, before installing wires.
- .21 Install communication conduits with the minimum separations from the following EMI sources:
 - Exposed power cables <2KV 125mm
 - Cables in conduit <2KV 62mm
 - Luminaire ballasts 300mm
 - Transformers and motors 1000mm
- .22 Do not install conduits above roof deck to avoid penetrations which encourage corrosion.
- .23 Conduit sizing, where indicated, is based on copper conductors and rigid steel conduit. Where NUAL is used or where EMT that requires an additional ground wire is used, adjust conduit size to suit.
- .24 Where metal type Q-Deck is being used, all cables/conduits are to be installed on room sides of upper portions of same (directly above tops of, and at right angles to steel joists) and secured directly to sides of metal flutes and/or structure. Under no circumstances are cables/conduits to be laid in, fished in, or otherwise installed in top or upper (roof) sides of metal flutes. All wiring is to be surface installed on, or to, the underside of room structure.

3.2 SURFACE CONDUITS

- .1 Surface conduits to be run parallel and perpendicular to building lines.
- .2 Conduits located near any heat producing equipment to have 1500 mm clearance.
- .3 Conduits adjacent to structural steel, beams or columns to be run within the flanged portion, unless otherwise shown.
- .4 Group exposed conduits on surface or suspended channels.

- .5 Do not pass conduits through structural members except where indicated.
- .6 Do not locate conduits less than 75mm parallel to steam or hot water lines. Provide a minimum clearance of 25mm at crossovers.

3.3 CONCEALED CONDUITS

- .1 Do not install horizontal runs in masonry walls.
- .2 Do not install conduits in terrazzo or concrete toppings.

3.4 CONDUITS IN CAST-IN-PLACE CONCRETE

- .1 Locate to suit reinforcing steel. Install in center 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 Where conduits pass through waterproof membrane, provide oversized sleeve before membrane is installed. Use cold mastic between sleeve and conduit.
- .5 Encase conduits completely in concrete.

3.5 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.

3.6 CONDUIT SIZE

- .1 The minimum conduit size to be 19mm.

3.7 EXPANSION FITTINGS

- .1 Conduit expansion fittings to be provided on all conduits crossing expansion joints, and at maximum of 60 m spacing.
- .2 Install expansion fittings perpendicular to expansion joint.
- .3 Refer to Structural Drawings for location of expansion joints.

3.8 COMMUNICATION CONDUIT

- .1 Where there are more than 2-90° bends, provide a pull box between sections so that there are two bends or less in any one section.
- .2 Where a conduit run requires a reverse bend (between 100 degrees and 180 degrees) insert a pull box at each bend having an angle from 100 degrees to 180 degrees.
- .3 A minimum of one (1) pull box to be installed for every 30m of conduit. Each 90° bend equals to a 10 m length of conduit.

- .4 The Contractor to inform the Engineer-Architect of any communication conduit lengths greater than 90m prior to installation.
- .5 Ream all conduit ends and install insulated bushings on each end.
- .6 Terminate all conduits that protrude through the structural floor 50mm above the concrete base.
- .7 Do not use a pull box in lieu of a bend. Align conduits that enter a pull box from opposite ends with each other.
- .8 Minimum space requirements in pull boxes having one conduit each in opposite ends of the pull box to be as noted in the table below:

Maximum Trade Size of Conduit	Size of Pull Box			For Each Additional Conduit Increase Width
	Width	Length	Depth	
19mm	100mm	300mm	75mm	50mm
25mm	100mm	400mm	75mm	50mm
31mm	100mm	400mm	75mm	75mm
38mm	150mm	500mm	100mm	100mm
50mm	150mm	500mm	100mm	125mm
62mm	150mm	500mm	125mm	150mm
75mm	200mm	900mm	125mm	150mm
81mm	200mm	900mm	150mm	150mm
100mm	250mm	1220mm	200mm	200mm

END OF SECTION

Part 1 General

1.1 NOT USED

- .1 Not used.

Part 2 Products

2.1 CABLETROUGH

- .1 Cabletroughs and fittings: to EEMAC F5-1.
- .2 Basket type.
- .3 Fittings and ground clamps: all required manufactured accessories for the cabletrough supplied.
- .4 60mm High x 200mm Wide.

2.2 SUPPORTS

- .1 Provide supports as indicated and/or as required, with end cut so as to not project more than 25mm from edge of hanger.

2.3 MANUFACTURERS

- .1 Acceptable manufacturer or approved equal:
 - .1 B-Line #FT2X8X10-EG
 - .2 Thomas & Betts
 - .3 Legrand

Part 3 Execution

3.1 INSTALLATION

- .1 Install cabletrough support systems as indicated or as required.
- .2 Support overhead cabletrough with hanger brackets and threaded rod through concrete ceiling.
- .3 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.
- .4 All fittings shall be field formed as needed.
- .5 Grounding to Code requirements.

3.2 CABLES IN CABLETROUGH

- .1 Install cables individually.
- .2 Secure cables in cabletrough with nylon ties.
- .3 Identify cables in accordance with Section 26 05 00.
- .4 Provide proper sealing through wall penetration once all cables are installed.

END OF SECTION

Part 1 General

1.1 REFERENCE

- .1 Read and be governed by Section 26 05 00.

1.2 RELATED WORK

- .1 Comply with relevant Sections of this and other Divisions of this Specification.

1.3 WORK INCLUDED

- .1 Provide seismic restraints for electrical equipment to prevent damage against movement in the event of an earthquake.

1.4 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 26 05 00.

Part 2 Products

2.1 N/A

Part 3 Execution

3.1 INSTALLATION

- .1 For conduit runs supported with rod and channel iron use rod hangers not less than 13 mm in diameter.
- .2 For lighting fixtures:
 - .1 Fasten recessed fixtures firmly to the suspended ceiling system with attachment devices capable of 100% of the fixture weight acting in any direction.
 - .2 For recessed fluorescent fixtures in inverted T-bar ceiling systems, use Caddy #ATS-41 or equal, attachment clips. Provide minimum of four clips per fixture, fastened to adjacent main runner members of T-bar system.
 - .3 For recessed fixtures weighing more than 9 kg (20 lbs) but less than 25 kg (56 lbs), in addition to the requirements of 3.1.5.1 and 3.1.5.2 above provide two #12 gauge steel wire hangers per fixture, with one end fastened to the fixture housing and the other end to either the ceiling system hanger or to the building structure above. These wire hangers may be slack.
 - .4 For recessed fixtures weighing more than 25 kg (56 lbs), support directly from the building structure above, independent of the suspended ceiling system, using approved hangers.
 - .5 Fasten surface mounted fixtures to the ceiling system with positive clamping devices which completely surround the supporting members. Provide safety wires

between the clamping device and the adjacent ceiling system hanger or to the building structure above. Use Erico Products Inc. Caddy fasteners type IDS for securing surface mounted fluorescent fixtures to inverted T-bar systems, with #12 gauge stainless steel wire hangers to the structure above.

- .6 Support pendant type fixtures directly from the building structure above, using #9 gauge stainless steel wire without using the ceiling suspension system for direct support.
- .3 Install all seismic restraint devices in accordance with the manufacturer's instructions and drawings.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Read and be governed by Section 26 05 00.

1.2 RELATED WORK

- .1 Comply with relevant Sections of this and other Divisions of this Specification.

1.3 PLANT ASSEMBLY

- .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.

1.4 ACCEPTABLE MATERIALS

- .1 Where materials are specified by the trade name within this Section, they are to establish an acceptable standard of quality. Alternates shall only be accepted upon approval prior to tender closing.

Part 2 Products

2.1 PANELBOARDS

- .1 All panelboards to be manufactured to CSA C22.2 No. 29, and be the product of a single manufacturer.
- .2 All panelboards to have aluminum bus bars rated for 22,000A withstand capacity. Provide a full size neutral for 600V and 250V boards, both with same withstand rating as mains.
- .3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .4 Panelboards to contain mains, ground and neutral busses, number of circuits, and number and size of branch circuit breakers as indicated.
- .5 Provide 2 (two) keys for each panelboard and key panelboards alike.
- .6 The mains to be suitable for bolt-on breakers.
- .7 The trim and door to be finished with baked grey enamel unless otherwise specified.
- .8 For recessed panelboards, paint trim and door to match finish of adjacent surface.
- .9 Panelboards are to be complete with factory installed bonding terminal strips. Where more than one bonding terminal strip is present in any one panelboard, both shall be hard-

wired together using identical size bonding conductor as the one accompanying the panel feeder conductors.

- .10 Where two (2) panels serve the same area, they are to be bonded together using #6 AWG minimum.

2.2 CUSTOM BUILT PANELBOARD ASSEMBLIES

- .1 Provide double lugs where indicated.
- .2 Contactors in mains as indicated.
- .3 Feed through lugs as required.
- .4 Isolated ground bus where indicated on panel schedules.

2.3 BREAKERS

- .1 Provide breakers as specified.
- .2 The main breaker to be separately mounted at the top or bottom of panel to suit cable entry.
- .3 Provide lock-on devices for pipetracing, fire alarm, door supervisory, intercom, stairway and exit devices circuits. Provide lock-on devices for 10% of 15-30A breakers installed. Turnover unused lock-on devices to Owner.
- .4 Shunt trip rating where indicated.

2.4 EQUIPMENT IDENTIFICATION

- .1 Provide size 4 nameplate for each panelboard.
- .2 Complete circuit directory with typewritten legend showing location and load of each circuit.

2.5 ACCEPTABLE MATERIALS

- .1 Schneider
- .2 Eaton (Cutler-Hammer)
- .3 Siemens

Part 3 Execution

3.1 INSTALLATION

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

- .2 Connect loads to circuits as indicated.
- .3 Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

- .1 Section 26 05 00 - Electrical General Requirements.

1.3 REFERENCES

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

1.4 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 26 05 00.

1.5 ACCEPTABLE MATERIALS

- .1 Where materials are specified by the trade name within this Section, they are to establish an acceptable standard of quality. Alternates shall only be accepted upon approval prior to tender closing.

Part 2 Products

2.1 STANDARDS

- .1 Construction of manually operated general purpose AC switches is to be based on CSA.2 No. 111, snap switches on CSA C22.2 No. 55, and receptacles, plugs and similar wiring devices on CSA C22.2 No. 42.
- .2 Devices to be Specification Grade and of one manufacturer throughout unless otherwise noted.

2.2 SWITCHES - LINE VOLTAGE

- .1 Switches to be 15A, 120 volt, silent, AC type, CSA listed, single pole, double pole, three-way or four way as indicated, with the following features:
 - .1 Terminal holes approved for No. 10 AWG wire, silver alloy contacts, and urea or melamine mouldings for parts subject to carbon tracking.

- .2 Suitable for back and side wiring, and rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.
- .2 White toggle style switches to be used for 120V in all areas.
- .3 Acceptable Materials
 - .1 Hubbell #CSB115W (toggle)
 - .2 Leviton
 - .3 P&S
 - .4 Bryant
 - .5 Cooper

2.3 RECEPTACLES

- .1 Duplex receptacles to be CSA Type 5-15R, 125V, 15A, U ground commercial specification grade and CSA Type 5-20R, 125V, 20A, U ground commercial specification grade with the following features:
 - .1 White and are to be commercial specification grade.
 - .2 Suitable for No. 10 AWG for back and side wiring, have break-off links for use as split receptacles, and 8 (eight) back wired entrances, 4 (four) side wiring screws and double wipe contacts with riveted grounding contacts.
- .2 Other receptacles to have configuration, ampacity and voltage as indicated.
- .3 Receptacles of one manufacturer throughout project.
- .4 Acceptable Materials:
 - .1 Hubbell #BR20WHI, #BR15WHI
 - .2 Leviton
 - .3 P&S
 - .4 Cooper
 - .5 Bryant

2.4 SPECIAL WIRING DEVICES

- .1 Pilot lights where indicated, shall be complete with neon lamp and red plastic jewel, flush type.
- .2 Where indicated, receptacles shall be ground fault protected by a test circuit integral to the receptacle. (Refer to specification Section 26 28 20).

2.5 COVERPLATES

- .1 Provide coverplates for single and combination wiring devices, of types, sizes and with gang in and cutouts as indicated. Select plates to match and mate wiring devices to which attached.

- .2 Stainless steel coverplates to be installed.
- .3 Sheet metal coverplates for wiring devices mounted in surface mounted FS or FD type conduit boxes.
- .4 Electrical Contractor to ensure coordination of all coverplates throughout project, including telephone and data. Numbers required are to be coordinated with telephone and data contractor.

2.6 WALL BOX DIMMERS

- .1 Line voltage dimmer designed to perform with 0-10V electronic dimming ballasts, or LED drivers with additional power packs, brightness control by means of single linear slide and:
 - .1 Fit single-gang standard switch box.
 - .2 Mechanical air-gap switch to disconnect load power.
 - .3 Rated: 0-10V, 16A.
 - .4 Radio frequency interference suppression circuitry.
 - .5 Acceptable manufacturer:
 - .1 Lutron #NTFTV-WH
 - .2 Wattstopper
 - .3 Cooper

Part 3 Execution

3.1 INSTALLATION

- .1 Switches:
 - .1 Install single throw switches with lever in 'UP' position when switch closed.
 - .2 Install switches in gang type outlet box when more than one switch is required in one location.
- .2 Receptacles:
 - .1 Install receptacles and telephone/data devices in gang type outlet box when more than one device is required in one location, and when adjacent to power devices, separated, yet under a single coverplate.
 - .2 Where split receptacle has one portion switched, mounted vertically and switch upper portion.
 - .3 Provide circuit identification with "Brady" type labeller and engraved with panel name and circuit number from which the receptacle is fed. Lettering to be 6mm high and as follows:
 - .1 Normal power: black lettering on white background.
 - .2 Provide additional label for dedicated circuit receptacles, of matching colour, indicating the words: "Dedicated Circuit."

- .4 All exterior receptacles will be GFI type mounted in weather-proof boxes.
- .5 Connect receptacle grounding terminal to the outlet box with an insulated green ground strap.
- .6 Install receptacles in “ground up” position.
- .3 Coverplates:
 - .1 Protect coverplate finish until painting and other work is finished, or install after painting is complete.
 - .2 Install suitable matching common (ganged) coverplates where wiring devices are grouped. Ensure blank sections where required for telephone and data devices.
 - .3 Do not use flush type coverplates on surface mounted boxes.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Read and be governed by Section 26 05 00.

1.2 RELATED WORK

- .1 Comply with relevant Sections of this and other Divisions of this Specification.

1.3 ACCEPTABLE MATERIALS

- .1 Where materials are specified by the trade name within this Section, they are to establish an acceptable standard of quality. Alternates shall only be accepted upon approval prior to tender closing.

Part 2 Products

2.1 MATERIALS

- .1 Ground fault circuit interrupters Class 'A' shall be manufactured to CSA and Electrical Bulletin No. 752.
- .2 Components forming the ground fault protective system, to be of same manufacturer.

2.2 SYSTEM NO. 1 - BREAKER TYPE

- .1 Ground fault interrupter breakers shall be suitable for 15A, 20A, 30A, or 40A 120V, 1P or 2P circuits and shall be complete with:
 - .1 Automatic shunt trip circuit breaker.
 - .2 Zero sequence transformer.
 - .3 Overcurrent, short circuit and GFI protection.
 - .4 Facilities for testing and reset.
 - .5 Maximum 5mA trip.

2.3 SYSTEM NO. 2 - PROTECTOR UNIT

- .1 Self-contained ground fault protector unit with 15 A, 120V (or 20A where noted) circuit interrupter and grounded duplex receptacle complete with:
 - .1 Test feature and reset switch c/w self test.
 - .2 Unit shall trip at 4-6mA, unless otherwise noted.
 - .3 Red indicator light.
 - .4 Trip time: 0.025 sec.
 - .5 White.

- .6 Tamper resistant where indicated.
- .7 Maximum Interrupting Capacity: 10 kA
- .8 Acceptable Materials:
 - .1 Hubbell: GF15WLA (15A)
 - .2 Leviton
 - .3 P&S
 - .4 Bryant
 - .5 Cooper

Part 3 Execution

3.1 INSTALLATION

- .1 Neutral must not be grounded on load side of ground fault relay.
- .2 Phase conductors and neutral must pass through zero sequence transformers.
- .3 Use GFI breakers for electric strike power supplies and for circuits where shown.
- .4 Connect supply and load wiring to equipment in accordance with manufacturer's recommendations.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Electrical General Requirements.
- .2 Demonstrate simulated ground fault tests.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Division 01.
- .2 Section 26 05 00 - Electrical General Requirements.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with Section 26 05 00.
- .2 Include time-current characteristic curves for breakers with ampacity of 400A and over with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

Part 2 Products

2.1 BREAKERS - GENERAL

- .1 Moulded case circuit breakers shall be manufactured to CSA C22.2 No. 5.
- .2 Bolt-on moulded case circuit breakers shall be quick make, quick break type, for manual and automatic operation with temperature compensation for 40 °C ambient.
- .3 Common trip breakers shall be complete with single handle for multiple applications.
- .4 Magnetic instantaneous trip elements in circuit breakers, to operate only when the value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3 to 8 times current rating.
- .5 Circuit breakers with interchangeable trips as indicated.
- .6 Mini circuit breakers, twin or tandem breakers are not acceptable.

2.2 THERMAL MAGNETIC BREAKER

- .1 Moulded case circuit breakers to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping under overload conditions and instantaneous magnetic tripping for short circuit protection.
- .2 Circuit breakers for frame sizes over 150A, shall be complete with interchangeable trips as indicated.

2.3 SOLID STATE TRIP BREAKERS

- .1 Moulded case circuit breakers are to operate by means of a solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, long time, short time and instantaneous tripping, for phase and ground fault short circuit protection.

2.4 ADDITIONAL FEATURES

- .1 Include, where required:
 - .1 Shunt trip.
 - .2 Auxiliary switch.
 - .3 Motor-operated mechanism c/w time delay unit.
 - .4 On-Off locking device.

2.5 ENCLOSURES

- .1 Enclosures for individual breakers shall be suitable for EEMAC 1 applications, and be complete with lever handle operator.

2.6 MANUFACTURERS

- .1 Acceptable manufacturer or approved equal to match panelboard (NEW):
 - .1 Siemens
 - .2 Eaton (Cutler-Hammer)
 - .3 Schneider
- .2 All new breakers within Panel "BB" to be Siemens.

Part 3 Execution

3.1 INSTALLATION

- .1 Install circuit breakers as indicated.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 51 02 - Ballasts.
- .2 Section 26 51 03 – Lenses and Louvres.
- .3 Section 26 51 04 - Luminaire Construction and Installation.
- .4 Section 26 51 05 - Luminaires.

1.2 SHOP DRAWINGS

- .1 Submit shop drawings and product data in accordance with Section 26 05 00.
- .2 Submit manufacturer's technical data for lamps which are specified to be installed in fixtures with each luminaire shop drawing attach the lamp technical data. Data to include:
 - .1 Operating voltage
 - .2 Wattage
 - .3 Rated lumens
 - .4 Rated life
 - .5 Colour temperature
 - .6 Colour rendering index (CRI)
 - .7 Base type
 - .8 Lamp shape
- .3 Refer to lamp schedule in conjunction with luminaire schedule.

1.3 ACCEPTABLE MATERIALS

- .1 Where materials are specified by the trade name within this Section, they are to establish an acceptable standard of quality. Alternates shall only be accepted upon approval prior to tender closing.

1.4 LAMP/BALLAST/FIXTURE COORDINATION

- .1 Electrical contractor is to ensure that the fixture manufacturer is providing a lamp, ballast and fixture combination that are fully compatible. Once installed, the fixture c/w lamp and ballast must operate as per specifications from both a thermal and photometric standpoint. Lamp life specified must not be altered dramatically due to fixture housing, operating conditions and/or ballast coordination.

Part 2 Products

2.1 GENERAL

- .1 Provide lamps as indicated in the luminaire schedule.

2.2 COLOUR

- .1 Unless noted otherwise, the following colour performance must be provided.
- .2 Fluorescent T8 lamps to have a colour temperature of 3500K with a CRI of 85.
- .3 LED fixtures to have a colour temperature of 3500K with a CRI of 80.

2.3 LIFE

- .1 All incandescent lamps to be long life with a minimum rated life as noted in luminaire schedule.
- .2 Fluorescent: minimum of 40,000 hrs. (rapid start @ 3hrs/start).
Fluorescent: minimum of 24,000 hrs. (instant start @ 3hrs/start).

2.4 SHIPMENT

- .1 All lamps provided on the site to be new and of the same shipment.

2.5 ACCEPTABLE MATERIALS

- .1 CGE
- .2 Philips
- .3 Osram/Sylvania

Part 3 Execution

3.1 INSTALLATION

- .1 Install all lamps in fixtures as noted in luminaire schedule.
- .2 Replace all lamps with new, if there is any rapid deterioration of lamps which the Engineer-Architect views as excessive in terms of the project warranty, and at no cost to the Engineer-Architect/Owner.
- .3 Replace all lamps with a colour shift which does not correlate to manufacturers published data.
- .4 Install lamps only after the luminaire is cleaned.
- .5 Ensure that lamps are suitable for luminaire prior to energization.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 Conform to Sections of Division 01, as applicable.

1.2 RELATED SECTIONS

- .1 Section 26 05 00 – Electrical General Requirements.
- .2 Section 26 51 01 – Lamps.
- .3 Section 26 51 05 – Luminaires.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 26 05 00.
- .2 Submit manufacturer's technical data for ballasts which are specified to be installed as indicated in Luminaire Schedule with each luminaire shop drawing. Attach Ballast technical data, which shall include:
 - .1 operating watts;
 - .2 input voltage;
 - .3 power factor;
 - .4 temperature range for operation;
 - .5 regulation;
 - .6 Confirmation of compatibility with Lamp manufacturer.
- .3 Ballasts shall be manufactured to CSA C22.2 No. 74, and meet or exceed the latest requirements of CBM manufacturers.
- .4 Ballast voltage shall be as noted in Luminaire Schedule or as required by circuit connection on drawings.

1.4 ACCEPTABLE MATERIALS

- .1 Where materials are specified by the trade name within this Section, they are to establish an acceptable standard of quality. Alternates shall only be accepted upon approval prior to tender closing.

1.5 LAMP/BALLAST/FIXTURE COORDINATION

- .1 Electrical contractor is to ensure that the fixture manufacturer is providing a lamp, ballast and fixture combination that are fully compatible. Once installed, the fixture c/w lamp and ballast must operate as per specifications from both a thermal and photometric standpoint. Lamp life specified must not be altered dramatically due to fixture housing, operating conditions and/or ballast coordination.

Part 2 Products

2.1 ELECTRONIC T8 BALLASTS: RAPID START

- .1 Ballast shall operate from a nominal line voltage as indicated in Luminaire Schedule.
- .2 Ballast shall operate with a line voltage variation of +/- 10%.
- .3 Ballast shall meet ANSI C62.41 Category 'A' transient voltage protection requirements.
- .4 Ballast shall be programmed rapid start.
- .5 Ballast Power Factor shall be 0.88 (min.).
- .6 Ballast THD shall be <10% for the highest wattage lamps and maximum number of lamps the ballast is designed to operate.
- .7 Ballast shall meet FCC Class 'A' (non-consumer) specifications for EMI/RFI.
- .8 Ballast shall start the lamp at a minimum temperature of 0 deg C (32 deg F).
- .9 Ballast shall have a lamp current crest factor <1.6 for F32T8 lamps.
- .10 Ballast shall be sound rated A.
- .11 Ballast shall be UL Listed Class P and CSA Approved.
- .12 Ballast must be potted to secure PC board, provide lead strain relief, provide a moisture barrier, and ensure proper thermal transmission.
- .13 Ballast shall contain no PCBs.
- .14 Ballast shall be permanently connected, internally soldered with #18 AWG leads as a minimum.
- .15 Ballast output to the lamps shall be above 40Khz to minimize interference with infrared control systems.

2.2 ACCEPTABLE MATERIALS

- .1 Advance
- .2 Lutron
- .3 Osram/Sylvania
- .4 Magnetek

Part 3 Execution

3.1 INSTALLATION

- .1 Generally, ballasts shall be integral with fixture unless otherwise noted.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 Conform to Sections of Division 01, as applicable.

1.2 RELATED SECTIONS

- .1 Section 26 51 01 – Lamps.
- .2 Section 26 51 04 – Luminaires Construction and Installation.
- .3 Section 26 51 05 – Luminaires.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 26 05 00.
- .2 All fixtures to be complete with integral lenses as specified.
- .3 Submit shop drawings of each lens and louvre specified along with fixture shop drawing.

Part 2 Products

2.1 LENSES

- .1 Lenses to be manufactured from injection molded clear acrylic.
- .2 Lenses to be as follows unless otherwise noted:
 - .1 A125 generic brand.
 - .2 Pattern No. 12 standard
 - .3 Polycarbonate as indicated.

Part 3 Execution

3.1 INSTALLATION

- .1 Install lenses and louvres in fixtures specified in Luminaire Schedule.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 Conform to Sections of Division 01, as applicable.
- .2 Refer to fixture schedule on drawings.

1.2 RELATED SECTIONS

- .1 Section 26 05 00 – Electrical General Requirements
- .2 Section 26 05 48 – Seismic Restraints
- .3 Section 26 51 01 – Lamps
- .4 Section 26 51 02 – Ballasts
- .5 Section 26 51 03 – Lenses and Louvres
- .6 Section 26 54 00 – Occupancy Sensors

1.3 SYSTEM DESCRIPTION

- .1 Catalog numbers indicated in the Fixture Schedule are a design series reference and do not necessarily represent the exact catalog number, size, voltage, wattage, type of lamp, ballast, finish trim, ceiling type, mounting hardware or special requirements as specified or as required by the particular installations. Provide complete luminaire to correspond with the features, accessories, number of lamps, wattage and/or size specified in the text description of each luminaire type. Additional features, accessories and options specified shall be included.
- .2 Provide all frames, supplementary support structures, hangers, spacers, stems, aligner canopies, auxiliary junction boxes and other hardware as required for a complete and proper installation. Recessed luminaires shall have frames that are compatible with the ceiling systems.
- .3 Luminaire voltage shall match the voltage of the circuit serving same.

1.4 DEFINITIONS

- .1 BF: Ballast Factor.
CCT: Correlated Colour Temperature.
CRI: Colour-rendering Index.
LER: Luminaire Efficacy Rating.
Lumen: Measured output of lamp and luminaire, or both.
Luminaire: Complete lighting fixture, including ballast housing if provided.

1.5 SUBMITTALS

- .1 Submit shop drawings and product data in accordance with Section 26 05 00 for each type of luminaire, arranged in order of luminaire designation. Include information on features, accessories, finishes, and the following:
 - .1 Material and physical description of luminaire including dimensions.
 - .2 Energy efficiency data.
 - .3 Photometric data, certified by a qualified independent testing agency, in IESNA format, based on certified results of laboratory tests of each luminaire type, outfitted with lamps, ballasts and accessories identical to those indicated for the luminaire as applied in the Project.
 - .4 LED power supplies.
- .2 Maintenance data shall be provided for luminaires and equipment to include in operation and maintenance manuals that include wiring diagrams that detail wiring for luminaires and differentiate between manufacturer installed and field installed wiring.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver luminaires individually wrapped in factory fabricated fiberboard type containers. Parabolic louvers shall be shipped in thermally sealed polyethylene wrapper.
- .2 Handle luminaires carefully to prevent breakage, denting and scouring of the luminaire finish.
- .3 Store product in a clean, dry space, protected from weather.

1.7 QUALITY ASSURANCE

- .1 Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated.
- .2 Designated manufacturers are listed to define the requirements for quality and function of the specified product.

1.8 COORDINATION

- .1 Coordinate layout and installation of luminaires with ceiling system and other construction that penetrates ceilings or is supported by them including mechanical system, fire suppression, and technology and partition assemblies.
- .2 Provide all frames, supplementary support structures, hangers, spacers, stems, aligner canopies, auxiliary junction boxes and other hardware as required for a complete and proper installation. Recessed luminaires shall have frames that are compatible with the ceiling system.
- .3 Coordination Meetings: This Contractor shall meet at least twice with the ceiling installer. Hold first meeting before submittal of shop drawings to coordinate each luminaire mounting condition with ceiling type. During second meeting, coordinate luminaire layout in each area. This Contractor shall meet at least twice with the mechanical systems

installer prior to fabrication and installation of ductwork. Coordinate depth and location of all luminaires with ductwork, fire suppression, and technology in all areas.

1.9 WARRANTY

- .1 General Warranty: Special warranty specified in this Section shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by this Contractor under requirements of the Contract Documents.
- .2 Special Warranty for LEDs' and Drivers: Manufacturers standard form in which manufacturer of LED's and drivers agrees to replace components that fails in materials or workmanship within specified warranty period including installation costs:
 - .1 LED arrays: 5 years from date of substantial completion.
 - .2 Drivers: 5 years from date of substantial completion.

Part 2 Products

2.1 GENERAL

- .1 All luminaires have been assigned a type designation as per the Fixture Schedule on drawings.
- .2 Provide wire guards on all fluorescent open strip type luminaires.
- .3 Provide plaster frame for recessed luminaires mounted in other than T-bar ceilings. Verify mounting with architectural reflected ceiling plan before ordering luminaires.
- .4 Luminaires shall be free of light leaks while providing sufficient ventilation of lamps to provide the required photometric performance.
- .5 Where the Engineer-Architect is to select colours and finish of lighting fixtures after award of Contract, it shall be the responsibility of the Electrical Contractor to obtain this information well in advance of installation schedule.
- .6 Electrical contractor is to ensure that the fixture manufacturer is providing a lamp, ballast and fixture combination that are fully compatible. Once installed, the fixture c/w lamp and ballast must operate as per specifications from both a thermal and photometric standpoint. Lamp life specified must not be altered dramatically due to fixture housing, operating conditions and/or ballast coordination.
- .7 Metal Parts: Free of burrs, sharp corners and edges. Metal work shall be free of tool marks and dents and shall have accurate angles bent as sharply as compatible with the gauges of the required metal. Intersections and joints shall be formed true and of adequate strength and structural rigidity to prevent any distortion after assembly. All miters shall be in accurate alignment with abutting intersection members.
- .8 Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging. Luminaires to be painted after fabrication. Finish ferrous mounting hardware and accessories to prevent corrosion and discoloration to adjacent materials.

- .9 Luminaire hardware to comply with the following material standards: For steel and aluminum luminaires, all screws, bolts, nuts and other fastening and latching hardware shall be cadmium or equivalent plated. For stainless steel luminaires, all hardware shall be stainless steel. For bronze luminaires, all hardware shall be stainless steel or bronze, unless otherwise noted.
- .10 Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Safety devices shall be detachable if necessary and shall not interfere with luminaire performance, maintenance or the seating of any luminaire element. Safety device shall not be visible during normal luminaire operation and from normal viewing angles.

2.2 DISCONNECTING MEANS

- .1 Each fluorescent luminaire installed on branch circuits with voltages exceeding 150 volts-to-ground, shall be:
 - .1 Provided with a disconnecting means integral with the luminaire that simultaneously opens all circuit conductors between the branch circuit conductors and the conductors supplying the ballast(s); and marked in a conspicuous, legible, and permanent manner adjacent to the disconnecting means, identifying the specific purpose.

2.3 FLUORESCENT LUMINAIRES

- .1 Housing shall be minimum code gauge steel construction painted after fabrication with high reflectance white paint unless otherwise indicated.
- .2 Doorframes shall be supplied with concealed hinges and latches. Provide mitered corners with no gaps or light leaks.
- .3 Fixture rigidity shall permit any suspension method without sag. Fluorescent fixtures shall be suitable for either individual or continuous mounting.
- .4 Fixtures shall be finished in baked white enamel with exposed surfaces matching the exposed tee-bars specified. Fixture finish shall resist chipping, corrosion, and discolouration. Before finishing, all metal shall be chemically degreased and neutralized. Finish shall not be less than two coats of enamel, sprayed and baked on. Reflecting surfaces shall be white with a reflectance of not less than 85%.
- .5 Fixture lenses, louvres and diffusers shall be rigid enough to be self supporting without sag, easily removable but not loose. Provide additional thickness of lens to prevent sag at no extra cost to the Owner.

2.4 LED LUMINAIRES AND DRIVERS

- .1 All Luminaires:
 - .1 Comply with IES LM-79-08 Approved Method for measuring lumen maintenance of LED light sources.

- .2 Comply with IES LM-80-08 Approved Method for electrical and photometric measurement of SSL product.
- .3 Comply with In-Situ testing for more reliable results.
- .4 LED's shall be Restriction of Hazardous Substances Directive (RoHS) compliant.
- .5 LED arrays shall be sealed, high performance, long life type; minimum 70% rated output at 50,000 hours.
- .6 LED luminaires shall deliver a minimum of 60 lumens per watt.
 - .1 LED's shall be "Bin No. 1" quality.
- .7 Drivers shall be solid state and accept 120 through 277 VAC at 60 Hz input.
- .8 LED color temperatures: 3500K as noted +/- 145K.
- .9 Luminaires shall have internal thermal protection.
- .10 Color spatial uniformity shall be within .004 of CIE 1976 diagram.
- .11 Color maintenance over rated life shall be within .007 of CIE 1976.
- .12 Indoor luminaires shall have a minimum CRI of 80.
- .13 Luminaire manufacturers shall adhere to device manufacturer guidelines, certification programs, and test procedures for thermal management.
- .14 Luminaires shall be fully accessible from below ceiling plane for changing drivers, power supplies and arrays.
- .2 Power supplies and drivers:
 - .1 Power Factor: 0.90 or higher.
 - .2 Maximum driver case temperature not to exceed driver manufacturer recommended in-situ operation.
 - .3 Output operating frequency: 60Hz.
 - .4 Interference: EMI and RFI compliant with FCC 47 CFR Part 15.
 - .5 Total Harmonic Distortion Rating: 20% Maximum.
 - .6 Meet electrical and thermal conditions as described in LM-80 Section 5.0.
 - .7 Compatibility: Certified by manufacturer for use with individually specified luminaire and individually specified control components.
 - .8 Solid-state control components to be integral or external per each specified luminaire. Remote control gear to be enclosed in Class 1, Class 2, or NEMA 3R enclosures as required.

2.5 SOCKETS

- .1 Fluorescent sockets shall be suitable for lamp and ballast type specified.

Part 3 Execution

3.1 INSTALLATION

- .1 Luminaires:
 - .1 Set level, plumb, and square with ceilings and walls, and secure according to manufacturers written instructions and approved submittal materials, unless otherwise indicated.

-
- .2 Install lamps in each luminaire.
- .2 Mounting height indicated from finished floor to bottom of pendant luminaire or to the center of the outlet box for wall mounted luminaires unless otherwise noted. Verify mounting heights with Engineer-Architect.
- .3 Mounting height may also be indicated as the length of the pendant below finished ceiling.
- .4 Dimensions of coves, valences and bulkheads as indicated on drawings, are for general information only. Exact dimensions shall be job measured, or obtained from Architectural drawings.
- .5 Provide all necessary hanging or mounting devices and accessories for all luminaires. Verify the types needed for various ceiling conditions. Plaster rings shall be provided where required.
- .6 Verify weight and mounting method of all luminaires prior to ordering and provide suitable support. Coordinate with General Contractor for luminaires that require additional blocking or support. Luminaire mounting assemblies shall comply with all local seismic codes and regulations. Refer to Section 26 05 48 for additional requirements.
- .7 Metal decking shall not be pierced for luminaire support.
- .8 Refer to architectural reflected ceiling plans for coordination of luminaire locations with mechanical, fire protection, technology and fire safety equipment. Where conflicts occur, coordinate with Engineer-Architect.
- .9 In accessible suspended ceilings, luminaire wiring connections, including equipment grounding conductor, is to be through use of 1800mm flexible conduit from a rigidly supported junction box.
- .10 Wire per requirements of branch circuit installation. Properly ground each luminaire.
- .11 Luminaires located in recessed ceilings with a fire resistive rating of 1 hour or more shall be enclosed in an approved fire resistive rated box/cover equal to that of the ceiling. Acoustical ceiling tiles are not acceptable. Fixtures shall be provided with thermal overload protection when enclosed within a fire rated box/cover. The fixture shall be of a type that will dissipate the heat build-up in the fixture without damage to the fixture components.
- .12 This Contractor shall be responsible for adjusting aperture flanges or rings on all recessed luminaires to be flush with the finished ceiling. Trim shall completely conceal ceiling opening.
- .13 Brace suspended luminaires installed near ducts or other elements so that they do not swing into obstructions.
- .14 Wall mounted luminaires shall be supported from four-square outlet box plaster ring and from wall at non-feed end with two 8mm (1/4 inch) toggle bolts for gypsum board walls or 8mm (1/4 inch) bolts to pre-set inserts for concrete wall.

- .15 Luminaires shall not be secured to ductwork or other Systems.

3.2 FLUORESCENT LUMINAIRES

- .1 Recessed Type: Support luminaires independent of the ceiling suspension system. Provide four integral tabs (one at each corner) which rotate into position and lock on ceiling tees after luminaire is lifted into the ceiling cavity or provide four clips similar to Caddy #535. Provide mounting frames suitable for the ceiling type. Refer to Section 26 05 48 for seismic requirements.
- .2 Wall Mounted Type: Support from four-square outlet box plaster ring and from wall at non-feed end with two 8mm (1/4 inch) toggle bolts for gypsum board walls or 8mm (1/4 inch) bolts to pre-set inserts for concrete wall.
- .3 If clearance above T-bar system is too restricted to "tip-in" luminaire, coordinate with acoustic ceiling installer by leaving one cross T-bar off until the cross T-bar shall be secured into its proper place. Fluorescent luminaires installed in hidden-spline-type ceilings shall have supporting channels installed by Ceiling Contractor to adequately support the luminaire without providing additional hangers from the structural ceiling above the suspended ceiling.
- .4 Surface Mounted Type:
- .1 Where mounted on accessible ceilings, support from structural members above ceiling by means of hanger rods through ceiling or as approved.
- .2 Continuous Runs of Luminaires: Laser sight to insure luminaires are straight and true when sighting from end to end, regardless of irregularities in the ceiling. Where luminaires are so installed, omit ornamental ends between sections. All seams/ joints shall be tightly fitted.
- .3 Where luminaires are specified for use in elevator, mechanical or electrical equipment rooms, install on chains, after and below equipment, ductwork and piping are installed, but not below 1.7m, unless noted otherwise.
- .5 Pendant Mounted Type:
- .1 Provide strong back channel entire luminaire length unless luminaire is designed specifically to be self-supporting.
- .2 Where suspended below accessible ceiling, provide structural support at suspended ceiling level from structural members above ceiling. Do not run hanger rods through ceiling.
- .3 Continuous Runs of Luminaires: Laser sight to insure luminaires are straight and true when sighting from end to end, regardless of irregularities in the ceiling. Where luminaires are so installed, omit ornamental ends between sections. All seams/joints shall be tightly fitted.
- .4 All power feeds shall originate from the same location/end of each run.
- .6 Install luminaire diffusers only after construction work, painting and clean up are completed.

3.3 LED LUMINAIRES

- .1 Adhere to manufacturers installation guidelines regarding proper thermal management.

3.4 LIGHTING CONTROL

- .1 Provide branch circuiting in coordination with lighting control requirements of Division 26 – and as indicated. Adjust variable position lampholders for proper lamp position prior to luminaire installation.

3.5 CLEANING AND ADJUSTING

- .1 Remove protective plastic covers from luminaires and luminaire diffusers only after construction work, painting and clean-up are completed. Remove, clean, and reinstall all dirty lamps, reflectors and diffusers.
- .2 Clean luminaires internally and externally after installation. Use methods and materials recommended by manufacturer for cleaning Alzak reflectors and other surfaces.
- .3 Make final adjustment of aimable luminaires and adjustable light settings as required by the Engineer-Architect during a scheduled period of time prior to the completion of the Project. Include all equipment and personnel expenses including overtime required for focusing.
- .4 Luminaires, reflectors, louvers and accessories which are damaged, blemished, or impregnated with fingerprints shall be replaced at this Contractor's expense. All finishes shall be unmarred upon Project completion.

3.6 IDENTIFICATION

- .1 Install labels with panel and circuit numbers on concealed junction and outlet boxes and at fixtures. Comply with requirements for identification specified in Section 26 05 00 Electrical General Requirements.

3.7 FIELD QUALITY CONTROL

- .1 Inspect each installed luminaire for damage. Replace damaged luminaires and components.
- .2 Replace all inoperable and burned out lamps at the end of construction prior to occupancy.
- .3 Malfunctioning Luminaires and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

3.8 START-UP

- .1 Burn-in all lamps that require specific aging period to operate properly, prior to occupancy.

END OF SECTION

Part 1 General

1.1 REFERENCE

- .1 Read and be governed by Section 26 05 00.

1.2 RELATED WORK

- .1 Comply with relevant Sections of this and other Divisions of this Specification.

1.3 DELIVERY

- .1 Deliver batteries in dry state unless hermetically sealed, and provide electrolyte in hazard-proof container.

1.4 PRODUCT DATA

- .1 Submit product data in accordance with Division 01.

1.5 WARRANTY

- .1 Provide a warranty, stating that the battery for emergency lighting is warrantied against defects in material and workmanship for a period of ten years, with a no-charge replacement during the first 1 year and a pro-rated charge on the second 9 years, from the date of issuance of the "Certificate of Substantial Completion".

1.6 ACCEPTABLE MATERIALS

- .1 Where materials are specified by the trade name within this Section, they are to establish an acceptable standard of quality. Alternates shall only be accepted upon approval prior to tender closing.

Part 2 Products

2.1 EQUIPMENT

- .1 Unit equipment for emergency lighting to be manufactured to CSA C22.2 No. 141.
- .2 Supply voltage, 120V AC.
- .3 Output voltage, 12V DC.
- .4 Operating time, 30 min.
- .5 Sealed valve regulated lead acid maintenance free battery, of a capacity to suit the specified load for the duration required.
- .6 Charger to be solid state, multi-rate, voltage/current regulated, inverse temperature compensated, fused, short circuit protected, and of modular construction.

- .7 Utilize sealed relay transfer mechanism.
- .8 Provide a solid state, modular, low voltage disconnect to operate at 80% of battery output voltage.
- .9 Signal lights to be solid state, with a life expectancy 100,000 hr. minimum, and used for 'AC Power ON' and 'High Charge'.
- .10 Cabinet to be suitable for mounting on wall with junction box for direct wiring and be of white finish. Provide removable front panel for access.
- .11 Auxiliary equipment:
 - .1 Ammeter.
 - .2 Voltmeter.
 - .3 Lamp disconnect switch.
 - .4 Test switch.
 - .5 Electrolyte level alarm.
 - .6 Time delay relay.
 - .7 Battery disconnect device.
 - .8 Output circuit breakers of the required quantity for connected loads.
- .12 Integral and remote single or double lamp heads to be adjustable type, 360 deg. horizontal and 180 deg. vertical, LED, 12 VDC, 5W lamps, polycarbonate light cubes c/w white impact resistant steel center cabinet.

2.2 ACCEPTABLE MATERIALS

- .1 Material must meet or exceed specifications provided in Luminaire Schedule of Section 26 51 05, by one of the following manufacturers:
 - .1 Emergi-Lite
 - .2 Ready-Lite
 - .3 Lumacell
 - .4 Aimlite
 - .5 Beghelli

Part 3 Execution

3.1 INSTALLATION

- .1 Install unit equipment and remote heads for emergency lighting where indicated and in accordance with CSA C22.1. Unit to be hardwired to source.
- .2 Batteries to be sized for the connected load, plus 50% for the duration as specified, however load must not be less than 25% of rated battery capacity.

- .3 Connect AC cable to junction box internally.
- .4 Size wiring to manufacturer's requirements to ensure maximum 2% voltage drop.
- .5 Comply with manufacturer's recommendation with regard to initial energization of unit batteries.
- .6 Test each unit for 30 minutes on emergency.
- .7 Functional testing of emergency lighting is to be performed to ensure an average level of illumination not less than 10 lux, with no area less than 1 lux.

3.2 FINAL ADJUSTMENT

- .1 Aim emergency lighting luminaires, as directed by Engineer-Architect.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Code for Preferred Packaging
- .2 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No.141, Unit Equipment for Emergency Lighting.
 - .2 CSA C860-01, Performance of Internally-Lighted Exit Signs.
 - .3 National Fire Protection Association (NFPA) requirements

1.2 SUBMITTALS

- .1 Submit product data in accordance with Division 01.
- .2 Submit product data sheets for exit lights. Include product characteristics, performance criteria, physical size, limitations and finish.

1.3 ACCEPTABLE MATERIALS

- .1 Where materials are specified by the trade name within this Section, they are to establish an acceptable standard of quality. Alternates shall only be accepted upon approval prior to tender closing.

Part 2 Products

2.1 MATERIALS

- .1 Aluminum housing with high impact, UV stabilized, thermoplastic construction, either surface, single or double face, end or ceiling mounted.
- .2 CSA C860 approved.
- .3 Green "Running Man" to meet or exceed fixture noted in Luminaire Schedule of Section 26 51 05.
- .4 Rated at 120 volts.

2.2 ACCEPTABLE MATERIALS

- .1 Emergi-Lite
- .2 Ready-Lite
- .3 Lumacell
- .4 Aimlite

.5 Beghelli

2.3 GENERAL

- .1 All exit lights shall have:
- .2 Have no light leakage from joints and fittings, and no downlight component.
- .3 Have canopy and/or stem hangers to match housing.
- .4 Meet the requirements of standard CSA C860.

Part 3 Execution

3.1 INSTALLATION

- .1 Install exit lights where shown.
- .2 Connect exit lights to circuits as indicated.
- .3 Ensure that exit light circuit breaker is locked in ON position.
- .4 Ensure that nowhere, are exit lights mounted less than 2m between underside of unit and finished floor.
- .5 For ceiling mounting in areas with unfinished ceiling, mount unit alongside junction box, with or without canopy, and supply unit laterally with conduit (or with buried conduit, where allowed or specified, or by using the exit light canopy as a junction box where approved).
- .6 All exit lights must be installed at a height which is visible from adjacent corridors. Prior to rough-in, ensure no equipment and/or architectural components shall block this view.

END OF SECTION

Part 1 General

1.1 REFERENCE

- .1 Read and be governed by Section 26 05 00.

1.2 RELATED WORK

- .1 Comply with relevant Sections of this and other Divisions of this Specification.

1.3 SUBMITTAL

- .1 Shop Drawings
 - .1 Submit shop drawings in accordance with Section 26 05 00.
 - .2 Submit detail drawings of all components, schematic and wiring diagrams.

1.4 ACCEPTABLE MATERIALS

- .1 Where materials are specified by the trade name within this Section, they are to establish an acceptable standard of quality. Alternates shall only be accepted upon approval prior to tender closing.

Part 2 Products

2.1 CEILING SENSOR - 360 ° COVERAGE:

- .1 Dual technology ceiling sensor (PIR and ultrasonic) for occupancy.
- .2 120V.
- .3 1000 sq.ft. of half-step walking motion, mounted at 10ft.
- .4 Time delays: Auto set, fixed (5, 10, 15, 20 or 30min.), walk-through/test modes.
- .5 Sensitivity adjustment: Auto set, reduced sensitivity (PIR), variable with trim pot (ultrasonic).
- .6 Automatically turns fixtures 'ON' upon detecting occupancy with automatic 'OFF' when no occupancy is detected for a user specified length of time. Acceptable manufacturer:
 - .1 Sensorswitch
 - .2 Wattstopper #DT-355
 - .3 Leviton
 - .4 Greengate

Part 3 Execution

3.1 GENERAL

- .1 Provide a complete and working occupancy sensing lighting system as outlined on the drawings and the specification herein.
- .2 Locate and install all equipment in accordance with manufacturer's recommendations and as indicated. Ensure proximity to air vents is coordinated and within manufacturer's tolerances.
- .3 Assist operating personnel in the start-up, operation, care and maintenance of all equipment.
- .4 All sensors to arrive on site with maximum setting (time delay) as possible.
- .5 Orientation of each sensor to be confirmed by Engineer-Architect on site prior to installation. Allow for on-site adjustments of sensors to obtain peak performance within each space.
- .6 Contractor will by-pass all noted sensors as requested by consultant during the construction period to eliminate pre-mature lamp failure.
- .7 Final adjustments (time-delay setting) of all sensors will be carried out 48 hours prior to total completion of the contract by the contractor as directed by Owner/User.
- .8 Provide initial adjustment of all sensors and assist Owner/User operating personnel in the start-up, operation, care and maintenance of all equipment to Section 26 05 00.
- .9 All equipment will be complete with accessory items such as yokes, plaster rings, etc., where required for proper installation.
- .10 Ensure sensor coverage provided is adequate for all areas to be controlled, provide additional sensors, switchpacks, etc, to operate areas as intended.
- .11 Wall switch sensors will be installed on latch side of door.

END OF SECTION