Part 1 General

1.1 SCOPE OF WORK

.1 Electrical subcontractor scope of work includes but is not limited to the following:

.1 Provide all required demolition and temporary interconnection

.2 Provide all required interconnection of existing remaining systems to the new distribution.

.3 Maintain power to the areas of the building under use while construction is ongoing.

.4 Coordinate with MB Hydro for the new service entrance and the service transfer.

.5 Supply and install new power distribution

.6 Supply and install all new interior and exterior lighting, lighting controls.

.7 Supply and install all new emergency and exit lighting.

.8 Supply and install all new structured cabling

.9 Supply and install a new fire alarm system complete with verification.

.10 Supply and install new speakers, wiring and commercial amplification

.11 Supply and install a new security system

.12 Co-ordination with the mechanical contractor to provide all power requirements and interconnections as necessary for operational controls and mechanical equipment.

.13 Supply and installation of new CO detection systems.

.14 Provision of all penetrations as required. All penetrations through concrete require coring and scanning. This can be co-ordinated with the general contractor if required.

.15 Co-ordination of the installation of all ceiling mounted devices with the roofing contractor to ensure that all penetrations are made below the roof membrane.

.16 Provision of shop-drawings, as-built drawings and Operation and maintenance manuals as well as on site training for the operational staff of the facility.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-06, Canadian Electrical Code, Part 1 (20th Edition), Safety Standard for Electrical Installations.

.2 CSA C22.2.

.3 CAN/CSA-C22.3 No. 1, Overhead Systems.

.4 CAN3-C235-83(R2000), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

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

.1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.

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

.1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.3 DEFINITIONS

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

1.4 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

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

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

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

1.5 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: submit WHMIS MSDS in accordance with Section 01 47 15 - Sustainable Requirements.

.3 Submit for review single line electrical diagrams under plexiglass and locate at main service.

.1 Electrical distribution system in main electrical room.

.4 Submit for review fire alarm riser diagram, plan and zoning of building under plexiglass at fire alarm control panel and annunciator.

.5 Shop drawings:

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

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

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

.4 Submit and product data to Contract Administrator. Quantities as required.

.5 If changes are required, notify Contract Administrator of these changes before they are made.

.6 Quality Control: in accordance with Section 01 45 00 - Quality Control.

.1 Provide CSA certified equipment and material. Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to site.

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

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

.4 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.

.5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Contract Administrator.

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

1.6 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Qualifications: electrical Work to be carried out by qualified, licensed electricians or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Acts respecting manpower vocational training and qualification.

.1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.

.2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

.3 Site Meetings:

.1 In accordance with Section 01 32 18 - Construction Progress Schedule - Bar (GANTT) Charts.

.2 Site Meetings: as part of Manufacturer's Field Services described in Section 01 45 00 Quality Control, schedule site visits, to review Work.

.4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 11 - Cleaning.

1.8 SYSTEM STARTUP

.1 Instruct Operating Personnel in operation, care and maintenance of systems, system equipment and components.

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

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant will aspects of its care and operation.

1.9 OPERATING INSTRUCTIONS

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

.2 Operating instructions to include following:

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

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

.3 Safety precautions.

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

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

.3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

.4 Post instructions where directed.

.5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

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

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.

.2 Material and equipment to be CSA certified. Where CSA certified material and equipment is not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.

.3 Factory assemble control panels and component assemblies.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

.2 Control wiring and conduit: in accordance with Section 26 29 03 - Control Devices except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical sections and as shown on mechanical drawings.

2.3 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of the authority having jurisdiction and the Contract Administrator.

.2 Decal signs, minimum size 175 x 250 mm.

2.4 WIRING TERMINATIONS

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

2.5 EQUIPMENT IDENTIFICATION

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

.1 Nameplates: lamicoid 3 mm matt white finish face, black core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.

.2 Sizes as follows:

NAMEPLATE SIZES

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

.2 Labels: embossed plastic labels with 6mm high letters unless specified otherwise.

.3 Wording on nameplates and labels to be approved by Contract Administrator prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per nameplate and label.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

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

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

2.6 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, numbered, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

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

2.7 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 5 m intervals.

.3 Colours: 25 mm wide prime colour and 15 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

2.8 FINISHES

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

.1 Paint outdoor electrical equipment "equipment green" finish.

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

Part 3 Execution

3.1 INSTALLATION

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

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

3.2 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

.1 All conduit and cable on the main floor is to be hidden and not exposed.

.2 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: schedule 40 plastic, sized for free passage of conduit, and protruding 50 mm.

.3 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.4 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.4 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

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

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors.

.1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.5 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation. Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: 1200 mm.

.2 Wall receptacles:

.1 General: 300 mm.

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

.3 Above top of counters or counter splash backs: 175 mm.

.4 In mechanical rooms: 1400 mm.

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

.4 Telephone and interphone outlets: 300 mm.

.5 Wall mounted intercom control outlets: 1200 mm.

.6 Fire alarm stations: 1200 mm.

.7 Fire alarm bells: 2100 mm.

.8 Wall mounted speakers: 2100mm.

.9 Clocks: 2100 mm.

.10 Door bell pushbuttons: 1200mm.

3.6 CO-ORDINATION OF PROTECTIVE DEVICES

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

3.7 FIELD QUALITY CONTROL

.1 Load Balance:

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

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

.3 Provide upon completion of work, load balance report as directed in PART 1 - SUBMITTALS: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.

.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, Security System, PA system, communications.

.6 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.3 Carry out tests in presence of Departmental Representative.

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

.5 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.8 CLEANING

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

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for wire and box connectors.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2No.18-98, 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 to: CSA C22.2 No.65, with current carrying parts of copper or copper alloy sized to fit copper or aluminum conductors as required.

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

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

2.2 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.

.2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2No.65.

.3 Install fixture type connectors and tighten. Replace insulating cap.

.4 Install bushing stud connectors in accordance with NEMA.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

.1 CSA C22.2 No .0.3-96, 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 01 33 00 - Submittal Procedures.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

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

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

Part 2 Products

2.1 BUILDING WIRES

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

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

.3 Aluminum conductors made of NUAL may be used only where clearly indicated on drawings.

2.2 TECK CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

.3 Aluminum conductors made of NUAL may be used only where clearly indicated on drawings.

.3 Insulation:

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

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking galvanized steel or aluminum.

.6 Overall covering: polyvinyl chloride material.

.7 Fastenings:

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

.2 Channel type supports for two or more cables at 50 mm centers.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.8 Connectors:

.1 Watertight approved for TECK cable. Explosion proof connectors shall be used in rated areas.

2.3 ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated. Aluminum conductors made of NUAL may be used only where clearly indicated on drawings.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from galvanized steel or aluminum strip.

.4 Connectors: Teck90 Style.

2.4 ALUMINUM SHEATHED CABLE

.1 Conductors: copper, size as indicated.

.2 Insulation: type RA90 rated 1000 V.

.3 Sheath: aluminum applied to form continuous sheath.

.4 Fastenings for aluminum sheathed cable:

.1 One hole aluminum straps to secure surface cables 25 mm and smaller. Two hole steel straps for cables larger than 25 mm. Use aluminum strap only with single conductor cable.

.2 Channel type supports for two or more cables.

.3 Threaded rods: 6 mm dia. to support suspended channels.

2.5 CONTROL CABLES

.1 Low energy 300 V control cable: stranded annealed copper conductors sized as indicated. All cables shall be FT-4 rated and meet manufacturers requirements for the intended

purpose. Cables shall be shielded as required. Cables for fire alarm systems shall be rated FA or FAS and meet the requirements of the fire alarm system manufacturer.

.2 600 V type: as above but with 600V insulation where required.

Part 3 Execution

3.1 INSTALLATION - General

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34.

.2 In cabletroughs in accordance with Section 26 05 36.

.3 In trenches in accordance with Section 16 26 05 44.

3.2 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34.

3.3 INSTALLATION OF TECK CABLE 0 -1000 V

.1 Install cables.

.1 Group cables wherever possible on channels.

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

3.4 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible.

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

3.5 INSTALLATION OF ALUMINUM SHEATHED CABLE

.1 Group cables wherever possible on channels.

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

3.6 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit.

.2 Ground control cable shield as required for application

3.7 INSTALLATION OF NON-METALLIC SHEATHED CABLE

.1 Install cables.

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

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

.1 ANSI/IEEE 837-1989(R1996), Qualifying Permanent Connections Used in Substation Grounding.

.2 Canadian Standards Association, (CSA International)

Part 2 Products

2.1 EQUIPMENT

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

.2 Rod electrodes: copper clad steel 19 mm dia by 3 m long.

.3 Plate electrodes: copper, surface area 0.5 m^2, 1.6 mm thick.

.4 Grounding conductors: bare stranded copper, soft annealed, size 4/0AWG.

.5 Insulated grounding conductors: green, type RWU90.

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

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

.1 Grounding and bonding bushings.

.2 Protective type clamps.

.3 Bolted type conductor connectors.

.4 Thermit welded type conductor connectors.

.5 Bonding jumpers, straps.

.6 Pressure wire connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.

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

.3 Protect exposed grounding conductors from mechanical injury.

.4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process.

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

.6 Soldered joints not permitted.

.7 Install bonding wire for flexible conduit.

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

.9 Install separate ground conductor to outdoor lighting standards.

.10 Ground secondary service pedestals.

3.2 ELECTRODES

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

.2 Install rod and plate electrodes and make grounding connections.

.3 Bond separate, multiple electrodes together.

.4 Use size 4/0 AWG copper conductors for connections to electrodes.

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

3.3 SYSTEM AND CIRCUIT GROUNDING

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

3.4 EQUIPMENT GROUNDING

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

3.5 GROUNDING BUS

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

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

3.6 COMMUNICATION SYSTEMS

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

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

.2 Sound, fire alarm, intercommunication systems as indicated.

3.7 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

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

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

END OF SECTION

Part 1 General

1.1 Not Used

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted suspended set in poured concrete walls and ceilings.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to masonry, tile and plaster surfaces with nylon shields.

.2 Secure equipment to poured concrete with expandable inserts.

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

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

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

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

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

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

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

.7 Suspended support systems.

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

.2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.8 For surface mounting of two or more conduits use channels at 2 m on centre spacing.

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

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

.11 Do not use wire lashing or perforated strap to support or secure raceways or cables.

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

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

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

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

1.2 WASTE MANAGEMENT AND DISPOSAL

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

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

Part 2 Products

2.1 SPLITTERS

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Connection bars to match required size and number of incoming and outgoing conductors as indicated.

.3 At least three spare terminals on each set of lugs in splitters 400 A or less.

2.2 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

2.3 CABINETS

.1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

.2 Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing sheet steel backboard for surface or flush mounting as required.

.3 All cabinets shall be sprinklerproof.

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Install splitters and mount plumb, true and square to the building lines.

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

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor.

.3 Install terminal block as required in Type T cabinets.

.4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30m of conduit run between pull boxes.

3.3 IDENTIFICATION

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

.2 Install size 2 identification labels indicating system name, voltage and phase.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA C22.1-2006, Canadian Electrical Code, Part 1.

1.2 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

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

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

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

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.3 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.4 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished tile walls.

2.3 MASONRY BOXES

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

2.4 CONCRETE BOXES

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

2.5 FLOOR BOXES

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

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

.2 Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 19 mm conduit. Minimum size: 73 mm deep.

2.6 CONDUIT BOXES

.1 Cast FS or FD boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle. This is only allowed in mechanical spaces.

2.7 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

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

2.8 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

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

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

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

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

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

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

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

END OF SECTION

Part 1 General

1.1 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 WASTE MANAGEMENT AND DISPOSAL

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

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

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

Part 2 Products

2.1 CONDUITS

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

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

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

.4 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

2.2 CONDUIT FASTENINGS

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

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

.3 Channel type supports for two or more conduits at 2 m oc.

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

2.3 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90E bends are required for 25 mm and larger conduits.

.3 Watertight connectors and couplings for EMT. Set-screws are not acceptable.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

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

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

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

2.5 FISH CORD

.1 Polypropylene.

Part 3 Execution

3.1 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms.

.3 Use RGS conduit in Industrial arts area where conduit is exposed.

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

.5 Use rigid pvc conduit underground.

.6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment.

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

.8 Install conduit sealing fittings in hazardous areas. Fill with compound.

.9 Minimum conduit size for lighting and power circuits: 19 mm.

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

.11 Mechanically bend steel conduit over 19 mm dia.

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

.13 Install fish cord in empty conduits.

.14 Run 2-25 mm spare conduits up to ceiling space from each flush panel. Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.

.15 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.16 Dry conduits out before installing wire.

3.2 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on surface channels.

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

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

.7 Surface conduits shall not be used where exposed.

3.3 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

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

3.4 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel. Install in centre one third of slab.

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

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

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.

.5 Do not place conduits is slabs in which slab thickness is less than 4 times conduit diameter.

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

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

3.5 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA-C22.2 No. 62-93/R1999, Surface Raceway Systems.

1.2 PRODUCT DATA

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

.2 Indicate types of raceways with terminology similar to that used in this Section.

1.3 WASTE MANAGEMENT AND DISPOSAL

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

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

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

1.4 GENERAL NOTES ON USE

.1 All wiring is intended to be concealed. Use of surface raceway is not anticipated unless there are extenuating circumstances reviewed and approved by the Contract Administrator.

Part 2 Products

2.1 SURFACE RACEWAY SYSTEM (WIRING PULLED IN)

.1 Steel: to CSA C22.2 No. 62, one piece, free of sharp edges.

.2 Corners, pull boxes, elbows, tees, two piece assembly to facilitate site wiring.

.3 Finish: enamel.

.4 Necessary switch, receptacle, extension boxes, adapters and utility fittings required for complete installation.

2.2 SURFACE RACEWAY SYSTEM (WIRING LAID IN)

.1 Steel: to CSA C22.2 No. 62, two piece.

.1 Finish: buff enamel.

.2 Necessary switch, receptacle, extension boxes, adapters and utility fittings required for complete installation.

2.3 CHANNEL RACEWAY

.1 Channel type raceway: to CSA C22.2 No. 62, aluminum, solid.

2.4 FITTINGS

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

Part 3 Execution

3.1 INSTALLATION

.1 Install raceways before installation of wiring. Install covers for raceways and fittings after installation or wiring.

.2 Install supports, elbows, tees, connectors, fittings, bushings, adaptors as required.

.3 Keep number of elbows, offsets, connections to minimum.

.4 Use wiring with mechanical protection in channel raceways.

.5 Install barriers in raceways where different voltage systems are indicated.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 31 23 10 - Excavating, Trenching and Backfilling.

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

1.2 REFERENCES

.1 Canadian Standards Association, (CSA International)

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

Part 2 Products

2.1 CABLE PROTECTION

.1 38 x 140 mm planks pressure treated with coloured, copper napthenate or 5% pentachlorophenol solution, water repellent preservative.

2.2 MARKERS

.1 Not Required

Part 3 Execution

3.1 DIRECT BURIAL OF CABLES

.1 After sand bed specified in Section 31 23 10 - Excavating, Trenching and Backfilling, is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable. Do not pull cable into trench.

.2 Provide offsets for thermal action and minor earth movements. Offset cables 150 mm for each 60 m run, maintaining minimum cable separation and bending radius requirements.

.3 Underground cable splices not acceptable.

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

.5 Cable separation:

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

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

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

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

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

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

.6 After sand protective cover specified in Section 31 23 10 - Excavating, Trenching and Backfilling, is in place, install continuous row of overlapping 38 x 140 mm pressure treated planks as indicated to cover length of run.

3.2 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated in ducts.

.1 Do not pull spliced cables inside ducts.

.2 Install multiple cables in duct simultaneously.

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

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

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

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

3.3 MARKERS

.1 Install concrete cable markers within 180 m from each side of runway centreline; 45 m from each side of taxi way centreline; 50 m from edge of taxi ramps or aprons.

.2 Install cedar post type markers.

.3 Lay concrete markers flat and centred over cable with top flush with finish grade.

3.4 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

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

.4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.

.5 Pre-acceptance tests.

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

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

.6 Acceptance Tests

.1 Ensure that terminations and accessory equipment are disconnected.

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

.3 High Potential (Hipot) Testing.

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

.4 Leakage Current Testing.

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

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

.3 Record leakage current at each step.

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

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No. 100-04, Motors and Generators.

.2 CSA C22.2 No. 145-M1986(R2004), Motors and Generators for Use in Hazardous Locations.

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

.1 EEMAC M1-7-[1992], Standard for Motors and Generators.

1.2 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: include: product characteristics, performance criteria, physical size, horsepower, watt rating, limitations and finish.

.3 Shop drawings:

.1 Indicate dimensions, recommended installation procedure, wiring diagrams, sizes and location of mounting bolt holes and recommended support method.

.4 Quality Assurance Submittals:

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

.2 Manufacturer's Instructions: submit manufacturer's installation instructions.

.5 Closeout Submittals:

.1 Provide maintenance data for fractional horsepower motors for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 FRACTIONAL HORSEPOWER MOTOR

.1 Non-hazardous locations: to CSA C22.2 No. 100 and EEMAC M1-7.

.2 Hazardous locations: to CSA C22.2 No. 145.

.1 Rating: As indicated.

.2 Type: As indicated.

.3 Bearings: As indicated.

.4 Frame size: As indicated.

.5 Enclosure: As indicated.

.6 Mounting: As indicated.

.3 Motor with inherent overheating protectors.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install wiring, flexible connections and grounding.

.2 Check rotation before coupling to driven equipment.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

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

END OF SECTION

Part 1 General

1.1 REFERENCES

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

.1 EEMAC M1-7, 1992 , Motors and Generators.

1.2 PRODUCT DATA

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

.2 Submit product data sheets for motors. Include product characteristics, performance criteria, physical size, horsepower, watt rating, limitations and finish.

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

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate:

.1 Overall dimensions of motor.

.2 Shaft centreline to base dimension.

.3 Shaft extension diameter and keyway, coupling dimensions and details.

.4 Fixing support dimensions.

.5 Dimensioned position of ventilation openings. Details of ventilation duct attachments.

.6 Terminal box location and size of terminals.

.7 Arrangement and dimensions of accessories.

.8 Diagram of connections.

.9 Starting current and relative data necessary for use in design of motor starting equipment.

.10 Speed/torque characteristic.

.11 Weight.

.12 Installation data.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for motors for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Data necessary for maintenance of motors.

.3 Manufacturer's recommended list of spare parts.

1.5 DELIVERY , STORAGE AND HANDLING

.1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Handle motors with suitable lifting equipment.

.3 Store motors in heated, dry, weather-protected enclosure.

1.6 QUALITY ASSURANCE

.1 Contract Administrator reserves the right to witness standard factory testing of motors 50 hp and above.

1.7 WASTE MANAGEMENT AND DISPOSAL

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

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

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

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

.5 Collect, package and store expired motors for either recycling or rebuilding and return to recycler or rebuilder.

1.8 EXTRA MATERIALS

.1 Provide maintenance materials and spare parts in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 MATERIALS

.1 Motors: to EEMAC M1-7.

.2 Lead markings: to EEMAC M2-1.

2.2 RATING

.1 Motor:

.1 As indicated.

2.3 MOTOR TYPE

.1 As Indicated.

2.4 DESIGN LETTERS

.1 Polyphase squirrel cage induction motors design As Indicated.

2.5 ENCLOSURE

.1 Totally enclosed fan cooled.

.2 Totally enclosed explosion proof for use in: Class as Indicated.

2.6 SERVICE CONDITIONS

.1 Service Factor: 1.15.

2.7 INSULATION

.1 Class: B or As Indicated.

.2 Ambient temperature: 40 ºC or As indicated.

2.8 BEARINGS

.1 Antifriction type bearings, fitted with readily accessible facilities for lubrication while motor running or stationary.

2.9 STARTING METHOD

.1 All motors shall be Inverter Duty rated.

.2 Include anchor devices and setting templates.

Part 3 Execution

3.1 INSTALLATION

.1 Dry out motor if dampness present in accordance with manufacturer's instructions.

.2 Install motor.

.3 Make wiring connections. Use liquid tight pvc jacketed flexible conduit between rigid conduit and motor.

.4 Make flexible conduit long enough to permit movement of motor over entire length of slide rails.

.5 Check for correct direction of rotation, with motor uncoupled from driven equipment.

.6 Align and couple motor to driven machinery to manufacturer's instructions, using only correct parts such as couplings, belts, sheaves, as provided by manufacturer.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results – Electrical.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 02 61 33 - Hazardous Materials.

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

.4 Section 26 50 00 - Lighting.

1.2 PRODUCT DATA

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

.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 61 33 - Hazardous Materials.

.3 Submit product data sheets for fluorescent lighting control equipment. Include product characteristics, performance criteria, physical size, limitations and finish.

1.3 REFERENCES

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

.1 C62.41-1991 – Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

.2 ASTM International (ASTM)

.1 D4674 -02a Standard Test Method for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Fluorescent Lighting and Window-Filtered Daylight.

.3 Canadian Standards Association (CSA) .

.1 CSA C22.2 # 14 Industrial Control Equipment

.2 CSA C22.2 # 184 1-96, Solid-State Lighting Controls (Bi-national standard with UL 1472)

.3 CSA C22.2 # 156 Solid-State Speed Controls

.4 International Electrotechnical Commission .

.1 (IEC) 801-2 Electrostatic Discharge Testing Standard.

.2 IEC/EN 60669-2-1 Switches for household and similar fixed electrical installations - electronic switches.

.5 National Electrical Manufacturers Association (NEMA)

.1 WD1 (R2005) - General Color Requirements for Wiring Devices.

.6 Underwriters Laboratories, Inc. (UL):

.1 1472 (1996) - Solid-State Dimming Controls.

1.4 SYSTEM DESCRIPTION

.1 Central dimming control system

.1 Factory assembled dimming controls. and interfaces and modules

.2 Low voltage control interfaces and sensors.

.3 Solid-state high frequency fluorescent dimming ballasts.

1.5 SUBMITTALS

.1 Submit under provisions of Section 013300.

.2 Specification Conformance Document: Indicate whether the submitted equipment:

.1 Meets specification exactly as stated.

.2 Meets specification via an alternate means and indicate the specific methodology used.

.3 Shop Drawings; include:

.1 Load schedule indicating actual connected load, load type, and voltage per circuit, circuits and their respective control zones, circuits that are on emergency, and capacity, phase, and corresponding circuit numbers.

.2 Schematic of system.

.4 Product Data: Catalog cut sheets with performance specifications demonstrating compliance with specified requirements.

1.6 QUALITY ASSURANCE

.1 Manufacturer: Minimum 10 years experience in manufacture of architectural lighting controls.

.2 Manufacturer's Quality System: Registered to ISO 9001:2000 Quality Standard, including in-house engineering for product design activities.

.3 Central dimming control system:

.1 Listed by CSA specifically for the required loads. Provide evidence of compliance upon request.

1.7 PROJECT CONDITIONS

.1 Do not install equipment until following conditions can be maintained in spaces to receive equipment:

.1 Ambient temperature: 0° to 40° C (32° to 104° F).

.2 Relative humidity: Maximum 90 percent, non-condensing.

.3 Lighting control system must be protected from dust during installation.

1.8 WARRANTY

.1 Provide manufacturer's full 10 year warranty covering 100% parts and 100% labor from the date of system commissioning.

1.9 COMMISSIONING

.1 Provide factory-certified field service sub contractor to a site visit to ensure proper system installation and operation under following parameters:

.1 Qualifications for factory-certified field service sub contractor:

.1 Minimum experience of 2 years training in the electrical/electronic field.

.2 Certified by the equipment manufacturer on the system installed.

.2 Make a visit upon completion of installation of central dimming control system:

.1 Verify connection of power feeds and load circuits.

.2 Verify connection and location of controls.

.3 Program system data.

.4 Verify proper connection of digital control link.

.5 Check dimming panel load types and currents and remove by-pass jumpers.

.6 Verify proper operation of manufacturers interfacing equipment.

.7 Verify proper operation of manufacturers supplied PC and installed programs.

.8 Obtain sign-off on system functions.

.9 User to be trained on system operation.

1.10 MAINTENANCE

.1 Make ordering of new equipment for expansions, replacements, and spare parts available to end user.

.2 Make new replacement parts available for minimum of ten years from date of manufacture.

.3 Provide factory direct technical support hotline 24 hours per day, 7 days per week.

.4 Provide on-site service support within 24 hours anywhere in continental United States and within 72 hours worldwide except where special visas are required.

.5 Offer renewable service contract on yearly basis, to include parts, factory labor, and annual training visits. Make service contracts available up to ten years after date of system commissioning.

Part 2 Products

2.1 MANUFACTURERS

.1 Basis of design product: Lutron GRAFIK Eye 3000 or subject to compliance and prior approval with specified requirements of this section, one of the following:

.1 Lutron GRAFIK Eye 3000

.2 Substitutions: Under provisions of Division 012500.

.1 All proposed substitutions or equals (clearly delineated as such) must be submitted in writing for approval by the design professional a minimum of 10 working days prior to the bid date and must be made available to all bidders.

.2 Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.

.3 By using pre-approved substitutions, as equals the contractor accepts responsibility and associated costs for all required modifications to circuitry, devices, and wiring.

.4 Provide complete engineered shop drawings (including power wiring) with deviations for the original design highlighted in an alternate color to the Contract Administrator for review and approval prior to rough-in.

2.2 GENERAL

.1 Provide system hardware that is designed, tested, manufactured, and warranted by a single manufacturer.

.2 Architectural Lighting Controls: Ten-year operational life while operating continually at any temperature in an ambient temperature range of 0° C (32°F) to 40° C (104°F) and 90 percent non-condensing relative humidity.

.3 Designed and tested to withstand electrostatic discharges up to 15,000 V without impairmentper IEC 801-2.

2.3 DIMMING PERFORMANCE REQUIREMENTS

.1 Electrolytic capacitors to operate at least 20° C below the component manufacturer's maximum temperature rating when device is under fully-loaded conditions in 40° C (104° F) ambient temperature.

.2 Load Handling Thyristors (SCRs and triacs), Field Effect Transistors (FETs), and Isolated Gate Bipolar Transistors (IGBTs): Manufacturer's maximum current rating minimum two times control's rated operating current.

.3 Capable of withstanding repetitive inrush current of 50 times operating current without impacting lifetime of dimmer.

.4 Design and test dimmers to withstand line-side surges without impairment to performance.

.1 Panels: Withstand surges without impairment of performance when subjected to surges of 6,000 volts, 3,000 amps per ANSI/IEEE C62.41 and per IEC 61000-4-5 surge requirements.

.2 Other power handling devices: Withstand surges without impairment of performance when subjected to surges of 6,000 volts, 200 amps per ANSI/IEEE C62.41.

.5 Utilize air gap off, activated when user selects "off" at any control to disconnect the load from line supply .

.6 Possess power failure memory such that if power is interrupted and subsequently returned, lights will automatically return to same levels (dimmed setting, full on, or off) prior to power interruption within 3 seconds.

.7 Multiple load type, tested to UL 508 to specifically control incandescent/tungsten, magnetic low voltage, electronic low voltage, fluorescent dimming ballasts, and non-dim loads.

.8 Each dimmer to be assigned a load type that will provide a proper dimming curve for the specific light source.

.9 Possess ability to have load types assigned per circuit, configured in field.

.10 Minimum and maximum light levels user adjustable on circuit-by-circuit basis.

.11 Control all light sources in smooth and continuous manor. Dimmers with visible steps are not acceptable.

.12 Provide real-time cycle-by-cycle compensation for incoming line voltage variations including changes in RMS voltage (plus or minus 2 percent change in RMS voltage/cycle), frequency shifts (plus or minus 2 Hz change in frequency/second), dynamic harmonics, and line noise. Systems not providing cycle-by-cycle compensation to include external power conditioning equipment to meet these requirements.

.13 Systems not providing cycle-by-cycle compensation to include external power conditioning equipment as part of dimming system.

.14 Each dimmer to incorporate electronic "soft-start" default at initial turn-on that smoothly ramps lights up to the appropriate levels within 0.5 seconds.

.15 Line Voltage Dimmers; Meet following load-specific requirements:

.1 Magnetic Low Voltage (MLV) transformer:

.1 Contain circuitry designed to control and provide a symmetrical AC waveform to input of magnetic low voltage transformers per UL 1472, Section 5.11.

.2 Dimmers using back-to-back SCR construction that could fail open causing DC power to flow into magnetic low voltage load are not acceptable.

.2 Electronic Low Voltage (ELV) transformer:Dimmer to operate electronic low voltage transformers via reverse phase control. Alternately, forward phase control dimming may be used if dimming equipment manufacturer has recommended specific ELV transformers being provided.

.3 Neon and cold cathode transformers:

.1 Magnetic transformers: UL listed for use with normal (low) power factor magnetic transformers.Electronic transformers: Must be supported by the ballast equipment manufacturer for control of specific ballasts being provided.

.4 Fluorescent electronic dimming ballast: Refer to Section 16580 for dimming ballast specifications and performance.

.16 Low Voltage Dimming Interface; Meet following requirements:

.1 Coordination between low voltage dimming module and line voltage relay: Capable of being electronically linked to single zone.

.2 Single low voltage dimming module; capable of controlling following light sources:

.1 0-10V analog voltage signal.

.1 Provide Class 2 isolated 0-10V output signal conforming to IEC 60929.

.2 Sink current via IEC 60929.

2.4 POWER INTERFACES

.1 Product: NGRX-PB. GRX-FDBI. HP-X.GRX-4M-GC

.2 Electrical:

.1 Phase independent of control input.

.2 Dimmer to meet limited short circuit test as defined in UL 20.

.3 Diagnostics and Service: Replacing power interface does not require re-programming of system or processor.

2.5 WALL STATIONS

.1 Line Voltage Wall Stations:

.1 PRESET LIGHTING CONTROL WITH ZONE OVERRIDE:

.1 Intensity for each zone indicated by means of one illuminated bar graph per zone.

.2 Fade time indicated by digital display for current scene while fading.

.3 Incorporate built-in wide angle infrared receiver.

.4 For temporary local overrides, individual raise/lower buttons to allow zones to be adjusted without altering scene values stored in memory.

.2 Low Voltage Wall Stations:

.1 Product: seeTouch. Large Button.

.2 Electronics:

.5 Use RS485 wiring for low voltage communication.

.3 Functionality:

.1 Upon button press, LEDs to immediately illuminate.

.2 LEDs to reflect the true system status. LEDs to remain illuminated if the button press was properly processed or the LEDs turn off if the button press was not processed.

.3 Allow for easy reprogramming without replacing unit.

.4 Replacement of units does not require reprogramming.

.4 Slider Controls; Lutron Model GRXSLD-XX:

.1 When controlled by slider wall station, light level to be indicated by position of slider. More than one zone may be proportionately raised or lowered at same time.

.5 Provide faceplates with concealed mounting hardware.

.6 Engrave wall stations with appropriate button, zone, and scene engraving descriptions furnished prior to fabrication.

.7 Silk-screened borders, logos, and graduations to use graphic process that chemically bonds graphics to faceplate, resistant to removal by scratching and cleaning.

.3 Color:

.8 Custom color to be selected.

.9 Color variation in same product family: Maximum $\Delta E=1$, CIE L*a*b color units.

.10 Visible parts: Exhibit ultraviolet color stability when tested with multiple actinic light sources as defined in ASTM D4674. Provide proof of testing upon request.

.4 Provide faceplates with concealed mounting hardware.

.5 Engrave wall stations with appropriate button, zone, and scene engraving descriptions furnished prior to fabrication.

.6 Silk-screened borders, logos, and graduations to use graphic process that chemically bonds graphics to faceplate, resistant to removal by scratching and cleaning.

2.6 LOW VOLTAGE CONTROL INTERFACES

.1 Contact Closure Interfaces; Lutron Model GRX-AV, GRX-CCO-8, and seeTouch keypads SG-xx:

.1 Where contact closures are used to integrate between lighting controls and other systems:

.1 Input open circuit voltage not to exceed 36V.

.2 Input short circuit current not to exceed 0.5 mA.

.3 Mechanical contact closures to be dry contact rated.

.4 Solid state contact closures:

.1 Output off-state leakage current not to exceed 50mA.

.2 Output on-state saturation voltage not to be less than 2V.

.5 The contact closure input device will accept both momentary and maintained contact closures.

.2 Serial Interfaces; Lutron Model GRX-RS232:

.1 Provide ability to communicate by means of RS232 serial communication to GRX-3000 series system by means of user-supplied PC or digital audiovisual equipment. Control to be located within 50 feet (15 meters) of RS232 source.

.2 RS232 interface

.1 Provide access to:

.1 Scene selections.

.2 Fade zone to a level.

.3 Fine-tuning of preset levels with scene raise/lower.

.4 Lock out scenes and zones.

.5 Fine-tuning of light levels with individual zone raise/lower.

.6 Enable/disable wall station.

.2 Provide status monitoring through button feedback and scene-status updates.

.3 Astronomical time clock and programmer interface

.1 Provide access to:

.1 Scene selections.

.2 Fade zone to a level.

.3 Fine-tuning of preset levels with scene raise/lower.

.4 Lock out scenes and zones.

.5 Fine-tuning of light levels with individual zone raise/lower.

.6 Enable/disable wall station.

.2 Software to provide as follows:

.1 System setup

.1 Program low voltage controls.

.2 Set up and run time clock schedules.

.3 Set up and run sequences.

.4 Set and report time.

.5 Archive system information.

.2 Provide status monitoring through button feedback and scene-status updates.

.3 Ethernet Interfaces; Lutron Model GRX-CI-NWK-E:

.1 Provide ability to communicate by means of TCP/IP over Ethernet to GRAFIK Eye 3000 system by means of user-supplied PC or digital audiovisual equipment. Control to be located within 300 feet (100 meters) of Ethernet source.

.2 Provide access to:

.1 Scene selections.

.2 Fade zone to a level.

.3 Fine-tuning of preset levels with scene raise/lower.

.4 Lock out scenes and zones.

.5 Fine-tuning of light levels with individual zone raise/lower.

.6 Enable/disable wall station.

.3 Provide status monitoring through button feedback and scene-status updates.

.4 Infrared Interface; Lutron GRX-IRI: Integrate third party infrared controls into preset lighting control system.

.5 Sivoia Quiet Electronic Drive (QED) Controller; Lutron Model SG-SVCN: Integrate control of QED shades into preset lighting control system.

.6 AC Motor Group Controller; Lutron Model GRX-4M-GC: Integrate control of AC motor shades into preset lighting control system.

.7 Emergency Lighting Interface; Lutron LUT-ELI

.1 Provides total system listing to UL924 when used with Lutron GRAFIK Eye 3000 system.

.2 Senses all three phases of building power.

.3 Provides an output to power panels if power on any phase fails.

.4 Accepts a contact closure input from a fire alarm control panel.

2.7 SENSORS

.1 Ceiling-Mounted Infrared Receivers have 360 degree reception of wireless infrared remote controls.

.2 Interior Daylight Sensors: Open-loop basis for daylight sensor control scheme.

.3 Exterior Daylight Sensors:

.1 Calibrated with independent turn-on and turn-off thresholds; minimum 2 foot-candles difference between the turn-on and turn-off thresholds.

.2 Enclosed in weatherproof housing with shading and lens protection visor.

.4 Infrared Partition Sensor: Provide contact closure based on status of sensor.

2.8 BALLASTS

.1 Ballast shall be electronic 1% dimming ballasts where required

.2 Ballasts shall be Lutron Hi-Lume or approved equivalent.

2.9 ACCESSORIES

.1 Tamper Proof Covers:

.1 Locking covers for preset control units and wall stations: Reversible to allow lock to be located on either side of control.

.2 Compatible with IR controls.

.3 Does not reduce specified IR range by more than 50 percent of its original specification.

.2 Infrared Transmitters:

.11 Provide wireless remote control capable of recalling preset light levels for four scenes plus “off” and of fine-tuning light levels with master raise/lower.

.12 Designed for use in conjunction with compatible infrared receiver and lighting control; dependent on that receiver, not transmitter.

.13 Operate up to 50 feet (15 meters) within line-of-sight to that receiver.

.14 “Learnable” by other variable frequency remote controls.

2.10 SOURCE QUALITY CONTROL

.1 Perform full-function testing on completed assemblies at end of line. Statistical sampling is not acceptable.

Part 3 Execution

3.1 INSTALLATION

.1 Install components comprising dimming system in accordance with manufacturer's instructions, and as indicated.

.2 Install wiring, shielding, grounding in accordance with manufacturer's instructions.

.3 Ensure shielded leads between intensity selector potentiometer and intensity controls have outer insulating jackets and are connected to ground at one point only.

.4 Keep radio, VCR, TV and intercom wiring a minimum of 1.8 m away from dimming circuitry. Where crossing of wiring is essential, ensure that grounded shields surround such intercom wiring, and that crossings take place at 90E.

.5 Locate intensity controls and "on-off" switches as indicated.

.6 Ensure positive, low resistance lamp to pin contact within lampholder.

.7 Season lamps by operating at full intensity for 100 h prior to final inspection. Operate ballasts in ambient temperature above 18°C.

.8 Ensure connections are correctly made and to same phase before energizing.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Demonstrate that dimming systems are installed as indicated.

.3 Demonstrate that dimming systems operate as intended and that there are no problems in starting lamps, nor in keeping them lit, and free of perceptible flicker at any setting of dimming intensity control.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate:

.1 Complete assembly.

.2 Contact surfaces.

.3 Construction features.

.4 Wiring diagrams.

.5 Catalogue information.

1.3 SAMPLES

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

Part 2 Products

2.1 COMPONENTS

.1 Designed for lighting control up to and including 120 V 20 amp.

.2 Integrally moulded thermoplastic, colour coded black for normal and red for emergency circuits.

.3 Certified to make or break under full rated load.

.4 Quick change frames with pre-assembled relays, transformer rectification, multi-recessed control ports, and one power-in plug and five power-out receptacles.

.5 Cable sets consisting of starter cables, joiner cables, and control cables.

.6 Low Voltage Switch Kit.

.7 Occupancy Sensor Kit.

.8 Ambient Light Sensor Kit.

.9 Mechanical Control Kits.

.10 Central Control or Building Automation System Kits.

2.2 ENCLOSURES

.1 Enclosures designed for ceiling or wall mounting with stand-off uni-directional brackets.

.1 Hinged fail safe cover with interceptor openings.

.2 Constructed of metal with safety blue paint, ventilated back with side air inlets, and complete with sixteen receptacle knockouts.

.3 Capable of mounting up to 6-six lamp ballasts.

2.3 FRAMES

.1 Quick change frames are pre-installed into enclosure and complete with up to ten control ports, one power-in plug and five power-out receptacles.

.1 Power-out receptacles 4 of 5 are controlled by internal low voltage relays connected to the control ports.

.2 One power out receptacles is for circuit feeding unswitched.

.3 Each of 4 power-out receptacles is controlled using one low voltage switch kit and/or one occupancy sensor kit.

.4 The remaining two control ports are for connection to central computer.

.5 Additional ports for 24/15 volts are available for feeding the VAV's and or additional equipment.

2.4 CABLE SETS

.1 Two to nine conductor - No. 12 to 18 stranded Ultralx-105 armoured cable c/w integrally moulded male and/or female caps.

.2 Factory assembled and integrally moulded.

.3 Four meter minimum lengths. Allow 2 meter extra cable for relocation of fixtures and equipment where required.

.4 Starter cables: complete with 1 end prepared for field installation and other end complete with integrally moulded female cap.

.1 Field prepared end: armour removed 150 mm and complete with locknutless connector and suitable for circuit connection to standard outlet box.

.5 Joiner cables: integrally moulded male cap on one end and integrally moulded female cap on the other end.

.6 Low voltage cables: one end prepared for field installation with locknutless box connector and six inch tails with mini-quick connector prepared for connection to low voltage switch kit or occupancy sensors kit. Other end complete with mini quick-connector for connection to the Smart-Light enclosure control ports.

2.5 LOW VOLTAGE SWITCH KIT

.1 Complete with low voltage push button switch, three position backplate, and single cover plate.

.1 Low voltage switch is provided with six inch tails and mini quick-connector ready for connection to low voltage cable.

2.6 SENSOR KIT

.1 Complete with bar hanger and outlet box pre-assembled for insertion of low voltage cable locknutless box connector into outlet box.

.1 Ceiling mounting occupancy sensor with mini quick-connector for connection through 7/8 tile hole to low voltage control cable inserted in outlet box.

2.7 MECHANICAL CONTROL KIT

.1 Complete with one end connected with mini quick-connector to Smart-Light Enclosure control port. Other end complete with locknutless box connector and prepared with 6 inch tails or mini plugs for connection to mechanical devices or other equipment

2.8 CENTRAL CONTROL

.1 Complete with one end connected with mini quick-connector for connection to Smart-Light enclosure control port. Other end complete with locknutless box connector and prepared with 36 inch tails for connection to central control panel.

Part 3 Execution

3.1 INSTALLATION

.1 Install system and components in accordance with manufacturer's instructions.

.2 Install starter cables to circuit outlet boxes and connect to power circuit and energize.

.3 Install Smart-Light enclosures as shown on drawings and connect starter cable to power-in plug.

.4 Connect joiner cables to each of power-out receptacles to first luminaire of controlled circuit as shown.

.5 Install joiner cables between interceptors in fixtures or equipment. Allow extra cable to facilitate removal and relocation of fixtures or equipment.

.6 Install blanking plugs in unconnected receptacles.

.7 Integrally moulded thermoplastic components to match colour identification system (i.e. black for normal power, red for emergency power).

.8 Install low voltage switch kits and low voltage cables as shown on drawings and connect to control ports of controlled circuits.

.9 Install sensor kits and low voltage cables as shown on drawings and connect to control ports of controlled circuits.

.10 Install central control kit from each or grouped Smart-Light enclosure to central control panel as shown on drawings.

.1 Connect to control port of Smart-Light as indicated.

.2 Connections within central control panel as instructed by control manufacturer.

3.2 FIELD QUALITY CONTROL

.1 On completion of installation, manufacturer representative shall be notified to carry out site inspection and report any inconsistencies to the Contract Administrator. Corrections are to be implemented to comply with manufacturer's report.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

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

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.47-M90(R2001), Air-Cooled Transformers (Dry Type).

.2 CSA C9-M1981(R2001), Dry-Type Transformers.

.2 National Electrical Manufacturers Association (NEMA)

1.4 PRODUCT DATA

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

1.5 WASTE MANAGEMENT AND DISPOSAL

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

.2 Divert unused wiring materials from landfill to metal recycling facility.

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

Part 2 Products

2.1 TRANSFORMERS

.1 Use transformers of one manufacturer throughout project and in accordance with CAN/CSA-C22.2No.47.

.2 Design.

.1 Type: ANN.

.2 3 phase, kVA as indicated, V input as indicated, V output as indicated, 60 Hz.

.3 Voltage taps:.

.4 Insulation: standard.

.5 Basic Impulse Level (BIL): standard.

.6 Hipot: standard.

.7 Average sound level: standard

.8 Impedance at 17 degrees C: standard

.9 Enclosure: CSA - Sprinklerproof, removable metal front panel.

.10 Mounting: as shown

.11 Finish: in accordance with Section 26 05 01 - Common Work Results - Electrical.

.12 *******NOTES ON MOUNTING AND DIMENSIONS*******

2.2 EQUIPMENT IDENTIFICATION

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

.2 Label size: 7.

Part 3 Execution

3.1 INSTALLATION

.1 Mount dry type transformers as indicated.

.2 Ensure adequate clearance around transformer for ventilation.

.3 Install transformers in level upright position.

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

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

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

.7 Energize transformers after installation is complete.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Service equipment and installation.

1.2 RELATED SECTIONS

.1 Section 26 05 28 - Grounding - Secondary.

.2 Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

.3 Section 26 28 21 - Moulded Case Circuit Breakers.

.4 Section 26 28 23 - Disconnect Switches - Fused and Non-Fused.

.5 Section 26 24 17 - Panelboards Breaker Type.

.6 Section 26 28 20 - Ground Fault Circuit Interrupters - Class "A".

Part 2 Products

2.1 EQUIPMENT

.1 Enclosed circuit breaker: in accordance with Section 26 28 21 - Moulded Case Circuit Breakers, rating as per drawings.

.2 Panelboard breaker type: in accordance with Section 26 24 17 - Panelboards Breaker Type, rating as per drawings.

.3 Cabinet type 'A' for utility revenue metering, Junction box, Pull box and Splitter boxes: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets, size as per drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Install service equipment.

.2 Connect to incoming service.

.3 Connect to outgoing load circuits.

.4 Install ground fault equipment.

.5 Make grounding connections in accordance with Section 26 05 28 - Grounding - Secondary.

.6 Make provision for power supply authority's metering.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for service entrance board.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 00 - Closeout Submittals.

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

1.3 REFERENCES

.1 CAN/CSA-C22.2 No.31-M89(R2000), Switchgear Assemblies.

1.4 SHOP DRAWINGS AND PRODUCT DATA

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

.2 Indicate on shop drawings.

.1 Floor anchoring method and foundation template.

.2 Dimensioned cable entry and exit locations.

.3 Dimensioned position and size of bus.

.4 Overall length, height and depth.

.5 Dimensioned layout of internal and front panel mounted components.

.3 Include time-current characteristic curves for circuit breakers and fuses.

1.5 QUALITY ASSURANCE

.1 Submit copies of certified test results.

1.6 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for service entrance board for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Submit copies maintenance data for complete assembly including components.

1.7 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 SERVICE ENTRANCE BOARD

.1 Service Entrance Board: to CAN/CSA-C22.2 No.31.

.2 Rating: as indicated.

.3 Cubicles: wall-mounted, or free standing, size as indicated.

.4 Barrier metering section from adjoining sections.

.5 Provision for installation of power supply authority metering in barriered section.

.6 Manitoba Hydro metering.

.7 Distribution section.

.8 Access panels with captive screws.

.9 Bus bars and main connections: 99.3% copper.

.10 Cable from load terminals of main breakerto metering section and cable from metering section to lugs of distribution section.

.11 Identify phases with colour coding.

2.2 MOULDED CASE CIRCUIT BREAKERS

.1 Refer to 26 28 21.

2.3 FUSIBLE DISCONNECTS AND FUSES

.1 N/A.

2.4 GROUNDING

.1 Copper ground bus extending full width of cubicles and located at bottom.

.2 Lugs at each end for size 4/0grounding cable.

.3 Provide external Ground Bus bonded to main Ground bus as well.

2.5 TVSS Unit

.1 Provide TVSS unit with digital indication and 200kA rating.

2.6 POWER SUPPLY AUTHORITY METERING

.1 Separate cubicle compartment and metal raceway for exclusive use of power supply authority metering.

.2 Mounting accessories and wiring for metering supplied by Contractor in accordance with power supply authority:

.1 potential transformers.

.2 current transformers.

.3 Watthour meter.

.4 Demand meter with kW.h register.

2.7 FINISHES

.1 Apply finishes in accordance with Section 26 05 01 - Common Work Results - Electrical.

.1 Service entrance board exterior: grey.

2.8 EQUIPMENT IDENTIFICATION

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

.2 Nameplates:

.1 White plate, black letters, size 7.

.2 Complete board labelled: "347/600V."

.3 Main disconnect labelled: "Main Breaker".

.4 Branch disconnects labelled: as indicated.

2.9 SOURCE QUALITY CONTROL

.1 Contract Administrator to witness final factory tests.

.2 Notify Contract Administrator in writing 5 days in advance that service entrance board is ready for testing.

Part 3 Execution

3.1 INSTALLATION

.1 Locate service entrance board and fasten to wall and/or floor as applicable.

.2 Connect main secondary service to line terminals of main breaker.

.3 Connect load terminals of distribution breaker's to feeders.

.4 Check factory made connections for mechanical security and electrical continuity.

.5 Run two grounding conductors 4/0 AWG bare copper in conduit from ground bus to building ground.

.6 Check trip unit settings against co-ordination study to ensure proper working and protection of components.

.7 Provide labelling indicating “Arc-Fault Hazard” as per the NFPA requirements.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 06 10 11 - Rough Carpentry - Short Form: Plywood Backboard.

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

.4 Section 26 28 21 - Moulded Case Circuit Breakers.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.29-M1989(R2000), Panelboards and enclosed Panelboards.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

Part 2 Products

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 250V panelboards: bus and breakers rated for 14 kA (symmetrical) interrupting capacity or as indicated.

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

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

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

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

.7 Copper bus with neutral of same ampere rating as mains and 200% neutral where indicated.

.8 Mains: suitable for bolt-on breakers.

.9 Trim with concealed front bolts and hinges.

.10 Trim and door finish: baked grey enamel.

2.2 CUSTOM BUILT PANELBOARD ASSEMBLIES

.1 Double stack panels as indicated.

.2 Contactors in mains as indicated.

.3 Feed through lugs as indicated.

.4 Isolated ground bus.

2.3 BREAKERS

.1 Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers.

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

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

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

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

2.4 TVSS

.1 Provide TVSS unit with digital indication and 100kA rating.

2.5 EQUIPMENT IDENTIFICATION

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

.2 Nameplate for each panelboard size 4 engraved as indicated.

.3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit.

Part 3 Execution

3.1 INSTALLATION

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

.2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height specified in Section 26 05 01 - Common Work Results - Electrical or as indicated.

.4 Connect loads to circuits.

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.2 REFERENCES

.1 The Munsell System of Colour Notation.

1.3 SHOP DRAWINGS AND PRODUCT DATA

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

Part 2 Products

2.1 MATERIALS

.1 Enclosure constructed with 2.7 mm thick minimum steel, with weather and corrosion resistant finish, Munsell Notation 7.5GY3.5/1.5, size as indicated.

.2 Entire enclosure capable of withstanding maximum impact force of 86 MN/m^2 area without rupture of material.

.3 Removable enclosure panels with formed edges, galvanized steel external fasteners removable only from inside enclosure.

.4 Enclosure equipped with hot dipped galvanized mounting rails 1 m adjustable horizontally and vertically to enable mounting of equipment at any location within housing.

.1 Rails: 14 mm holes and 50 x 14 mm slots on 100 mm centres for horizontal adjustment.

.2 Holes in side panel flanges in 60 mm increments for vertical adjustment.

.5 Cover: tamperproof, bolt-on, domed to shed water.

.6 Door: minimum 1 m wide, hinged, 3 point latching, with padlocking means.

.7 Ventilation panel constructed to allow air circulation yet preventing entry of foreign objects, wild life, vermin.

.8 Door interlocks: as required.

.9 Enclosure construction such as to allow any configuration of single or ganged enclosures.

.10 Enclosure capable of being shipped in knocked-down condition.

Part 3 Execution

3.1 INSTALLATION

.1 Assemble enclosure in accordance with manufacturer's instructions and mount on concrete pad.

.2 Mount equipment in enclosure.

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 01 33 00 - Submittal Procedures.

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

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-C22.2 No.42-99(R2002), General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CSA-C22.2 No.42.1-00, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA-C22.2 No.55-M1986(July 2001), Special Use Switches.

.4 CSA-C22.2 No.111-00, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.4 SHOP DRAWINGS AND PRODUCT DATA

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

Part 2 Products

2.1 SWITCHES

.1 15 or 20 A, 120 V, single pole, three-way, or four-way switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111.

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

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

.2 Silver alloy contacts.

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

.4 Suitable for back and side wiring.

.5 White toggle.

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

.4 Switches of one manufacturer throughout project.

.5 Acceptable materials: Specification Grade Commercial switches.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:

.1 White urea moulded housing for normal switches. Co-ordinate with City for all unique coloured switches. (Red- UPS, Orange – IG Wiring Type)

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

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

.4 Eight back wired entrances, four side wiring screws.

.5 Triple wipe contacts and rivetted grounding contacts.

.2 Other receptacles with ampacity and voltage as indicated.

.3 Receptacles of one manufacturer throughout project.

.4 Acceptable materials: Specification Grade Commercial switches.

2.3 COVER PLATES

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

.2 Cover plates from one manufacturer throughout project.

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

.4 Stainless steel, vertically brushed, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.

.5 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.6 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

.7 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

Part 3 Execution

3.1 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Receptacles:

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

.2 Mount receptacles at height in accordance with Section 26 05 01 - Common Work Results - Electrical.

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

.3 Cover plates:

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

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

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Equipment and installation for ground fault circuit interrupters (GFCI).

1.2 RELATED SECTIONS

.1 Section 01 29 83 - Payment Procedures: testing Laboratory Services.

.2 Section 01 33 00 - Submittal Procedures.

.3 Section 01 45 00 - Quality Control.

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

1.3 PAYMENT PROCEDURES

.1 Payment for field testing of ground fault equipment performed by Contractor in accordance with Section 01 29 83 - Payment Procedures: Testing Laboratory Services.

1.4 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.144-M91(R2001), Ground Fault Circuit Interrupters.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA PG 2.2-1999, Application Guide for Ground Fault Protection Devices for Equipment.

1.5 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit product data and shop drawings.

.3 Submit test report for field testing of ground fault equipment to Contract Administrator and a certificate that system as installed meets criteria specified herein.

Part 2 Products

2.1 MATERIALS

.1 Equipment and components for ground fault circuit interrupters (GFCI): to CAN/CSA-C22.2 No.144.

.2 Components comprising ground fault protective system to be of same manufacturer.

2.2 BREAKER TYPE GROUND FAULT INTERRUPTER

.1 Single and Two pole ground fault circuit interrupter for 15 and 20 A, 120 V, 1 and 2 phase circuit c/w test and reset facilities.

2.3 GROUND FAULT PROTECTOR UNIT

.1 Self-contained with 15 A, 120 V circuit interrupter and duplex receptacle complete with:

.1 Solid state ground sensing device.

.2 Facility for testing and reset.

.3 CSA Enclosure 1, flush mounted with stainless steel face plate.

Part 3 Execution

3.1 INSTALLATION

.1 Do not ground neutral on load side of ground fault relay.

.2 Pass phase conductors including neutral through zero sequence transformers.

.3 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 01 - Common Work Results - Electrical and co-ordinate with Section 01 45 00 - Quality Control if required.

.2 Arrange for field testing of ground fault equipment by Contractor before commissioning service.

.3 Demonstrate simulated ground fault tests.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials for moulded-case circuit breakers, and ground-fault circuit-interrupters.

.2 Text to complete:

.1 Section 26 24 02 - Service Entrance Board.

.2 Section 26 28 18 - Ground Fault Equipment Protection.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 23 00 - Low Voltage Switchgear.

.3 Section 26 24 02 - Service Entrance Board.

.4 Section 26 28 18 - Ground Fault Equipment Protection.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.4 SUBMITTALS

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

.2 Include time-current characteristic curves for breakers with ampacity of 100 A and over or with interrupting capacity of 25 kA symmetrical (rms) and over at system voltage.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers, and Ground-fault circuit-interrupters,: to CSA C22.2 No. 5

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation.

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

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

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

.5 Circuit breakers with interchangeable trips as indicated.

.6 Circuit breakers to have minimum 35kA symmetrical rms interrupting capacity rating.

2.2 THERMAL MAGNETIC BREAKERS

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 SOLID STATE TRIP BREAKERS [DESIGN D]

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

2.4 OPTIONAL FEATURES

.1 Include:

.1 Shunt trip.

.2 Auxiliary switch.

.3 On-off locking device.

.4 Handle mechanism.

2.5 ENCLOSURE

.1 Sprinklerproof.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated on drawings.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for fused and non-fused disconnect switches.

.2 Text to complete:

.1 Section 26 23 00 - Low Voltage Switchgear.

.2 Section 26 24 02 - Service Entrance Board.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

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

.3 Section 26 23 00 - Low Voltage Switchgear.

.4 Section 26 24 02 - Service Entrance Board.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA C22.2 No.4-M89 (R2000), Enclosed Switches.

.2 CSA C22.2 No.39-M89 (R2003), Fuseholder Assemblies.

1.4 SUBMITTALS

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

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Non-fusible, horsepower rated disconnect switch in CSA Enclosure, to CAN/CSA C22.2 No.4 sized as per drawings.

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

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

.4 Sprinkler-proof indoors, weatherproof outdoors.

.5 Quick-make, quick-break action.

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

.7 Where required (For VFDs) provide an auxilliary contact to break prior to main contacts and interlock with the VFD emergency stop.

2.2 EQUIPMENT IDENTIFICATION

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

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

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for contactors for system voltages up to 600 V

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

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

.3 Section 26 29 03 - Control Devices.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.14-95 (R2001), Industrial Control Equipment.

1.4 PRODUCT DATA

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

Part 2 Products

2.1 CONTACTORS

.1 Contactors: to CSA C22.2 No.14.

.2 Electrically held controlled by pilot devices as indicated and rated for type of load controlled.

.3 Fused switch combination contactor as indicated.

.4 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.

.5 Mount in CSA Enclosure unless otherwise indicated.

.6 Include following options in cover:

.1 Red LED indicating lamp.

.2 Hand-Off-Auto selector switch.

.7 Control transformer: in accordance with Section 26 29 03 - Control Devices, in contactor enclosure.

2.2 EQUIPMENT IDENTIFICATION

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

.2 Size 4 nameplate indicating name of load controlled.

Part 3 Execution

3.1 INSTALLATION

.1 Install contactors and connect auxiliary control devices.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for industrial control devices including pushbutton stations control and relay panels.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

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

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.14-95(R2001), Industrial Control Equipment.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 1-2001, Industrial Control and Systems: General Requirements.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Include schematic, wiring, interconnection diagrams.

1.5 QUALITY ASSURANCE

.1 Submit one copy of test results to the Contract Administrator.

Part 2 Products

2.1 AC CONTROL RELAYS

.1 Control Relays: to CSA C22.2 No.14 and NEMA ICS 1.

.2 Convertible contact type: contacts field convertible from NO to NC, electrically held solid state. Contact rating: as required.

2.2 RELAY ACCESSORIES

.1 Standard contact cartridges: normally-open - convertible to normally-closed in field.

2.3 OPERATOR CONTROL STATIONS

.1 Enclosure: CSA Type 4, flush mounting:

2.4 PUSHBUTTONS

.1 Illuminated, Heavy duty Oil tight. Operator flush type, as indicated. With 1-NO and 1-NC contacts rated at as required.

2.5 SELECTOR SWITCHES

.1 Maintained 3 position labelled as indicated heavy duty oil tight, operators standard, contact arrangement as indicated.

2.6 INDICATING LIGHTS

.1 Heavy duty Oil tight, full voltage, LED type, as indicated.

2.7 CONTROL AND RELAY PANELS

.1 CSA Type sprinklerproof sheet steel enclosure with hinged padlockable access door, accommodating relays timers, labels, as indicated, factory installed and wired to identified terminals.

2.8 CONTROL CIRCUIT TRANSFORMERS

.1 Single phase, dry type.

.2 Primary: 208 V, 60 Hz ac.

.3 Secondary: 24 or 120 V, AC. As required.

.4 Rating: VA rating as shown.

.5 Secondary fuse:rated as required.

.6 Close voltage regulation as required by magnet coils and solenoid valves.

2.9 THERMOSTAT (LINE VOLTAGE)

.1 Wall mounted.

.2 Full load rating: 15A at 120V.

.3 Temperature setting range: 5 degrees C to 40 degrees C.

.4 Thermometer Range: 5 degrees C to 50 degrees C.

.5 Markings in 5 degrees increments.

Part 3 Execution

3.1 INSTALLATION

.1 Install as required.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at time and check out operation of section.

.3 Upon completion of sectional test, undertake group testing.

.4 Check out complete system for operational sequencing.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI C82.1-97, Electric Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.

.2 ANSI C82.4-92, Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps.

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

.1 ANSI/IEEE C62.41-1991, Surge Voltages in Low-Voltage AC Power Circuits.

.3 American Society for Testing and Materials (ASTM)

.1 ASTM F1137-88(1993), Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

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

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

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 45 00 - Quality Control.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by the Contract Administrator.

.3 Photometric data to include: VCP Table and spacing criterion.

Part 2 Products

2.1 LAMPS

.1 Incandescent lamps.

.1 As Indicated.

.2 Fluorescent lamps.

.1 As indicated.

2.2 BALLASTS

.1 Fluorescent ballast: CBM and CSA certified, energy efficient type, IC electronic and IC electronic dimmable.

.1 Rating: 120V, 60 Hz, for use with lamps as indicated.

.2 RFI/EMI suppression circuit to: FCC (CFR47) Part 18, sub-part C, Class A and Part 15, sub-part B, Class B.

.3 Totally encased and designed for 40 C ambient temperature.

.4 Power factor: minimum 95 % with 95% of rated lamp lumens.

.5 Crest factor: 1.5 maximum current, 2.0 maximum voltage.

.6 Capacitor: thermally protected.

.7 Harmonics: 10 % maximum THD, including 49th for electronic discrete and hybrid ballasts.

.8 Operating frequency of electronic ballast: 21 khz minimum.

.9 Total Circuit Power: 62 Watts (for t 32W T8 Lamps).

.10 Ballast Factor: greater than 0.90.

.11 Sound rated: Class A.

.12 Mounting: integral with luminaire.

.13 Manitoba PowerSmart Approved premium efficiency electronic ballasts. Apply for rebates. Contract Administrator to sign rebates over to contractor.

2.3 FINISHES

.1 Baked enamel finish:

.1 Conditioning of metal before painting:

.1 For corrosion resistance conversion coating to ASTM F1137.

.2 For paint base, conversion coating to ASTM F1137.

.2 Metal surfaces of luminaire housing and reflectors finished with high gloss alzak aluminum to give smooth, uniform appearance, free from pinholes or defects.

.3 Reflector and other inside surfaces finished as follows:

.1 White, minimum reflection factor 85%.

.2 Colour fastness: yellowness factor not above 0.02 and after 250 hours exposure in Atlas fade-ometer not to exceed 0.05.

.3 Film thickness, not less than 0.03 mm average and in no areas less than 0.025 mm.

.4 Gloss not less than 80 units as measured with Gardner 60E gloss meter.

.5 Flexibility: withstand bending over 12 mm mandrel without showing signs of cracking or flaking under 10 times magnification.

.6 Adhesion: 24 mm square lattice made of 3 mm squares cut through film to metal with sharp razor blade. Adhesive cellulose tape applied over lattice and pulled. Adhesion satisfactory if no coating removed.

.2 Alzak finish:

.1 Aluminium sheet fabricated from special aluminum alloys and chemically brightened, subsequently anodically treated to specifications established by Alcoa, to produce:

.1 Finish for mild commercial service, minimum density of coating 7.8 g/m^2, minimum reflectivity 83% for specular, 80.5% for semi-specular and 75% for diffuse.

2.4 LIGHT CONTROL DEVICES

.1 Design.

.1 As per design basis material specified.

2.5 LUMINAIRES

.1 As per design basis material specified.

Part 3 Execution

3.1 INSTALLATION

.1 Locate and install luminaires as indicated.

3.2 WIRING

.1 Connect luminaires to the lighting control panel.

3.3 LUMINAIRE SUPPORTS

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

3.4 LUMINAIRE ALIGNMENT

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

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for emergency lighting systems.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 21 - Wires and Cables (0-1000 V).

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

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.141-M1985(R1999), Unit Equipment for Emergency Lighting.

1.4 SUBMITTALS

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

.2 Data to indicate system components, mounting method, source of power and special attachments.

1.5 WARRANTY

.1 For batteries, the 12 months warranty period prescribed in subsection GC32.1 of General Conditions "C" is extended to 120 months, with no-charge replacement during the first 5 years and pro-rate charge on the second 5 years.

Part 2 Products

2.1 EQUIPMENT

.1 Emergency lighting equipment: to CSA C22.2 No.141.

.2 Supply voltage: 120 V, ac.

.3 Output voltage: 24 V, dc.

.4 Operating time: 60 min.

.5 Battery: sealed, maintenance free.

.6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01V for plus or minus 10% input variations.

.7 Solid state transfer circuit.

.8 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

.9 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.

.10 Lamp heads: integral on unit and remote, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: MR-16 20W, minimum.

.11 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.

.12 Finish: White.

.13 Auxiliary equipment:

.1 Ammeter.

.2 Voltmeter.

.3 Test switch.

.4 Time delay relay.

.5 Battery disconnect device.

.6 AC input and DC output terminal blocks inside cabinet.

.7 Cord and single twist-lock plug connection for AC.

.8 RFI suppressors.

2.2 WIRING OF REMOTE HEADS

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

.2 Conductors: in accordance with Section 26 05 21 - Wires and Cables 0-1000 V, sized in accordance with manufacturer's recommendations to minimize voltage drop.

Part 3 Execution

3.1 INSTALLATION

.1 Install unit equipment and remote mounted fixtures.

.2 Direct heads.

.3 Connect exit lights to unit equipment.

.4

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Atomic Energy Control Board Regulations

.2 Canadian Code for Preferred Packaging

.3 Canadian Standards Association (CSA)

.1 CSA C22.2 No.141- M1985(R1992), Unit Equipment for Emergency Lighting.

.2 CSA C860- 96, Performance of Internally-Lighted Exit Signs.

.4 National Fire Protection Association (NFPA) requirements

1.2 SUBMITTALS

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

.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 61 33 - Hazardous Materials. WHMIS acceptable to Labour Canada, and Health and Welfare Canada.

.3 Submit product data sheets for exit lights. Include product characteristics, performance criteria, physical size, limitations and finish.

.4 Manufacturer’s Instructions: Provide to indicate special handling criteria, installation sequence, cleaning procedures.

Part 2 Products

2.1 STANDARD UNITS

.1 Exit lights: to CSA C22.2 No.141 and CSA C860, packaged in accordance with the Canadian Code for Preferred Packaging guidelines.

.2 Housing: extruded aluminum housing, brush aluminum finish.

.3 Face and back plates: extruded aluminum.

.4 Lamps: two - LED- over 500,000 hours.

.5 Operation: designed for over 100,000 hours of continuous operation without relamping.

.6 Face plate to remain captive for relamping.

.7 Exit signs to be green running man.

.8 Universal Mount.

Part 3 Execution

3.1 INSTALLATION

.1 Install exit lights.

.2 Connect fixtures to exit light circuits.

.3 Connect emergency lamp sockets to emergency circuits.

.4 Ensure that exit light circuit breaker is locked in on position.

END OF SECTION