

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-09, Canadian Electrical Code, Part 1 (21st Edition), Safety Standard for Electrical Installations.
- .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.

1.2 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.

1.3 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 and French.
- .4 Use one nameplate or label for each language.

1.4 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: Construction and Section 02 81 01 - Hazardous Materials.
- .3 Submit for review single line electrical diagrams under plexiglass and locate in electrical room.
- .4 Shop drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

- .2 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.
- .3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
- .4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
- .5 Submit copies of 600 x 600mm minimum size drawings and product data to authority having jurisdiction and inspection authorities.
- .6 If changes are required, notify Departmental Representative of these changes before they are made.
- .5 Quality Control: in accordance with Section 01 45 00 - Quality Control.
 - .1 Provide CSA certified equipment and material.
 - .2 Where CSA certified equipment is not available, submit such equipment to authority having jurisdiction and inspection authorities for approval before delivery to site.
 - .3 Submit test results of installed electrical systems and instrumentation.
 - .4 Permits and fees: in accordance with General Conditions of contract.
 - .5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
 - .6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.
- .6 Manufacturer's Field Reports: submit to Departmental Representative 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.

1.5 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 who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction, as per the conditions of Provincial Act 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 16.06 - Construction Progress Schedule - Critical Path Method (CPM) Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Charts.
 - .2 Site Meetings: as part of Manufacturer's Field Services described in Part 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.

- .1 After delivery and storage of products, and when preparatory Work is complete but before installation begins.
- .2 Twice during progress of Work at 40% and 80% complete.
- .3 Upon completion of Work, after cleaning is carried out.
- .4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Material Delivery Schedule: provide Departmental Representative with schedule within 2 weeks after award of Contract.
- .2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.7 SYSTEM STARTUP

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

1.8 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 and inspection authorities 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 authority having jurisdiction, inspection authorities, Departmental Representative.
- .2 Porcelain enamel 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 aluminum conductors.

2.5 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplate as follows:
 - .1 Nameplates: lamicoid 3 mm thick melamine, black matt face, white core, lettering accurately aligned and engraved into core. Mechanically attached with self tapping screws. Emergency systems to be Red face with white core.
 - .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

NAMEPLATE SIZES

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 Departmental Representative 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, coloured plastic tapes, 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 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 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. Generator enclosure colour to be determined at shop drawing stage.
 - .2 Paint indoor switchgear and distribution enclosures light gray 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 Install conduit and sleeves prior to pouring of concrete.
 - .1 Sleeves through concrete.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.4 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment to be as per CSA B651 unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
 - .1 Panelboards: as required by Code or as indicated.

3.5 CO-ORDINATION OF PROTECTIVE DEVICES

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

3.6 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 generation and distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .4 Systems: fire alarm system.
 - .5 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing.
- .3 Carry out tests in presence of Department 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.

3.7 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 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2No.18 (latest edition), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
 - .2 CSA C22.2No.65 (latest edition), 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 C22.2No.65, with current carrying parts of copper or aluminum sized to fit copper or aluminum conductors as required.
- .2 Fixture type splicing connectors to: CSA C22.2No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
 - .1 Connector body and stud clamp for copper conductors.
 - .2 Clamp for stranded copper conductors.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper bar.
 - .5 Sized for conductors as indicated.
- .4 Clamps or connectors for armoured cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2No.18.

Part 3 Execution

3.1 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.

- .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2No.65.
- .3 Install fixture type connectors and tighten. Replace insulating cap.
- .4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

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

Part 2 Products

2.1 BUILDING WIRES

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with 600 or 1000 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE.

2.2 CONTROL CABLES

- .1 Type: LVT: 2 soft annealed copper conductors, sized as indicated:
 - .1 Insulation: thermoplastic.
 - .2 Sheath : thermoplastic jacket.
- .2 Type: low energy 300 V control cable: solid annealed copper conductors sized as indicated:
 - .1 Insulation: RW90.

Part 3 Execution

3.1 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform tests using method appropriate to site conditions and to approval of Engineer/Consultant and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

- .1 Install cable in trenches in accordance with Section 33 71 73.02 - Underground Electrical Service.
- .2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .3 Cable Colour Coding: to Section 26 05 00 Common Work Results for Electrical.
- .4 Conductor length for parallel feeders to be identical.

- .5 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .6 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
- .7 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.
- .8 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
 - .2 In underground ducts in accordance with Section 33 .
 - .3 In wireways and auxiliary gutters in accordance with Section 26 05 37.

3.4 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in PVC conduit in underground ducts.
- .2 Ground control cable shield.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.41-M1987(R1999), Grounding and Bonding Equipment.

1.3 PRODUCT DATA

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

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

- .1 Copper compression connectors to CSA C22.2 as required sized for conductors.
- .2 Contact aid for aluminum cables where applicable.

Part 3 Execution

3.1 INSTALLATION

- .1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.
- .2 Bond and ground as required to CSA C22.2No.41.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Section 26 05 00 - 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 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, soft annealed, size as indicated.
- .3 Rod electrodes: galvanized steel 19 mm dia by 3 m long.
- .4 Plate electrodes: copper, surface area 0.2 m², 1.6 mm thick.
- .5 Grounding conductors: bare stranded copper, soft annealed, size as indicated.
- .6 Insulated grounding conductors: green colour.
- .7 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.
- .8 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Thermit welded type conductor connectors.
 - .5 Bonding jumpers, straps.
 - .6 Pressure wire connectors.

Part 3 Execution

3.1 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 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.
- .6 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .7 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .8 Ground secondary service pedestals.

3.2 ELECTRODES

- .1 Make ground connections to continuously conductive underground water pipe on street side of water meter.
- .2 Install water meter shunt.
- .3 Install concrete encased electrodes in building foundation footings, with terminal connected to grounding network.
- .4 Install rod or plate electrodes and make grounding connections.
- .5 Bond separate, multiple electrodes together.
- .6 Use size 2/0AWG copper conductors for connections to electrodes.
- .7 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.3 SYSTEM AND CIRCUIT GROUNDING

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

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, distribution panels.

3.5 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative/Consultant 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 RELATED SECTIONS

- .1 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

Part 2 Products

2.1 SUPPORT CHANNELS

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted

Part 3 Execution

3.1 INSTALLATION

- .1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors or nylon shields.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.
- .5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .6 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 50 mm.
 - .3 Beam clamps to secure conduit to exposed steel work.
- .7 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
 - .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .8 For surface mounting of two or more conduits use channels at 3 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 Departmental Representative/Consultant.
- .13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-09, Canadian Electrical Code, Part 1, 21st Edition.

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Provide drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

Part 2 Products

2.1 SPLITTERS

- .1 Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Terminations: main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3 Spare Terminals: minimum three spare terminals or lugs on each connection or lug block sized less than 400 A.

2.2 JUNCTION AND PULL BOXES

- .1 Construction: welded steel enclosure.
- .2 Covers Flush Mounted: 25 mm minimum extension all around.
- .3 Covers Surface Mounted: screw-on turned edge covers.

2.3 CABINETS

- .1 Construction: welded sheet steel hinged door, handle, latch lock 2 keys and catch
- .2 Type E Empty: flush overlapping sides mounting as indicated.
- .3 Type T Terminal: flush overlapping sides mounting as indicated.

Part 3 Execution

3.1 SPLITTER INSTALLATION

- .1 Mount plumb, true and square to 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 except where indicated otherwise.
- .3 Install terminal block as indicated in Type T cabinets.
- .4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

3.3 IDENTIFICATION

- .1 Equipment Identification: to Section 26 05 00 - Common Work Results for Electrical.
- .2 Identification Labels: size 2 indicating system name, voltage and phase.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-09, Canadian Electrical Code, Part 1, 21st Edition.

1.2 SUBMITTALS

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

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.
 - .1 Boxes to be hot dip galvanized to ASTM A 924(M) designation Zinc coating Z180 (G60).
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 347 V outlet boxes for 347 V switching devices.
- .6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 GALVANIZED STEEL OUTLET BOXES

- .1 One-piece electro-galvanized construction.
- .2 Single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .4 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .5 Extension and plaster rings for flush mounting devices in finished plaster 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 CONDUIT BOXES

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

2.5 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

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

2.6 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 35mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.
- .5 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .6 Identify systems for outlet boxes as required.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA C22.2 No. 18-98(R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
 - .2 CSA C22.2 No. 45-M1981(R2003), Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83-M1985(R2003), Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2-M1984(R2003), Rigid PVC (Unplasticized) Conduit.
 - .6 CAN/CSA C22.2 No. 227.3-05, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheets.
 - .1 Submit cable manufacturing data.
- .3 Quality assurance submittals:
 - .1 Test reports: submit certified test reports.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.

Part 2 Products

2.1 CABLES AND REELS

- .1 Provide cables on reels or coils.
 - .1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.
- .2 Each coil or reel of cable to contain only one continuous cable without splices.
- .3 Identify cables for exclusively dc applications.

2.2 CONDUITS

- .1 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, steel liquid-tight flexible metal.

2.3 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 50 mm and smaller.
 - .1 Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 5 m on centre.
- .4 Threaded rods, 6mm diameter, to support suspended channels.

2.4 CONDUIT FITTINGS

- .1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT.
 - .1 Set-screws are not acceptable.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 FISH CORD

- .1 Polypropylene.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms.

- .3 Use rigid galvanized steel threaded conduit except where subject to mechanical injury.
- .4 Use electrical metallic tubing (EMT) above 2.4 m not subject to mechanical injury.
- .5 Use flexible metal conduit for connection to motors in dry areas, connection to recessed incandescent fixtures without prewired outlet box, connection to surface or recessed fluorescent fixtures.
- .6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .7 Use explosion proof flexible connection for connection to explosion proof motors.
- .8 Install conduit sealing fittings in hazardous areas.
 - .1 Fill with compound.
- .9 Minimum conduit size for lighting and power circuits: 21 mm.
- .10 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .11 Mechanically bend steel conduit over 21 mm diameter.
- .12 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .13 Install fish cord in empty conduits.
- .14 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
- .15 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

- .1 Run conduits surface when no ceiling or wall cavity exists.
- .2 Run parallel or perpendicular to building lines.
- .3 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .4 Run conduits in flanged portion of structural steel.
- .5 Group conduits wherever possible on channels.
- .6 Do not pass conduits through structural members except as indicated.
- .7 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.

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

3.5 CONDUITS IN CAST-IN-PLACE CONCRETE

- .1 Locate to suit reinforcing steel.
 - .1 Install in centre one third of slab.
- .2 Protect conduits from damage where they stub out of concrete.
- .3 Install sleeves where conduits pass through slab or wall.
- .4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed.
 - .1 Use cold mastic between sleeve and conduit.
- .5 Conduits in slabs: minimum slab thickness 4 times conduit diameter.
- .6 Encase conduits completely in concrete with minimum 25 mm concrete cover.
- .7 Organize conduits in slab to minimize cross-overs.

3.6 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

- .1 Run conduits 25 mm and larger below slab and encase in 75 mm concrete envelope.
 - .1 Provide 50 mm of sand over concrete envelope below floor slab.

3.7 CONDUITS UNDERGROUND

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

3.8 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 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSAC22.2No.26-R1999, Construction and Test of Wireways, Auxiliary Gutters and Associated Fittings.

1.3 PRODUCT DATA

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

Part 2 Products

2.1 WIREWAYS

- .1 Wireways and fittings: to CSA C22No.26.
- .2 Sheet steel with hinged cover to give uninterrupted access.
- .3 Finish: baked grey enamel.
- .4 Elbows, tees, couplings and hanger fittings manufactured as accessories to wireway supplied.

Part 3 Execution

3.1 INSTALLATION

- .1 Install wireways and auxiliary gutters.
- .2 Keep number of elbows, offsets, connections to minimum.
- .3 Install supports, elbows, tees, connectors, fittings.
- .4 Install barriers where required.
- .5 Install gutter to full length of equipment.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .3 Section 26 05 00 - 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 clear, or copper naphthenate or 5% pentachlorophenol solution, water repellent preservative.

2.2 MARKERS

- .1 Concrete type cable markers: 600 x 600 x 100 mm with words: cable, joint or conduit impressed in top surface, with arrows to indicate change in direction of cable and duct runs.
- .2 Cedar post type markers: 89 x 89 mm, 1.5 m long, pressure treated with clear, or copper naphthenate or 5% pentachlorophenol solution, water repellent preservative, with nameplate fastened near post top, on side facing cable or conduit to indicate depth and direction of duct and cable runs.
 - .1 Nameplate: aluminum anodized 89 x 125 mm, 1.5 mm thick mounted on cedar post with mylar label 0.125 mm thick with words Cable, Joint or Conduit with arrows to indicate change in direction.

Part 3 Execution

3.1 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.

3.2 MARKERS

- .1 Mark cable every 150 m along cable duct runs and changes in direction.
- .2 Mark underground splices.
- .3 Where markers are removed to permit installation of additional cables, reinstall existing markers.
- .4 Lay concrete markers flat and centred over cable with top flush with finish grade.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - 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 at original factory test voltage 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 Engineer/Consultant with list of test results showing location at which each test was made, circuit tested and result of each test.
- .8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .3 Section 06 10 00 - Rough Carpentry
- .4 Section 06 10 00.01 - Rough Carpentry - Short Form: Plywood Backboard.
- .5 Section 26 05 00 - Common Work Results - Electrical.
- .6 Section 26 28 21 - Moulded Case Circuit Breakers.

1.2 REFERENCES

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

1.3 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 C22.2No.29 and product of one manufacturer.
 - .1 Install circuit breakers in panelboards before shipment.
 - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .2 250, 600 V panelboards: bus and breakers rated for 22,000 A (symmetrical) interrupting capacity or as indicated.
- .3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .5 Two keys for each panelboard and key panelboards alike.
- .6 Copper bus with neutral of same ampere rating as mains.

- .7 Mains: suitable for bolt-on breakers.
- .8 Trim with concealed front bolts and hinges.
- .9 Trim and door finish: as per colour schedule.

2.2 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 fire alarm, emergency and exit circuits.

2.3 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Nameplate for each panelboard size 4 engraved.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit.

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 in accordance with Section 06 10 00 - Rough Carpentry. Where practical, group panelboards on common backboard.
- .3 Mount panelboards to height specified in Section 26 05 00 - Common Work Results - Electrical.
- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .3 Section 26 05 00 - Common Work Results - Electrical.

1.2 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).

1.3 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 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 Ivory urea moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Eight back wired entrances, four side wiring screws.
 - .5 Triple wipe contacts and rivetted grounding contacts.
- .2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:
 - .1 Ivory urea moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Four back wired entrances, 2 side wiring screws.
- .3 Other receptacles with ampacity and voltage as indicated.
- .4 Receptacles of one manufacturer throughout project.

2.2 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, 1 mm thick cover plates 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 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 00 - Common Work Results - Electrical.
 - .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
- .2 Cover plates:
 - .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
 - .2 Install suitable common cover plates where wiring devices are grouped.
 - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.

1.2 REFERENCES

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

1.3 SUBMITTALS

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

Part 2 Products

2.1 BREAKERS GENERAL

- .1 Moulded-case circuit breakers and Circuit breakers to CSA C22.2 No. 5
- .2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .3 Common-trip breakers: with single handle for multi-pole applications.
- .4 Circuit breakers to have minimum 22,0000 ampere symmetrical rms interrupting capacity rating.

2.2 THERMAL MAGNETIC BREAKERS

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

Part 3 Execution

3.1 INSTALLATION

- .1 Install circuit breakers as indicated.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 35 29.06 - Health and Safety Requirements.
- .3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .4 Section 26 05 00 - Common Work Results - Electrical.
- .5 Section 26 28 13.01 - Fuses - Low Voltage.

1.2 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.

1.3 SUBMITTALS

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

1.4 HEALTH AND SAFETY

- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

Part 2 Products

2.1 DISCONNECT SWITCHES

- .1 Fusible, non-fusible, horsepower rated disconnect switch in CSA Enclosure , to CAN/CSA C22.2 No.4 size as indicated.
- .2 Provision for padlocking in on-off switch position.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Fuses: size as indicated
- .5 Fuseholders: to CSA C22.2 No.39 relocatable and suitable without adaptors, for type and size of fuse indicated.
- .6 Quick-make, quick-break action.
- .7 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Indicate name of load controlled on size 4 nameplate.

Part 3 Execution

3.1 INSTALLATION

- .1 Install disconnect switches complete with fuses if applicable.

END OF SECTION

Part 1 General

1.1 DESCRIPTION OF SYSTEM & SITE

- .1 Provide a 100 kW standby power system to supply electrical power at 600 V, 60 Hertz, 3 Phase. The generator shall consist of a liquid cooled diesel engine, a synchronous AC alternator, and system controls with all necessary accessories for a complete operating system, including but not limited to the items as specified hereinafter.
- .2 The genset shall be applied at the listed ambient and elevation. Bidders to submit the generators rated power output at 40 ambient (°C) and 930 elevation (m). The genset shall be an open configured for outdoor installation complete with sound attenuated weatherproof enclosure and sub base fuel tank.

1.2 REQUIREMENTS OF REGULATORY AGENCIES

- .1 An electric generating system, consisting of a prime mover, generator, governor, coupling and all controls, must have been tested, as a complete unit, on a representative engineering prototype model of the equipment to be sold.
- .2 The generator set must conform to applicable CSA-282-09.
- .3 The generator set must be CSA or CUL approved
- .4 The generator set must meet EPA federal emission guidelines for stationary standby power generation.
- .5 Fuel tank must be ULC certified as required by the Alberta Fire Code

1.3 MANUFACTURER QUALIFICATIONS

- .1 This system shall be supplied by an original equipment manufacturer (OEM) who has been regularly engaged in the production of engine-alternator sets, automatic transfer switches, and associated controls for a minimum of 25 years, thereby identifying one source of supply and responsibility.
- .2 Approved suppliers are Generac, Cummins, Waterous, Kohler or approved equal meeting the requirements of this specification.
- .3 The manufacturer shall have printed literature and brochures describing the standard series specified, not a one of a kind fabrication.
- .4 Manufacturer's authorized service representative shall meet the following criteria:
 - .1 Certified, factory trained, industrial generator technicians
 - .2 Service support 24/7

1.4 SUBMITTALS

- .1 Engine Generator specification sheet
- .2 Controls specification sheet(s)

- .3 Installation / Layout dimensional drawing
- .4 Wiring schematic
- .5 Sound data
- .6 Emission certification
- .7 Warranty statement
- .8 Proto type test report
- .10 Alternator thermal damage and decrement curves
- .11 Generator protective device time current curves
- .12 Generator protective device time current curves

Part 2 Products

2.1 ENGINE RATING AND PERFORMANCE

- .1 The prime mover shall be a liquid cooled, diesel fueled, turbocharged after-cooled engine of 4-cycle design. It will have adequate horsepower to achieve rated kW output with at an operating speed of 1800 RPM.
- .2 The engine shall support a 100% load step.
- .3 The generator system shall support generator start-up and load transfer within 10 seconds.

2.3 ENGINE OIL SYSTEM

- .1 Full pressure lubrication shall be supplied by a positive displacement lube oil pump. The engine shall have a replaceable oil filter(s) with internal bypass and replaceable element(s).
- .2 The engine shall operate on mineral based oil.
- .3 The oil shall be cooled by a oil cooler which is integrated into the engine system.

2.4 ENGINE COOLING SYSTEM

- .1 The engine is to be cooled with a unit mounted radiator, fan, water pump, and closed coolant recovery system. The coolant system shall include a coolant fill box which will provide visual means to determine if the system has adequate coolant level. The radiator shall be designed for operation in 50 degrees C ambient temperature.
- .2 The engine shall have (a) unit mounted, thermostatically controlled water jacket heater(s) to aid in quick starting. The wattage shall be as recommended by the manufacturer.
- .3 Engine coolant and oil drain extensions, equipped with pipe plugs and shut-off valves, must be provided to the outside of the mounting base for cleaner and more convenient engine servicing.
- .4 A radiator fan guard must be installed for personnel safety.

2.5 ENGINE STARTING SYSTEM

- .1 Starting shall be by a solenoid shift, DC starting system.
- .2 The engine's cranking batteries shall be lead acid. The batteries shall be sized per the manufacturer's recommendation and shall be the largest available by the manufacture for the generator set. The batteries supplied shall meet CSA-282 cranking requirements. Battery specifications (type, amp-hour rating, cold cranking amps) to be provided in the submittal.
- .3 Provide battery metal rack to facilitate battery placement at 300 mm above floor.
- .4 The genset shall have an engine driven, battery charging alternator with integrated voltage regulation.
- .5 The genset shall have an automatic dual rate, float equalize, 10 amp battery charger. The charger must be protected against a reverse polarity connection. The chargers charging current shall be monitored within the generator controller to support remote monitoring and diagnostics. The battery charger is to be factory installed on the generator set. Due to line voltage drop concerns, a battery charger mounted in the transfer switch will be unacceptable.

2.6 ENGINE FUEL SYSTEM

- .1 The engine fuel system shall be designed for operation on #2 diesel fuel and cold weather diesel blends.
- .2 The engine shall include a primary fuel filter, water separator, manual fuel priming pump, and engine flexible fuel lines must be installed at the point of manufacture. Element shall be replaceable paper type.
- .3 The engines suction line shall be fitted with a check valve to secure prime for the engines injection pump.

2.7 ENGINE CONTROLS

- .1 Engines that are equipped with an electronic engine control module (ECM), shall monitor and control engine functionality and seamlessly integrate with the genset controller through digital communications. ECM monitored parameters shall be integrated into the genset controllers NFPA 110 alarm and warning requirements. All ECM fault codes shall be displayed at the genset controller in standard language – fault code numbers are not acceptable.
- .2 Engine speed shall be controlled with an integrated isochronous governor function with no change in alternator frequency from no load to full load. Steady state regulation is to be 0.25%.
- .3 Solid state indicator lights for alarm with 1 set manually reset NO/NC contacts wired to terminal block for remote annunciation on:
 - .1 Low fuel level.

- .2 Low battery voltage.
- .3 Ventilation failure.
- .4 Low coolant temperature.
- .5 General failure to start alarm for FA system.

2.8 ENGINE EXHAUST & INTAKE

- .1 The manufacturer shall supply its recommended stainless steel, flexible connector to couple the engine exhaust manifold to the exhaust system. All components must be properly sized to assure operation without excessive back pressure when installed.
- .2 A Hospital grade exhaust silencer with a minimum 35dBA noise reduction shall be supplied. Muffler to have minimum 6 inch inlet and outlet connection and be of side inlet, end outlet design.
- .3 The engine intake air is to be filtered with engine mounted, replaceable, dry element filters.

2.9 OUTDOOR GENERATOR-SET ENCLOSURE

- .1 Description: Vandal-resistant, weatherproof steel or aluminum housing, wind resistant up to 100 mph. Multiple housing-access panels shall provide adequate access to components requiring maintenance. Panels shall be hinged and lockable. Instruments and controls are mounted within enclosure.
- .2 Engine Cooling Airflow through Enclosure: Adequate to maintain temperature rise of system components within required limits when unit operates at 100 percent of rated load for 2 hours with ambient temperature at top of range specified in "Service Conditions" Article.
- .3 Louvers: Fixed-engine cooling air inlet and discharge. Louvers prevent entry of rain and snow.
- .4 The genset silencer shall be mounted on the discharge hood of the enclosure. Due to architectural concerns, silencers mounted on the top of the generator enclosure are not acceptable. Genset silencers to be mounted inside the main generator compartment and be thermally wrapped to minimize heat stress on the surrounding components.
- .4 Sound Attenuating Enclosure: Noise reduction shall reduce the A-Weighted noise level of the generator-set by 55 dBA at 7 meters. Sound Attenuating Enclosures shall include all of the operational parameters described above for the weatherproof housing.

2.10 ALTERNATOR

- .1 The alternator shall be the voltage and phase configuration as specified in section 1.1.1.
- .2 The alternator shall be a 4 pole, revolving field, stationary armature, synchronous machine. The excitation system shall utilize a brushless exciter with a three phase full wave rectifier assembly protected against abnormal transient conditions by a surge protector. Photo-sensitive components will not be permitted in the rotating exciter.

- .3 The alternator shall include a permanent magnet generator (PMG) for excitation support. The system shall supply a minimum short circuit support current of 300% of the rating for 10 seconds.
- .4 The alternator shall support 464 skVA with a maximum voltage dip of 35%.
- .5 Three phase alternators shall be 12 lead, broad range capable of supporting voltage reconnection. Single phase alternators shall be four lead and dedicated voltage designs (600v) shall be six lead. All leads must be extended into a NEMA 1 connection box for easy termination. A fully rated, isolated neutral connection must be included by the generator set manufacturer.
- .6 The alternator shall use a single, sealed bearing design. The rotor shall be connected to the engine flywheel using flexible drive disks. The stator shall be direct connected to the engine to ensure permanent alignment.
- .7 The alternator shall meet temperature rise standards of 130 degrees. The insulation system material shall be class "H" capable of withstanding 150 degrees C temperature rise.
- .8 The alternator shall be protected against overloads and short circuit conditions by advanced control panel protective functions. The control panel is to provide a time current algorithm that protects the alternator against short circuits. To ensure precision protection and repeatable trip characteristics, these functions must be implemented electronically in the generator control panel. 2 RTD's per phase complete with monitoring may be provided in lieu digital protection -- thermal magnetic breaker implementation are not acceptable

2.11 CONTROLS

- .1 The generator control system shall be a fully integrated microprocessor based control system for standby emergency engine generators meeting all requirements of NFPA 110 level 1.
- .2 The generator control system shall be a fully integrated control system enabling remote diagnostics and easy building management integration of all generator functions. The generator controller shall provide integrated and digital control over all generator functions including: engine protection, alternator protection, speed governing, voltage regulation and all related generator operations. The generator controller must also provide seamless digital integration with the engine's electronic engine control module (ECM) if so equipped.
- .3 Communications shall be supported with building automation via the Modbus protocol without network cards. Internet and intranet connectivity shall be available.
- .4 Diagnostic capabilities should include time-stamped event and alarm logs, ability to capture operational parameters during events, simultaneous monitoring of all input or output parameters,

- .5 The control system shall provide pre-wired customer use I/O: 4 relay outputs (user definable functions), communications support via RS232, RS485, or an optional modem. Additional I/O must be an available option.
- .6 The control panel will display all user pertinent unit parameters including: engine and alternator operating conditions; oil pressure and optional oil temperature; coolant temperature and level alarm; fuel level (where applicable); engine speed; DC battery voltage; run time hours; generator voltages, amps, frequency, kilowatts, and power factor; alarm status and current alarm(s) condition per NFPA 110 level 1.

2.12 ENGINE / ALTERNATOR PACKAGING

- .1 The engine/alternator shall be isolated from the generator frame with rubber isolators. The packaging shall not require the addition of external spring isolators.
- .2 A mainline, thermal magnetic circuit breaker carrying the UL mark shall be factory installed. The breaker shall be rated at **150** amp. The line side connections are to be made at the factory. Output lugs shall be provided for load side connections. The breaker shall include auxiliary contacts to Alarm panel when open.
- .3 A lug set for the connection of a load bank for required maintenance load testing of generator.

2.13 SUB-BASE FUEL TANK

- .1 The packaging shall include a double wall, sub-base mounted, ULC 142 labeled fuel tank as required by the Alberta Fire Code and compliant with CAN/CSA-B139-09. The tank shall be sized to provide a minimum 8 hours of run time.
- .2 The tank shall include fuel suction and return connections, normal and emergency vents, secondary containment emergency vent and rupture basin sensor, mechanical fuel level indication and a stub-up area convenient for electrical conduit entry.
- .3 The fuel tank shall use an electric fuel sensor to provide remote analog indication of fuel level at fuel fill station. The controller shall have a warning indication on low fuel level and provide optional shutdown functionality for low, low fuel level.
- .4 The fuel tank shall have a sloped top and bottom. The sloped top allows water to run off. The sloped bottom allows the water and other impurities in the fuel to collect near the back of the tank away from the fuel suction point.

2.14 SPARE PARTS:

- .1 One spare set Fuses

Part 3 Additional Project Requirements

3.1 FACTORY TESTING

- .1 Before shipment of the equipment, the engine-generator set shall be tested under rated load for performance and proper functioning of control and interfacing circuits. Tests shall include:
 - 1.0 Verify voltage & frequency stability.
 - 2.0 Verify transient voltage & frequency dip response.
 - 3.0 Load test the generator for 30 minutes.
 - 4.0 Factory certified test report to be on site during field commissioning.

3.2 OWNER'S MANUALS

- .1 Three (3) sets of owner's manuals specific to the product supplied must accompany delivery of the equipment. General operating instruction, preventive maintenance, wiring diagrams, schematics and parts exploded views specific to this model must be included.

3.3 WARRANTY

- .1 The standby electric generating system components, complete genset and instrumentation panel shall be warranted by the manufacturer against defective materials and factory workmanship for a minimum period of one (1) year and 1500 hours of operation. Such defective parts shall be repaired or replaced at the manufacturer's option, free of charge for parts, labor and travel.
- .2 The warranty period shall commence when the standby power system is first placed into service. Multiple warranties for individual components (engine, alternator, controls, etc.) will not be acceptable. Satisfactory warranty documents must be provided. Also, in the judgment of the specifying authority, the manufacturer supplying the warranty for the complete system must have the necessary financial strength and technical expertise with all components supplied to provide adequate warranty support.

3.4 STARTUP AND CHECKOUT

- .1 The supplier of the electric generating plant and associated items covered herein shall provide factory trained technicians to checkout the completed installation and to perform an initial startup inspection to include:
 - 3.4.1.1** Field commissioning to include 6 hour 100% load test at unity and a 2 hour building operational test.
 - 3.4.1.2** Field commissioning to be in compliance with CSA 282-09 requirements. Commission reports and load test reports to be provided.

3.5 TRAINING

- .1 Training is to be supplied by the start-up technician for the end-user during commissioning. The training should cover basic generator operation and common generator issues that can be managed by the end-user.

END OF SECTION

Part 1 General

1.1 DESIGN CRITERIA

- .1 Automatic load transfer equipment to:
 - .1 Monitor voltage of normal power supply.
 - .2 Initiate cranking of standby generator unit on normal power failure or abnormal voltage on any phase below preset adjustable limits for adjustable period of time.
 - .3 Transfer load from normal supply to standby unit when standby unit reaches rated frequency and voltage preset adjustable limits.
 - .4 Transfer load from standby unit to normal power supply when normal power restored, confirmed by sensing of voltage in all phases above adjustable preset limit for adjustable period of time.
 - .5 Shut down standby unit after running unleased to cool down using adjustable time delay relay.

1.2 SHOP DRAWINGS

- .1 Submit shop drawings as follows:
 - .1 Within thirty (30) days of the award of contract, prepare or obtain equipment shop drawings as required. The drawings shall show construction and fabrication details, weights, outline dimensions, performance characteristics, ratings, schematic and connection diagrams of equipment being purchased. Review and verify all dimensions and ratings and where necessary, alter these shop drawings in order to have the equipment comply with the intent of the specifications. Where applicable, include wiring, single line and schematic diagrams. Wiring drawings showing interconnection with work of other divisions are required.
 - .2 All shop drawings shall be delivered complete with a cover sheet indicating project name, date, name(s) of shop drawings enclosed, number of pages attached, and space for review stamps and comments.
 - .3 The review of shop drawings and technical data will be for general design only and will not relieve the manufacturer from responsibility for their accuracy. Inadvertent approval of shop drawings or technical data which are incomplete in detail or which contain original errors in technical data or sizes of equipment that does not fit the space available shall not be construed as approving departure from requirements of the drawings or specifications.
- .2 Include:
 - .1 Make, model and type.
 - .2 Single line diagram showing controls and relays.
 - .3 Description of equipment operation including:
 - .1 Automatic starting and transfer to standby unit and back to normal power.
 - .2 Test control.
 - .3 Manual control.
 - .4 Automatic shutdown.

1.3 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for automatic load transfer equipment for incorporation into manual.
- .2 Detailed instructions to permit effective operation, maintenance and repair.
- .3 Technical data:
 - .1 Schematic diagram of components, controls and relays.
 - .2 Certified copy of factory test results.
 - .3 Illustrated parts list with parts catalogue numbers.

1.4 SOURCE QUALITY CONTROL

- .1 Complete equipment, including transfer mechanism, controls, relays and accessories factory assembled and tested, to following standards:
 - .1 CSA C22.2 No. 178-1978.
 - .2 (R2006)
 - .3 CAN/CSA-Q9003-91.
 - .4 CAN3-Z299.3-85 (R2006).
 - .5 IEEE Standard 472-1974 (ANSI C37.90a-1974).
- .2 Tests:
 - .1 Operate equipment both mechanically and electrically to ensure proper performance.
 - .2 Check selector switch, in 4 positions (Test, Auto, Manual, Engine Start) and record results.
 - .3 Check voltage sensing and time delay relay settings.
 - .4 Check:
 - .1 Automatic starting and transfer of load on failure of normal power.
 - .2 Retransfer of load when normal power supply resumed.
 - .3 Automatic shutdown.
 - .4 In phase monitor operation.
 - .5 Test:
 - .1 Overload and endurance as per CSA C22.2 No.178-1978, tables 6, 7 and 10.
 - .2 Temperature rise within allowable limits of insulation.
 - .3 Withstand current rating, with no contact welding.
 - .4 Dielectric rating, at 2000 V rms.
- .3 Submit typewritten test results to Consultant.

1.5 CARE, OPERATION AND START-UP

- .1 Provide systems demonstration to Owner. Allow two (2) hours at designated time as established by contractor.

Part 2 Products

2.1 MATERIALS

- .1 Enclosure: CSA 1.

2.2 CONTACTOR TYPE TRANSFER EQUIPMENT

- .1 Two- three phase contactors (one normal, one emergency) mounted on common frame, in double throw arrangement, mechanically and electrically interlocked, solenoid operated, open type.
- .2 Rated: 600 V. 60 Hz, 3 wire, solid neutral.
- .3 Main contacts: silver surfaced segmented contacts, protected by arc disruption means including separate arcing contacts, arc splitters and blow out coils for load current.
- .4 Switch and relay contacts, coils, spring and control elements accessible for inspection and maintenance from front of panel without removal of switch panel or disconnection of drive linkages and power conductors.
- .5 Auxiliary contact: to initiate emergency generator start-up on failure of normal power.
- .6 Fault withstand rating: 42 kA symmetrical.
- .7 Lever to operate switch manually when switch is isolated.

2.3 CONTROLS

- .1 Selector switch - four position "Test" "Auto" "Manual" "Engine start".
 - .1 Test position - Normal power failure simulated. Engine starts and transfer takes place. Return switch to "Auto" to Stop engine.
 - .2 Auto position - Normal operation of transfer switch on failure of normal power; retransfers on return of normal voltage and shuts down engine.
 - .3 Manual position - Transfer switch may be operated by manual handle but transfer switch will not operate automatically and engine will not start.
 - .4 Engine start position - Engine starts but unit will not transfer unless normal power supply fails. Switch must be returned to "Auto" to stop engine.
- .2 Control transformers: dry type with 120 V secondary to isolate control circuits from:
 - .1 Normal power supply.
 - .2 Emergency power supply.
- .3 Monitoring and relays: solid state, continuous duty, industrial control type, with wiping action contacts rated 10 A minimum:
 - .1 Voltage sensing, one per phase, close differential, adjustable pick up of 85% to 100% of nominal, adjustable drop out of 75% to 98% of pick up.
 - .2 Time delay, normal power to standby, adjustable 0 to 8 mm.
 - .3 Time delay on engine starting to override momentary power outages or dips, adjustable 0.5 s to 6 s delay.
 - .4 Time delay on retransfer from standby to normal power, adjustable 0 to 30 min. The time delay shall be automatically bypassed if the emergency source fails and normal power is available.

- .5 Time delay for engine cool-off to permit standby set to run unloaded after retransfer to normal power, adjustable 0 to 5 min.
- .6 (In phase monitor to permit rapid in phase transfer of motor loads.
- .7 Frequency sensing, to prevent transfer from normal power supply until frequency of standby unit reach preset values, adjustable 90% to 100% of nominal.

2.4 ACCESSORIES

- .1 Pilot lights to indicate switch position, green for normal, red for standby, mounted in panel.
- .2 Solid neutral bar: full capacity, on isolator block.
- .3 Auxiliary relay to provide 2 N.O. and 2 N.C. contacts for remote alarms.
- .4 Load break bypass and isolation switch: draw out type, manually operated with doors closed and visual indication of switch position, two -way bypass-isolation, double throw, to provide bypass around transfer switch to facilitate maintenance on transfer switch. Switch lockable in bypass position. Interruption of load during bypass is not acceptable.
- .5 Lugs: suitable for two (2) runs of 3#300 MCM cable entry.

2.5 EQUIPMENT IDENTIFICATION

- .1 Control panel:
 - .1 For selector switch and manual switch: size 2 nameplates.
 - .2 For meters, indicating lights, minor controls: size 1 nameplates.

2.6 FABRICATION

- .1 Shop assemble transfer equipment including:
 - .1 Mounting base and enclosure.
 - .2 Transfer switch and operating mechanism.
 - .3 Control transformers and relays.
 - .4 Accessories.

2.7 MANUFACTURERS

- .1 Acceptable manufacturers:
 - .1 Contactor type with bypass: Ascolectric Ltd. 300 series, Kohler KB series, Generac, Cummins.

Part 3 Execution

3.1 INSTALLATION

- .1 Locate, install and connect transfer equipment in accordance with manufacturer's instructions.
- .2 Check relays and solid state monitors and adjust as required.

- .3 Install and connect battery and remote alarms as indicated.

3.2 FIELD QUALITY CONTROL

- .1 Provide the services of a qualified technician, authorized by the manufacturer, to test automatic load transfer equipment on site.
- .2 Provide a written start-up report to the Consultant listing data such as operating setpoints, characteristics and identification.
- .3 Energize transfer equipment from normal power supply.
- .4 Set selector switch in “Test” position to ensure proper standby start, running, transfer, re-transfer. Return selector switch to “Auto” position to ensure standby shuts down.
- .5 Set selector switch in “Manual” position and check to ensure proper performance.
- .6 Set selector switch in “Engine start” position and check to ensure proper performance. Return switch to “Auto” to stop engine.
- .7 Set selector switch in “Auto” position and open normal power supply disconnect. Standby should start, come up to rated voltage and frequency, and then load should transfer to standby. Allow to operate for 10 min, then close main power supply disconnect. Load should transfer back to normal power supply and standby should shutdown.
- .8 Repeat, at 1 h intervals, 2 times, complete test with selector switch in each position, for each test.
- .9 Demonstrate operation of manual bypass switch.
- .10 All tests to be done in the presence of the Consultant or their representative, suitably logged, tabulated, signed and incorporated into the Operating and Maintenance Manuals.
- .11 Testing and commissioning to be carried out under this contract at no extra cost to the Owner.

Automatic Transfer Switches 120/208 Volt, 3 Pole, solid Neutral

ATS	Rating	Mounting	Brkr Frame Size/Tripd (AMPS)	Poles	By-Pass	Feeder Lugs
ATS-1	200	surface	200 / 200	3	yes	Two 1/0 AWG to 250 MCM or One #4 AWG to 600 MCM

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .3 Section 26 05 21 - Wires and Cables (0-1000 V).
- .4 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.141-M1985(R1999), Unit Equipment fo Emergency Lighting.

1.3 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.

1.4 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: 12 V dc.
- .4 Operating time: 30 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'.
- .10 Lamp heads: integral on unit and remote, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: mini quartz 12 W.
- .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 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.

Part 3 Execution

3.1 INSTALLATION

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

END OF SECTION