

1.0 General

1.1 REFERENCES

- .1 The most current edition of the following:
- .2 Canadian Standards Association (CSA International)
 - .1 CSA C22.1, Canadian Electrical Code, Part 1 (20th Edition), Safety Standard for Electrical Installations.
 - .2 CAN/CSA-C22.3 No. 1, Overhead Systems.
 - .3 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000V.
- .3 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
 - .1 EEMAC 2Y-1, Light Gray Colour for Indoor Switch Gear.
- .4 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
 - .1 IEEE SP1122, 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 for control items in English.
- .4 Use one nameplate for each language.

1.4 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit for review single line electrical diagrams under plexiglass and locate as indicated.
 - .1 Electrical distribution system in main electrical room.
 - .2 Electrical power generation and distribution systems in power plant rooms.
- .3 Submit for review fire alarm riser diagram, plan and zoning of building under plexiglass at fire alarm control panel and annunciator.
- .4 Shop drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, 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 If changes are required, notify Contract Administrator 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 and material is not available, submit such

- equipment and material to authority having jurisdiction for special approval before delivery to site.
- .3 Submit test results of installed electrical systems and instrumentation.
- .4 Permits and fees: in accordance with General Conditions of contract.
- .5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
- .6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Contract Administrator.
- .6 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.

1.5 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.
 - .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:
 - .1.2 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 25% and 60% complete.
 - .3 Upon completion of Work, after cleaning is carried out.
- .4 Health and Safety Requirements: in accordance with Part D - Supplemental Conditions.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Material Delivery Schedule: provide Contract Administrator with schedule within 2 weeks after award of Contract.
- .2 Dispose of waste materials in accordance with Section 01 73 00 - Execution.

1.7 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 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 accepted 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.

2.0 Products

2.1 MATERIALS AND EQUIPMENT

- .1 Provide material in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Material and equipment to be CSA certified. Where CSA certified material and equipment are 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 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of authority having jurisdiction.
- .2 Porcelain enamel signs, minimum size 175 x 250 mm.

2.3 WIRING TERMINATIONS

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

2.4 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates as follows:
 - .1 Nameplates: plastic laminate mm thick plastic engraving sheet, black face, black core, lettering accurately aligned and engraved into core.
 - .2 Sizes as follows:
- .2 NAMEPLATE SIZES
- .3 Size 1 10 x 50 mm 1 line 3 mm high letters
- .4 Size 2 12 x 70 mm 1 line 5 mm high letters
- .5 Size 3 12 x 70 mm 2 lines 3 mm high letters
- .6 Size 4 20 x 90 mm 1 line 8 mm high letters
- .7 Size 5 20 x 90 mm 2 lines 5 mm high letters
- .8 Size 6 25 x 100 mm 1 line 12 mm high letters
- .9 Size 7 25 x 100 mm 2 lines 6 mm high letters
- .10 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .11 Wording on nameplates to be reviewed by Contract Administrator prior to manufacture.
- .12 Allow for minimum of twenty-five (25) letters per nameplate.
- .13 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .14 Junction and Pull Boxes: indicate the load, circuit number (if applicable) or tag number as required.

- .15 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .16 Terminal cabinets and pull boxes: indicate system and voltage.
- .17 Transformers: indicate capacity, primary and secondary voltages.

2.5 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.

2.6 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.

System	Prime colour	Auxiliary colour
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

2.7 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 gray to EEMAC 2Y-1.

3.0 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: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, 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 Canadian Electrical Code.
- .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 centerline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
 - .1 Local switches: 1400 mm.
 - .2 Wall receptacles:
 - .1 General: 300 mm.
 - .2 Above top of continuous baseboard heater: 200 mm.
 - .3 In mechanical rooms: 1400 mm.
 - .3 Panelboards: as required by Code or as indicated.

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 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 Contract Administrator.

- .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 review 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

1.0 General

1.1 REFERENCES

- .1 CSA C22.2 No. 0.3-96, Test Methods for Electrical Wires and Cables.

1.2 PRODUCT DATA

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

2.0 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 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, Jacketted.
- .3 Copper conductors: size as indicated, with thermoplastic insulation type TWU rated at 600 V.
- .4 Neutral supported cable: 1 phase insulated conductors of Copper and one neutral conductor of Copper steel reinforced, size as indicated. Type: NS75 Insulation: Type NS-1 rated 300 V.

2.2 TECK 90 CABLE

- .1 Cable: in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
- .3 Insulation:
 - .1 Ethylene propylene rubber EP.
 - .2 Cross-linked polyethylene XLPE.
 - .3 Rating: , 600 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: flat.
- .6 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.
- .7 Fastenings:
 - .1 One hole malleable iron straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
 - .2 Threaded rods: 6 mm diameter to support suspended channels.
- .8 Connectors:
 - .1 Watertight, explosion-proof approved for TECK cable.

2.3 MARKING

- .1 Conductor insulation shall be marked with information on conductor size, conductor material, insulation type, CSA listings ('RW90', 'RWU90', etc.).
- .2 Cable jacket shall be marked with information on conductor sizes, conductor material, insulation types, cable CSA listings ('TECK90', 'CIC', 'CMP', etc.).

3.0 Execution

3.1 FIELD QUALITY CONTROL

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

3.2 GENERAL CABLE INSTALLATION

- .1 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.
- .3 Conductor length for parallel feeders to be identical.
- .4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .5 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

3.3 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)

- .1 Group cables wherever possible on channels.
- .2 Install cable exposed, securely supported by staples.

END OF SECTION

1.0 General

1.1 REFERENCES

- .1 Section 26 05 00 - Common Work Results for Electrical.
- .2 All other reference Sections

2.0 Products

2.1 SUPPORT CHANNELS

- .1 Components: formed channel sections, concrete inserts complete with anchor caps and insert fillers, nuts, bolts, washers and machine screws, framing and angle fittings, etc., beam clamp hanger rods, supports brackets and other accessories forming an integrated bolted support system.
- .2 Materials:
 - .1 Indoors, ordinary dry locations: form from galvanized sheet steel.
 - .2 Indoors, wet (Category 1 & 2) locations (areas), or outdoors:
 - .1 PVC coated steel acceptable.
 - .2 Fiberglass for light loads.
 - .3 Nuts, bolts, machine screws: stainless steel.
- .3 Standard of acceptance: Unistrut or equal in accordance with Part B - Bidding Procedures.

2.2 ANGLES, CHANNELS

- .1 Materials:
 - .1 Mild steel in ordinary dry locations.
 - .2 Stainless steel (304) in category 1 & 2 locations.
 - .3 PVC coated steel acceptable.
- .2 Components: standard structural shapes.
- .3 Nut, bolts, machine screws, all hardware and miscellaneous components - stainless steel (304).

2.3 CONCRETE AND MASONRY ANCHORS

- .1 Materials: stainless steel inserts.
- .2 Components: non-drilling anchors for use in predrilled holes.
- .3 Manufacturer: Hilti (Canada) Limited or equal in accordance with Part B - Bidding Procedures.

2.4 NON-METALLIC ANCHORS

- .1 Material: plastic anchors for sheet metal or wood screws.
- .2 Manufacturer: Hilti (Canada) Limited or equal in accordance with Part B - Bidding Procedures.

2.5 CONDUIT SUPPORTS

- .1 General: one-hole conduit straps and two hole conduit straps.
- .2 Structural Steel: Efcor Jay Clamps or equal in accordance with Part B - Bidding Procedures.
- .3 Masonry, concrete, stone, etc.: anchors.
- .4 Tile: toggle bolts.
- .5 Metal studs, ceiling hangars, etc.: "Caddy-Clips"
- .6 Materials:

- .1 Indoors, ordinary dry locations: form from galvanized sheet steel.
- .2 Indoors, wet (Category 1 & 2) locations (areas), or outdoors:
 - .1 PVC coated steel acceptable.
 - .2 Fiberglass for light loads.
- .3 Nuts, bolts, machine screws: stainless steel.

2.6 CABLE SUPPORT AND CLAMPS

- .1 General: per conduit supports, except that for single conductor cables, suitable non-ferrous clamps shall be used.

3.0 Execution

3.1 INSTALLATION

- .1 Support equipment, outlet boxes, junction boxes, panel tubs, etc., on rigid backing, independent of conduits running to them. Do not support on sheet metal such as siding or ductwork.
- .2 Do not cut or drill beams, joists of structural steel unless written permission of the Structural Engineer is obtained. Do not support heavy loads from bottom chords of open web steel joists.
- .3 Supports to be suitable for the live and dead loads imposed by equipment, plus snow loads as applicable, where this is deemed necessary.
- .4 Secure equipment to poured concrete with expandable inserts.
- .5 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .6 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.
- .7 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .8 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.
- .9 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.
 - .2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.
- .10 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .11 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .12 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .13 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and acceptance of Construction Manager.
- .14 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.
- .15 For installation in Category 1 & 2 areas, all support material to be selected for resistance to corrosion, such as stainless steel, fiberglass, or other suitable material.

END OF SECTION

1.0 General

1.1 REFERENCES

- .1 Section 26 05 00 - Common Work Results for Electrical.
- .2 All other reference Sections.

1.2 SHOP DRAWINGS AND PRODUCT DATA

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

2.0 Products

2.1 SPLITTERS

- .1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Ampacity rating and lug sizing for conductors as indicated on drawing.
- .3 At least three spare terminals on each set of lugs in splitters less than 400 A.

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 19 mm plywood backboard for surface mounting.

2.4 ENCLOSURES

- .1 NEMA 4X, or NEMA 6P based on application. Match area classifications and construction materials and methods as specified for each area.

3.0 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 indicated in Type T cabinets.
- .4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.3 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Install size 2 identification labels indicating system name, voltage, and phase.

END OF SECTION

1.0 General

1.1 REFERENCES

- .1 The most current edition of the following:
- .2 Canadian Standards Association (CSA International)
 - .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
 - .2 CSA C22.2 No. 45, Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83, Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.
 - .6 CAN/CSA C22.2 No. 227.3, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).

1.2 LOCATION OF CONDUIT

- .1 Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only. Coordinate routes on site to provide neat installation.

2.0 Products

2.1 CONDUITS

- .1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .3 Flexible metal conduit: to CSA C22.2 No. 56, steel.

2.2 CONDUIT FASTENINGS

- .1 One hole straps to secure surface conduits 53 mm and smaller. Two hole steel straps for conduits larger than 53 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1.5 m spacings.
- .4 Threaded rods, 9 mm dia., to support suspended channels.
- .5 The standard of acceptance shall be uni-strut or equal in accordance with Part B - Bidding Procedures.
- .6 The Contractor may utilize hot-dipped galvanized after fabrication, for special supports in dry plant areas as directed by the Construction Manager if suitable manufactured supports are not available.

2.3 CONDUIT FITTINGS

- .1 Fittings: Manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory "elbows" where 90° bends are required for 53 mm and larger conduits.
- .3 Fittings for EMT to be steel. Watertight connectors and couplings where required. Set-screws are not acceptable.

2.4 FISH CORD

- .1 Polypropylene.

3.0 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms.
- .3 Use electrical metallic tubing (EMT) except in cast concrete.
- .4 Use flexible metal conduit for connection to motors in dry areas.
- .5 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .6 Minimum conduit size for lighting and power circuits: NPS 3/4.
- .7 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .8 Mechanically bend steel conduit over 19 mm diameter.
- .9 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .10 Install fish cord in empty conduits.
- .11 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
- .12 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONDUITS UNDERGROUND

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

3.5 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

1.0 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 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2 No. 47 - Air-Cooled Transformers (Dry Type).
 - .2 CSA C9-, Dry-Type Transformers.
- .2 National Electrical Manufacturers Association (NEMA)

1.3 PRODUCT DATA

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

2.0 Products

2.1 TRANSFORMERS

- .1 Use transformers of one manufacturer throughout project and in accordance with CAN/CSA-C22.2 No. 47, and CAN/CSA C802.2-00.
- .2 Design 1.
 - .1 Type: ANN.
 - .2 kVA, as indicated on plans.
 - .3 Input: 600 V, 3 phase, delta connected.
 - .4 Output: 120/208 V, 3 phase, 4 wire, Y-connected.
 - .5 "T" connected (or, Scott connected) windings are not acceptable.
 - .6 Voltage taps: standard.
 - .7 Insulation: Class H, 150°C temperature rise.
 - .8 Basic Impulse Level (BIL): standard.
 - .9 Hipot: standard.
 - .10 Sound Level: low noise, with internal and external vibration damping.
 - .11 Impedance at 170°C: standard.
 - .12 Enclosure: NEMA 4X.
 - .13 Mounting: as indicated on plans.
 - .14 Finish: in accordance with Section 26 05 00 - Common Work Results for Electrical.
 - .15 Windings: copper.
- .3 Transformers located in areas where fire protection sprinklers are located shall be complete with a non-combustible hood or shield to prevent spray from fire protection sprinklers from entering the transformer.
- .4 Transformers located in process areas or other corrosive or wet locations shall be NEMA 4X.
- .5 Manufacturers: Bemag, Hammond, Rex, Delta, or equal in accordance with Part B - Bidding Procedures.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Label size: 7. Specify the following:
 - .1 Capacity in kVA

- .2 Primary voltage and source
- .3 Secondary voltage
- .4 3 phase
- .5 Disconnect location and circuit number

3.0 Execution

3.1 INSTALLATION

- .1 Floor mount dry type transformers or 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 Where mounted on floor, install on 100 mm high concrete housekeeping pad.
- .7 Energize transformers after installation is complete.
- .8 Field adjust tap settings as required to achieve proper voltage.
- .9 Maintain minimum transformer enclosure clearance as per C22.1-09, section 26-248

3.2 CONNECTIONS

- .1 Make primary and secondary with liquid tight flexible conduit in accordance with wiring diagram.
- .2 Do not make primary or secondary connections through top of transformer.

3.3 NOISE/VIBRATION ISOLATION

- .1 Isolate transformer noise and vibration. Provide neoprene isolation for support of the transformer, and utilize flexible wiring connections.
- .2 Utilize Vibro-Acoustics type NSN resilient elements below transformers.

3.4 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

END OF SECTION

1.0 General

1.1 SECTION INCLUDES

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

1.2 REFERENCES

- .1 The most current edition of the following:
- .2 Canadian Standards Association (CSA International)
 - .1 CSA C22.2No.29, 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.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Dispose of waste materials in accordance with Section 26 05 00 - Common Work Results for Electrical.

2.0 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 Interrupting capacity: 250 V panelboards: bus and breakers rated for 22 kA (RMS symmetrical); 600 V panelboards: bus and breakers rated for 22 kA (RMS symmetrical); 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: baked grey enamel.
- .10 Enclosure: NEMA 4X.

2.2 BREAKERS

- .1 Breakers: to Section 26 28 21 - Circuit Breakers.
- .2 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

2.3 EQUIPMENT IDENTIFICATION

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

3.0 Execution

3.1 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Mount panelboards to height specified in Section 26 05 00 - Common Work Results for Electrical or as indicated.
- .3 Connect loads to circuits.
- .4 Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION

1.0 General

1.1 PRODUCT DATA

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

1.2 OPERATION AND MAINTENANCE DATA

- .1 Provide data for incorporation into electrical maintenance manual as specified in Section 01 33 00 - Submittal Procedures.

2.0 Products

2.1 MAIN ELECTRICAL SERVICE AND DISTRIBUTION

- .1 Equipment shall be 3 phase, 4 wire, with full capacity neutral. Bussing shall be braced for 22 kA or greater fault levels at 600 volts. All breakers in the distribution center shall have interruption capacities to match, or as indicated.
- .2 The service entrance equipment and main distribution section shall consist of the following components:
 - .1 Incoming cable provision.
 - .2 Main circuit breaker.
- .3 The main distribution shall be a floor mounted, front access assembly constructed of 11 gauge steel frame and 12 gauge steel bolt on panels. The assembly shall be rated as a NEMA 4X enclosure, suitable for area to be installed in.
- .4 The assembly shall be complete with ground bus and covers for unused spaces.
- .5 Acceptable Manufacturers: Schneider, Allen Bradley, Eaton, or equal in accordance with Part B - Bidding Procedures.

3.0 Execution

3.1 INSTALLATION

- .1 Install distribution centre on 150 mm base. Base shall be Uni-strut channel stainless steel base. Bolt base on concrete floor.
- .2 Examine and torque all bus connections.
- .3 Securely bond the ground bus to the building ground system, with new 3/0 copper conductors.
- .4 Shape incoming conductors and feeder conductors prior to connecting to breakers so that no strain is placed on breaker support hardware or main lugs.
- .5 Provide a minimum of 1000 mm clear space in front of the distribution centre.
- .6 Provide adequate protection of electrical equipment, from damage.

3.2 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Provide engraved nameplates for each breaker. Nameplates to be size 4.
- .3 Nameplate (75 mm H x 150 mm W) identifying amperage, voltage, phase, installing contractor, and electrical consultant.

END OF SECTION

1.0 General

1.1 REFERENCES

- .1 The most current edition of the following:
- .2 Canadian Standard Association (CSA International).
 - .1 CSA C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CAN/CSA C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
 - .3 CSA C22.2 No.55, Special Use Switches.
 - .4 CSA C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20).

1.2 SHOP DRAWINGS AND PRODUCT DATA

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

2.0 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 Urea moulded housing to match existing. (Where applicable).
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Four side wiring screws.
 - .5 Triple wipe contacts and rivetted grounding contacts.
- .3 Other receptacles with ampacity and voltage as indicated.
- .4 Receptacles of one manufacturer throughout project.
- .5 Receptacles to be specification grade.

2.2 COVER PLATES

- .1 Cover plates for wiring devices to: CSA C22.2 No.42.1.
- .2 Stainless steel, vertically brushed, 1 mm thick cover plates for wiring devices mounted in surface-mounted outlet box.
- .3 Cover plates from one manufacturer throughout project.

2.3 SWITCHES

- .1 15 A, 120 V, single pole, three-way, switches to: CSA-C22.2 No. 55 and CSA-C22.2 No. 111.
- .2 15 A, 345 V, single pole, three-way, switches to: CSA-C22.2 No. 55 and CSA-C22.2 No. 111.
- .3 Manually-operated general purpose AC switches with following features:
 - .1 Terminal holes approval 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 Toggle colour to match existing. (Where applicable).

- .4 Switches of one manufacturer throughout project.
- .5 Provide weatherproof, corrosion resistant switches in humid, damp, wet, or corrosive locations. Body, operating lever, and exposed parts shall be of fiberglass or other resistant materials.

3.0 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wiring devices installation in accordance with manufacturer's written instructions.
 - .1 Visually review substrate in presence of Contract Administrator.
 - .2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written direction to proceed from Contract Administrator.

3.2 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 for Electrical.
 - .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
 - .4 Install GFI type receptacles as indicated.
- .2 Cover plates:
 - .1 Install suitable common cover plates where wiring devices are grouped.
 - .2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
- .3 Repair damage to adjacent materials caused by wiring device installation.

END OF SECTION

1.0 General

1.1 SECTION INCLUDES

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

1.2 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).

1.3 SUBMITTALS

- .1 Submit 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 14,000 A symmetrical (rms) and over at system voltage.

2.0 Products

2.1 BREAKERS GENERAL

- .1 Moulded-case circuit breakers, circuit breakers, ground fault circuit-interrupters, fused circuit breakers, and accessory high-fault protectors: to CSA C22.2 No. 5.
- .2 Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .3 Plug-in moulded case circuit breakers: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .4 Common-trip breakers: with single handle for multi-pole applications.
- .5 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 3-10 times current rating.
- .6 Circuit breakers with interchangeable trips as indicated.
- .7 Voltage and current ratings as indicated on the drawings to match the application.
- .8 Interrupting current ratings to match the panel in which they are installed.
- .9 Enclosure to suit environment of installation for standalone breaker, enclosure rated 'service entrance' for standalone main breaker.

2.2 THERMAL MAGNETIC BREAKERS DESIGN A

- .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 MAGNETIC BREAKERS DESIGN B

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

2.4 CURRENT LIMITING AND SERIES RATED THERMAL MAGNETIC BREAKERS DESIGN C

- .1 Thermal magnetic breakers with current limiters.
 - .1 Time current limiting characteristics of fuses limiters coordinated with time current tripping characteristics of circuit breaker.
 - .2 Co-ordination to result in interruption by breaker of fault-level currents up to interrupting capacity of breaker.
- .2 Series rated breakers to be manufacturer tested and listed. Breakers to be applied following manufacturer's guidelines and accepted best practice.
 - .1 Breakers applied following manufacturer's guidelines and accepted best practice.

2.5 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 trip under overload condition, and long time, short time, and instantaneous tripping for phase and ground fault short circuit protection.
- .2 LSI breakers shall have:
 - .1 Independently adjustable long time ampere pickup.
 - .2 Independently adjustable long time delay.
 - .3 Independently adjustable short time pickup.
 - .4 Independently adjustable short time delay.
 - .5 Independently adjustable defeatable instantaneous pickup.

2.6 EQUIPMENT IDENTIFICATION

- .1 In accordance with Section 26 05 00 - Common Work Results for Electrical.

2.7 OPTIONAL FEATURES

- .1 Include:
 - .1 Shunt trip.
 - .2 Auxiliary switch.
 - .3 Motor-operated mechanism c/w time delay unit if specified.
 - .4 Under-voltage release.
 - .5 On-off locking device.
 - .6 Handle mechanism.

3.0 Execution

3.1 INSTALLATION

- .1 Install circuit breakers as indicated.
- .2 Install breaker locks as indicated, and on equipment such as emergency lighting, exit lighting, fire alarm and any life safety equipment.
- .3 Contractor to ensure breakers are set in accordance with manufacturers guidelines and to short circuit study information.
- .4 Supply and install all related hardware required to install breakers in the indicated equipment.

END OF SECTION

1.0 General

1.1 SECTION INCLUDES

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

1.2 REFERENCES

- .1 The most current edition of the following:
- .2 Canadian Standards Association (CSA International).
 - .1 CAN/CSA C22.2 No.4, Enclosed Switches.
 - .2 CSA C22.2 No.39, 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 Part D - Supplemental Conditions.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Dispose of waste in accordance with Section 26 05 00 - Common Work Results for Electrical.

2.0 Products

2.1 DISCONNECT SWITCHES

- .1 Fusible and non-fusible, disconnect switch in CSA Enclosure to suit location size as indicated.
- .2 Provision for padlocking in on-off switch position by three locks.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Exterior mounted disconnect door to prevent opening when handle in ON position.
- .5 Fuseholders: to CSA C22.2 No.39 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.
- .8 Shall be lockable
- .9 Solid neutral for 4-wires, 3 phase and 3 wire, 1 phase applications.
- .10 Horsepower rated for motor applications.

2.2 EQUIPMENT IDENTIFICATION

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

3.0 Execution

3.1 INSTALLATION

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

END OF SECTION

1.0 General

1.1 REFERENCES

- .1 The most current edition of the following:
- .2 American National Standards Institute (ANSI)
 - .1 ANSI C82.1, Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.
 - .2 ANSI C82.4, Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps Multi Supply Type.
- .3 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE C62.41, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
- .4 ASTM International Inc.
 - .1 ASTM F1137, Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.
- .5 Canadian Standards Association (CSA International)

1.2 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 Contract Administrator.
- .3 Photometric data to include:
 - .1 Total input volt - amps (maximum at any time during the start run-run cycle.)
 - .2 Candela
 - .3 Distribution zonal lumen summary
 - .4 Luminaire efficiency
 - .5 Coefficient of utilization
 - .6 Lamp type

1.3 SPARE LAMPS

- .1 Provide spare lamps as follows:
 - .1 5% of each lamp type, with a minimum of 2 per type.

1.4 GUARANTEE

- .1 Replace:
 - .1 Fluorescent and HID lamps burning out within 6 months of takeover.
 - .2 Ballasts that fail or exceed their original noise level rating within 12 months of takeover.

2.0 Products

2.1 LAMPS

- .1 Fluorescent lamps to be - T8, 32 Watt, medium bi-pin, rapid-start, 4100 K, 30,000 hour lamp life, 2950 initial lumens, CRI 80; or as indicated.

2.2 BALLASTS

- .1 Fluorescent ballast (T8): CBM and CSA certified, energy efficient type, electronic instant start design.
 - .1 Rating: shall be as indicated in luminaire schedule with a range of plus or minus 10% of nominal.

- .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 %.
- .5 Crest factor: shall not exceed 1.5.
- .6 Capacitor: thermally protected.
- .7 Thermal protection: on coil.
- .8 Harmonics: ballasts shall meet all applicable ANSI and IEEE standards regarding harmonic distortion, and as a minimum, input current THD content shall be less than 10%.
- .9 Operating frequency of electronic ballast: 21 kHz or higher.
- .10 Total Circuit Power: total ballast watts (2-F32T8 lamps) shall not exceed 62 input Watts.
- .11 Ballast Factor: greater than 0.90.
- .12 Sound rated: Class A.
- .13 Mounting: integral with luminaire.
- .14 In failed lamp mode, the ballast shall shut off or operate remaining lamp at <32% THD and >0.85 power factor.
- .15 Warranty: 3 year.
- .16 Ballast manufacturer: shall be Advance, Magnatek, or Osram and meet Power Smart characteristics.

2.3 FINISHES

- .1 To match with the existing make and model.

2.4 LUMINAIRES

- .1 To match with the existing make and model.

3.0 Execution

3.1 INSTALLATION

- .1 Locate and install luminaires as indicated. Mounting height to match with existing.
- .2 Provide adequate support to suit ceiling system.

3.2 WIRING

- .1 Connect luminaires to lighting circuits:

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.

3.5 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1.0 General

1.1 REFERENCES

- .1 The most current edition of the following:
- .2 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.141-02, Unit Equipment for Emergency Lighting.
 - .2 CSA C860-01(December 2002), Performance of Internally-Lighted Exit Signs.
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 101-2006, Life Safety Code.

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Quality Assurance Submittals: submit following in accordance with Section 01 45 00 - Quality Control.
 - .1 Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.

2.0 Products

2.1 STANDARD UNITS

- .1 Shall be LED exit sign consist of a green pictogram and a white or lightly tinted graphic meeting the colour specification referred to in ISO 3864-1 as per latest edition of National Building Code and Manitoba Building Code. Unit should include a test switch and high charge pilot light. The light source for the exit sign shall be light-emitting diodes (LED). The LED lamps shall provide illumination in normal and emergency operation and shall be mounted inside the exit housing, not on the face.
- .2 Exit sign shall be industrial grade and suitable for dust and corrosive environment.

2.2 MANUFACTURERS

- .1 Minimum standard of acceptance; Thomas & Betts or equal in accordance with Part B - Bidding Procedures. Unit must conform to CSA C860 an Manitoba Hydro Power Smart criteria
- .2 Single face with die-cast face plate to remain captive for relamping.
- .3 Arrow: right.
- .4 Wireguard.

3.0 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install exit lights to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.
- .2 Connect fixtures to exit light circuits as indicated.
- .3 Connect emergency lamp sockets to emergency circuits.
- .4 Coordinate installation of exit lights with ceiling or wall construction. If necessary provide hanger to suspend exit light below visual obstructions.
- .5 Exit lighting/emergency light shall furnish exit illumination from the normal AC source. When power failure occurs the exit sign shall run from a battery pack and illuminate for a minimum of 1.5 hours.
- .6 Install exit lights in plain view as indicated and in accordance with latest edition of the Nation Building Code.
- .7 Ensure that exit light circuit breaker is locked in on position.

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