PART 1 - GENERAL

1.1 General

.1 Include in electrical section, provision of labour, new materials, tools, transportation, services and facilities for a complete electrical installation. The installation shall be left complete in all respects and ready for operation to the complete satisfaction of the responsible Departmental Representative.

.2 The electrical scope of work includes, but is not necessarily limited to the following provisions:

.1 Provision of new electrical including new weather-proof power pedestal and associated feeders, all branch circuitry as indicated and as required. Any new circuit breakers required in existing panelboards are to match existing manufacturer and type.

.2 Provision of lighting, associated switching, control, and branch circuitry. (See drawings and Luminaire Schedule for details). Direct type A & B heads on all type L luminaires to illuminate river walk (unless otherwise indicated). Allow for re-aiming the fixtures one additional time with Departmental Representative.

.3 Provision of code conforming emergency lighting including remote dual heads and DC battery banks to accommodate connected load plus a minimum of 25% additional load, for a duration of 30 minutes.

.4 Provision of receptacles and branch circuitry as indicated on the drawings and as per code.

.5 Provision of wire & connection of all mechanical equipment. Refer to mechanical for details. Coordinate equipment requirements with Mechanical Contractor.

.6 Provision of new electric heaters and hand dryers as indicated including branch circuitry.

.7 Provision of electrical demolition as indicated and as required to remove existing site lighting, electrical within the orientation node building, and associated wiring and raceways. Contractor is to visit the site and review existing conditions prior to tender.

END

Part 1 General

1.1 Codes and Standards

.1 Do complete installation in accordance with CSA C22.1 as ammended by the Winnipeg Electrical Bylaw, except where specified otherwise.

.2 Comply with CSA Electrical Bulletins in force at time of tender submission, while not identified and specified by number in this Division, are to be considered as forming part of related CSA Part II standard.

.3 Do overhead and underground systems in accordance with CSA C22.3No.1-M1979 except where specified otherwise.

.4 Do complete installation in accordance with latest Electrical Bulletins of the local inspection authority.

.5 Abbreviations for electrical terms: to CSA Z85-1963.

1.2 Permits, Fees

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

.2 Pay associated fees.

.3 Architect will provide drawings at no cost.

1.3 Shop Drawings, Product Data and Samples

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

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

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

.4 Include wiring drawings or diagrams showing interconnection with work of other Sections and Divisions.

.5 Include shop drawings for all electrical items and equipment including wiring devices, motor starters, distribution equipment, luminaires, etc.

1.4 Operation and Maintenance Data

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

.2 Include in operations and maintenance data:
.1 Details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.
.2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature not acceptable.
.3 Wiring and schematic diagrams and performance curves.
.4 Names and addresses of local suppliers for items included in maintenance manuals.

.3 O & M manuals to be provided in hard copy and electronic ".PDF" format.

1.5 Maintenance Materials

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

1.6 Care, Operation and Start-up

.1 Instruct operating personnel in the operation, care and maintenance of equipment.

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

.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.

1.7 Voltage Ratings

.1 Operating voltages: to CSA C235-1969(R1979).

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Where appliances such as stoves are supplied by other sections, advise the General Contractor in writing of the voltage at the outlet.

1.8 Inspection

.1 Furnish a Certificate of Acceptance from Inspection Department on completion of work.

1.9 Materials and Equipment

.1 Shall be new and CSA approved.

.2 Shall be manufactured in accordance with current CEMA, NEMA, or CSA standards.

.3 Bidders shall submit a quotation only on the material and equipment specified and as shown on the drawings.

.4 No lot pricing shall be allowed. Distributors submitting prices to Electrical Contractors shall not group products and materials.

.5 Requests for approval of material and equipment, other than those specified on the drawings, shall conform to Division 1 requirments. Requests for approval shall be submitted with complete details of the construction and performance of the materials and equipment. Requests submitted without sufficient supporting information shall be rejected.

.6 Materials and equipment of the same classification, type of function, shall be provided by the same manufacturer.

.7 Shall be sprinkler-proof. Nema 1 enclosures will not be accepted.

.8 All new products shall contain low VOC content.

1.10 Electric Motors, Equipment and Controls

.1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

.2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 23 and shown on mechanical drawings.

1.11 Finishes

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

.1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1-1955.

.2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1-1958.

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

.3 Clean, prime and paint exposed hangers, racks, fastenings to prevent rusting.

1.12 Equipment Identification

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

.2 Nameplates:
.1 Lamacoid 5mm thick plastic engraving sheet, black face, white core, mechanically attached unless specified otherwise.

NAMEPLATE SIZES

Size 1 13x38 mm 1 line 3mm high letters
Size 2 13x51 mm 1 line 5mm high letters
Size 3 13x51 mm 2 lines 3mm high letters
Size 4 19x76 mm 1 line 8mm high letters
Size 5 19x76 mm 2 lines 3mm high letters
Size 6 25x102 mm 1 line 13mm high letters
Size 7 25x102 mm 2 lines 6mm high letters

.3 Wording on nameplates to be approved prior to manufacture.

.4 Allow for average of twenty-five (25) letters per nameplate.

.5 Identification to be English.

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

.7 Panelboards and distributions shall indicate panel designation, voltage, phase, and where fed from.

.8 Identify all electrical equipment such as motor starters, panelboards, distributions, distribution circuit breakers with nameplates.

.9 Identify all wiring devices (switches and receptacles) and disconnect switches indicating panel and circuit number. All self-adhesive labels must be pre-approved prior to use. Provide sample to Architect and Departmental Representative.

1.13 Wiring Identification

.1 Identify wiring with permanent indelible identifying markings, either numbered or 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 code: to CSA C22.1.

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

1.14 Conduit and Cable Identification

.1 Colour code conduits 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 to be 1 inch wide prime colour and 19mm wide auxiliary colour.

Prime/Auxiliary	
yellow	up to 250 V
yellow/green	up to 600 V
yellow/blue	up to 5 kV
yellow/red	up to 15 kV
green	Telephone
green/blue	Lighting
red	Fire Alarm
red/blue	Emergency voice
red/yellow	Other systems

1.15 Wiring Terminations

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

1.16 Manufacturers and CSA labels

.1 Manufacturers nameplates and CSA labels to be visible and legible after equipment is installed.

1.17 Warning Signs

.1 Provide warning signs, as specified or to meet requirements of Inspection Department and Departmental Representative.

1.18 Location of Outlets

.1 Make all necessary adjustments after interior finishes are completed.

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

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

.4 Locate light switches on latch side of doors. Locate disconnect devices in mechanical rooms on latch side of door. Confirm direction of door swing on Architectural drawings prior to installation.

1.19 Mounting Heights

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

.2 If mounting height of equipment is not indicated verify before proceeding with installation.

.3 Confirm luminaire locations with Architect prior to rough-in.

.4 Install electrical equipment at the following heights unless indicated otherwise.
- .1 Local switches: 1200mm.
- .2 Wall receptacles:
  - .1 General: 4500mm.
  - .2 Above top of continuous baseboard heater: 200mm.
  - .3 Above top of counters or splash back: 200mm.
  - .4 In mechanical rooms: 1200mm
- .3 Panelboards: as required by Code.
- .4 Telephone outlets: 450mm
- .5 In accordance with accessibility guidelines CAN/CSA B651-04.

1.20 Protection

.1 Protect exposed live equipment during construction for personnel safety.

.2 Shield and mark live parts "LIVE 120 VOLTS", or with appropriate voltage in English.

.3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

1.21 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 Submit, at completion of work, a report listing phase and neutral currents on panelboards operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

1.22 Conduit and Cable Installation

.1 Install conduit, and sleeves, prior to pouring of concrete. Sleeves through concrete: metal, sized for free passage of conduit, and protruding 52mm.

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

.3 All penetrations through exterior walls are to be made water and weatherproof.

1.23 Fireproofing

.1 Where cables or conduits pass through floors and fire rated walls, complete integrity of wall type to the satisfaction of the Departmental Representative and local inspection authority. All products are to be approved prior to installation.

1.24 Tests

.1 Conduct and pay for tests of the following:
  .1 Lighting and it's control.

.2 Furnish manufacturer's, certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturers instructions.

.3 Carry out tests in presence of Departmental Representative.

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

.5 Submit test results.

1.25 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.

1.26 Co-ordination of Protective Devices

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

1.27 Cleaning

.1 Clean all outlets, cabinets, enclosures, tubs and similar electrical equipment of all construction dust and dirt.

.2 At time of final cleaning, clean lighting reflectors, lenses, and other lighting surfaces that have been exposed to construction dust and dirt.

.3 Clean all coverplates and insure all paint is removed from wiring devices, panels, luminaires and other electrical equipment.

1.28 Excavation and Backfilling

.1 Ensure that excavation for underground electrical services is in location, configuration and depth in accordance with CSA22.1. Electrical contractor to provide and directly supervise excavation and backfilling.

.2 All work to be accordance with the latest eddition of CSA22.1.

.3 Identify all existing underground utilities prior to excavation. Take care not to damage same.

1.29 Guarantee

.1 The Electrical Contractor shall quarantee the satisfactory operation of all work and apparatus included and installed under this section of the specification.

.2 Replace forthwith at no additional material, or labour cost any part which may fail or prove defective within a period of twelve (12) calender months after the final acceptance of the complete building, provided that such failure is not due to improper usage, or ordinary wear and tear.

.3 No certificate given payment made, partial or entire use of the equipment by the Owner, shall be construed as acceptance of defective work.

.4 This general guarantee shall not act as a waiver of any specified guarantee for any greater length of time.

1.30 Cutting and patching

.1 Pay all costs for cutting and patching required for the installation of electrical work.

.2 Assume full responsibility for laying out electrical work and for any damage caused by incorrectly located equipment or improper performance of this work.

.3 Study the architectural plans and co-operate with other trades so that the elevation of all outlets shall not necessitate any unnecessary cutting of dados, mirrors, tiles or other construction material. If this is not done, the Electrical Contractor may be required by the Departmental Representativeto move these outlets at no additional cost to the Owner (including repair).

1.31 Co-operation

.1 Schedule execution of work with associated work specified in other Divisions. Check shop drawings of other sections prior to electrical rough-in to co-ordinate physical and electrical requirements. Adjust as required.

1.32 Drawings

.1 Carefully examine all drawings and specifications relating to the work to be certain that the work under this contract can be satisfactorily carried out and prior to submission of tender, examine the work of the other trades and report at once to the Departmental Representative, any defect, discrepancy, omission or interference affecting the work of section or the warranty of same.

.2 The drawings accompanying these specifications are intended to show the general arrangement and extent of the work to be done, but the exact location and arrangement of all parts shall be determined as the work progresses. The location of the outlets, equipment, etc. as given on the drawings are approximately correct but it shall be understood that they are subject to such modifications as may be found necessary or desirable at the time of installation to meet any structural, mechanical or architectural conditions. Such changes shall be made by the Electrical Contractor, as directed by the Departmental Representative without additional charge.

.3 At completion of project, provide a complete print of revisions, additions and conduit location as-built drawings to the satisfaction of the Departmental Representative. Information is to include conduit runs (routes and sizes), junction and pull boxes, j-hooks, final circuitry (existing and new circuit numbers), branch feeder sizes, types and quantities, incorporation of all addendums, clarifications, pcns, etc. Provide electronic AutoCAD ".dwg" format files of as-builts. Departmental Representative will provide electronic copies of original electrical drawings.

1.33 Air Quality Control

.1 Indoor Air Quality Control Requirements: Perform work in accordance with IAQ requirements specified in Section 01 81 19.

1.34 Spare Parts

.1 Provide the following spare parts to the Departmental Representative at the close of the project:
.1 Lighting: 10% of all refurbished pole globe lenses (upper and lower sizes), 10% of all type A & B flood lights on type L# luminaires (including snoot/visor), two(2) type N6 luminaires, three(3) type T luminaires, two(2) type B luminaires.

END

PART 1 - GENERAL

1.1 Related Work

.1 Wire and Cable: Section 26 05 21

.2 Outlet Boxes: Section 26 05 32

PART 2 - PRODUCTS

2.1 Materials

.1 Connectors complete with locking bushings for armoured cable.

.2 Aluminum "wet" type or "dry" type for aluminum sheathed cable depending on application.

.3 Wet type connectors for sealtite flexible conduit.

PART 3 - EXECUTION

3.1 Installation

.1 Remove insulation carefully from ends of conductors and:
- .1 Install connector in box.
- .2 Install conductor in connector and tighten. Complete joints inside box using Marrette type connectors.

END

PART 1 - GENERAL

1.1 Related work Specified elsewhere

.1 Conduit: Section 26 05 34

PART 2 - PRODUCTS

2.1 Materials

.1 Conductors: stranded for 8 AWG and larger.

.2 Copper conductors sized as indicated with minimum size to be #12 AWG rated RW90 : to CAN/CSA-C22.2 No. 0.3-M96.

.3 Copper conductors with minimum size #18 AWG for fire alarm initiating circuits only.

.4 Minimum size: 12 AWG.

2.2 Armoured Cables

.1 Insulated conductors copper, sizes as indicated.

.2 Type AC90: toCSA C22.2 No.51-1968.

.3 Armour: interlocking type fabricated from aluminum strip.

2.3 Aluminum Sheathed Cable

.1 Conductors: copper sized as indicated.

.2 Insulation: type RA90 rated 90 °C at 600 V.

.3 Sheath: aluminum applied to form continuous corrugated seamed sheath.

.4 Outer jacket of pvc applied over sheath for direct burial and wet locations.

2.4 Fastenings

.1 Two hole aluminum straps to secure surface cables.

.2 Channel type supports for two or more conductors.

.3 6 mm diam threaded rods to support suspended channels.

PART 3 - EXECUTION

3.1 Installation

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

.2 Armoured Cables shall be installed only where permitted in lieu of flexible conduit as indicated in Section 26 05 34.

.3 Armoured cable shall not be surface run.

.4 Home runs to panelboards shall not be armoured cable.

.5 Group aluminum sheathed cables wherever possible on channels.

.6 Terminate cables in accordance with manufacturers instructions and to the satisfaction of the local inspection authority.

.7 Provide dedicated neutrals for all lighting circuits that incorporate dimming.

.8 Night light circuitry is to be run independently from all other circuitry.

END

PART 1 - GENERAL

PART 2 - PRODUCTS

2.1 Materials

.1 Grounding equipment to: CSA C22.2No.41 1950(R1967).

.2 Copper grounding conductors to: ASA G7.1- 1964.

2.2 Equipment

.1 Clamps for grounding of conductor, size as required to electrically conductive underground water pipe or ground rods as required by inspection authority.

.2 System and circuit, equipment, grounding conductors, bare stranded copper, soft annealed, size as required.

.3 Insulated grounding conductors to Section 26 05 21.

.4 Non-corroding accessories necessary for grounding systems, type, size, material as required, including but not necessarily limited to:
- .1 Grounding and bonding bushings.
- .2 Thermit welded type conductor connectors.
- .3 Bolted type conductor connectors.
- .4 Bonding jumpers, straps.

2.3 Manufacturers

.1 Acceptable manufacturers: Burndy, Cadweld, Erico.

PART 3 - EXECUTION

3.1 Installation General

.1 Install complete permanent, continuous, system and circuit, equipment, grounding systems including, ground electrodes, conductors, connectors, accessories, as indicated, to conform to requirements of Departmental Representative and local authority having jurisdiction over installation. Where EMT is used, run ground wire in conduit.

.2 Install connectors to manufacturers instructions.

.3 Protect exposed grounding conductors from mechanical injury.

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

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

.6 Soldered joints not permitted.

.7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.8 Install separate ground conductor, to outdoor lighting standards.

.9 Provide a ground wire in all conduits, regardless of type of conduit.

3.2 Electrodes

.1 Make ground connections to continuously conductive underground water pipe on street side of water meter if available.

.2 Install rods as required by local inspection autority. Provide all grounding as per local inspection authority requirements.

3.3 Tests

.1 Perform tests in accordance with Section 260501.

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

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

END

PART 1 - GENERAL

1.1 Related Work

.1 General Provisions: Section 26 05 01

PART 2 - PRODUCT

2.1 Support Channels

.1 U shape, size 38mm x 38mm, 25mm thick, surface mounted, suspended, set in poured concrete walls and ceilings as required.

2.2 Manufacturers

.1 Acceptable manufacturers: Burndy, Electrovert, Unistrut

2.3 Fastenings

.1 Lead anchors or nylon shields to secure equipment and conduit straps.

PART 3 - EXECUTION

3.1 Installation

.1 Secure fastenings and supports as required for each type of equipment, cables and conduits and to manufacturers installation recommendations.

END

PART 1 - GENERAL

1.1 Shop Drawings and Product Data

.1 Submit shop drawings and product data for cabinets in accordance with Section 260501.

PART 2 - PRODUCTS

2.1 Junction and Pull Boxes

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

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

.3 Provide cast junction boxes for all exterior/weatherproof installations.

PART 3 - EXECUTION

3.1 Junction, Pull Boxes and Cabinets Installation

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 1830mm above finished floor.

.3 Provide pull boxes so as not to exceed 30m of conduit run between pull boxes.

3.2 Identification

.1 Install size 2 identification labels indicating system name voltage and phase in accordance with Section 260501.

END

PART 1 - GENERAL

1.1 Related Work

.1 Box connectors: Section 260520.

PART 2 - PRODUCT

2.1 Outlet and Conduit Boxes General

.1 Size boxes in accordance with CSA C22.1, Section 12.

.2 100mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

2.2 Sheet Steel Outlet Boxes

.1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 75mm x 50mm x 38mm or as required. 100mm square outlet boxes when more than one conduit enters one, side with extension and plaster rings as required.

.2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 100mm x 50mm x 50mm.

.3 100mm square or octagonal outlet boxes for lighting fixture outlets.

.4 100mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster or tile walls.

2.3 Masonry Boxes

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

2.4 Concrete Boxes

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

2.5 Floor Boxes

.1 Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with brass faceplate. Device mounting plate to accommodate short or long ear duplex receptacles. Minimum depth 65mm for receptacles; 75mm for communication equipment.

2.6 Conduit Boxes

.1 Cast FS boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle in exterior or wet or Class 1 areas.

2.7 Fittings- General

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of foreign materials.

.3 Conduit outlet bodies for conduit up to 32mm 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 construction material.

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

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

.5 Use of boxes with built-in connectors is not permitted.

.6 Use of sectional boxes is not permitted.

.7 Insulated connector bushings are to be provided at each conduit end including all telecommunications runs.

END

PART 1 - GENERAL

1.1 Location of Conduit

.1 Drawings do not show all conduits. Those shown are in diagrammatic form only.

PART 2 - PRODUCTS

2.1 Conduits

.1 Rigid galvanized steel threaded conduit: size as indicated or required; to CSA C22.2 No.45

.2 Electrical metallic tubing (EMT), with couplings to CSA22.2 No.83

.3 Rigid pvc conduit: size as indicated; to CSAC22.2 No.136

.4 Flexible metal conduit and liquid-tight flexible metal conduit: size as indicated; to CSAC22.2 No. 56.

2.2 Conduit Fastenings

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

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

.3 Channel type supports for multiple conduits.

.4 6mm dia. threaded rods to support suspended channels.

2.3 Conduit Fittings

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

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

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

PART 3 - EXECUTION

3.1 Installation

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

.2 Conceal conduits except in mechanical and electrical service rooms and in areas with exposed concrete block wall or as otherwise noted.

.3 Use electrical metallic tubing (EMT) unless otherwise noted.

.4 Use flexible metal conduit or AC90 for connection to motors in dry areas, connection to recessed incandescent fixtures without a prewired outlet box, connection to surface or recessed fluorescent fixtures, work in movable metal partitions.

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

.6 Mechanically bend steel conduit over 21mm dia.

.7 Install polypropylene fish cord in empty conduits.

.8 Where conduits become blocked, remove and replace blocked section.

.9 Dry conduits out before installing wire.

.10 Minimum conduit size to be 21mm for line voltage wiring and 27mm for communication wiring.

.11 Do not install horizontal conduit runs in walls.

3.2 Surface Conduits

.1 Run parallel or perpendicular to building lines.

.2 Run conduits in flanged portion of structural steel.

.3 Group conduits wherever possible on suspended surface channels.

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

3.3 Concealed Conduits

.1 Do not install horizontal runs in masonry walls.

.2 Do not install conduits in terrazo or concrete toppings.

END

PART 1 - GENERAL

1.1 Related Sections

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

.2 Section 26 05 01 - Electrical General Requirements.

PART 2 - PRODUCTS

2.1 Cable Protection

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

2.2 Markers

.1 Cedar post type markers: 89 x 89 mm, 1.5 m long, pressure treated with clear coloured, or copper napthenate 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.

PART 3 - EXECUTION

3.1 Direct Burial of Cables

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

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

.3 Underground cable splices not acceptable.

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

.5 Cable separation:
.1 Maintain 75 mm minimum separation between cables of different circuits.
.2 Maintain 300 mm horizontal separation between low and high voltage cables.
.3 When low voltage cables cross high voltage cables maintain 300 mm vertical separation with low voltage cables in upper position.
.4 At crossover, maintain 75 mm minimum vertical separation between low voltage cables and 150 mm between high voltage cables.

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

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

.7 Soil disruption is to be minimized where possible. No trenching work is to occur without prior approval from Departmental Representative.

3.2 Markers

.1 Mark cable every 150 m along cable runs and changes in direction.

.2 Where markers are removed to permit installation of additional cables, reinstall existing markers.

3.3 Field Quality Control

.1 Perform tests in accordance with Section 260501 - Electrical General Requirements.

.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 prior to test.
.2 Ground shields, ground wires, metallic armour and conductors not under test.
.3 High Potential (Hipot) Testing.
.1 Conduct hipot testing in accordance with manufacturer's recommendations.

.7 Provide Departmental Representative 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 test.

END

PART 1 - GENERAL

1.1 Shop Drawings

.1 Submit shop drawings in accordance with Section 26 05 01.

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

1.2 Plant Assembly

.1 Install circuit breakers in panelboards before shipment.

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

PART 2 - PRODUCTS

2.1 Panelboards

.1 Panelboards: to CSA C22.2No.29-1955.

.2 Panelboards to be product of one manufacturer.

.3 250 and 600 V panelboards: bus and breakers rated for available (symmetrical) interrupting capacity or as indicated.

.4 Sequence phase bussing with breakers numbered as shown on drawings, with each breaker identified by permanent number identification as to circuit number.

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

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

.7 Copper bus with full size neutral.

.8 Mains suitable for bolt-on breakers.

.9 Finish trim and door baked grey enamel.

.10 Sprinkler proof.

2.2 Custom Built Panelboards

.1 Upstream circuit breaker on mains as indicated.

.2 Double stack panels as indicated.

2.3 Breakers

.1 Breakers to Section 26 28 21.

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

.3 Main breaker: separately mounted on top or bottom of panel to suit cable entry.

.4 Lock-on devices for receptacles, fire alarm, emergency, door supervisory, intercom, stairway, exit and night light circuits.

2.4 Equipment Identification

.1 Provide equipment identification in accordance with Section 26 05 01.

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

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

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

.5 Nameplate identification to indicate name, voltage, phase and where fed from.

2.5 Manufacturers

.1 Acceptable manufacturers: to match existing service entrance equipment (FPE - Schneider).

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 fireguard backboards. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height given in Section 26 05 01 or as indicated.

.4 Connect loads to circuits as indicated.

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

.6 For flush mounted panelboards, the general contractor is to provide adequate wall depth at no additional cost.

END

PART 1 - GENERAL

1.1 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with Section 26 05 01.

PART 2 - PRODUCTS

2.1 Switches

.1 15 A, 120 V, single pole, double pole, three-way, four-way switches as indicated.

.2 Manually-operated general purpose ac switches as indicated and with following features:
- .1 Terminal holes approved for No. 10 AWG wire.
- .2 Silver alloy contacts.
- .3 Urea or melamine molding for parts subject to carbon tracking.
- .4 Suitable for back and side wiring.
- .5 White toggle.

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

.4 Switches of one manufacturer throughout project.

.5 Devices to be specification grade.

.6 Acceptable manufacturers: Arrow Hart, Bryant, Hubbell, Smith and Stone, Leviton 1200 series.

2.2 Receptacles

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features:
- .1 White urea molded 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 Double wipe contacts and rivetted grounding contacts.

.2 Other receptacles with ampacity and voltage as indicated.

.3 Receptacles of one manufacturer throughout project.

.4 Devices to be specification grade.

.5 Acceptable manufacturers: Arrow Hart, Bryant, Hubbell, Eagle, Leviton 5262-S series.

.6 Isolated ground receptacles to match above characteristics with the exception of the isolated ground feature. Colour to be orange.

2.3 Specialty Equipment

.1 Complete installation shall be to the satisfaction of the Departmental Representative.

.2 Electrical section shall wire and connect all specialty equipment as shown and/or required so as to leave all equipment in an operating condition to the satisfaction of the Departmental Representative, the local inspection authority. Any equipment that is supplied with a cord and cap and is not deemed portable by the Departmental Representative, shall be direct wired at no additional subsequent cost. Electrical section shall supply and install all disconnects and starters for equipment not supplied with same. Shop equipment to be connected via Cabtyre ceiling drop supported with Kellems grip. Ampacity and number of conductors of cord to match nameplate rating of equipment

2.4 Cover Plates

.1 Provide cover plates for all wiring devices.

.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 cover plates, thickness 3/16" for wiring devices mounted in a flush-mounted outlet box.

PART 3 - EXECUTION

3.1 Installation

.1 Switches:
.1 Install single throw switches with handle in "UP" position when switch closed.
.2 Install switches in gang type outlet box when more than one switch is required in one location.
.3 Mount toggle switches at height specified in Section 26 05 01 or as indicated.

.2 Receptacles:
.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
.2 Mount receptacles at height specified in Section 26 05 01 or as indicated.
.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.3 Cover plates:

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

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

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

.4 Complete with nameplate indicating circuit and panel fed from.

END

PART 1 - GENERAL

1.1 Product Data

.1 Submit product data in accordance with Section 26 05 01.

PART 2 - PRODUCTS

2.1 Breakers General

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

.2 Common-trip breakers with single handle for multipole applications.

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

.4 Instantaneous interupting capacity to be co-ordinated with available fault current.

.5 Moulded case circuit breakers: to CSA C22. No. 5 -1963.

.6 Circuit breakers to be series rated.

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 under overload conditions and instantaneous magnetic tripping for short circuit protection.

2.3 Manufacturers

.1 Acceptable manufacturers: see section 26 24 17. Any new circuit breakers in existing panels are to match existing.

PART 3 - EXECUTION

3.1 Installation

.1 Install circuit breakers as indicated.

END

PART 1 - GENERAL

1.1 PRODUCT DATA

.1 Submit product data in accordance with Section 26 05 01.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Enclosed manual air break switches in non- hazardous locations: to CSA C22.2No.4-1974.

.2 Fuseholder assemblies to CSA C22.2No.39-1972.

.3 Fusible and non-fusible disconnect switch in CSA Enclosure 1 .

.4 Fusible and non-fusible disconnect switch in CSA Enclosure 3 if located on exterior of building.

.5 Provision for padlocking.

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

.7 Fuses as required where indicated.

.8 Fuseholders in each switch suitable without adaptors, for type of fuse as indicated.

.9 Quick-make, quick-break action.

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

2.2 EQUIPMENT IDENTIFICATION

.1 Indicate name of load controlled on nameplate to Section 26 05 01.

2.3 MANUFACTURERS

.1 Acceptable manufacturers: to match Section 26 24 17.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses as indicated.

END

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1 Breakers: Section 26 28 21

1.2 Product Data

.1 Submit shop drawing in accordance with Section 26 05 01.

PART 2 - PRODUCTS

2.1 Contactors

.1 Contactors: to CSA C22.2No.14-1973 and EEMAC No.1CS-1970.

.2 Electrically held controlled by pilot devices as indicated and rated for 1.5x load controlled. Half size contactors not accepted.

.3 Mount in CSA Enclosure 1 unless otherwise indicated.

.4 Include following options in cover:
- .1 Red indicating lamp.
- .2 On-Off selector key switch.

.5 Control transformer in contactor enclosure.

2.2 Equipment Identification

.1 Size 4 nameplate in accordance with Section 26 05 01 indicating name of load controlled as indicated.

2.3 Manufacturers

.1 Acceptable manufacturers: Allen-Bradley, Square D, Westinghouse

PART 3 - EXECUTION

3.1 Installation

.1 Install contactors and connect auxiliary control devices as indicated.

.2 Control voltage to be 120VAC.

END

PART 1 - GENERAL

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 26 05 01

.2 Indicate:
- .1 Mounting method and dimensions.
- .2 Starter size and type.
- .3 Layout of identified internal and front panel components.
- .4 Enclosure types.
- .5 Wiring diagram for each type of starter.
- .6 Interconnection diagrams.

1.2 OPERATION AND MAINTENANCE DATA

.1 Provide data for incorporation into maintenance manuals.

.2 Include operation and maintenance data for each type and style of starter.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Starters: to the latest edition of CSA C22.2No.14, EEMAC E14-1.
- .1 Half size starters not acceptable.

2.2 MANUAL MOTOR STARTERS

.1 Manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:
- .1 Switching mechanism, quick make and break.
- .2 Overload heaters, manual reset, trip indicating handle.

.2 Accessories: Toggle switch: standard labelled as indicated.
- .1 Indicating light: standard and color as indicated.
- .2 Locking tab to permit padlocking in "ON" or "OFF" position.

2.3 FULL VOLTAGE MAGNETIC STARTERS

.1 Combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
- .1 Contactor solenoid operated, rapid action type.
- .2 Motor overload protective device in each phase, manually reset from outside enclosure.
- .3 Power and control terminals.
- .4 Wiring and schematic diagram inside starter enclosure in visible location.

.5 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
.6 Two spare auxillary contacts.
.7 Hand-off-automatic control.
.8 Control transformer and fusing.

2.4 IDENTIFICATION

.1 In accordance with Section 26 05 01.

2.5 MANUFACTURERS

.1 Acceptable manufacturers are: Allen Bradley, Group Schneider, Siemens, Westinghouse.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install starters, connect power and control as indicated.

.2 Ensure correct fuses and overload devices elements installed.

3.2 TESTS

.1 Perform tests in accordance with Section 26 05 01 and manufacturer's instructions.

.2 Operate switches, contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

END

PART 1 - GENERAL

1.1 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with Section 26 05 01.

1.2 Accessories

.1 Provide supporting devices, plaster frames, rings, integral surface mounted junction boxes and outlet boxes where required.

PART 2 - PRODUCTS

2.1 Luminaires

.1 Provide luminaires as indicated on luminaire schedule and as indicated.

2.2 Lamps

.1 Provide lamps as indicated.

2.3 Ballasts and Accessories

.1 All ballasts/drivers/power supplies to be electronic, Manitoba Hydro Power Smart approved and suitable for mounting in location indicated.

.2 Suitable for dimming were indicated. Ensure compatibility with dimming controls.

PART 3 - EXECUTION

3.1 Installation

.1 Locate luminaires as indicated.

.2 Clean all construction dirt and dust from luminaires prior to building turnover.

.3 Install lamps (where applicable).

3.2 Wiring

.1 Connect luminaires to lighting circuits as indicated.

.2 Connect luminaires to dimmers, occupancy sensors, daylight sensors or switches as indicated.

3.3 Tests

.1 Perform tests in accordance with Section 26 05 01.

.2 Check luminaires and replace defective lamps, ballasts/drivers/power supplies and accessories.

END

PART 1 - GENERAL

1.1 Product Data

.1 Submit product data in accordance with Section 26 05 01.

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

1.2 Warranty

.1 For batteries, 120 months warranty period with a no-charge replacement during the first 5 years and a pro-rate charge on the second 5 years.

PART 2 - PRODUCTS

2.1 Equipment

.1 Supply voltage: to match general lighting in the area.

.2 Output voltage: 12V DC.

.3 Operating time: 30 min or as required by Code.

.4 Lamp heads: 345° horizontal and 180° vertical adjustment. Lamp type: 5W (200 lumen min) LED MR16. All integral and remote luminaires are to be double-head.

.5 Finish: white.

.6 Backup battery capacity to suit load plus 25% (for future) for a minimum 30 minute backup duration.

.7 Provide zone sensing relays as required to activate emergency lighting upon loss of night light or normal lighting in the area of all emergency lighting heads.

2.2 Wiring of Remote Heads

.1 Conduit: to Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 Conductors: to Section 26 05 21 - Building Wires, sized in accordance with manufacturer's recommendations.

2.3 Manufacturers

.1 Acceptable manufacturers: Lumacell, Aim-Lite, Ready-Lite.

PART 3 - EXECUTION

3.1 Installation

.1 Install remote mounted fixtures.

.2 Direct heads.

.3 Provide load schedule on as-built drawings of each battery bank.

END