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. Installation shall be deemed incomplete and final payment shall not be released until the electrical installation is completed to the complete satisfaction of the responsible Contract Administrator.

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

.1 Provision of normal electrical distribution including CSTE, feeders, panelboards, and branch circuitry.

.2 Provision of a code-compliant two stage addressable fire alarm system including all required initiating and audible/visual alarm devices. Connection of all sprinkler switches to fire alarm system, including pre-action sprinkler system.

.3 Provision of lighting, associated switching, programmable lighting control system, and branch circuitry. Local switches are to be provided in all non-public areas. Provision of lighting and associated controls, commissioned and programmed to City of Winnipeg's requirements.

.4 Provision of code conforming emergency lighting and exit signage.

.5 Arranging for and co-ordinating any utilities work in connection with power, telephone, CATV and future fibre optic service to the building. Provide service entrance conduit and equipment backboards to associated utility satisfaction. Pay all contribution charges.

.6 Provision of specification grade receptacles and branch circuitry. Installation to be completed in accordance with the latest edition of the Canadian Electrical Code including bulletins of authorities having jurisdiction.

.7 Provision of power supply for mechanical equipment. Provision of all line voltage control wiring and power to control transformers. Coordinate with Mechanical Contractor.

.8 Provision of a complete Panic Alarm/Public Address system with speakers throughout facility. Mass Paging is to be through remote connection or automated messaging.

.9 Provision of a complete closed circuit television system (CCTV) c/w minimum 7 day digital video storage. Locations of cameras indicated on plans. DVR equipment to be located in Mech/Elec Room. Monitoring to be on computer monitors and may be accessed through the LAN (password protected).

.10 Provision of the wire & connection of all owner's equipment. Confirm electrical requirments with nameplate data. Adjust wiring and c.b.(s) to suit. Provide matching cord end.

.11 E.C. to apply for Manitoba Hydro Power Smart rebate on all applicable electrical items. E.C. may retain rebate, however must provide copies of application and subsequent rebate to Contract Administrator for their records.

1.2 LIGHTING DESIGN CRITERIA

.1 The following lighting design criteria has been used for this project. This information is provided to assist manufacturers wishing to submit equal requests for type A luminaires on this project.

.1 Lighting criteria is for the interior of the station only.

.2 Luminaire mounting height of 7.0m.

.3 Reflectances: Floor/Road: 10%, Walls: 10%, Ceiling: 10%. (Note, these values have already been derated for diesel effect and cleaning schedule)

.4 Light Loss Factor (LLF): 0.80.

.5 Uniformity: Lighted surfaces shall have an average to minimum not exceeding 3.5:1 and a maximum to minimum ratio of 5.0:1.

.6 Average Light Level of no less than 33 f.c.

.7 Voltage: 120V-1ph. Maximum power draw with all luminaires operating at rated wattage: 11.8kW.

END

1 Codes and Standards

.1 Do complete installation in accordance with the latest eddition of CSA C22.1 as ammended by the Manitoba Building Code and the Winnipeg Electrical By-law, 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 supply authority and local inspection authority. Comply with all additional requirements of local inspection authority.

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

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 Contract Administrator will provide drawings at no cost.

3 Shop Drawings, Product Data and Samples

.1 Submit shop drawings, product data and samples as requested by Contract Administrator and as requested by City of Winnipeg.

.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, distribution equipment, luminaires, lighting control system, etc.

4 Operation and Maintenance Data

.1 Provide operation and maintenance data for incorporation into maintenance manual.

.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.
.5 Panelboard schedules.

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

5 Maintenance Materials

.1 Provide 3 maintenance manuals which include local inspection authority Certificate of Inspection.

.2 O&M manuals are to be provided in hard and soft (.pdf) formats.

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.

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 Contract Administrator in writing of the voltage at the outlet.

8 Inspection

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

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 No lot pricing shall be allowed. Distributers submitting prices to Electrical Subcontractors shall not group products and materials.

.4 Request for approval of material and equipment, other than those specified on the drawings, shall be submitted in accordance with B6.

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

10 Electric Motors, Equipment and Controls

.1 Power wiring to all equipment, motors or control panels to be performed by Electrical Subcontractor. Refer to mechanical section.

.2 Control wiring is to be provided by the Mechanical Controls Subcontractor or Electrical Subcontractor as indicated in mechanical section of specification. Co-ordinate with mechanical section. Mechanical Subcontractor to provide wiring details.

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.

.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, unless equipment is constructed of galvanized steel.

12 Equipment Identification

.1 Identify electrical equipment with lamacoid nameplates with black face and white lettering sized to the approval of the Contract Administrator.

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

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

.4 Identification to be English.

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

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

.7 Identify panel and circuit number on all outlets with lamacoid nameplates.

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 C22.1-2006.

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

.5 Idenfify all underground wiring with Brady Identoline underground warning tape. Installation to be as per manufacturers typical installation proceedure.

.6 For each conductor identify at each termination and junction box, the panel and circuit number for power circuits and zone for fire alarm.

14 Wiring Terminations

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

15 Manufacturers and CSA labels

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

16 Warning Signs

.1 Provide warning signs, as specified or to meet requirements of inspection department and Contract Administrator.

17 Location of Outlets

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

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

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

18 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 Contract Administrator prior to rough-in.

.4 Install electrical equipment at the following heights unless indicated otherwise.
- .1 Local switches: 1200mm.
- .2 Wall receptacles:
  - .1 General: 300mm.
  - .2 In mechanical rooms: 1400mm
- .3 Panelboards: 1200mm or as required by Code.
- .4 Telephone outlets: 300mm
- .5 Wall mounted telephone outlets: 1400mm
- .6 Fire alarm stations: 1200mm
- .7 Fire alarm audible devices: 2000mm
- .8 Wall mounted speakers: 2000mm
- .9 P. A. Station: 1400mm
- .10 In accordance with accessibility guidelines.

19 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.

20 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 Submit, at completion of work, a report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

21 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 raceways are to be made water and weatherproof.

22 Tests/Studies

.1 Conduct and pay for tests of the following:
.1 Power distribution system including phasing, voltage, grounding and load balancing. Co-ordination study.
.2 Circuits originating from branch distribution panels.
.3 Lighting and its control.
.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
.5 Systems: fire alarm system, CCTV, communications, panic alarm, P.A., door access.
.6 Emergency power systems including emergency lighting.

.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 Contract Administrator. Notify Contract Administrator two days prior to testing.

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

.5 Submit test results.

23 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.

24 Co-ordination of Protective Devices

.1 Ensure circuit protective devices such as overcurrent trips, relays, fuses, are installed to values and settings as indicated. Co-ordinate overcurrent protection short circuit interupting capacity with utility. Ratings to the satisfaction of the Contract Administrator.

25 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.

26 Excavation and Backfilling

.1 Ensure that excavation for underground electrical services is in location and at depth indicated. Electrical Subcontractor to provide and directly supervise excavation and backfilling.

.2 All work to be accordance with CSA22.1-2006 Section 12.

27 Guarantee

.1 The Electrical Subcontractor shall guarantee 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 project, provided that such failure is not due to improper usage.

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

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

28 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 structural plans and co-operate with other trades so that the elevation of all outlets shall not necessitate any unnecessary cutting of construction material. If this is not done, the Electrical Subcontractor may be required by the Contract Administrator to move these outlets at no additional cost to The City (including repair).

29 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 (Cont'd)

30 Spare Materials

.1 Provide the following spare parts:
.1 Fire Alarm System: 2 heat detectors, 1 pull station c/w cover, 2 horn/strobes.
.2 Lighting: 10% of all lamps, 5% of all ballasts, 10% of lenses for type A, 1 & 6 luminaires
.3 Exit Signage/Emergency Lighting: 2 double remote heads, 2 exit signs
.4 Other spare parts as noted in individual sections.

31 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 Bid Opportunity, examine the work of the other trades and report at once to the Contract administrator, any defect, discrepancy, omission or interference affecting the Work of section or the warranty of same in accordance with B4.

.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 Subcontractor, as directed by the Contract Administrator without additional charge.

.3 At completion of project, provide a complete print of revisions, changes and conduit location as-built drawings to the satisfaction of the responsible Contract Administrator. These drawings are to include conduit fill complete with associated wire sizes. Provide accurate locations and construction details of all buried wiring runs. Provide AutoCAD .dwg files of all changes, revisions, and conduit layouts suitable for printing drawing size reproductions of electrical drawings. Contract Administrator will provide .dwg copies of original electrical drawings.

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

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 R90 : to CSA C22.2No.38-1977.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install wiring as follows:
.1 In conduit systems in accordance with Section 26 05 21.

.2 Install in conformance with wire manufacturers recommendations.

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

PART 3 - EXECUTION

3.1 Installation General

.1 Install complete permanent, continuous, system and circuit, equipment, grounding systems including, electrodes, conductors, connectors, accessories, as indicated, to conform to requirements of Contract Administrator 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 Ground secondary service pedestals.

.10 Route all ground conductors back to existing main building ground.

3.2 Electrodes

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

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

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 Contract Administrator 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 SHOP DRAWING AND PRODUCT DATA

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

PART 2 - PRODUCTS

2.1 SPLITTERS

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

.2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

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

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.

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

PART 3 - EXECUTION

3.1 SPLITTER INSTALLATION

.1 Install splitters as indicated 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 Provide pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.3 IDENTIFICATION

.1 Install size 2 identification labels indicating system name voltage and phase in accordance with Section 26 05 01.

END

PART 1 - GENERAL

1.1 RELATED WORK

.1 Box connectors: Section 26 05 20.

PART 2 - PRODUCT

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with the latest eddition of CSA C22.1,

Section 12-3042.

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

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

2.2 RIGID PVC OUTLET BOXES

.1 Rigid PVC utility boxes for outlets connected to surface-mounted PVC conduit, minimum size 102 x 54 x 48 mm.

.2 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.3 Gasketted and water-tight for spray washing (IP66) environment.

2.3 FITTINGS - GENERAL

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

.2 Water-tight for spray washing (IP66) environment, for all exposed conduit 4m AFF and under.

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 Provide correct size of openings in boxes for conduit connections. Reducing washers not allowed.

END

PART 1 - GENERAL

1.1 LOCATION OF CONDUIT

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

1.2 SIZING

.1 Size in accordance with tables 5 & 6 of CSA C22.1 - latest edition.

PART 2 - PRODUCTS

2.1 CONDUITS

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

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

.3 Make provisions for expansion and contraction of conduits in accordance with 12-1012 of CSA C22.1.

2.2 CONDUIT FASTENINGS

.1 Two hole PVC straps for all conduits.

.2 Channel type supports for multiple conduits.

2.3 CONDUIT FITTINGS

.1 Fittings manufactured for use with conduit specified.

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

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install conduits in neat groupings and where they will cause minimum interference in spaces through which they pass.

.2 Use Rigid PVC conduit unless otherwise noted.

.3 Use liquidtight flexible metal conduit for connection to luminaires.

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

.5 Install polypropylene fish cord in empty conduits.

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

.7 Dry conduits out before installing wire.

3.2 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Group conduits wherever possible on suspended surface channels.

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

END

PART 1 - GENERAL

1.1 Related work Specified Elsewhere

.1 General Provisions Section 26 05 01.

1.2 Co-ordination with Power Supply Authority

.1 Co-ordinate and meet requirements of power supply authority. Ensure availability of power when required.

PART 2 - PRODUCTS

2.1 Materials

.1 Transformer tap box to Section 26 05 31.

PART 3 - EXECUTION

3.1 Installation

.1 Allow adequate conductor length for connection to weatherproof tapbox.

.2 Provide trenching and backfilling for buried feeders as indicated.

.3 Complete grounding as per Section 26 05 28.

END

PART 1 - GENERAL

1.1 Related Work

.1 Luminaire Schedule: Section 26 50 00

1.2 Product Data

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

.2 Submit dimensioned drawings of lighting control system and accessories including but not limited to: relay panels, switches, DTC, photocells and other interfaces. Drawings shall indicate exact location and programming of each device. Indicate all time schedules and switch button engraving.

PART 2 - PRODUCTS

2.1 Lighting Control System

.1 Lighting control system shall be digital and consist of a master LCP with up to 48 individual relays, slave LCPs (for expansion), a micro LCP with up to 4 individual relays, which can be switchable or 0-10VDC Dimmable, digital switches and digital interface cards. All system components shall connect in a "DAISY CHAIN" Style configuration and be controlled via category 5 patch cable with RJ45 connectors, providing real-time two-way communication with each system component. Analog systems are not acceptable. If indicated on the plans, lighting control system shall be able to fully integrate smartbreaker panelboards. All cables supplied by sub-contractor.

.2 Relay panels shall by pre-wired, pre-assembled, pre-programmed and listed to UL916(normal). Panels shall be provided with dual voltage power supply and 16 gauge barriers to separate high and low voltage.

.3 Standard relays shall have normally closed (NC) contacts rated for 120/277V 20A tungsten, ballast or HID. Standard relays shall be zero-cross type. Optional 600v, 2-pole relay, NO or NC, and 347V single pole relay shall be available.

.4 Relay panel electronics shall provide current visual status and control of each relay or zone. All system control electronics shall store programming in a non-volatile memory and provide 10 year battery back up for time of day.

.5 Lighting control system shall consist of master and slave panel(s) controlled by a 32-channel digital time clock (DTC) that controls and programs the entire lighting control system. The DTC shall supply all time functions and accept other inputs. The DTC shall accept control locally using built in button prompts and use of an 8 line 21-letter display, from a computer, modem, ethernet or internet. All commands shall be in plain english. Help pages shall display on the DTC screen.

.6 All switches shall communicate via RS 485, Cat 5 patch cable with RJ45 connectors. Contact closure style switches are not acceptable. Any switch button function shall be able to be changed locally (at the DTC or a PC) or remotely, via modem, ethernet or internet. Refer to single line diagram for wiring details. Switches which cannot be programmed remotely shall not be acceptable.

.7 Photocell, exterior (PCO) or interior (PCI), shall provide readout on the DTC screen in number values analogous to foot-candles. Each photocell shall provide a minimum of 14 trigger points. Each trigger can be programmed to control any relay or zone. Each trigger shall be set through DTC, locally or remotely. Photocells that require the use of set screws or manual adjustments at the photocell control card shall not be acceptable.

.8 Lighting control system interfaces to include a dry contact input interface, BMS interface, dimming system interface, ethernet/internet interface and an interface to smartbreaker panel boards. Verify and install only those interfaces indicated on the plans.

.9 Standard lighting control system software, pre-installed into the DTC, shall consist of and use standard graphical management software (GMS) pages. GMS software shall provide via local or remote PC a visual representation of each device on the bus, show real time status and the ability to change the status of any individual device, relay or zone. Optional software that accepts job specific graphics shall be available.

2.2 Manufacturers

.1 Lighting control system to be manufactured by Lighting Control & Design, Los Angeles, CA with local representation required.

.2 Other manufacturers may submit equal requests in accordance with specification section 26 05 01.

PART 3 - EXECUTION

3.1 Installation

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

.2 Connect luminaire circuits to control panel(s) as indicated.

.3 Electrical Subcontractor shall contact manufacturer at least 7 days prior to final inspection. Manufacturer will remotely dial into the lighting control system, run diagnostics and confirm system programming. Electrical Subcontractor shall be available at the time of dial in to perform any corrections required by manufacturer. Electrical Subcontractor is responsible for coordinating with Contract Administrator and The City, the installation of a dedicated telephone line or a shared phone line with a/b switch. Phone jack to be mounted within 12" of master LCP. Label jack with

.3 (Cont'd)
phone number. Electrical Subcontractor shall connect phone line from jack to master LCP.

3.2 Testing

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

.2 Demonstrate that control systems are installed as indicated.

.3 Demonstrate that the control systems operate as intended and that there are no problems in starting or extinguising lamps at the intended foot-candle set-points.

.4 Demonstrate that no interference is carried by system.

3.3 Warranty

.1 Telephone factory dial-up support shall be available at no additional cost to the Electrical Subcontractor or The City both during and after the Warranty period. Factory to preprogram the lighting control system per plans and approved submittal. The lighting control manufacturer, at no added cost, shall provide additional programming via modem as required by the Electrical Subcontractor or The City for the operational life of the system. Manufacturer warrants that the DTC software can be upgraded and monitored remotely.

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.

2.5 Manufacturers

.1 Acceptable manufacturers: Siemens, Group Schneider, Cutler-Hammer.

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 RELATED WORK

.1 Contactors: Section 26 29 01.

1.2 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 5 mm^2 wire.
- .2 Silver alloy contacts.
- .3 Urea or melamine molding for parts subject to carbon tracking.
- .4 Suitable for back and side wiring.
- .5 Ivory rocker.

.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 premium specification grade.

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

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features:
- .1 Black urea molded housing.
- .2 Suitable for No. 10 AWG 5 mm^2 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 premium specification grade.

.5 Acceptable manufacturers: Arrow Hart, Bryant, Hubbell

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 Contract administrator, the local inspection authority. Any equipment that is supplied with a cord and cap and is not deemed portable by the Contract administrator, shall be direct wired at no additional subsequent cost. Electrical section shall supply and install all disconnects, magnetic starters and matching receptacles for equipment not supplied with same. Ampacity, number of conductors of cord and receptacle configuration 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 Weather proof PVC for all switches in PVC outlet boxes.

.4 Weather proof double lift spring loaded cast aluminum cover plates, complete with gaskets for duplex receptacles.

.5 Provide lamacoid labels rivited to cover plate with circuit and panel identification.

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 260501 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 260501 or as indicated.
.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.3 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.

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 Submit fuse time-current characteristics for each fuse type and size. Time-current characteristics to include: average melting time-current, I^2t (for fuse coordination), and peak let-through current.

.3 Provide current limiting fuses.

1.2 Maintenance Materials

.1 Provide maintenance materials in accordance with Section 26 05 01.

1.3 Delivery and Storage

.1 Ship fuses in original containers.

PART 2 - PRODUCTS

2.1 Fuses General

.1 Fuses to limit fault current to downstream devices to 10Ka SCIC.

.2 HRC fuses to have interrupting capability of 200,000 A symmetrical.

.3 Fuses: product of one manufacturer.

2.3 Fuse Storage

.1 Provide one complete set of spare fuses in cabinet.

2.4 Manufacturers

.1 Acceptable Material: Bussman

PART 3 - EXECUTION

3.1 Installation

.1 Install fuses in mounting devices immediately before energizing circuit.

.2 Ensure correct fuses fitted to physically matched mounting devices.

.3 Ensure correct fuses fitted to assigned electrical circuit.

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 Integrated instantaneous interupting capacity to be as required by Contract Administrator and co-ordinated with utility.

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

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: to match Section 26 24 17 Panelboards.

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 28 21.

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 Nameplate in accordance with Section 26 05 01 indicating name of load controlled as indicated.

2.3 MANUFACTURERS

.1 Acceptable manufacturers: Allen-Bradley, Group Schneider, 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 CSA C22.2No.14-1973, 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 auxilliary contacts.

.1 (Cont'd)
.7 Provide HOA or ON-OFF switches as required and pilot lights.
.8 Complete with control transformer and fusing.

2.4 Identification

1. In accordance with Section 26 05 01.

2.5 Manufacturers

.1 Acceptable manufacturers are: Westinghouse, Allen Bradley, Siemens, Square D, General Electric.

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, integral surface mounted junction boxes and outlet boxes where required.

PART 2 - PRODUCTS

2.1 LUMINAIRES

.1 Type A luminaires are to have the following provisions:
.1 Fixture shall be IP65 rated for Dust-tight and water-tight construction.
.2 Housing shall be extruded aluminum. All external hinges, fasteners and screws shall by Type 316 stainless steel or better.
.3 The reflector shall consist of die-formed white specular steel, with greater than or equal to 98% reflectance. The luminaires shall provide photometric distribution as specified.
.4 Complete with two ballasts per fixture, each to operate two T5 HO lamps. (4 lamps/8' section)
.5 Stem suspended with 3" stem.
.6 Equal to Peerless Station series.

.2 Type B luminaires shall be equal to Lithonia UNS 1 54T5HO 120 GEB10PS, c/w 1-54W T5HO lamp.

.3 Type 1 luminaires shall be equal to FC Lighting FCSL400 120V 3-3W LED WH BK c/w 3-3W LED lamps.

.4 Type 2 luminaires are to have the following provisions:
.1 Fixture shall be IP65 rated for Dust-tight and water-tight construction.
.2 Complete with 1-150W MH lamp, wide asymmetric distribution.
.3 Equal to Lithonia WFL-2 150M HPW 120 CSA LPI.

.5 Type 5 luminaires shall be equal to Rebelle CYL-003 7600 c/w 1-150W G12 MH lamp. Color TBA by Contract Administrator. Provide matching 18' 5" round steel pole and secure to concrete grade beam.

.6 Type 6 luminaires shall be equal to Holophane PD 100HP 12 L c/w 1-100W HPS lamp. Confirm exact locations and mounting method with Contract Administrator.

2.2 LAMPS

.1 Provide lamps as indicated.

.2 T5 HO lamps to be equal to Phillips Silhouette with an initial lumen output of 5,000 lumens, and rated life of 25,000 hours (at 3 hours/start). Lamps to operate on an electronic programmed start ballast.

2.3 BALLASTS AND ACCESSORIES

.1 All ballasts to be Manitoba Power Smart approved, high power factor. All ballasts to be suitable for mounting in location indicated.

.2 Ballasts shall reliably start and operate the lamp in ambient temperatures to minus 40 degrees F and be UL listed for 40 degrees C.

.3 Ballasts shall provide 100% wattage to the lamp a have a published ballast factor of 1.0.

2.4 WARRANTY

.1 The electrical assembly of luminaires shall be fully warranted for a period of 2 years and the housing for a period of 2 years from date of manufacture.

2.5 APPROVED MANUFACTURERS

.1 Lighting design and fixture construction is based on the specified Lithonia products. Other manufacturers are welcome to submit product information for luminaires they feel are equal to those specified. Equal requests shall be in accordance with section 26 05 01. Additionally, a complete photometric analysis must be provided to the Contract administrator for review. Contract administrator will provide CAD drawings of the building for this purpose. Lighting design criteria is described in section 26 00 05, which must be followed.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Locate luminaires as indicated.

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

.3 Install lamps.

3.2 WIRING

.1 Connect luminaires to lighting circuits as indicated.

.2 Connect luminaires to controls as indicated.

3.3 TESTS

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

.2 Check luminaires and replace defective lamps, ballasts 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: 24V dc.

.3 Operating time: 60 min.

.4 360W or as required.

.5 Battery: sealed, maintenance free.

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

.7 Solid state transfer circuit.

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

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

.10 Lamp heads: vandal-resistant remote, 345° horizontal and 180° vertical adjustment. Lamp type: 20W quartz MR16. All integral and remote luminaires are to be double-head.

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

.12 Finish: white.

.13 Auxiliary equipment:
.1 Test switch.
.2 Shelf.
.3 Cord and plug connection for ac.
.4 Self-test.
.5 Zone sensing relays as required.

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, Ready-Lite, Aim-Lite.

PART 3 - EXECUTION

3.1 Installation

.1 Install unit equipment and remote mounted fixtures.

.2 Direct heads.

END

PART 1 - GENERAL

1.1 Product Data

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

PART 2 - PRODUCTS

2.1 Materials

.1 Housing: heavy-duty ABS thermopolastic body and faceplate with red plastic letter panel. Weather-proof and fully gasketed for wash-down locations.

.2 Universal mounting: Wall, pendant, end, or ceiling mount.

.3 Arrows: snap out for univeral directional capability.

.4 Lamps: LED with 25 year life expectancy.

.5 CSA C860 Compliant

.6 Manufacturer to match Emergency Lighting Section 26 52 01.

PART 3 - EXECUTION

3.1 Installation

.1 Install exit lights as indicated, and to requirements of NBC-2005.

.2 Connect fixtures to exit light circuits as indicated.

.3 Mount at suitable height. Provide rigid pendant if required. Provide single or double faceplate as required. Provide mounting as required.

.4 Fasten properly and level.

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

.6 Connect to emergency battery banks as indicated. Wire to be sized as per manufacturers recommendations. Do not exceed 5% voltage drop.

END