Part 1 General

1.1 REFERENCES

.1 Definitions:

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

.2 Reference Standards:

.1 CSA Group

.1 CSA C22.1-15, Canadian Electrical Code, Part 1 (23nd Edition), Safety Standard for Electrical Installations.

.2 CSA C22.2

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

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

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for electrical equipment and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop drawings:

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

.2 Submit as required number of copies of drawings and product data to authority having jurisdiction inspection authorities.

.3 If changes are required, notify Departmental Representative of these changes before they are made.

.4 Certificates:

.1 Provide CSA certified equipment and material.

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

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

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

.5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for electrical equipment for incorporation into manual.

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

.2 Operating instructions to include following:

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

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

.3 Safety precautions.

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

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

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

1.4 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.2 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 COORDINATION

.1 Cooperate and co-ordinate with the Facility Manager all work related to this contract.

.2 Coordinate and co-ordinate with other contractors on site.

.3 Locate equipment so as to maximize usable space. Install neatly and close to the building structure all raceways, fittings, pull boxes, junction boxes, wiring and cables which are to be concealed, in order that the necessary furring can be kept as small as possible.

.4 Review relevant shop drawings and product data of other Divisions where they affect the work of this Section, prior to commencing the work.

2.2 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

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

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

2.3 MATERIALS AND EQUIPMENT

.1 Material and equipment to be CSA certified. Where CSA certified material or equipment is not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval to Departmental Representative.

2.4 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors. Note that aluminum conductors are not permitted except by special written permission.

2.5 EQUIPMENT IDENTIFICATION

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

.1 Nameplates: lamicoid 3 mm thick mechanically attached with self tapping screws.

.2 Sizes as follows:

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

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

.3 Wording on nameplates or labels to be approved by Departmental Representative prior to manufacture.

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

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

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

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

2.6 WIRING IDENTIFICATION

.1 Identify wiring with permanent coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

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

2.7 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
Up to 250 V, Normal Power	Yellow	Blue
Up to 600 V, Normal Power	Yellow	Green
Up to 250 V, Emergency Power	Yellow	Blue & Red
Up to 600 V, Emergency Power	Yellow	Green & Red
Controls	Yellow	Black
Intrusion and Access Control	Orange	Orange
Fire Alarm	Red	---
Emergency Voice	Red	Blue

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

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

3.3 NAMEPLATES AND LABELS

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

3.4 CONDUIT AND CABLE INSTALLATION

.1 Provide core drilling through concrete, sized for free passage of conduit where indicated.

.2 Provide radio detection scan at each floor slab core drill location.

.3 Arrange for holes through exterior walls and roof to be flashed and made weatherproof.

.4 Separation of conduit and wiring shall be as per COMSEC requirements. Refer to Section 26 05 34 - Conduits, Fastenings and Conduit Fittings

.5 Provide fire stop where required to retain continuity of existing separations.

3.5 LOCATION OF OUTLETS

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

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

3.6 MOUNTING HEIGHTS

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

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

.3 Install electrical equipment at following heights unless indicated otherwise.

.1 Wall mounted Thermostats: 1500 mm.

.2 Air handling unit controller 1500 mm.

3.7 FIELD QUALITY CONTROL

.1 Load Balance:

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

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

.3 Provide upon completion of work, load balance report as directed in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS, phase and neutral currents on panelboards, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

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

.1 Circuits originating from branch distribution panels.

.2 Insulation resistance testing:

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

.2 Check resistance to ground before energizing.

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

3.8 SYSTEM STARTUP

.1 Instruct Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.

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

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

3.9 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 05 21 - Wire and Cables 0 - 1000V.

1.2 REFERENCES

.1 CSA International

.1 CAN/CSA-C22.2 No.18-98(R2003), Outlet Boxes, Conduit Boxes and Fittings.

.2 CAN/CSA-C22.2 No.65-03(R2008), Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).

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

.1 EEMAC 1Y-2-1961, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.2 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2No.65, with current carrying parts of copper sized to fit copper conductors as required.

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

.3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:

- .1 Connector body and stud clamp for stranded.
- .2 Clamp for stranded copper conductors.
- .3 Stud clamp bolts.
- .4 Bolts for copper conductors.
- .5 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable, as required to: CAN/CSA-C22.2No.18.

Part 3 Execution

3.1 INSTALLATION

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

3.2 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

- .1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

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

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

1.2 REFERENCES

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

1.3 PRODUCT DATA

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

Part 2 Products

2.1 BUILDING WIRES

.1 Conductors: stranded for 8 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

.3 Branch circuit wiring:

- .1 Conductors smaller than #12 AWG not permitted.
- .2 For 120 volt control circuits, minimum size of wire shall be #14 AWG.
- .3 Wiring for branch circuits shall be sized to limit the voltage drop from the Panelboard to the farthest outlet/fixture to 2% when carrying 80% of the branch circuit breaker rated current.

.4 For 120 volt circuits using shared neutrals, minimum wire sizes shall be:

- .1 #12 AWG for runs up to 30 m.
- .2 #10 AWG for runs in excess of 30 m up to a distance that ensures compliance with above.

Note: Shared neutrals may be used for branch circuits serving lighting, normal power receptacles and emergency power receptacles.

.5 For 120 volt circuits, using separate neutrals, minimum wire sizes shall be:

- .1 #12 AWG for runs up to 21 m.
- .2 #10 AWG for runs in excess of 21 m up to a distance that ensures compliance with item above.
- .3 -Not less than #10 AWG homeruns from "P" boxes in any case.

Part 3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

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

.2 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.

.3 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.4 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.5 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.

.6 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

.1 Install wiring in conduit, in accordance with the requirements of the pertinent sections and manufacturer's recommendations as applicable and as noted below:

.1 In conduit systems in accordance with Section 260534. Note: All wiring shall be in conduit unless specifically indicated otherwise.

.2 Type THHN will not be permitted in lieu of RW-90.

.2 All wiring shall be RW90 X-link except as noted in clauses 2.1.4, 2.1.5 and 2.1.6 above.

.3 For branch circuit wiring, requirements for "neutrals" are as follows:

.1 Normal Power circuits, unless specifically noted otherwise, may share one neutral with up to the three phases A, B & C

.4 Colour code throughout building, same colour for same phase throughout, by insulation colour or permanently applied colour banding at all distribution centres, panels and outlet boxes. Colour code to be as follows:

.1 Equipment grounding conductor: green

.2 Neutral conductor: white

.3 Standard 120/208 V phase wires: red, black, and blue

.5 Connecting lugs for all conductors size #4 or larger shall be Burndy Hylugs type YA or approved equal. Lugs using threaded type pressure connections will not be accepted.

.6 For splicing of conductors #6 AWG and smaller, connectors shall be Scotchlok spring type.

.7 Do not splice cables unless indicated.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA Group

.1 CSA C22.1-15, Canadian Electrical Code, Part 1 (23nd Edition), Safety Standard for Electrical Installations.

.2 CSA C22.2 No.41-15 Grounding and Bonding Equipment (Tri-National Standard, with NMX-J-590ANCE and UL 467).

.3 CSA C22.2 No.65-15, Wire connectors (Tri-National Standard, with UL 486A-486B NMX-J-543-ANCE).

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

.1 Copper compression connectors to CSA C22.2 No.65 as required sized for conductors.

Part 3 Execution

3.1 INSTALLATION

.1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.

.2 Bond and ground as required to CSA C22.2No.41.

3.2 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-, Canadian Electrical Code, Part 1, 20th Edition.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 DELIVERY, STORAGE AND HANDLING

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

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse or recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

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

.2 102 mm square or larger outlet boxes as required.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 347 V outlet boxes for 347 V switching devices.

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

2.2 GALVANIZED STEEL OUTLET BOXES

.1 One-piece electro-galvanized construction.

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

.3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.5 Extension and plaster rings for flush mounting devices in finished plaster or tile walls.

2.3 CONDUIT BOXES

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

2.4 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

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

2.5 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

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

.3 Conduit outlet bodies for conduit up to 35mm and pull boxes for larger conduits.

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

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

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

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

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

.5 Vacuum clean interior of outlet boxes before installation of wiring devices.

.6 Identify systems for outlet boxes as required.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

- .1 CAN/CSA C22.2 No. 18-98(R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
- .2 CSA C22.2 No. 45-M1981 (R2003), Rigid Metal Conduit.
- .3 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .4 CSA C22.2 No. 83-M1985 (R2003), Electrical Metallic Tubing.
- .5 CSA C22.2 No. 211.2-M1984 (R2003), Rigid PVC (Unplasticized) Conduit.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product data: submit manufacturer's printed product literature, specifications and datasheets.

- .1 Submit cable manufacturing data.

.3 Quality assurance submittals:

- .1 Instructions: submit manufacturer's installation instructions.

Part 2 Product

2.1 CABLES AND REELS

.1 Provide cables on reels or coils.

- .1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.

.2 Each coil or reel of cable to contain only one continuous cable without splices.

.3 Identify cables for exclusively dc applications.

2.2 CONDUITS

.1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83. Steel galvanised EMT with reamed ends. Couplings, steel type with insulated throats. Die-cast fittings are not acceptable. Watertight compression couplings and connectors shall be used in access floors, areas exposed to sprinklers and in damp/humid areas.

.2 Rigid galvanized steel threaded conduit with reamed ends to CSA C22.2 No. 45. Couplings: threaded rigid galvanized steel. Bushings: threaded, grounding type with insulated throats.

.3 Flexible metal conduit: galvanized interlocked steel to CSA C22.2 No. 56, and as follows:.

.1 Flexible metal conduit: Spirally wound, interlocked zinc coated inside and outside strip steel, minimum 21 mm diameter, except for lighting fixture and control connections where minimum 16 mm diameter is permitted.

.2 Flexible metal conduit fittings: Threadless hinged clamp style.

.3 Connectors: with nylon insulated throats

.4 Liquid tight flexible conduit: galvanized interlocked steel with overall PVC jacket.

.1 Continuous interlocked and double-wrapped steel, zinc coated inside and outside, coated with liquid-tight jacket of flexible PVC, minimum 21 mm diameter.

.2 Liquid-tight flexible metal conduit fittings: Cadmium plated, malleable iron fittings with compression type steel ferrule and neoprene gasket sealing rings.

.3 Liquid-tight flexible metal conduits in the access floor shall be FT rated for use in plenums, in accordance with the requirements of the authorities having jurisdiction.

.4 Connectors: Liquid tight, with nylon insulated throats, 'O' ring gasket and retainer.

2.3 CONDUIT FASTENINGS

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

.1 Two hole steel straps for conduits larger than 50 mm.

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

.3 Channel type supports for two or more conduits at 1.2 m on centre.

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

2.4 CONDUIT FITTINGS

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

.1 Factory "ells" for 90 degree bends are not permitted.

.2 Die cast fittings not permitted.

.3 Set screw type steel couplings and connectors.

.4 All set screw connectors to have insulated throats.

.5 Watertight couplings and connectors in access floors, areas exposed to sprinklers and at all panelboards and cabinets.

2.5 FISH CORD

.1 Polypropylene.

Part 3 Execution

3.1 COMSEC

.1 Separate conduit systems in accordance with the following tables.

	Int.Data	Int.Tel	Int. STS	Data Pwr	UPS Pwr	Ext Data
Int. Data	0	0	0	0	0	50/150
Int.Tel	0	0	0	0	0	50/150
Int STS	0	0	0	0	0	50/150
Data Pwr	0	0	0	0	0	50/150
UPS Pwr	0	0	0	0	0	50/150
Ext Data	50/150	50/150	50/150	50/150	50/150	0
Ext Tel	50/150	50/150	50/150	50/150	50/150	0
EMCS	50/150	50/150	50/150	50/150	50/150	0
Fire Alarm	50/150	50/150	50/150	50/150	50/150	0
Em. Pwr	50/150	50/150	50/150	50/150	50/150	0
Nrml.Pwr	50/150	50/150	50/150	50/150	50/150	0
Maglocks	50/150	50/150	50/150	50/150	50/150	50/150
CCTV	50/150	50/150	50/150	50/150	50/150	50/150
Sec.Access	50/150	50/150	50/150	50/150	50/150	50/150
Ext STS	50/150	50/150	50/150	50/150	50/150	50/150
STS Radio	50/150	50/150	50/150	50/150	50/150	50/150
Cable TV	50/150	50/150	50/150	50/150	50/150	50/150

	Ext Tel	EMCS	Fire Al.	Em. Pwr	Nrml.Pwr
Int. Data	50/150	50/150	50/150	50/150	50/150
Int.Tel	50/150	50/150	50/150	50/150	50/150
Int STS	50/150	50/150	50/150	50/150	50/150
Data Pwr	50/150	50/150	50/150	50/150	50/150
UPS Pwr	50/150	50/150	50/150	50/150	50/150
Ext Data	0	0	0	0	0
Ext Tel	0	0	0	0	0
EMCS	0	0	0	0	0
Fire Alarm	0	0	0	0	0
Em. Pwr	0	0	0	0	0
Nrml.Pwr	0	0	0	0	0
Maglocks	50/150	50/150	50/150	50/150	50/150
CCTV	50/150	50/150	50/150	50/150	50/150
Sec.Access	50/150	50/150	50/150	50/150	50/150
Ext STS	50/150	50/150	50/150	50/150	50/150
STS Radio	50/150	50/150	50/150	50/150	50/150
Cable TV	50/150	50/150	50/150	50/150	50/150

	Maglks	CCTV	SecAcces	Ext STS	STS Radio	Cable TV
Int. Data	50/150	50/150	50/150	50/150	50/150	50/150
Int.Tel	50/150	50/150	50/150	50/150	50/150	50/150
Int STS	50/150	50/150	50/150	50/150	50/150	50/150
Data Pwr	50/150	50/150	50/150	50/150	50/150	50/150
UPS Pwr	50/150	50/150	50/150	50/150	50/150	50/150
Ext Data	50/150	50/150	50/150	50/150	50/150	50/150
Ext Tel	50/150	50/150	50/150	50/150	50/150	50/150
EMCS	50/150	50/150	50/150	50/150	50/150	50/150
Fire Alarm	50/150	50/150	50/150	50/150	50/150	50/150
Em. Pwr	50/150	50/150	50/150	50/150	50/150	50/150
Nrml.Pwr	50/150	50/150	50/150	50/150	50/150	50/150
Maglocks	0	0	0	50/150	50/150	50/150
CCTV	0	0	0	50/150	50/150	50/150
Sec.Access	0	0	0	50/150	50/150	50/150
Ext STS	50/150	50/150	50/150	0	50/150	50/150
STS Radio	50/150	50/150	50/150	50/150	0	50/150
Cable TV	50/150	50/150	50/150	50/150	50/150	0

NOTES:

Measurements are in millimeters and for parallel runs less than 30m/greater than 30m.

Deviations from this table must be assessed and approved by the Departmental Comsec authority.

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass. Conduits shall be installed in hallways and not above other areas unless these are serving those specific areas.

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

.3 Use rigid galvanized steel conduit to a height of 2.4m outside electrical rooms where there is risk of mechanical injury and where specified or indicated. Threads on rigid steel conduits shall be of sufficient length to draw conduits tight together. Use rigid galvanized steel conduit for all applications outside the security perimeter.

.4 Use electrical metallic tubing (EMT) except where specified or indicated otherwise. Properly anchor all conduits exiting from Panels, Communication Cabinets and Distribution Racks to ensure that they can withstand applicable wire pulling forces.

.5 Liquid tight flexible metal conduit for connection to motors or vibrating equipment. All flexible conduit to be of sufficient length to prevent transmissions of vibration.

.6 Provide plastic protection bushings at all conduit terminations.

.7 Provide ground bushings at main conduits.

.8 Minimum conduit size: 19 mm.

.9 Provide long radius bends for conduits. Factory "ells" for 90 deg. bends are not permitted.

.10 Install fish cord in empty conduits.

.11 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits. Seal both ends of new empty conduits to prevent ingress of foreign material, dirt and moisture.

.12 Clean and dry conduits out before installing wire, seal both ends to prevent ingress of foreign materials, dirt and moisture.

.13 Mechanically bend steel conduit over 19 mm. dia. Bend cold and replace conduit if kinked or flattened more than 1/10th of its original diameter. Radius of the inner edge of the conduit shall comply with the C.E.C. or as specified, whichever is greater.

.14 Where conduits pass through fire separating floors, ceilings or walls, close off space between conduit with tight fitting metal caps on both ends and non-combustible insulation. Caulk to the approval of the engineer and Authorities.

.15 Separation between conduits shall be as per the COMSEC chart. Refer to clause 3.1.

.16 Avoid connect between dissimilar metals and use of corrosive materials.

3.4 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

3.5 CLEANING

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

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CSA C22.2 No.42-10, General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CAN/CSA C22.2 No.42.1-00(R2009), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by Contractor

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wiring devices from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 RECEPTACLES

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

.1 Colour to match existing, urea moulded housing.

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

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

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

.5 Triple wipe contacts and rivetted grounding contacts.

.6 Heavy duty one piece grounding system.

.7 Heavy duty, corrosion resistant double plated yoke

.2 Receptacles of one manufacturer throughout project.

2.2 GROUND FAULT PROTECTOR UNIT

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

.1 Solid state ground sensing device.

.2 Facility for testing and reset.

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

2.3 COVER PLATES

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

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

.3 Cover plates from one manufacturer throughout project.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wiring devices installation in accordance with manufacturer's written instructions.

.1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Ground Fault Protector Units:

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

.2 Connect supply and load wiring to equipment in accordance with manufacturer's recommendations.

.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 as indicated or in accordance with Section 26 05 00 - Common Work Results for Electrical.

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

.4 Install GFI type receptacles as indicated.

.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.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

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

.3 Repair damage to adjacent materials caused by wiring device installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CSA C22.2 No. 5-09, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2010).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Include time-current characteristic curves for breakers with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.2 Storage and Handling Requirements:

.1 Store circuit breakers indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers: to CSA C22.2 No. 5

.2 Bolt-on or to match existing, moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

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

.4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.5 Circuit breakers to have symmetrical rms interrupting capacity ratings as indicated or as determined by the coordination study, whichever is higher.

2.2 THERMAL MAGNETIC BREAKERS DESIGN A

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

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install circuit breakers as indicated.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 OPTIONAL FEATURES

.1 Include:

.1 On-off locking device.

.2 Handle mechanism.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI C82.1-0], Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.

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

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

.3 ASTM International Inc.

.1 ASTM F1137-00(2006), Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.4 Canadian Standards Association (CSA International)

.5 Underwriters' Laboratories of Canada (ULC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Departmental Representative.

1.3 DELIVERY, STORAGE AND HANDLING

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

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Disposal and recycling of fluorescent lamps as per local regulations.

Part 2 Products

2.1 LAMPS

.1 Design F1: Fluorescent lamps to be - T8, 32 Watt, medium bi-pin, rapid-start, 4100 K, 30,000 hour lamp life, 2950 initial lumens, CRI 80; or as indicated.

2.2 BALLASTS

.1 Design FB1: Fluorescent ballast: CBM and CSA certified, energy efficient type, IC electronic.

.1 Rating: voltage 347 V to match existing on site, 60 Hz, for use with 2-32W, rapid start lamps.

.2 Totally encased and designed for 40 degrees Celsius ambient temperature.

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

.4 Current crest factor: 1.7maximum.

.5 Harmonics: 10 % maximum THD.

.6 Operating frequency of electronic ballast: 20 kHz minimum.

.7 Total circuit power: 62 Watts.

.8 Ballast factor: greater than 0.90.

.9 Sound rated: Class A.

.10 Mounting: integral with luminaire.

2.3 LUMINARIES

.1 Type A1

.1 Existing on Site

.2 Type A2

.1 Number of lamps: 2.

.2 Lamp design: F1.

.3 Ballast design: FB1.

.4 Recessed, indirect/direct troffer for Imperial T-bar ceiling grid.

.5 Nominal dimensions: 1220 mm long x 610 mm wide x 140 mm high (maximum).

.6 Ballast chamber: built in.

.7 Housing: multi-stage phosphate treated for maximum corrosion resistance. Finish is matte white with a polyester powder coating. Fixture to be completely post painted.

.8 Fixture to be CSA approved.

Part 3 Execution

3.1 INSTALLATION

.1 Locate and install luminaires as indicated.

.2 Provide adequate support to suit ceiling system.

3.2 WIRING

.1 Connect luminaires to lighting circuits:

.1 Install flexible or rigid conduit for luminaires to match existing.

3.3 LUMINAIRE SUPPORTS

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

3.4 CLEANING

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

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION