PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CSA C22.1, Canadian Electrical Code, Part 1 (20th Edition), Safety Standard for Electrical Installations.
.2 CSA C22.2 - Latest Edition.
.3 CAN/CSA-C22.3 No. 1-01(Update March 2005), Overhead Systems.
.4 CAN3-C235-83(R2000), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
.1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.

.3 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
.1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.2 DEFINITIONS

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

1.3 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

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

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

.4 Use one nameplate or label for both languages.

1.4 SUBMITTALS

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

.2 Product Data: submit WHMIS MSDS in accordance with Section 02 81 01 - Hazardous Materials.

.3 Submit for review single line electrical diagrams under plexiglass in glazed frames.
.1 Electrical distribution system in main electrical room.

.4 Submit for review fire alarm riser diagram, plan and zoning of building under plexiglass in glazed frames at fire alarm control panel and annunciator.

.5 Shop drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of New Brunswick, Canada.
.2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.
.3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
.4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
.5 Submit number of copies of drawings and product data to authority having jurisdiction.
.6 If changes are required, notify Departmental Representative of these changes before they are made.

.6 Quality Control: in accordance with Section 01 45 00 - Quality Control.
.1 Provide CSA certified equipment and material.
.2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to site.
.3 Submit test results of installed electrical systems and instrumentation.
.4 Permits and fees: in accordance with General Conditions of contract.

1.4 SUBMITTALS (Cont'd)

.6 Quality Control:(Cont'd)

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

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

.7 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

1.5 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Act respecting manpower vocational training and qualification.

.1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.

.2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

.3 Site Meetings:

.1 In accordance with Section 01 32 16.07 - Construction Progress Schedule - Critical Path Method (CPM) Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Charts.

.2 Site Meetings: as part of Manufacturer's Field Services described in Part 3 - FIELD QUALITY CONTROL, in appropriate NMS Section, schedule site visits, to review Work, at stages listed.

.1 After delivery and storage of products, and when preparatory Work is complete but before installation begins.

.2 Twice during progress of Work at 25% and 60% complete.

1.5 QUALITY ASSURANCE (Cont'd)

.3 Site Meetings:(Cont'd)
.2 Site Meetings:(Cont'd)
.3 Upon completion of Work, after cleaning is carried out.

.4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Departmental Representative with schedule within 2 weeks after award of Contract.

.2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.7 SYSTEM STARTUP

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

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

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

1.8 OPERATING INSTRUCTIONS

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

.2 Operating instructions to include following:
.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

1.8 OPERATING INSTRUCTIONS (Cont'd)

.2 (Cont'd)
.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 Post instructions where directed.

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

.5 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

1.9 Addenda and Revisions

.1 All addenda, instructions and revisions issued during the tendering period shall become part of the Contract Documents and shall be included in the Tender, and shall take precedence over previous instructions.

.2 The Owner and Engineer reserve the right to make revisions to the drawings during the period of construction and these revisions shall take precedence over previously issued drawings. All revisions to work shall be executed by duly authorized change orders with the amount of addition or deduction to the contract amount approved by the Owner before the execution of any work entailed in the revisions.

1.10 Substitutions

.1 It is the intent of these drawings to establish the required quality of materials. Where manufacturers names or catalogue references are used, it is done in order to establish the required quality, style, size or function. Products of other manufacturers will not be permitted after the signing of the contract. The decision as to suitability shall rest with the Engineer.

.2 Should the Contractor propose to furnish material and equipment other than those

1.10 Substitutions (Cont'd)

.2 (Cont'd)
specified, he shall submit a written request for any or all substitutions 10 days prior to the tender closing date. Such a request shall be accompanied by a complete description including manufacturer, brand name, catalogue number, and technical data for all items. If requested by the Engineer, the Contractor shall submit for inspection a sample of the proposed item.

.3 All material not meeting the standards as set down by these specifications shall not be allowed on the job site.

.4 Substitutions affecting the design will not be permitted. Additional costs to any other trade as a result of a change or substitution by this Contractor, shall be borne by this Contractor.

.5 The listing of a manufacturer as acceptable does not imply acceptance of all products of that manufacturer and only products meeting the standards as set out in the specifications will be accepted.

1.11 Scope of Work

.1 The Electrical Contractor shall furnish all labour, materials, tools, appliances and equipment to entirely complete and provide for the operation of the electrical systems.

.2 The overall intention is to provide for a finished piece of work complete in all aspects, and all items reasonably inferrable as called for by the plans and specifications, and by normally accepted good practice, notwithstanding that every item necessarily required may not be particularly mentioned. This Contractor shall fulfill his obligation and not take advantage of any unintentional errors or omissions should such exist, to the detriment of the Owner's interest. The work shall include but not be limited to:

.1 Power Distribution
.2 Branch Circuit Wiring
.3 Power Wiring and Connection to Equipment Supplied Under Other Divisions.
.4 Lighting

1.11 Scope of Work (Cont'd)

.2 (Cont'd)

.5 (Cont'd)

.5 Heating, Controls by Division 26 and Wiring to Controls by controls contractor.

.6 Fire Alarm System

.7 Telephone System

.8 Data System

.9 Co-ordination with GMCS cabling contractor to facillitate the installation of the data and telephone cabling.

1.12 Electrical Drawings

.1 The drawings which constitute an integral part of this contract shall serve as working drawings. They indicate the general layout of the complete electrical system; arrangements of feeders, circuits, outlets, switches, controls, panelboards, service equipment, communications, underground duct banks, overhead pole lines, power centers, etc..

.2 Field verification of scale dimensions on plans is required since actual locations, distances, and levels will be governed by the field conditions.

.3 All discrepancies related to the electrical work shall be promptly brought to the attention of the Engineer for clarification.

1.13 Examination of Drawings and Existing Conditions

.1 The Electrical Contractor shall become completely familiar with the drawings and specifications, as well as construction methods of other trades related to his work to avoid possible conflictions on the project. Should drastic changes be necessary to resolve such conflictions, this Contractor shall notify the Engineer and secure written approval and agreement on necessary adjustments before the installation is started.

.2 Before submitting his tender,this Contractor shall visit the site and become familiar with site conditions, avaibility of storage space and all other factors that might influence his tender.

1.13 Examination of Drawings and Existing Conditions (Cont'd)

.3 The Contractor shall determine all working conditions and rigidly comply. Conditions requiring special consideration include but not be limited to:

.1 Dust.
.2 Noise.
.3 Vibration.
.4 Water.
.5 Use of powder actuated tools.
.6 Working hours.
.7 Access to working locations.
.8 Continuity of power.
.9 Project schedule.
.10 Physical protection of Owner's facility and equipment.

.4 No extras will be allowed due to failure to take site conditions into consideration.

.5 The exact roughing-in dimensions and connection points shall be determined from shop drawings and on-site measurements.

1.14 Discrepancies

.1 Bidders in preparing their tenders, finding any errors, omissions, or discrepancies in the plans, specifications or other documents, or having any doubt in the intent or meaning of any part thereof, shall immediately notify the Engineer, who will send written instructions or clarification to all bidders. Where such discrepancies exist and it is evident that this Contractor could not have properly tendered without clarification and where such clarification was not requested, no extra to the contract will be considered in order to have the installation properly made. The Owner and Engineer will not be responsible for oral instruction.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.

.2 Material and equipment to be CSA certified. Where CSA certified material and equipment is not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.

.3 Factory assemble control panels and component assemblies.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

2.3 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of authority having jurisdiction , and Departmental Representative.

.2 decal signs, minimum size 175 x 250 mm.

2.4 WIRING TERMINATIONS

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

2.5 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates as follows:

.1 Nameplates: lamicoid 3 mm thick plastic engraving sheet , black face, white core, lettering accurately aligned and engraved into core 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 Wording on nameplates to be approved by Departmental Representative prior to manufacture.

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

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

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

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

.7 Transformers: indicate capacity, primary and secondary voltages.

2.6 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, numbered, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

2.6 WIRING IDENTIFICATION (Cont'd)

.3 Colour coding: to CSA C22.1.

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

2.7 CONDUIT AND CABLE IDENTIFICATION

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

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

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

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

2.8 FINISHES

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

.1 Paint outdoor electrical equipment "equipment green" finish to.

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

PART 3 - EXECUTION

3.1 INSTALLATION

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

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

3.2 NAMEPLATES AND LABELS

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

3.3 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.
.1 Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.

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

3.4 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

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

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

.4 Locate light switches on latch side of doors.
.1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.5 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to 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 Local switches: 1400 mm.
- .2 Wall receptacles:
  - .1 General: 300 mm.
  - .2 Above top of continuous baseboard heater: 200 mm.
  - .3 Above top of counters or counter splash backs: 175 mm.
  - .4 In mechanical rooms: 1400 mm.
- .3 Panelboards: as required by Code or as indicated.
- .4 Telephone and interphone outlets: 300 mm.
- .5 Wall mounted telephone and interphone outlets: 1500 mm.
- .6 Fire alarm stations: 1500 mm.
- .7 Fire alarm bells: 2100 mm.
- .8 Television outlets: 300 mm.
- .9 Wall mounted speakers: 2100 mm.
- .10 Clocks: 2100 mm.
- .11 Door bell pushbuttons: 1500 mm.

3.6 CO-ORDINATION OF PROTECTIVE DEVICES

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

3.7 CO-CODINATION WITH OTHERS

.1 Co-ordinate interruptions of electrical services and installation of equipment to minimize inconvenience to Owner.

.2 Care must be taken to prevent interference with normal operations of the Owner.

.3 Work by other contractors will be done concurrently with work in this contract. This contractor shall schedule and arrange his work and store his material in co-operation and so as to avoid interference with others.

3.7 CO-CODINATION WITH OTHERS (Cont'd)

.4 Co-ordinate with GMCS cabling contractor to facillitate the installation of the data and telephone cabling.

3.8 FIELD QUALITY CONTROL

.1 Load Balance:

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
.3 Provide upon completion of work, load balance report as directed in PART 1 - SUBMITTALS: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
.1 Power distribution system including phasing, voltage, grounding and load balancing.
.2 Circuits originating from branch distribution panels.
.3 Lighting and its control.
.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
.5 Systems: fire alarm system, telephone, data and communications.
.6 Insulation resistance testing:
.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
.3 Check resistance to ground before energizing.

.3 Carry out tests in presence of Departmental Representative.

3.8 FIELD QUALITY CONTROL (Cont'd)

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

.5 Manufacturer's Field Services:
.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.9 CLEANING

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

.2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

3.10 Record Drawings

.1 Refer to General Conditions.

.2 Two sets of white prints shall be maintained for the exclusive purpose of recording deviations from that shown on the contract drawings. One set shall be kept up to date at all times. At the completion of the project, the information shall be transferred to the second set of drawings and to a set of reproducible drawings, both shall be turned over to the Owner.

.3 For Security and Communications systems the contractor shall revise the existing record drawings to indicate all changes.

3.11 Cutting

.1 The Contractor shall be responsible for all cutting required to complete the work shown on the drawings and described herein.

3.11 Cutting (Cont'd)

.2 All holes through concrete or masonry shall be made by core drilling. Care must be taken to contain dust and debris.

.3 Seal all holes and openings using a non-shrink, fire proof compound.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for wire and box connectors.

1.2 RELATED SECTIONS

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

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)
- .1 CAN/CSA-C22.2 No.18-98, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
- .2 CSA C22.2 No.65-93(R1999), Wire Connectors.

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
- .1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused wiring materials from landfill to metal recycling facility as approved by Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

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

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

.3 Bushing stud connectors: to EEMAC 1Y-2 NEMA to consist of:
.1 Connector body and stud clamp for stranded round copper conductors.
.2 Stud clamp bolts.
.3 Bolts for copper.
.4 Sized for conductors as required.

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

PART 3 - EXECUTION

3.1 INSTALLATION

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

END

PART 1 - GENERAL

1.1 PRODUCT DATA

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

1.2 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: remove for reuse and return by manufacturer of pallets crates paddling and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

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

2.2 ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from galvanized steel strip.

.4 Connectors: anti short connectors.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

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

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

.3 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

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

.2 Conductor length for parallel feeders to be identical.

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

.4 Wiring in walls: 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 as follows:

.1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings. Where larger conduits are used for multiple circuits the contractor shall adhear to Table 5C for the

3.3 INSTALLATION OF BUILDING WIRES (Cont'd)

.1 (Cont'd)

.1 (Cont'd)

ampacity correction factors for conductors based on the current carrying capacity of Table 2. Conductor size shall be adjusted appropriately.

3.4 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible on channels.

.2 Use Armoured cables for wiring to light fixtures from a ceiling mounted octagon box.

3.5 Installation General

.1 Branch wiring shall be #12 up to 20m in length maximum. Any length greater than 20m and less than 36m shall be #10. Any length greater than 36m shall be sized to suit equipment load and voltage drop.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

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

.2 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

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

.1 ANSI/IEEE 837-1989(R1996), Qualifying Permanent Connections Used in Substation Grounding.

.2 Canadian Standards Association, (CSA International)

.3 CAN/CSA Z32-1999, Electrical Safety and Essential Electrical Systems in Health Care Facilities.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Engineer Consultant.

.5 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.

.2 Grounding conductors: bare stranded copper, tinned, soft annealed, size as required.

.3 Insulated grounding conductors: green, type. RW90.

.4 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
.1 Grounding and bonding bushings.
.2 Protective type clamps.
.3 Bolted type conductor connectors.
.4 Thermit welded type conductor connectors.
.5 Bonding jumpers, straps.
.6 Pressure wire connectors.

PART 3 - EXECUTION

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

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

.5 Soldered joints not permitted.

.6 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.7 Ground secondary service pedestals.

3.2 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of 347/600 volt system.

3.3 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.

3.4 COMMUNICATION SYSTEMS

.1 Install grounding connections for telephone, sound, fire alarm, intercommunication systems as follows:

.1 Telephones: make telephone grounding system in accordance with telephone company's requirements.

.2 Sound, fire alarm, intercommunication systems as required.

3.5 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

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

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

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

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Engineer Consultant.

.5 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Secure equipment to masonry, tile and plaster surfaces with lead anchors.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

3.1 INSTALLATION (Cont'd)

.4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Fasten exposed conduit or cables to building construction or support system using straps.
.1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
.2 Two-hole steel straps for conduits and cables larger than 50 mm.
.3 Beam clamps to secure conduit to exposed steel work.

.7 Suspended support systems.
.1 Support individual conduit runs with 6 mm dia threaded rods and spring clips.
.2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.8 For surface mounting of two or more conduits use channels.

.9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.11 Do not use nylon straps, wire lashing or perforated strap to support or secure raceways or cables.

.12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval ofDepartmental Representative.

.13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END

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 SUBMITTALS

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

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

.3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.
.1 Provide drawings stamped and signed by professional engineer registered or licensed in Province of New Brunswick, Canada.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

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

PART 2 - PRODUCTS

2.1 SPLITTERS

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

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

.3 Spare Terminals: minimum three spare terminals on each connection or lug block sized less than 400 A.

2.2 JUNCTION AND PULL BOXES

.1 Construction:welded steel enclosure.

.2 Covers Flush Mounted: 25 mm minimum extension all around.

.3 Covers Surface Mounted: screw-on flat turned edge covers.

PART 3 - EXECUTION

3.1 SPLITTER INSTALLATION

.1 Mount plumb, true and square to building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

3.3 IDENTIFICATION

.1 Equipment Identification: to Section 26 05 00 - Common Work Results for Electrical.

.2 Identification Labels: size 2 indicatingsystem name, voltage and phase or as indicated.

END

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 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 and 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.

.3 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.4 Extension and plaster rings for flush mounting devices in finished plaster ortile walls.

2.3 MASONRY BOXES

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

2.4 CONCRETE BOXES

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

2.5 CONDUIT BOXES

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

2.6 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

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

.3 Conduit outlet bodies for conduit up to 35 mm 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

PART 1 - GENERAL

1.1 REFERENCES

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

1.2 SUBMITTALS

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

.2 Product data: submit manufacturer's printed product literature, specifications and datasheets.
- .1 Submit cable manufacturing data.

.3 Quality assurance submittals:
- .1 Test reports: submit certified test reports.
- .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .3 Instructions: submit manufacturer's installation instructions.

1.3 WASTE MANAGEMENT AND DISPOSAL

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

.2 Place materials defined as hazardous or toxic waste in designated containers.

1.3 WASTE MANAGEMENT AND DISPOSAL (Cont'd)

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

PART 2 - PRODUCTS

2.1 CABLES AND REELS

.1 Provide cables on reels or coils.

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

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

2.2 CONDUITS

.1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.2 Flexible metal conduit: to CSA C22.2 No. 56, steel liquid-tight flexible metal.

2.3 CONDUIT FASTENINGS

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

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

.3 Channel type supports for two or more conduits.

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

2.4 CONDUIT FITTINGS

.1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.

.3 Set Screw steel couplings for EMT.

2.5 FISH CORD

.1 Polypropylene.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

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

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

.3 Use electrical metallic tubing (EMT.

.4 Use flexible metal conduit for connection to motors in dry areas.

.5 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.6 Minimum conduit size for lighting and power circuits: 19 mm. Where larger conduits are used for multiple circuits the contractor shall adhear to Table 5C for the ampacity correction factors for conductors based on the current carrying capacity of Table 2. Conductor size shall be adjusted appropriately.

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

.8 Mechanically bend steel conduit over 19 mm diameter.

.9 Install fish cord in empty conduits.

.10 Remove and replace blocked conduit sections.
.1 Do not use liquids to clean out conduits.

3.2 INSTALLATION (Cont'd)

.11 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on channels.

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

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.5 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel.

.1 Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed.

.1 Use cold mastic between sleeve and conduit.

3.5 CONDUITS IN CAST-IN-PLACE CONCRETE (Cont'd)

.5 Conduits in slabs: minimum slab thickness 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

3.6 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

PART 1 - GENERAL

1.1 Product Data

.1 Submit product data.

.2 Indicate meter outline dimensions, panel drilling dimensions and include cutout template.

PART 2 - PRODUCTS

2.1 Digital Metering

.1 Where indicated provide a digital Line Metering. The device shall be CSA certified and also meet ANSI Standard C37.90.
.1 Monitoring Functions: The device shall provide direct reading metered or calculated values of the items listed below and shall auto range between Units, Kilo-units, and Mega-units for all metered values. Accuracy indicated below to be of read or calculated values. AC Amperes in each Phase, 1% accuracy. AC Voltage, phase to Phase, Phase to Neutral, 1% accuracy. Watts, 2% accuracy. Vars, 2% accuracy. Power Factor, 2% accuracy. Frequency, 0.005Hz accuracy. Watt Demand (5, 10, 15, 30 minute interval programmable or from utility synchronizing pulse) 2% accuracy. Watt Hours, 2% accuracy. All displays shall be on modular graphic workstations.
.2 Data communication: Provide addressable communications capable of transmitting all data, including trip data over a network to a central personal computer for storage and/or print out. The network shall also be capable of transmitting data via modem.
.3 Software to be provided for power monitoring, analysis and control.

2.2 Manufacturers

.1 Acceptable Manufacturer:
.1 Power Measurement 7650 ION meter with Monitoring software. No substitutions will be permitted.

2.3 Meter Cabinet

.1 Sheet steel CSA enclosure with openings to accommodate meters, and associated equipment.

PART 3 - EXECUTION

3.1 Metering Installation

.1 Install new meters in cabinet as indicated.

.2 Make connections as directed by manufacturer.

.3 Do not connect other instruments, relays, devices to metering circuits.

.4 Connect meter cabinet to ground.

3.2 Field Quality Control

.1 Conduct tests in accordance with Section 26 05 00 - Common Work Results and in accordance with manufacturer's recommendations.

.2 Perform simulated operation tests with metering, instruments disconnected from permanent signal and other electrical sources.

.3 Verify correctness of connections, polarities of meters, instruments, potential and current transformers, transducers, signal sources and electrical supplies.

.4 Perform tests to obtain correct calibration.

.5 Install software and configure system for proper operation, connection to system, and transmission of data.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and components for dry type transformers up to 600 V primary, equipment identification and transformer installation.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

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

.3 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CAN/CSA-C22.2 No.47-M90(R2001), Air-Cooled Transformers (Dry Type).
.2 CSA C9-M1981(R2001), Dry-Type Transformers.

.2 National Electrical Manufacturers Association (NEMA)

1.4 PRODUCT DATA

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

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

1.5 WASTE MANAGEMENT AND DISPOSAL (Cont'd)

.4 Divert unused wiring materials from landfill to metal recycling facility as approved by Engineer Consultant.

.5 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

2.1 TRANSFORMERS

.1 Use transformers of one manufacturer throughout project and in accordance with CAN/CSA-C22.2 No.47 CSA-C9.

.2 Design:
.1 Type: ANN.
.2 3 phase, kVA, V input, V output, 60 Hz.
.3 Voltage taps: standard.
.4 Insulation: Class 220,115 degrees C temperature rise.
.5 Basic Impulse Level (BIL): standard.
.6 Hipot: standard.
.7 Average sound level: standard
.8 Impedance at 17 degrees C: standard
.9 Enclosure: NEMA CSA, removable metal front panel.
.10 Mounting: floor wall
.11 Finish: in accordance with Section 26 05 00 - Common Work Results - Electrical.

2.2 EQUIPMENT IDENTIFICATION

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

.2 Label size: 7.

.3 Nameplate wording:.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Mount dry type transformers up to 75 kVA as indicated.

.2 Mount dry type transformers above 75 kVA on floor.

.3 Ensure adequate clearance around transformer for ventilation.

.4 Install transformers in level upright position.

.5 Remove shipping supports only after transformer is installed and just before putting into service.

.6 Loosen isolation pad bolts until no compression is visible.

.7 Make primary and secondary connections in accordance with wiring diagram.

.8 Energize transformers after installation is complete.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

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

.3 Section 06 10 00 - Rough Carpentry - Short Form: Plywood Backboard.

.4 Section 26 05 00 - Common Work Results - Electrical.

.5 Section 26 28 21.02 - Moulded Case Circuit Breakers.

1.3 REFERENCES

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

1.4 SHOP DRAWINGS

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

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

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins

1.5 WASTE MANAGEMENT AND DISPOSAL (Cont'd)

.3 (Cont'd) for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.

PART 2 - PRODUCTS

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.
.1 Install circuit breakers in panelboards before shipment.
.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 250 and 600 V panelboards: bus and breakers rated for 22000 A (symmetrical) interrupting capacity or as indicated.

.3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

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

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

.6 Copper bus with neutral of same ampere rating as mains.

.7 Mains: suitable for bolt-on breakers.

.8 Trim with concealed front bolts and hinges.

.9 Trim and door finish: baked grey enamel.

2.2 BREAKERS

.1 Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers.

2.2 BREAKERS (Cont'd)

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

.3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

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

2.3 EQUIPMENT IDENTIFICATION

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

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

.3 Nameplate for each circuit in large distribution panelboards, without a directory card) size 2 engraved as indicated.

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

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards in accordance with Section 06 10 00 - Rough Carpentry. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height specified in Section 26 05 00 - Common Work Results - Electrical or as indicated.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral b.s with respective neutral identified

PART 1 - GENERAL

PART 2 - PRODUCTS

2.1 TVSS Surge Protection

.1 Industrial Grade Surge Protective devices:
- .1 Rating: 347/600 volt.
- .2 Impulse 6kV/500A: L-L 1800.
- .3 Maximum Surge Current in KA: L-L 150.
- .4 Operating Temperature: -10 Deg C to -60 Deg C.
- .5 CSA Certified
- .6 UL 1449 listed.
- .7 To ANSI/IEEE C62.41 and C62.45 Categories A, B, and C.

2.2 Acceptable Manufacturers

.1 Acceptable Manufacturers: Leviton 57000 Series.

PART 3 - EXECUTION

3.1 Installation

.1 Install Surge Suppression Device and make all interc onnections as required for a complete and working system as intended.

.2 Provide all required wiring, conduit, and circuit breeakers for interconnection to the system.

END

PART 1 - GENERAL

1.1 SUBMITTALS

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

.2 Submit product data sheets for sills, busbars and compartments. Include product characteristics, physical size and finish.

.3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, and cleaning procedures.

.4 Submit shop drawings and indicate:
.1 Outline dimensions.
.2 Configuration of identified compartments.
.3 Floor anchoring method and dimensioned foundation template.
.4 Cable entry and exit locations.
.5 Dimensioned position and size of busbars and details of provision for future extension.
.6 Schematic and wiring diagrams.

.5 Closeout Submittals: provide operation and maintenance data for motor control centre for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
.1 Include data for each type and style of starter.

1.2 WASTE MANAGEMENT AND DISPOSAL

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

.2 Collect, package and store existing busbars, wireways, sills, copper ground straps and other associated components for recycling and reuse.

1.3 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

PART 2 - PRODUCTS

2.1 SUPPLY CHARACTERISTICS

.1 347/600 V, 60Hz, wye connected, 3 phase, 4 wire.

2.2 GENERAL DESCRIPTION

.1 Compartmentalized vertical sections with common power busbars.

.2 Floor mounting, free standing, enclosed dead front.

.3 Indoor CSA 1 gasketted enclosure, front mounting, sprinkler proof.

2.3 VERTICAL SECTION CONSTRUCTION

.1 Independent vertical sections fabricated from rolled flat steel sheets bolted together to form rigid, completely enclosed assembly.

.2 Each vertical section divided into compartment units, minimum 165 mm high.

.3 Each unit to have complete top and bottom steel plate for isolation between units.

.4 Horizontal wireways, equipped with cable supports, across top and bottom, extending full width of motor control centre, isolated from busbars by steel barriers.

.5 Vertical wireways c/w doors for load and control conductors extending full height of vertical sections, and equipped with cable tie supports. Installation wiring to units accessible with doors open and units in place.

.6 Openings, with removable cover plates, in side of vertical sections for horizontal wiring between sections.

.7 Incoming cables to enter as required.

.8 Provision for outgoing cables to exit via top or bottom with terminals.

.9 Removable lifting means.

2.3 VERTICAL SECTION CONSTRUCTION (Cont'd)

.10 Provision for future extension of both ends of motor control centre including busbars without need for further drilling, cutting or preparation in field.

.11 Divide assembly for shipment to site, as required complete with hardware and instructions for re-assembly.

2.4 SILLS

.1 Continuous 100 mm channel iron floor sills for mounting bases with 19 mm diameter holes for bolts.

2.5 BUSBARS

.1 Main horizontal and branch vertical, three phase and neutral high conductivity tin plated copper busbars in separate compartment bare self-cooled, extending entire width and height of motor control centre, supported on insulators and rated:
.1 Main horizontal busbars: 600 A.
.2 Branch vertical busbars: 300 A.

.2 Branch vertical busbars for distribution of power to units in vertical sections.

.3 No other cables, wires, equipment in main and branch busbar compartments.

.4 Brace buswork to withstand effects of short-circuit current of 42 kA rms symmetrical.

.5 Bus supports: with high dielectric strength, low moisture absorption, high impact material and long creepage surface designed to discourage collection of dust.

2.6 GROUND BUS

.1 Copper ground bus extending entire width of motor control centre.

.2 Vertical ground bus strap, full height of section, tied to horizontal ground bus, engaged by plug-in unit ground stab.

2.7 MOTOR STARTERS AND DEVICES

.1 Starters to section 26 29 10.

2.8 STARTER UNIT COMPARTMENTS

.1 Units EEMAC size 5 and smaller, circuit breaker units 225A and smaller, plug-in type with self-disconnect. Guide rail supports for units to ensure that stabs make positive contact with vertical bus. Provision for units to be installed or removed, off load, while buses energized.

.2 Unit mounting:
.1 Engaged position - unit stabbed into vertical bus.
.2 Withdrawn position - unit isolated from vertical bus but supported by structure. Terminal block accessible for electrical testing of starter.
.3 Provision for positive latching in either engaged or withdrawn position and padlocking in withdrawn position.
.4 Stab-on connectors free floating tin plated clips, self-aligning, backed up with steel springs.

.3 External operating handle of circuit switch interlocked with door to prevent door opening with switch in "on" position. Provision for 3 padlocks to lock operating handle in "off" position and lock door closed.

.4 Hinge unit doors on same side.

.5 Overload relays manually reset from front with door closed.

.6 Pushbuttons and indicating lights mounted on door front.

.7 Devices and components by one manufacturer to facilitate maintenance.

.8 Pull-apart terminal blocks for power and control to allow removal of starter units without removal of field wiring.

2.9 WIRING IDENTIFICATION

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

2.10 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - For Electrical.
.1 Motor control centre main nameplate: size No. 7, engraved.
.2 Individual compartment nameplates: size No. 5, engraved as indicated.

2.11 FINISHES

.1 Apply finishes in accordance with Section 26 05 00 - Common Work Results - For Electrical.

.2 Paint motor control centre exterior light gray and interiors white.

2.12 SOURCE QUALITY CONTROL

.1 Provide manufacturer's type test certificates including short circuit fault damage certification up to short circuit values specified under bus bracing.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Set and secure motor control centre in place on channel bases, rigid, plumb and square to building floor and wall.

.2 Make field power and control connections as. required.

.3 Ensure correct overload heater elements are installed.

3.2 FIELD QUALITY CONTROL

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

.2 Ensure moving and working parts are lubricated where required.

3.2 FIELD QUALITY CONTROL (Cont'd)

.3 Operate starters in sequence to prove satisfactory performance of motor control centre during 8 hours period.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Switches, receptacles, wiring devices, cover plates and their installation.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

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

.3 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-C22.2 No.42-99(R2002), General Use Receptacles, Attachment Plugs and Similar Devices.

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

.3 CSA-C22.2 No.55-M1986(July 2001), Special Use Switches.

.4 CSA-C22.2 No.111-00, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.4 SHOP DRAWINGS AND PRODUCT DATA

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

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins

1.5 WASTE MANAGEMENT AND DISPOSAL (Cont'd)

.3 (Cont'd)
for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Engineer Consultant.

PART 2 - PRODUCTS

2.1 15A, 120V Switches

.1 15 A, 120 V, specification grade, single pole, three-way, four-way switches .

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

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

.4 Switches of one manufacturer throughout project.

.5 Acceptable materials:
.1 Hubbell: 1201 to 1204
.2 Leviton: 1201 to 1204
.3 Bryant: 4801 to 4804
.4 Pass & Seymore: 15AC1 to 15AC4

2.2 20A,120V Switches

.1 20 A, 120 V, single pole, three-way, four-way specification grade switches.

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

2.2 20A,120V Switches (Cont'd)

.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 Acceptable materials:
.1 Hubbell: 1221 to 1224
.2 Leviton: 1221 to 1224
.3 Bryant: 4901 to 4904
.4 Pass & Seymore: 20AC1 to 20AC4

2.3 15A,347V Switches

.1 15 A, 347 V, single pole, double pole, three-way, four-way switches.

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

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

.4 Switches of one manufacturer throughout project.

.5 Acceptable materials:
.1 Hubbell: 18201 to 18204
.2 Leviton: 18201 to 18204
.3 Bryant: 6801 to 6804
.4 Pass & Seymore: 371510 to 371540

2.4 20A,347V Switches

.1 20 A, 347 V, single pole, double pole, three-way, four-way switches.

.2 Manually-operated general purpose ac switches with following features:
.1 Terminal holes approved for No. 10 AWG wire.
.2 Silver alloy contacts.
.3 Urea or melamine molding for parts subject to carbon tracking.

2.4 20A,347V Switches (Cont'd)

.2 (Cont'd)
.4 Suitable for back and side wiring.
.5 White toggle.

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

.4 Switches of one manufacturer throughout project.

.5 Acceptable materials:
.1 Hubbell: 18221 to 18224
.2 Leviton: 18221 to 18224
.3 Bryant: 6901 to 6904
.4 Pass & Seymore: 372010 to 372040

2.5 15A,120V Receptacles

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features:
.1 White urea molded housing.
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Break-off links for use as split receptacles.
.4 Eight back wired entrances, four side wiring screws.
.5 Triple wipe contacts and rivetted grounding contacts.

.2 Receptacles of one manufacturer throughout project.

.3 Acceptable materials:
.1 Hubbell: 5262
.2 Leviton: 5262
.3 Bryant: 5262
.4 Pass & Seymore: 5262

2.6 15A,120V, Isolated Ground Receptacles

.1 Isolated Ground duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features:
.1 White urea molded housing.
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Break-off links for use as split receptacles.
.4 Eight back wired entrances, four side wiring screws.

2.6 15A,120V, Isolated Ground Receptacles (Cont'd)

.1 (Cont'd)
.5 Triple wipe contacts and rivetted grounding contacts.

.2 Receptacles of one manufacturer throughout project.

.3 Acceptable materials:
.1 Hubbell: IG-5262
.2 Leviton: 5262IG
.3 Bryant: 5262IG
.4 Pass & Seymore: IG6200

2.7 15A,120V, Ground Fault Receptacles

.1 Ground fault duplex receptacles, CSA type 5-15R , 125 V, 15 A, U ground, with following features:
.1 White urea molded housing.
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Break-off links for use as split receptacles.
.4 Eight back wired entrances, four side wiring screws.
.5 Triple wipe contacts and rivetted grounding contacts.

.2 Receptacles of one manufacturer throughout project.

.3 Acceptable materials:
.1 Hubbell: GF-5262
.2 Leviton: 6598
.3 Bryant: GFR52FT
.4 Pass & Seymore: 1591CN

2.8 15A,120V, Surge Suppression Receptacles

.1 Surge Suppression duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features:
.1 White urea molded housing.
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Break-off links for use as split receptacles.
.4 Eight back wired entrances, four side wiring screws.
.5 Triple wipe contacts and rivetted grounding contacts.

2.8 15A,120V, Surge Suppression Receptacles (Cont'd)

.2 Receptacles of one manufacturer throughout project.

.3 Acceptable materials:
.1 Hubbell: 5252S
.2 Leviton: 5280
.3 Bryant: SP52
.4 Pass & Seymore: 5252ISP

2.9 COVER PLATES

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

.2 Cover plates from one manufacturer throughout project.

.3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 White plastic cover plates, thickness 2.5 mm for wiring devices mounted in flush-mounted outlet box.

.5 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.6 Weatherproof "while in use" coverplates, complete with gaskets for duplex receptacles as indicated.

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 in accordance with Section 26 05 01 - Common Work Results - Electrical as indicated.

.2 Receptacles:
.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

3.1 INSTALLATION (Cont'd)

.2 Receptacles:(Cont'd)

.2 Mount receptacles, with "U" ground up, at height in accordance with Section 26 05 01 - Common Work Results - Electrical.

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

.3 Cover plates:

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

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

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

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials for moulded-case circuit breakers, and circuit breakers.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).

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

1.4 SUBMITTALS

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

.2 Include time-current characteristic curves for breakers with ampacity of 400 A and over or with interrupting capacity over 22,000 A symmetrical (rms) at system voltage.

.3 Provide a certificate of authenticity, from the manufacturer, for each circuit breaker installed certifying that the circuit breakers being used are new, and that they have not been refurbished or modified

1.5 WASTE MANAGEMENT AND DISPOSAL

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

.2 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

1.5 WASTE MANAGEMENT AND DISPOSAL (Cont'd)

.3 Separate for reuse and recycling and place in designated containers Steel Metal Plastic waste in accordance with Waste Management Plan.

PART 2 - PRODUCTS

2.1 BREAKERS GENERAL

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

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

.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.
.1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.5 Circuit breakers to have minimum 22000 A symmetrical rms interrupting capacity rating.

2.2 THERMAL MAGNETIC BREAKERS

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

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Equipment and installation for ground fault circuit interrupters (GFCI).

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

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

.3 Section 01 45 00 - Quality Control.

.4 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CAN/CSA-C22.2 No.144-M91(R2001), Ground Fault Circuit Interrupters.

.2 National Electrical Manufacturers Association (NEMA)
.1 NEMA PG 2.2-1999, Application Guide for Ground Fault Protection Devices for Equipment.

1.4 SUBMITTALS

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

.2 Submit product data and shop drawings.

.3 Submit test report for field testing of ground fault equipment to Engineer and a certificate that system as installed meets criteria specified herein.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

1.5 WASTE MANAGEMENT AND DISPOSAL (Cont'd)

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Engineer Consultant.

.5 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Equipment and components for ground fault circuit interrupters (GFCI): to CAN/CSA-C22.2 No.144 NEMA PG 2.2.

.2 Components comprising ground fault protective system to be of same manufacturer.

2.2 BREAKER TYPE GROUND FAULT INTERRUPTER

.1 Single andTwo pole ground fault circuit interrupter for 1 phase circuit c/w test and reset facilities.

2.3 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 1, flush mounted.

PART 3 - EXECUTION

3.1 INSTALLATION

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

.2 Pass phase conductors including neutral through zero sequence transformers.

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

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical and co-ordinate with Section 01 45 00 - Quality Control if required.

.2 Arrange for field testing of ground fault equipment by independent testing laboratory ground fault equipment manufacturer Contractor before commissioning service.

.3 Demonstrate simulated ground fault tests.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 35 29 - Health and Safety Requirements.

.3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).
.1 CAN/CSA C22.2 No.4-M89 (R2000), Enclosed Switches.
.2 CSA C22.2 No.39-M89 (R2003), Fuseholder Assemblies.

1.4 SUBMITTALS

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

1.5 HEALTH AND SAFETY

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

1.6 WASTE MANAGEMENT AND DISPOSAL

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

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins

1.6 WASTE MANAGEMENT AND DISPOSAL (Cont'd)

.3 (Cont'd) for recycling in accordance with Waste Management Plan.

.4 Separate for reuse and recycling and place in designated containers Steel Metal Plastic waste in accordance with Waste Management Plan.

.5 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

.1 Fusible, non-fusible, horsepower rated disconnect switch in CSA Enclosure, to CAN/CSA C22.2 No.4 size as indicated.

.2 Provision for padlocking in on-off switch position by three locks.

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

.4 Fuses: HRC type, size as indicated.

.5 Fuseholders: to CSA C22.2 No.39relocatable and suitable without adaptors, for type and size of fuse indicated.

.6 Quick-make, quick-break action.

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

2.2 EQUIPMENT IDENTIFICATION

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

.2 Indicate name of load controlled on size 4 nameplate.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for contactors for system voltages up to 600 V

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

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

.3 Section 26 05 00 - Common Work Results - Electrical.

.4 Section 26 29 03 - Control Devices.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CSA C22.2 No.14-95 (R2001), Industrial Control Equipment.

1.4 PRODUCT DATA

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

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Departmental Representative Consultant.

PART 2 - PRODUCTS

2.1 CONTACTORS

.1 Contactors: to CSA C22.2 No.14.

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

.3 Breaker combination contactor as indicated.

.4 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.

.5 Mount in CSA Enclosure 1, sprinkler proof, unless otherwise indicated.

.6 Include following options in cover:
- .1 Red indicating lamp.
- .2 Hand-Off-Auto selector switch.

.7 Control transformer: in accordance with Section 26 29 03 - Control Devices, in contactor enclosure.

2.2 EQUIPMENT IDENTIFICATION

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

.2 Size 4 nameplate indicating name of load controlled as indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install contactors and connect auxiliary control devices.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for industrial control devices including pushbutton stations.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

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

.3 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CSA C22.2 No.14-95(R2001), Industrial Control Equipment.

.2 National Electrical Manufacturers Association (NEMA)
.1 NEMA ICS 1-2001, Industrial Control and Systems: General Requirements.

1.4 SHOP DRAWINGS

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

.2 Include schematic, wiring, interconnection diagrams.

1.5 QUALITY ASSURANCE

.1 Submit to Departmental Representative one copy of test results.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

1.6 WASTE MANAGEMENT AND DISPOSAL (Cont'd)

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Departmental Representative Consultant.

PART 2 - PRODUCTS

2.1 PUSHBUTTONS

.1 Heavy duty Oil tight. Operator flush type,. Black, with 1-NO and 1-NC contacts rated at 15 A, AC, labels as indicated. Stop pushbuttons coloured red, provision for padlocking in depressed position labelled "emergency stop".

2.2 SELECTOR SWITCHES

.1 Maintained, 3 position labelled Hand/Off/auto, heavy duty oil tight, operators wing lever, contact arrangement and sizing as required.

2.3 INDICATING LIGHTS

.1 Heavy duty Oil tight, full voltage, LED type, push-to-test, lens colour: red labels as indicated.

2.4 CONTROL CIRCUIT TRANSFORMERS

.1 Single phase, dry type.

.2 Primary: 600 V, 60 Hz ac.

.3 Secondary: 120 V, AC.

.4 Rating: 250 VA.

.5 Secondary fuse: as required.

.6 Close voltage regulation as required by magnet coils and solenoid valves.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install pushbutton stations, control devices and interconnect.

3.2 FIELD QUALITY CONTROL

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

.2 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at time and check out operation of section.

.3 Upon completion of sectional test, undertake group testing.

.4 Check out complete system for operational sequencing.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 International Electrotechnical Commission (IEC)
.1 IEC 947-4-1-2002, Part 4: Electromechanical contactors and motor-starters.

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.

.3 Shop Drawings:
.1 Provide shop drawings: in accordance w.th Section 01 33 00 - Submittal Procedures
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of New Brunswick, Canada.
.2 Provide shop drawings for each type of starter to indicate:
.1 Mounting method and dimensions.
.2 Starter size and type.
.3 Layout and components.
.4 Enclosure types.
.5 Wiring diagram.
.6 Interconnection diagrams.

1.3 CLOSEOUT SUBMITTALS

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

.2 Submit operation and maintenance data for each type and style of motorstarter for incorporation into maintenance manual.

.3 Extra Materials:
.1 Provide listed spare parts for each different size and type of starter.
.1 3 contacts, stationary.
.2 3 contacts, movable.

1.3 CLOSEOUT SUBMITTALS (Cont'd)

.3 Extra Materials:(Cont'd)
.1 (Cont'd)
.3 1 contacts, auxiliary.
.4 1 control transformers.
.5 1 operating coil.
.6 2 fuses.
.7 10 % indicating lamp bulbs used.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle 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 Packaging Waste Management: remove for reuse and return by manufacturer of pallets crates paddling and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Starters: All starters to be full size. Half size starters not acceptable. All stareters to be NEMA rated.

2.2 MANUAL MOTOR STARTERS

.1 Single and Three phase 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 heaterswith manual reset, and trip indicating handle.

.2 Accessories:
.1 Toggle switch: standard Duty labelled as indicated.
.2 Indicating light: standard duty type and red colour.
.3 Locking tab to permit padlocking in "ON" or "OFF" position.

2.3 FULL VOLTAGE MAGNETIC STARTERS

.1 Magnetic and 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 Wiring and schematic diagram inside starter enclosure in visible location.
.4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.2 Combination type starters to include operating lever on outside of enclosure to control disconnect, and provision for:
.1 Locking in "OFF" position with up to 3 padlocks.
.2 Independent locking of enclosure door.
.3 Provision for preventing switching to "ON" position while enclosure door open.

.3 Accessories:
.1 HOA Selector switches: standard duty labelled as indicated.
.2 Indicating lights: standard duty type and Red color.
.3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

2.4 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage as required, complete with secondary fuse, installed in with starter as indicated.

.2 Size control transformer for control circuit load plus 20% spare capacity.

2.5 FINISHES

.1 Apply finishes to enclosure in accordance with Section 26 05 00 - Common Work Results for Electrical.

2.6 EQUIPMENT IDENTIFICATION

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

2.6 EQUIPMENT IDENTIFICATION (Cont'd)

.2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.

.3 Magnetic starter designation label, white plate, black letters, size engraved as indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install starters and control devices in accordance with manufacturer's instructions.

.2 Install and wire starters and controls as indicated.

.3 Ensure correct fuses installed.

.4 Confirm motor nameplate and adjust overload device to suit.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and manufacturer's instructions.

.2 Operate switches and 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.

3.3 CLEANING

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

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American National Standards Institute (ANSI)
.1 ANSI C82.1-04, Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.
.2 ANSI C82.4-02(R2007), Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps Multi Supply Type.

.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 F 1137-00(2006), Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.4 Canadian Standards Association (CSA International)

.5 ICES-005-07, Radio Frequency Lighting Devices.

.6 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 when requested for review by Departmental Representative.
.3 Photometric data to include: VCP Table where applicable spacing criterion.

.3 Samples:
.1 Provide samples when requested. Install sample fixtures in mock-up ceiling. Do not

1.2 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd)

.3 Samples:(Cont'd)
.1 (Cont'd)
include cost of mock-up in project price. Locate mock-up on site.

.4 Quality assurance submittals: provide following in accordance with Section01 45 00 - Quality Control.
.1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, i.stallation sequence, cleaning procedures and

1.3 QUALITY ASSURANCE

.1 Provide mock-ups in accordance with Section 01 45 00 - Quality Control.

1.4 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 Packaging Waste Management: remove for reuse and return by manufacturer of pallets crates paddling and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Divert unused metal materials from landfill to metal recycling facility.

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

.6 Disposal of old PCB filled ballasts.

PART 2 - PRODUCTS

2.1 LAMPS .1 Refer to Fixture Schedule

2.2 BALLASTS .1 Fluorescent ballast: CBM and CSA certified, energy efficient type, IC electronic orIC electronic dimmable.
.1 Rating: voltage as required, 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: 1.7 maximum.
.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 FINISHES .1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

2.4 OPTICAL CONTROL DEVICES .1 As indicated in luminaire schedule.

2.5 LUMINAIRES .1 As indicated in luminaire schedule.

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 as indicated.

3.3 LUMINAIRE SUPPORTS

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

3.4 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.5 CLEANING

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

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for emergency lighting systems.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

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

.3 Section 26 05 21 - Wires and Cables (0-1000 V).

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

1.3 REFERENCES

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

1.4 SUBMITTALS

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

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

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

1.5 WASTE MANAGEMENT AND DISPOSAL (Cont'd)

.4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative Consultant.

.5 Dispose of unused batteries at official hazardous material collections site approved by Departmental Representative Consultant.

.6 Fold up metal banding, flatten and place in designated area for recycling.

1.6 WARRANTY

.1 For batteries, the 12 months warranty period prescribed in subsection GC32.1 of General Conditions "C" is extended to 120 months, with no-charge replacement during the first 5 years and pro-rate charge on the second 5 years.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Emergency lighting equipment: to CSA C22.2 No.141.

.2 Supply voltage:as indicaqted.

.3 Operating time: 30 min.

.4 Battery: sealed, maintenance free.

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

.6 Solid state transfer circuit.

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

.8 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.

.9 Lamp heads: see fixture schedule;

.10 Cabinet: see fixture schedule

.11 Finish:see fixture schedule.

2.1 EQUIPMENT (Cont'd)

.12 Auxiliary equipment:
- .1 Test switch.
- .2 Battery disconnect device.
- .3 AC input and DC output terminal blocks inside cabinet.
- .4 RFI suppressors.

2.2 WIRING OF REMOTE HEADS

.1 Conduit: type, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 Conductors: RW90 type in accordance with Section 26 05 21 - Wires and Cables 0-1000 V, sized in accordance with manufacturer's recommendations.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install unit equipment and remote mounted fixtures.

.2 Direct heads.

.3 Connect exit lights to unit equipment.

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CSA C22.2 No.141-02, Unit Equipment for Emergency Lighting.
.2 CSA C860-01(December 2002), Performance of Internally-Lighted Exit Signs.

.2 National Fire Protection Association (NFPA)
.1 NFPA 101-2006, Life Safety Code.

1.2 SUBMITTALS

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

.2 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.

.4 Quality Assurance Submittals: submit following in accordance with Section 01 45 00 - Quality Control.
.1 Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures and.

1.3 WASTE MANAGEMENT AND DISPOSAL

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

PART 2 - PRODUCTS

2.1 STANDARD UNITS

.1 Exit lights: to CSA C22.2 No.141 and CSA C860.

.2 Housing: see fixture schedule

.3 Face and back plates: see fixture schedule.

.4 Lamps: LED.

.5 Letters: 150 mm high x 19 mm, with 13 mm thick stroke, red on white face, reading EXIT and SORTIE.

.6 Downlight: white glass in bottom of unit.

.7 Third lamp socket for emergency lamp lighting circuit.

.8 Face plate to remain captive for relamping.

2.2 SELF-POWERED UNITS

.1 Exit lights: to CSA C22.2 No.141 and CSA C860.

.2 Housing: see fixture schedule

.3 Face and back plates: see fixture schedule

.4 Lamps: LED

.5 Letters: 150 mm high x 19 mm wide, with 13 mm thick stroke, red on white face, reading EXIT and SORTIE.

.6 Downlight: white glass in bottom of unit.

.7 Third lamp socket for emergency lamp lighting circuit.

.8 Face plate to remain captive for relamping.

.9 Supply voltage: as indicated

.10 Operating time: 30 minimum.

.11 Recharge time: 12 hours

.12 Battery: sealed, maintenance free.

2.2 SELF-POWERED UNITS (Cont'd)

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

.14 Solid state transfer circuit.

.15 Signal lights: solid state, for 'AC Power ON' and 'High Charge' condition.

.16 Lamp heads: integral on unit, 345 degrees horizontal and 180 degrees vertical adjustment.
.1 Lamp type: tungsten quartz, 20 W, minimum.

.17 Mounting: suitable for universal mounting directly on junction box and c/w knockouts for conduit.
.1 Removable or hinged front panel for easy access to batteries.

.18 Cabinet: finish: white.

.19 Auxiliary equipment:
.1 Lamp disconnect switch.
.2 Test switch.
.3 AC/DC output terminal blocks inside cabinet.
.4 RFI suppressor.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install exit lights to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.

.2 Connect fixtures to exit light circuits.

.3 Connect emergency lamp sockets to emergency circuits.

3.2 INSTALLATION (Cont'd)

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

3.3 CLEANING

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

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

END