Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

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

.2 CSA C22.2.

.3 CAN/CSA-C22.3 No. 1, Overhead Systems.

.4 CAN3-C235-83, 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 ELECTRICAL SUBCONTRACTOR REQUIREMENTS

.1 Comply with all Department of Labour, Workplace and Health requirements at all times.

.2 All Subcontractors shall have a valid license to operate in the City of Winnipeg.

.3 The complete installation shall be carried out in neat and workmanlike manner to the satisfaction of the Contract Administrator.

.4 All Electrical Subcontractor employees on Site shall have valid Trade Licenses.

.5 Electrical Subcontractor shall maintain the appropriate ratio of Journeymen Electricians & Apprentices required by Provincial Codes. Only qualified workmen shall be employed on this Contract. Supervision shall be by Journeymen Electricians and Work carried out by Journeymen and/or registered apprentices only.

.6 Obtain all necessary permits & pay all fees and arrange for inspection with City of Winnipeg.

.7 Obtain a certificate of final inspection and approval from inspection department having jurisdiction on completion of Work.

.8 All materials, tools, appliances, scaffolding, apparatus and labour necessary for the execution, erection and completion of specified systems shall be furnished.

.9 Provide all labour and materials necessary for complete and operating systems as indicated on the drawings and specified herein. Any Work and material, even if not shown or specified, which is obviously necessary or reasonably implied to complete the Work shall be provided as if it was both shown, and specified.

.10 Unless otherwise specifically noted, any issues which are not part of electrical / telecommunication area of expertise, even if mentioned in these documents, are indicated only for reference and coordination purposes only (with other trades).

.11 The Electrical Subcontractor shall consult with all other sub-trades involved to confirm the locations of the various outlets and equipment and shall cooperate fully to ensure that no conflict arises during the installation. In case of any difference of opinion, the matter shall be referred to the Contract Administrator for final decision.

.12 Electrical Subcontractor is responsible for arranging and coordinating with other divisions for proper drainage of electrical conducts entering from outside, drainage of all exterior electrical junction and pull boxes, sealing and waterproofing of all electrical penetrations; methods of firestopping, and envelope penetration.

1.3 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.

1.4 DESIGN REQUIREMENTS

.1 All electrical design drawings, details and specifications are diagrammatic, and unless specifically noted by figured dimensions, indicate the general arrangement of receptacles, light fixtures, switches, risers, panels, etc. Any information involving accurate dimensions, shall be obtained from detailed dimensioned drawings or by actual measurements at the building. If doubt exists as to the final location, the Electrical Subcontractor shall contact the Contract Administrator for clarification prior to installation. The location of switches, receptacles, outlets, etc., shall be coordinated with built-in units, appliances and equipment, mechanical equipment, etc., as shown on the architectural and mechanical drawings and/or as existing.

.2 Where space is indicated for future equipment, leave such space clear and install feeders and equipment pertaining to this Contract in such a way that future equipment can be easily installed.

.3 Electrical Subcontractor shall coordinate locations of lighting fixtures with sprinklers, mechanical ducts, diffusers, beams and other architectural, structural and mechanical items. Any relocation required shall be performed at no cost to the City

.4 Operating voltages: to CAN3-C235.

.5 Language operating requirements: provide identification nameplates and labels for control items in English.

1.5 PLANS

.1 The Electrical Subcontractor shall familiarize them self with the plans which show the approximate locations of outlets and apparatus. The right is reserved to make such changes in location as may be necessary to meet contingencies of construction. No extras will be allowed for such changes to any piece of electrical equipment, outlets, etc., unless the distance exceeds 3000mm.

.2 Should a discrepancy appear between plans, specifications, or the actual conditions encountered on the Site, which leaves the Electrical Subcontractor in doubt as to the true intention and meaning of the plans and specifications, a ruling shall be obtained in writing from the Contract Administrator which will be final.

1.6 SUBMITTALS

.1 Submittals: in accordance with Section E3 – Shop Drawings.

.2 Shop drawings:

.1 Prior to manufacturing any item required for this job, the Electrical Subcontractor shall submit detailed shop drawings of the item. 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.

.2 Shop drawings must be received by the Contract Administrator at a date early enough to permit reasonable study prior to review and manufacturer, or to permit alterations where necessary. Facsimile transmission of shop drawings will **NOT BE ACCEPTED**. Late submissions of shop drawings will be sufficient reason for stoppage of construction pending review, or removal and replacement of any unsatisfactory item at the Electrical Subcontractor's expense.

.3 Electrical Subcontractor shall allow a minimum of ten (10) business days for shop drawing review by the Contract Administrator and time shall be incorporated in construction schedule so no delays occur due to late submission of shop drawings.

.4 Shop drawings shall to be submitted by email, bearing Electrical Subcontractors' signatures. All shop drawings shall be stamped by the Electrical Subcontractor prior to submission. Prints will be returned with review stamp and/or appropriate comments.

.5 Shop drawings shall be reviewed by the Contract Administrator. Corrections or comments made on the shop drawings during this review do not relieve Electrical Subcontractor from compliance with requirements of the drawings and specifications. This review is only for the general conformance with the design concept of the project and general compliance with the information given in the Contract documents. The Electrical Subcontractor is responsible for: confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his or her Work with that of all other trades and performing all Work in a safe and satisfactory manner.

.6 Shop drawings shall be provided for all system components.

.3 Quality Control:

.1 Any electrical material and/or equipment supplied by Contractor or Subcontractors for installation on this project must bear evidence of certification by authorized organization (e.g. CSA) or special certification acceptable to the Chief Inspector of Electrical Energy for the Province of Manitoba.

.2 Any material and/or equipment not complying with this requirement and found on the job Site will be subject to rejection and replacement with approved equipment at no additional cost

.3 Electrical Subcontractor, upon receipt of equipment purchased by the City for installation on this project, shall examine it for compliance with the above requirements. Report any non approved equipment to the Contract Administrator

for action. Such equipment shall be returned to its packing crate until instructions are received from the Contract Administrator.

.4 Submit test results of installed electrical and telecommunication systems.

.5 Permits and fees: in accordance with General Conditions of Contract.

.6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Contract Administrator.

.4 Substitutions:

.1 Unless otherwise noted on the plans or specifications, substitutions may be allowed by the Contract Administrator, when requested by the Electrical Subcontractor or by equipment suppliers, for items specified by manufacturer and catalogue number.

.2 Requests for review of such substitutions shall be submitted via email at least seven working days prior to the Bid date. Facsimile transmission of substitution drawings and/or specifications will **NOT BE ACCEPTED**.

.3 Descriptive catalogue sheets accompanying the approval application which may show several items of varying specifications shall be conspicuously marked in such a manner that the offered substitute item may easily be recognized for comparison.

.4 Proposed substitutions must be at least of equal quality to that of the specified item. The manufacturer's specification of the item shall apply for comparison if no other clause of this specification applies. The Contract Administrator will review substitution proposal and will make final decision for the City.

.5 Off-the-shelf items which are specified by description only, without any manufacturer, model type or catalogue number, do not require approval prior to the Bid date. However, Electrical Subcontractor shall submit to the Contract Administrator a request for review of such items prior to their use, in sufficient time to permit rejection if unsatisfactory.

.6 All additional expenses incurred as a result of substitution will be the direct responsibility of the Electrical Subcontractor.

1.7 QUALITY ASSURANCE

.1 Qualifications: electrical Work to be carried out by qualified, licensed electricians or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Acts 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.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section D15 – Environmental Protection Plan.

1.9 SYSTEM STARTUP

.1 Instruct Operating Personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service technician 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.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

.1 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.

.2 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 Control wiring and conduit: in accordance with Section 26 29 03 - Control Devices except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical sections and as shown on mechanical drawings.

2.3 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of authority having jurisdiction and Contract Administrator.

.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 aluminium conductors.

2.5 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment, including but not limited to electrical panels, disconnect switches and motors, with nameplates and labels as follows:

.1 Nameplates:

.1 Equipment supplied by the non-emergency power system shall be identified using lamicoid 3 mm matt white finish face, black core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.

.2 Equipment supplied by the emergency power system shall be identified using lamicoid 3 mm matt red finish 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 Labels: embossed plastic labels with 6mm high letters unless specified otherwise.

.3 Wording on nameplates and labels to be approved by Contract Administrator prior to manufacture.

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

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

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

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

.8 Transformers: indicate tag, 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.

.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 5 m intervals.

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.

.2 Paint indoor switchgear and distribution enclosures light grey 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 The Electrical Subcontractor shall obtain and ascertain information from all other sub-trades as to the extent and details of any additional electrical Work to complete all systems served with electrical power or controlled electrically and, where necessary, allow in his Bid for such Work. No extra claim will be accepted for Work on such systems whether they are; as specified in architectural, structural, landscape or mechanical plans and specifications; or proposed and accepted as alternate systems.

.4 Any electrical and communication Work carried out on behalf of, or by, other Subcontractors shall be in accordance with the regulations of the Canadian Electrical Code and the applicable clauses of this specification.

.5 It shall be the Electrical Subcontractor's responsibility to ensure that all Subcontractors and suppliers of electrical equipment observe the applicable clauses of the electrical specifications.

.6 In case of differences between Subcontractors regarding extent of Work responsibilities, such matters shall be referred to the Contract Administrator through the Electrical Subcontractor. Should any discrepancy between the specification and drawings leave the Electrical Subcontractor in doubt as to the true intent and meaning, a ruling shall be obtained from the Contract Administrator before the Bid is submitted. If this is not done it will be the Electrical Subcontractor’s responsibility to ensure that the more expensive alternate has been included.

.7 Prior to the Bid, the Electrical Subcontractor shall visit the Site and report to the Contract Administrator any condition which might prevent him from performing his Contract as specified. No extra will be allowed for if this procedure is not followed.

.8 Should any Work or material be needed which is not specified or shown on the drawings and is nevertheless necessary for properly carrying out the obvious intent, such Work or materials shall be provided without additional cost.

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 plastic, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

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

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

- .1 Local switches: 1200 mm.
- .2 Wall receptacles:
  - .1 General: 400 mm
  - .2 Above top of counters or counter splash backs: 150 mm
- .3 Panelboards: as required by Code or as indicated.

3.5 CO-ORDINATION OF PROTECTIVE DEVICES

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

3.6 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:

- .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, Security System, PA system, 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 Contract Administrator.

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

3.7 CLEANING

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

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

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1	Mechanical Specifications	Division 22 and 23
.2	Common Work Results - Electrical	Section 260500
.3	Wires and Cables (0-1000 V)	Section 260521
.4	Outlet Boxes, Conduit Boxes and Fittings	Section 260532
.5	Conduits, Conduit Fastenings and Conduit Fittings	Section 260534
.6	Disconnect Switches - Fused and Non-Fused	Section 262823

1.2 SYSTEM DESCRIPTION

.1 Provide complete electrical power and control connections for mechanical equipment, except as noted herein, or as noted on the drawings.

Part 2 Products

2.1 MATERIALS

.1 Include motor starters, lockable disconnects, conduit, wire, fittings, interlocks, outlet boxes, junction boxes, and all associated equipment required to provide power wiring for mechanical equipment, unless otherwise indicated.

.2 Include pushbutton stations, motor protective switches, interlocks, conduit, wire, devices, and fittings required to provide control wiring for mechanical equipment, except for temperature/humidity control systems.

.3 Unless otherwise noted, motors and control devices shall be supplied by Division 22 and 23. Motor horsepower ratings shall be as shown in the Division 22 and 23 specifications. Motor voltage and phase ratings shall be as shown on the Division 26 drawings.

2.2 EXTERIOR EQUIPMENT

.1 All equipment, mounted on the exterior of the building, shall be weatherproof.

Part 3 Execution

3.1 POWER WIRING

.1 Install power feeders, starters, lockable disconnects, and associated equipment and make connections to all mechanical equipment.

.2 Install branch circuit wiring for mechanical system control panels, time clocks, and control transformers.

.3 Install main power feeders to starter/control panels furnished by Division 22 and 23. Install branch wiring from starter/control panels to controlled equipment such as motors, electric coils, etc.

.4 Conduit, wire, devices and fittings required to wire and connect low voltage temperature control systems, shall be supplied and installed by the trade supplying the temperature control system. Control wiring shall be installed in conduit.

.5 Wire and connect electrical interlocks for starters supplied by Division 22 and 23.

3.1 COORDINATION

.1 Refer to mechanical drawings for the exact location of motor control devices, and other mechanical equipment requiring an electrical connection.

.2 Obtain full information from Division 22 and 23, regarding wiring controls, overload heaters, equipment ratings and over-current protection. Notify the Division 22 and 23, at once, if any information provided is incorrect or unsatisfactory.

.3 Refer to Division 22 and 23 specifications for any further electrical requirements.

.4 Review both electrical and mechanical drawings and specifications and coordinate all controls with Mechanical Subcontractors through Electrical Subcontractor. Report all discrepancies to the Contract Administrator before close of Bid. No additional money will be justified for assumptions made on any duplication of information.

.5 Submit to Electrical Subcontractor, as part of the bid submission, a list of controls and wiring to be provided by the Electrical Subcontractor.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for wire and box connectors.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.

.2 CSA C22.2 No.65-93, 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)

Part 2 Products

2.1 MATERIALS

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

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

.3 Clamps or connectors for armoured cable, aluminum sheathed cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2 No.18.Execution

2.2 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.

.2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.

.3 Install fixture type connectors and tighten. Replace insulating cap.

.4 Install bushing stud connectors in accordance with NEMA.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section E3 – Shop Drawings.

1.3 SCOPE OF WORK

.1 Provide a complete system of wiring systems, making all required connections as indicated on the drawings, specified herein and as required. Unless noted as larger, install and rate all cables and conductors in accordance with the requirements of the current edition of the Canadian Electrical Code.

.2 Unless otherwise noted, all systems in the building shall be wired in conduit.

Part 2 Products

2.1 WIRES (CONDUCTORS)

.1 All conductors to be copper only, unless otherwise shown or specified. All conductors shall be 98% conductivity copper 600 volt "RW90" X-link insulated, and be of minimum size #12 AWG.

.2 Provide cross-linked thermosetting polyethylene (RW90 X-link) type insulation for all fire alarm system conductors. Where run in cable form with outer jacket, provide Nexans, "Securex II", FAS-105, 300 volts, 105°C (220°F) conductor temperature rated fire alarm system flexible armoured cable with solid copper conductor, shielding, flame retardant PVC insulation and red colour outer overall jacket, ULC listed and labelled and CSA certified to C22.2 No. 208, or equivalent in accordance with section B7.

.3 Wire for 120 volt lighting and receptacle branch circuits shall be #12 AWG for runs up to 27m (90'-0") and #10 AWG minimum for runs over 27m (90'-0"). Wire for 347 volt lighting branch circuits shall be #12 AWG for runs up to 75m (250'-0") and #10 AWG minimum for runs over 75m (250'-0"). Wire for branch circuits shall be sized for proper current-carrying capacity to limit the voltage drop at the outlet to 3%. Do not use common neutrals for IG circuits or for any electronic loads, e.g. computers, etc. For lighting circuits using electronic ballasts, minimum neutral conductor, one (1) size larger than current carrying conductor. Wire for 120-volt control circuits shall be #14 AWG minimum and for 24-volt control circuits shall be #16 AWG minimum. Wiring drops for luminaires to be copper, #14 AWG flame retardant, heat and moisture resistant, rated at 600 volt, 125 degrees C Insulation.

.4 Conductors up to #10 AWG may be solid. Conductors #8 AWG and above shall be stranded, unless specifically mentioned to be solid.

.5 Equipment bonding conductors shall be insulated.

.6 Provide RWU90 XLPE rated cable for underground wiring. Related to new service entrance feeders and site lighting circuits. RWU90 XLPE not required under interior floor slabs.

.7 Cord drops (dropcord receptacles) shall be manufactured to comply with Tables 11 and 12 of CANADIAN ELECTRICAL CODE

2.2 TECK CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper and ACM alloy, size as indicated.

.3 Insulation:

.1 Cross-linked polyethylene XLPE, rating – 600 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum, compliant to applicable Building Code classification for this project.

.6 Outer jacket: PVC jacket, FT-4 rated and suitable for direct burial applications.

.7 Fastenings:

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

.2 Channel type supports for two or more cables at 1500 mm centers.

.3 Threaded rods: 6 mm dia. to support suspended channels.

2.3 ARMOURED CABLES

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

.2 Type: AC90.

.3 Armour: interlocking type fabricated from aluminum strip.

.4 Connectors: standard as required, complete with double split rings.

2.4 CONTROL CABLES

.1 Type LVT: 2 soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket.

.2 Low energy 300 V control cable: stranded annealed copper conductors sized as indicated, with PVC insulation type TW -40°C polyethylene insulation with shielding of tape coated

with paramagnetic material wire braid over each conductor and overall covering of PVC jacket.

2.5 ACM CONDUCTORS

.1 Annealed, compacted aluminum alloy conductor material (ACM) single or multi-conductor, 600 volt insulation.

.2 Type: AC90, ACWU90 and TECK90 as indicated on the drawings.

.3 Armour: interlocked aluminum strip.

.4 Outer jacket: ACWU90 PVC jacket, FT-4 rated suitable for direct buried and Div. 1 and Div. 2 hazardous locations.

2.6 CONNECTORS AND TERMINALS

.1 Mechanical connectors and terminals are restricted to branch circuit wiring.

.1 Mechanical connectors shall be torqued to manufacturer's recommendations.

.2 Connectors #8 AWG gauge and larger shall be compression type.

.3 Terminals shall be compression type with spade type lugs.

.4 Wire and cables shall be as manufactured by Canada Wire and Cable, Canadian General Electric, Alcan or Phillips Cable.

.5 Use approved compression connectors and terminal (i.e. the type that are formed around the conductor using mechanical or hydraulic tools).

.1 Compression terminal for conductor sizes 350 MCM and larger shall have two holes.

.2 The following compression terminals are approved:

.1 Alcan "Alcons" and Alterms";

.2 Burndy "Hylugs" and "Hylinks", YA-A-TN and YS-A series;

.3 llsco compression tubes, AS series;

.4 llsco compression terminals, ACL and 2AC series;

.5 Thomas and Betts colour key connectors;

.6 Thomas and Betts colour key two-way connectors;

.7 Thomas and Betts "H" taps.

.8 Or Equivalent in accordance with section B7

.3 Attach compression type connections only with the manufacturer's approved tools and dies and in accordance with his recommendations.

.4 Watertight and/or type approved for TECK cable, as indicated.

.6 Before applying any connector to an aluminum conductor, abrade the conductor with a wire brush and, in the case of mechanical connectors, it shall be immediately covered with a heavy coat of approved aluminum joint compound already inside the connector.

.1 Approved aluminum jointing compounds are as follows:

.1 Burndy Penatrox "A";

.2 Thomas and Betts aluminum joint compound;

.3 Ideal "Noalox";

.4 Penn Union "Cual-Aid".

.5 Or Equivalent in accordance with section B7

.2 Provide a photograph(s) of application.

.7 When aluminum lugs are connected to bus and/or lugs with steel or copper studs or bolts, ensure that bellville and chrome or stainless steel flat washer combinations are used and that unplated aluminum surfaces are cleaned and coated with compound.

.1 Bellville washers are not required where aluminum-to-aluminum contact is made with an aluminum bolt.

.2 If lug is to be bolted to unplated aluminum bus, the bus shall be lightly wire brushed and approved aluminum joint compound shall be applied over the contact area. Do not use a particular compound on a plated aluminum or copper bus.

.8 When connecting aluminum conductors to copper conductors, outdoors or in damp conditions, use CSA approved CU/AL bi-metallic connectors for this purpose and apply them in accordance with the manufacturer's instructions. The completed connection shall be sealed from the ingress of moisture.

Part 3 Execution

3.1 INSTALLATION

.1 Conductor length for parallel feeders to be identical.

.2 Lace or clip groups of feeder conductors at all distribution centres, pull boxes, panel boards and termination points.

.3 All exterior wiring to be minimum RW90 X-link with 600 volt insulation.

.4 All buried wiring to be minimum RWU90 X-link with 600 volt insulation.

.5 Provide permanent plastic name tag indicating load fed on all cable ends.

.6 In applications where multiple conductors in conduit are being run, provide a trapeze configuration of metal C-channels and threaded rod hangers to support cable/conduit from ceiling slab. Wall mounted cable/conduit brackets and ring type conduit hangers may also be permitted in applications approved by Contract Administrator. Provide required cable support system accessories which are not specified herein or shown on drawings but are required for proper installation.

.7 Support flexible armoured cable in ceiling spaces and in stud wall construction with steel two (2) hole cable straps to "Code" requirements. Flexible armoured cables must run in a neat manner parallel to building lines. Utilize centralized conduit runs to maintain maximum permitted runs of flexible armoured cables as specified. Provide insulating grommet at cut ends of flexible armoured cable to protect conductor insulation.

.8 All wiring shall be done concealed and in conduit except:

.1 Modular wiring where specified.

.2 Wiring for receptacles and lighting fixtures. From receptacles and lighting fixtures to the local area Junction Box, wiring may be done using AC90 Cable. Home run from local area Junction Box to the Panelboard shall be done in conduit. Typically each room shall be equipped with at least one Junction Box with conduit home run.

.9 Electrical Subcontractor shall ensure that all conduits and boxes are installed concealed in brick work, block work, furred out walls, steel stud and wood stud walls, unless specifically permitted. Any conduit installed on surface shall be removed and reinstalled concealed at Electrical Subcontractor's expense. All costs of making good walls and finishes will be borne by Electrical Subcontractor.

.10 Generally, conductor sizes are indicated on drawings. Such sizes are minimum requirements and must be increased, where required, to suit length of run and voltage drop in accordance current edition of the Canadian Electrical Code.

.11 Provide sizes of conductors as required by Canadian Electrical Code or as indicated on the drawings. Voltage drop from panels to farthest device must not exceed 3% at full load. Voltage drop from the main distribution to the panel board must not exceed 2%.

.12 When pulling wires into conduit use lubricant and ensure that wires are kept straight and are not twisted or abraised.

.13 Nylon or similar pulling rope only shall be used to pull conductors into metallic and/or non-metallic conduit.

.14 Neatly secure exposed wire in apparatus enclosures with approved supports or ties.

.15 Exposed wiring, where permitted, shall be installed neatly, parallel or at right angles to the building lines.

.16 An allowance shall be made for re-routing conduits where they go from ceiling to the wall, so they do not appear on side of beams.

.17 No reduction is permitted on neutral conductors.

3.2 IDENTIFICATION OF CONDUCTORS

.1 Line voltage conductors in conduit shall be colour coded to identify service voltage. Conductor colours for 120V circuits shall be:

120/208 Volt

- Phase A Red
- Phase B Black
- Phase C Blue
- Neutral White
- Ground Green
- Control Orange.

600V conductor colour to be confirmed with Contract Administrator

.2 Loop conductor in a three-way and four-way switching circuit shall be:

- Brown

.3 Switch leg conductors of line voltage switches on lighting and any manually controlled plug receptacle circuits shall be colour coded as follows:

- A Yellow
- B Orange
- C Pink

The sequence of colours shall be repeated if more than three switch legs leave a switch box.

.4 Colour code conductors for communications systems in accordance with system component manufacturer's recommendations.

3.3 WORKMANSHIP

.1 Before installing wire, ensure conduit is clean and dry. If moisture present, thoroughly dry out conduit; vacuum if necessary. To facilitate pulling, recognized specially manufactured wire pulling lubricants may be used. Do not use grease. Employ suitable techniques to prevent damage to wire when ambient temperature is below the minimum permitted for each insulation type.

.2 Installation to be free of opens and grounds. Before energization, megger each feeder to ensure that insulation resistance complies with Canadian Electrical Code requirements

.3 Do not install any conductor smaller than #12 AWG gauge, except where specifically indicated otherwise.

3.4 Insulation Test

.1 The insulation resistance between wires and between any wire and ground shall not be less than the Canadian Electrical Code requirements with all circuits complete and connected. Include tests results in maintenance manual.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 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, Qualifying Permanent Connections Used in Substation Grounding.

.2 Canadian Standards Association, (CSA International)

1.3 SCOPE OF WORK

.1 Provide all labour and material to constitute a complete system, equipment grounding and bonding.

.2 Ground all components of the electrical system in accordance with the requirements of the Canadian Electrical Code, local authorities and, where more stringent, manufacturers requirements.

.3 Securely and adequately ground all components of the electrical system in accordance with the requirements of the Canadian Electrical Code and additional requirements set up in the Contract documents.

.4 The system shall consist of, but not be limited to, ground electrodes (ground rods, underground, etc.) ground buses, cables and supports and all necessary materials to provide a complete system.

1.4 TESTS

.1 Measure the ground grid resistance with an earth test megger and install additional ground rods as required until the resistance to ground is 5 ohms or less. Under no circumstances shall the resistance of the network for under 750V system exceed 5 ohms.

Part 2 Products

2.1 CONDUCTORS

.1 Unless otherwise shown, the ground conductor of a system shall have a minimum size of that shown on Table #16A of the Canadian Electrical Code.

2.2 GROUND ELECTRODES

.1 Provide a minimum of three grounding rods 20mm dia. x 3m copper clad steel driven rods with bare #4/0AWG CU interconnecting cable. The three ground rods shall be arranged in triangle formation and shall be spaced 3m apart.

2.3 GROUND BUSES

.1 All main distribution centres, motor control centres, switchgear, transformers, distribution centres and all panelboards requiring equipment ground shall contain a ground bus sized adequately for the number of connections required.

2.4 MAIN BUILDING GROUND BUS

.1 Main building ground bus: 300 mm x 50 mm x 9 mm (12" x 2" x 3/8") copper ground bus with a minimum of eight (8) drilled taped holes; mounted on walls with standoff insulators.

.2 Ground Conductor for Grounding Grid and Associated Connections: size #3/0 AWG bare CU, 7-strand medium hard-drawn copper unless indicated otherwise.

.3 Ground Braid: constructed from flat 98% conductivity tinned copper grounding braid.

2.5 TELECOM GROUND BUS

.1 Telecommunications Equipment Rack And Cabinet Ground Bars: solid copper ground bars designed for mounting on framework of open or cabinet-enclosed equipment racks with minimum dimensions of 6 mm (1/4") thick by 20 mm (3/4") wide; At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks. Where bolting to painted surfaces, use paint piercing type washers.

.2 LAN Room Ground Bus: 300 mm x 50 mm x 9 mm (12" x 2" x 3/8") copper ground bus with a minimum of eight (8) drilled taped holes; mounted on walls with standoff insulators.

.3 Ground Conductor for Grounding Grid and Associated Connections: size #3/0 AWG bare CU, 7-strand medium hard-drawn copper unless indicated otherwise.

.4 Ground Braid: constructed from flat 98% conductivity tinned copper grounding braid.

Part 3 Execution

3.1 INSTALLATION GENERAL

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

.2 All locknuts, connectors and couplings shall be tight fitting and properly cinched, throughout the entire electrical distribution system for grounding and bonding purposes as required by the CEC.

.3 Ground Connections:

.1 Below Grade: Exothermic-welded type connectors, Erico Cadweld or equivalent in accordance with Section B7.

.2 Above Grade or in Manholes: Compression type connectors or Exothermic connections permitted above grade if approved by Contract Administrator.

.3 When making ground and bonding connections, apply a corrosion inhibitor to contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between metals used.

.4 The Electrical Subcontractor shall bond the waterman with a copper bonding conductor not less than #6 AWG at the point of entry into the building.

.5 Ground conductors shall be installed from Main Distributions copper ground bus to CSTE, panel boards, transformers, equipment, etc. From main distributions ground bus provide ground conductors to:

.1 Three Ground rods #4/0 AWG stranded bare copper conductor. Sleeve into building using 27mm rigid PVC conduit.

.2 Each and every transformer secondary side.

.3 The buildings main ground bus #2/0 AWG green insulated copper conductor.

.6 Ground conductors shall be installed from the building's main ground bus to the following:

.1 HHW Building steel columns #2/0 AWG RW90 green insulated in 25mm conduit.

.2 Telecom ground bus located in the HHW building LAN closet #2/0 AWG RW90 green insulated in 25mm conduit

.7 Ground conductors shall be installed from the telecom ground bus to the following:

.1 Water main #6 AWG RW90 green insulated stranded copper conductor in 16mm conduit. Connect ahead of water meter. Install one ground conductor jumper of flexible copper strapped around water meter and associated unions and valves to ground building side of water system.

.2 Refer to Section 3.2 Telecommunication grounding for IT equipment grounding requirements.

.8 Where a single bond wire is installed in EMT conduit the conduit shall be bonding at both ends per CEC requirements.

.9 Ground conductors shall terminate to ground busses, building structure, equipment, etc. with Burndy type GAR connectors, or equivalent in accordance with B7, installed to manufacturer's instruction.

.10 All joints between conductors of #6 AWG and larger shall be made with "Cadweld" process or equivalent in accordance with Section B7.

.11 All bolted ground connections must be accessible.

.12 Install rigid PVC conduit sleeves where ground wires pass through concrete slabs.

.13 Conduits installed buried in earth, installed in or under grade floor slabs shall have a separate ground wire installed in each and every conduit.

.14 Connect grounding conductors to motors 10 hp and above or circuits 20A or above, with a solderless terminal and a bolt tapped to motor frame or equipment housing. Connect to smaller motors or equipment by fastening terminal to a connection box. Connect junction boxes to equipment grounding system with grounding clips mounted directly on box or with machine screws. Completely remove paint, dirt, or other surface coverings at grounding conductor connection points so good metal-to-metal contact is made.

.15 Ground and bond various telecommunications, security, life safety and control systems in accordance with respective system manufacturers recommendations and in accordance with local governing electrical code requirements.

.16 Bond any metal equipment platforms which support electrical equipment to equipment ground.

.17 Install bonding wire in all flexible conduit connected at each end to a grounding bushing by a solderless lug, clamp, cup washer and screw. Soldered joints not permitted.

.18 Measure ground resistance and install additional ground rods and conductors as required until resistance to ground complies with CEC, as shown herein and on the drawings.

.19 Each electrical room and telecommunication room shall be equipped with copper ground bus. Provide identification labels for all grounding and/or building conductors.

.20 Install #6 AWG bare CU bond wire along the full length of cable trays and between separate sections of trays and bond cable tray as required.

.21 Ground conductors not sized on drawings are to be sized in accordance with local governing electrical authority requirements. Ground conductor size is to be no smaller than CEC requirements and as specified herein or on drawings.

.22 Exterior post mounted lights signs etc., shall be properly bonded to ground.

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

.24 Protect exposed grounding conductors from mechanical injury.

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

.26 Install bonding wire for flexible conduit.

.27 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.28 Clearly mark exact locations of Ground Rods and Ground routes on As-Built drawings.

3.2 TELECOMMUNICATION GROUNDING

.1 Locate the HHW building telecom copper ground bus in the LAN closet on wall with standoff insulators. Connect ground bus to computer equipment racks and to building ground system.

.2 Comply with TIA/EIA-607 grounding and bonding requirements.

.3 Provide wire and hardware required to properly ground, bond, and connect communications raceway, cable tray, metallic cable shields, and equipment to a ground source.

.4 Ground bonding jumpers to be continuous with no splices. Use shortest length of bonding jumper possible.

.5 Provide ground paths which are permanent and continuous with a resistance of 1 ohm or less from raceway, cable tray, and equipment connections to building grounding electrode. Resistance across individual bonding connections to be 10 milliohms or less.

.6 Bonding Jumpers:

- .1 Use insulated ground wire of size and type if identified on Drawings if not identified, comply with local governing code, but which is to be a minimum of #6 AWG insulated copper wire.
- .2 Assemble bonding jumpers using insulated ground wire terminated with compression connectors.
- .3 Use compression connectors of proper size for conductors specified. Use connector manufacturer’s compression tool.

.7 Bonding Jumper Fasteners:

- .1 Conduit: Fasten bonding jumpers using screw lugs on grounding bushings or conduit strut clamps, or clamp pads on push-type conduit fasteners. When screw lug connection to a conduit strut clamp is not possible, fasten plain end of a bonding jumper wire by slipping this plain end under conduit strut clamp pad; tighten clamp screw firmly. Where appropriate, use zinc-plated external tooth lockwashers.
- .2 Wireway and Cable Tray: Fasten bonding jumpers using zinc-plated bolts, external tooth lockwashers, and nuts. Install protective cover; e.g., zinc-plated acorn nuts, on any bolts extending into wireway or cable tray to prevent cable damage.
- .3 Ground Plates and Busbars: Fasten bonding jumpers using two-hole compression lugs. Use tin-plated copper or copper alloy bolts, external tooth lockwashers, and nuts.
- .4 Unistrut and Raised Floor Stringers: Fasten bonding jumpers using zinc-plated, self-drill screws and external tooth lockwashers.

.8 Ground metallic conduits, wireways, and other metallic equipment located away from equipment racks or cabinets to cable tray pan or telecommunications ground busbar, whichever is closer, using insulated #6 AWG RW90 CU ground wire bonding jumpers.

.9 Ground metallic conduit at each end using #6 AWG bonding jumpers.

.10 Comply with cable tray manufacturer's grounding and bonding recommendations. Bond metallic structures of wireway to provide 100% electrical continuity throughout wireway system.

3.3 TESTS

.1 Perform tests in accordance with Section 26 05 00.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of the local inspection authority. A report shall be submitted to the Contract Administrator from the testing agency.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator, if provided, during tests.

.5 A ground electrode with an unsatisfactory resistance test result shall be altered as necessary until the required resistance reading is achieved.

END OF SECTION

Part 1 General

1.1 Not Used

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted suspended set in poured concrete walls and ceilings.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to masonry, tile and plaster surfaces with lead shields. Use Aluminum shields or as approved by anchoring manufactures recommendations for specific surfaces.

.2 Secure equipment to poured concrete with expandable inserts.

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

.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 where above 2700mm.
- .2 Two-hole steel straps to secure surface conduits and cables 50 mm and smaller where below 2700mm.
- .3 Two-hole steel straps for conduits and cables larger than 50 mm.
- .4 Beam clamps to secure conduit to exposed steel work.

.7 Suspended support systems.

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

.8 For surface mounting of two or more conduits use channels at 2 m on centre spacing.

.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 Luminaires Recessed in T-Bar ceilings shall be supported independent of T-Bar system via aircraft cable and shall be firmly attached directly to the existing or new roof building structure.

.12 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.13 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Contract Administrator.

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

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data for cabinets in accordance with Section E3 – Shop Drawings.

Part 2 Products

2.1 SPLITTERS

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

.2 Connection bars to match required size and number of incoming and outgoing conductors as indicated.

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

.4 No Splitters without approval by Contract Administrator.

2.2 JUNCTION AND PULL BOXES

.1 Sprinkler proof, welded steel construction with screw-on flat covers for surface mounting.

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

2.3 CABINETS

.1 Type E: sprinkler proof, sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

.2 Type T: sprinkler proof, sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing sheet steel backboard for surface or flush mounting as required.

.3 All cabinets shall be sprinklerproof

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Install splitters and mount plumb, true and square to the building lines.

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

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

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

.3 Install terminal block as required in Type T cabinets.

.4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30m of conduit run between pull boxes.

3.3 IDENTIFICATION

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

.2 Install size 2 identification lamacoid labels indicating system name, voltage and phase.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA C22.1, Canadian Electrical Code (CEC), Part 1.

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 for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

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

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel 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.

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

.3 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished tile walls.

2.3 CONDUIT BOXES

.1 Cast FS or FD boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle. This is only allowed in mechanical spaces.

2.4 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

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

2.5 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

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

.3 Conduit outlet bodies for conduit up to 32 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. Reducing washers are not allowed.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA C22.2 No. 18-98, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.

.2 CSA C22.2 No. 45-M1981, Rigid Metal Conduit.

.3 CSA C22.2 No. 56-1977, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.4 CSA C22.2 No. 83-M1985, Electrical Metallic Tubing.

.5 CSA C22.2 No. 211.2-M1984, Rigid PVC (Unplasticized) Conduit.

.6 CAN/CSA C22.2 No. 227.3-M91, Flexible Nonmetallic Tubing.

1.2 SCOPE OF WORK

.1 Provide conduit system as indicated herein, on the drawings and as required

.2 All wiring in the building shall be installed in conduits unless otherwise noted.

1.3 RESTRICTION OF PLACEMENT

.1 All conduit locations or placements shall be coordinated with structural drawings, prior to installation.

.2 Unless specifically permitted by Contract Administrator, for slabs on grade, no horizontal conduit shall be run in the slab. The conduits shall be placed below the slab in the gravel or fill layer.

.3 Conduit penetrations of the vapour membrane shall be minimized and treated as per the appropriate specification section.

.4 For suspended floor slabs, conduits shall be installed on the underside of the metal deck or slab. Horizontal conduit runs are not permitted in the slab unless authorized by the Contract Administrator.

.5 Under no circumstances shall Electrical Non-metallic Tubing be used.

.6 DB-2 PVC conduit may be used only where specifically identified as such.

Part 2 Products

2.1 RIGID STEEL CONDUIT

.1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel threaded.

.2 Galvanized with threaded joints and connections.

.3 Connections in dry locations: steel or malleable iron lock nuts inside and outside enclosures.

.4 Connectors subject to moisture: Liquid and dust tight with insulated throat.

.5 Fittings: steel

2.2 EMT CONDUIT

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

.2 Fittings in dry locations: steel or malleable iron set screw type fastener with insulated throats or non-metallic bushings.

.3 Fittings in wet locations: steel or malleable iron in rain tight, compression-type, with insulated throat or non-metallic bushings.

2.3 RIGID PVC CONDUIT

.1 Rigid PVC conduit: to CSA C22.2 No. 211.2.

.2 Conduit: rigid non-metallic conduit of non-plasticized polyvinyl chloride, Sceptre Rigid Conduit made by IPEX.

.3 Fittings: threaded male or female solvent weld connectors and solvent weld couplings.

.4 Solvent: as recommended by conduit manufacturer.

2.4 RIGID PVC DUCT

.1 Duct: rigid, non-metallic conduit of un-plasticized polyvinyl chloride, type EB-1 or DB-2 (as approved by the C.E.C.) requiring concrete encasement, conforming to CSA standards.

.2 Accessories: bell ends, coupling adapters, bends and other fittings of same material as duct. Use solvent recommended by manufacturer. Horizontal, vertical and foundation spacers as recommended by manufacturer.

2.5 FLEXIBLE CONDUIT

.1 Conduit: spiral wound, interlocking flexible.

.2 Connectors: slip-proof insulated throat or non-metallic bushings, steel type.

2.6 LIQUID TYPE FLEXIBLE CONDUIT

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

.2 Conduit: flexible metal conduit with PVC liquid type jacket.

.3 Connectors: captive sealing jacket with ground cone insulated throat, steel. Provide sealing rings at all box entries.

2.7 CONDUIT FASTENINGS

.1 Two hole steel straps for conduits larger than 50 mm. One hole steel straps to secure surface conduits 50 mm and smaller where mounted above 2700mm. Two hole steel straps for conduits smaller than 50 mm in all other areas.

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

.3 Channel type supports for two or more conduits at 2 m oc.

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

2.8 CONDUIT FITTINGS

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

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

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

2.9 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 200 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.10 FISH CORD OR WIRE

.1 Polypropylene.

Part 3 Execution

3.1 GENERAL

.1 Flexible Conduit shall be used for line and low voltage circuit connections to all motors or equipment subject to vibration and shall be metal PVC coated water tight, except for lighting fixture drops. Connectors shall be approved for flexible liquid tight conduits.

.2 Unless otherwise noted, Electrical Metallic Tubing (EMT) - shall be utilized in the building.

.3 Exposed conduit running horizontally in areas subject to mechanical injury shall be rigid galvanized steel to a height of 4' (1218mm).

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

.5 Conduit for telecommunication systems shall be a minimum 27mm diameter unless noted as larger.

.6 Install all conduit and wiring concealed, except where specifically noted otherwise. Do not recess conduit in columns or concrete slabs unless approved by the Contract Administrator.

.7 Where conduit is run exposed and in accessible ceiling spaces, run parallel to building lines. Where conduits are grouped (two or more), space evenly, make bends concentric and mount on racks.

.8 Lay out conduit to avoid interference with other work. Maintain a minimum clearance of 150mm from steam or hot water piping, etc.

.9 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment.

.10 Use explosion proof flexible connection for connection to explosion proof motors.

.11 Install conduit sealing fittings in hazardous areas. Fill with compound.

.12 Minimum conduit size for lighting and power circuits: 21 mm.

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

.14 Mechanically bend steel conduit over 21 mm dia. Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.15 Dry conduits out before installing wire.

.16 Slabs on grade: install rigid PVC conduit in the gravel base below concrete slabs. Provide mechanical protection around stub-ups, through slab and extend 150mm beyond concrete. When rigid steel conduit is installed in contact with earth, it shall be protected with tape or asphaltum paint. Extend taping or paint 300mm above finished grade.

.17 Conduit ends emerging from concrete slab, which are to remain as exposed conduit, shall be rigid galvanized steel. Provide rigid steel oversized sleeve over the exposed PVC portion of conduit.

.18 All conduit exposed to weather shall be approved for the location and be complete with weatherproof fittings.

.19 All rigid PVC conduit installed under slab-on-grade shall include a bonding wire sized as required by Canadian Electrical Code.

.20 Where used, sleeves shall be complete with proper connectors and plastic bushing; this is particularly important for telecommunications cabling installation.

.21 An allowance shall be made for rerouting conduits so they do not appear on the side of beams where they go from ceiling to walls.

.22 Install a separate ground wire in underground conduits or in conduits imbedded in concrete or masonry slab in contact with the earth.

.23 Watertight fittings shall be installed in areas exposed to moisture and concrete type fittings in concrete slabs.

.24 At all recessed panels provide 3-27mm conduits c/w pull string and end cap from panel into the accessible ceiling space above for future use. Terminate these conduits in 152mm x 152mm x 102mm junction boxes in ceiling space.

.25 Where conduit or ducts enter or exit concrete structures below grade, provide 19mm x 1500mm steel reinforced dowels to prevent shearing. Extend dowel 1 meter beyond concrete and bend conduit to this dowel.

.26 Where conduit is required to be bent, do not heat and do not bend in such a way as to reduce the cross-sectional area at any point.

.27 For all runs of conduit, do not include more than the equivalent of four 90 degree bends, including bends located immediately adjacent to an outlet box or fitting. Provide pulling elbows, pull boxes and/or junction boxes where necessary.

.28 Where possible, install conduits so that they are not trapped. Cap turned up conduits to prevent the entrance of any dirt or moisture during construction. If necessary, swab out conduit and thoroughly clean internally before wires and cables are pulled.

.29 Take extreme care in reaming ends of all conduit to ensure a smooth, interior finish that will not damage the insulation of the wires.

.30 Use insulated non-metallic bushings on all conduit terminators. Ensure electrical continuity in all conduit systems. All conduits shown exposed in finished areas are to be free of labels and trademarks. Install a 45kg test line in all empty conduits. Conduits and ducts crossing building expansion joints shall have conduit expansion fittings to suit the type of conduit used. Seal conduits with duct seal where conduits are run between heated and unheated areas or into freezers. Where conduits, cables, or cable trays pierce fire separations, seal openings with approved sealing compound.

.31 Where conduits enter the top or side of exposed equipment; panels, etc. provide seal rings and water resistant connectors (i.e. in Electrical and Mechanical Rooms).

3.2 SLEEVES AND CHASES

.1 Sleeves shall be provided and set for conduit passing through foundations, concrete walls and floors. Sleeves shall have sufficient diameter to allow free conduit movement resulting from thermal expansion and contraction. Sleeves installed through foundation walls, beams and footings shall be installed flush with walls, partitions, floors and ceilings. All sleeves installed below grade shall be caulked with oakum and lead on both sides of the wall. Sleeves in floors where water is present shall be caulked, graphite packing and waterproof sealant used.

.2 Exact locations of conduit stub-ups for connection to service equipment, signs etc., shall be checked and verified with the City. Shop drawings shall be issued prior to rough-in and slab being poured.

.3 No extra claim will be accepted by the Contract Administrator for stub up adjustments as a result of the Electrical Subcontractor not following the checking procedure.

.4 Adjustments of stub-ups shall be carried out to the satisfaction of the Contract Administrator. Damaged surfaces shall be repaired to their original condition. Conduit extension shall comply with Canadian Electrical Code and wires are to be re-pulled.

.5 For each telecommunication outlet (data, voice, etc.) provide a corresponding sleeve in every wall leading to the local cable tray to facilitate installation of telecommunication cables.

3.3 EMPTY CONDUITS

.1 All empty conduits shall be tested for clear bore using a ball mandrel, brushes and snake. Clear any conduit which rejects the ball mandrel. All costs involved in making good any work, restoring any surface to original condition shall be borne by the Electrical Subcontractor. All empty conduits to be c/w nylon pull cord (181Kg/400Lb test).

.2 All conduits stubbed out shall be provided with rubber grommets and end caps.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No. 100, Motors and Generators.

.2 CSA C22.2 No. 145-M1986, Motors and Generators for Use in Hazardous Locations.

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

.1 EEMAC M1-7-1992 or latest revision, Standard for Motors and Generators.

1.2 SUBMITTALS

.1 Submittals: in accordance with Section E3 – Shop Drawings.

.2 Product Data:

.1 Indicate product characteristics, performance criteria, physical size, horsepower, watt rating, limitations and finish.

.3 Shop drawings:

.1 Indicate dimensions, recommended installation procedure, wiring diagrams, sizes and location of mounting bolt holes and recommended support method.

.4 Quality Assurance Submittals:

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Manufacturer's Instructions: submit manufacturer's installation instructions.

.5 Closeout Submittals:

.1 Provide maintenance data for fractional horsepower motors for incorporation into manual specified in Section E5 – Additional Submittals.

Part 2 Products

2.1 FRACTIONAL HORSEPOWER MOTOR

.1 Non-hazardous locations: to CSA C22.2 No. 100 and EEMAC M1-7.

.2 Hazardous locations: to CSA C22.2 No. 145.

.1 Rating: As indicated.

.2 Type: As indicated.

.3 Bearings: As indicated.

.4 Frame size: As indicated.

.5 Enclosure: As indicated.

.6 Mounting: As indicated.

.3 Overload Protection: Integral.

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 wiring, flexible connections and grounding.

.2 Check rotation before coupling to driven equipment.

.3 Provide lamacoid label in accordance with section 25 05 00 – Common Work Results – Electrical.

3.3 CLEANING

.1 Proceed in accordance with Section D15 – Environmental Protection Plan.

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)

.1 EEMAC M1-7, Motors and Generators.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section E3 – Shop Drawings.

.2 Submit product data sheets for motors. Include product characteristics, performance criteria, physical size, horsepower, watt rating, limitations and finish.

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

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section E3 – Shop Drawings.

.2 Indicate:

.1 Overall dimensions of motor.
.2 Shaft centreline to base dimension.
.3 Shaft extension diameter and keyway, coupling dimensions and details.
.4 Fixing support dimensions.
.5 Dimensioned position of ventilation openings. Details of ventilation duct attachments.
.6 Terminal box location and size of terminals.
.7 Arrangement and dimensions of accessories.
.8 Diagram of connections.
.9 Starting current and relative data necessary for use in design of motor starting equipment.
.10 Speed/torque characteristic.
.11 Weight.
.12 Installation data.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for motors for incorporation into manual specified in Section E5 – Additional Submittals.

.2 Data necessary for maintenance of motors.

.3 Manufacturer's recommended list of spare parts.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Handle motors with suitable lifting equipment.

.2 Store motors in heated, dry, weather-protected enclosure.

1.6 QUALITY ASSURANCE

.1 Contract Administrator reserves the right to witness standard factory testing of motors 50 hp and above.

Part 2 Products

2.1 HORSEPOWER MOTOR

2.2 MATERIALS

.1 Motors: to EEMAC M1-7.

.2 Lead markings: to EEMAC M2-1.

.3 Rating: As indicated.

.4 Motor Type: As indicated.

.5 Service Factor: 1.15.

2.3 DESIGN LETTERS

.1 Polyphase squirrel cage induction motors design or as indicated.

2.4 ENCLOSURE

.1 Totally enclosed fan cooled.

2.5 INSULATION

.1 Class B or as indicated.

.2 Ambient temperature: 40 ºC

2.6 BEARINGS

.1 Antifriction type bearings, fitted with readily accessible facilities for lubrication while motor running or stationary.

2.7 STARTING METHOD

.1 All motors shall be inverter duty rated.

.2 Include anchor devices and setting templates.

Part 3 Execution

3.1 INSTALLATION

.1 Dry out motor if dampness present in accordance with manufacturer's instructions.

.2 Install wiring, flexible connections and grounding.

.3 Make wiring connections. Use liquid tight PVC jacketed flexible conduit between rigid conduit and motor.

.4 Make flexible conduit long enough to permit movement of motor over entire length of slide rails.

.5 Check for correct direction of rotation with motor uncoupled from driven equipment.

.6 Align and couple motor to driven machinery to manufacturer's instructions, using only correct parts such as couplings, belts, sheaves, as provided by manufacturer.

.7 Provide lamacoid label in accordance with section 25 05 00 – Common Work Results – Electrical.

3.2 FIELD QUALITY CONTROL

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

END OF SECTION

Part 1 General

1.1 SCOPE

.1 This section defines dry-type, enclosed and ventilated low voltage low loss transformers designed constructed and rated in accordance with efficiency levels defined (where applicable) in CSA C802.2 as referenced in the Canadian Energy Efficiency Regulations (SOR/94-651).

1.2 RELATED DOCUMENTS

.1 Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.3 REFERENCES

.1 NEMA ST-20 Dry-Type Transformer For General Applications

.2 IEEE C57.110 Recommended Practice for establishing transformer capability when feeding non-sinusoidal load currents.

.3 CSA C802.2 as referenced in the Canadian Energy Efficiency Regulations SOR/94-651.

.4 UL 1561, CSA C9 & CA 22.2 No. 47.

1.4 SUBMITALS

.1 Submit shop drawing and product data for approval and final documentation in the quantities listed according to the Conditions of the Contract. Customer name, customer location and customer order number shall identify all transmittals.

.2 Product Data including kVA rating, average winding temperature rise, detailed enclosure dimensions, primary & secondary nominal voltages, primary voltage taps, no load & full load losses, impedances, unit weight, warranty.

.1 Efficiency under linear load at 15%, 25%, 35%, 50%, 65%, 75%, 100% of name plate rating.

.2 Percentage regulation at 35% & 100% load at 80% & 100% power factor.

1.5 TESTING & QUALITY CONTROL:

.1 Production tests: each unit according to:

.1 NEMA ST-20

.2 CSA C9 & C22.2 No. 47

.3 DOE 10 CFR Part 431 sub part K, NEMA TP2

.2 Type Test each model design and submit report.

.3 Type test to include:

.1 Induced voltage test
.2 Power frequency withstand voltage test
.3 Insulation resistance (Megger) test
.4 Positive sequence impedance
.5 No load and full load losses in watts
.6 Sound level in decibels

1.6 STORAGE AND HANDLING

.1 Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from potential damage from weather and construction operations. Store so condensation will not form on or in the transformer housing and if necessary, apply temporary heat where required to obtain suitable service conditions.

.2 Handle transformer using proper equipment for lifting and handling; use when necessary lifting eye and/or brackets provided for that purpose.

1.7 WARRANTY

.1 The transformer shall carry a 10 year limited warranty.

Part 2 Products

2.1 GENERAL CONSTRUCTION:

.1 Single phase transformers rated at 15kVA and larger and three phase transformers 9kVA and larger, shall be ventilated type. Convection air cooled. All three phase transformers shall be constructed with three coils and a single core. The primary side of each transformer shall, if applicable, be provided with taps that meet or exceed NEMA standards.

.2 Transformers shall be designed, constructed and rated in accordance with UL, CSA, and NEMA standards.

.3 If transformer is to be used for non-linear load applications, the transformer shall be derated as per ANSI/IEEE C57.110.

2.2 VOLTAGE AND KVA REQUIREMENTS:

.1 Primary Voltage: Three Phase - 600 Volts

.2 Secondary Voltage: Three Phase - 208Y/120 Volts

.3 kVA Rating: Three Phase - As indicated

.4 System Frequency: 60 Hertz

2.3 KEY REQUIREMENTS:

.1 Typical impedance at 60Hz: 2.5% to 6.5% up to 225kVA, 3.0% to 7.5% greater than 225kVA.

.2 Nameplate Rating: Linear load, 60Hz.

.3 Efficiencies:

.1 Meets efficiency levels defined (where applicable) in accordance with CSA C802.2 as referenced in the Canadian Energy Efficiency Regulations SOR/94-651 at 35% of rated load when measured under a linear load profile.

.2 Efficiencies and load losses will be calculated at temperature reference of 75°C at Unity Power Factor (UPF).

2.4 BASIC REQUIREMENTS:

.1 Insulation Class: 220°C system

.2 Temperature Rise: 150°C

.3 Core construction: high grade non-aging, fully processed silicon steel laminations or better.

.4 Coil conductors: copper windings, with terminations brazed, welded or bolted.

.5 Impregnation: vacuum impregnated core & coils.

.6 Excitation current: 3% of full load current rating (max.)

.7 Sound level: 3dB below NEMA ST-20.

.8 Enclosure:

.1 Indoor Enclosure: Ventilated, Type 3R

.2 Outdoor Enclosure: Weatherproof

.9 Enclosure Finish: ANSI 61 Grey suitable for UL50 outdoor applications

.10 Transformers shall terminate in mounting pads. Bring out primary and secondary terminations to terminals on the same side of the transformer mounted on separate insulated support. Provide mechanical lugs on primary, secondary and neutral for customer terminations. Mounting lugs will be included on all aluminum and copper units up to and including 270 amp ratings. Electrical Subcontractor shall provide all necessary lugs not already provided with transformer.

.11 Anti-vibration pads/isolators shall be used between the transformer core and coil and the enclosure.

.12 Vibration Isolators shall be used between the transformer and pad for indoor units.

.13 Listings: ULC, CSA

.14 Built to NEMA ST-20 and in accordance with all applicable UL, CSA and ANSI/IEEE standards.

.15 Ground core & coil assembly to enclosure with a flexible copper grounding strap or equivalent.

.16 Mounting:

.1 Ventilated units up to 750 lbs.: Suitable for wall, floor or ceiling mounting (drip plate required).

.2 Ventilated units over 750 lbs.: Suitable for floor mounting only.

Part 3 Execution

3.1 INSTALLATION

.1 The installing Electrical Subcontractor shall install the transformer per the manufacturer's recommended installation practices as found in the installation, operation, and maintenance manual and comply with all applicable codes.

.2 Make sure that the transformer is level.

.3 Check for damage and loose connections.

.4 Mount transformer to comply with all applicable codes.

.5 Install optional vibration isolation pads between transformer enclosure and the mounting surface.

.6 Coordinate all work in this section with all work of other sections.

.7 Prior to energizing transformer, verify secondary voltages and if necessary adjust primary taps.

.8 Provide lamacoid nameplate in accordance with section 25 05 00 – Common Work Results – Electrical.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Service equipment and installation.

1.2 RELATED SECTIONS

.1 Section 26 05 28 - Grounding - Secondary.

.2 Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

.3 Section 26 28 21 - Moulded Case Circuit Breakers.

.4 Section 26 28 23 - Disconnect Switches - Fused and Non-Fused.

.5 Section 26 24 16 - Panelboards Breaker Type.

Part 2 Products

2.1 EQUIPMENT

.1 Fused disconnect switch: in accordance with Section 26 28 23 - Disconnect Switches - Fused and Non-Fused, rating as per drawings.

.2 Enclosed circuit breaker: in accordance with Section 26 28 21 - Moulded Case Circuit Breakers, rating as per drawings.

.3 Panelboard breaker type: in accordance with Section 26 24 16 - Panelboards Breaker Type, rating as per drawings.

.4 Cabinet type 'A' for utility revenue metering, Junction box, Pull box and Splitter boxes: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets, size as per drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Install service equipment.

.2 Connect to incoming service.

.3 Connect to outgoing load circuits.

.4 Make grounding connections in accordance with Section 26 05 28 - Grounding - Secondary.

.5 Make provision for power supply authority's metering.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for service entrance board.

1.2 RELATED SECTIONS

.1 Section E3 – Shop Drawings

.2 Section E5 – Additional Submittals

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

1.3 REFERENCES

.1 CAN/CSA-C22.2 No.31-M89, Switchgear Assemblies.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section E3 – Shop Drawings.

.2 Indicate on shop drawings.

- .1 Floor anchoring method and foundation template.
- .2 Dimensioned cable entry and exit locations.
- .3 Dimensioned position and size of bus.
- .4 Overall length, height and depth.
- .5 Dimensioned layout of internal and front panel mounted components.

.3 Include time-current characteristic curves for circuit breakers and fuses.

1.5 QUALITY ASSURANCE

.1 Submit copies of certified test results.

1.6 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for service entrance board for incorporation into manual specified in Section E5 – Additional Submittals.

.2 Submit copies maintenance data for complete assembly including components.

1.7 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section E5 – Additional Submittals.

Part 2 Products

2.1 SERVICE ENTRANCE BOARD

.1 Service Entrance Board: to CAN/CSA-C22.2 No.31.

.2 Confirm access requirements, provide narrow depth board if required.

.3 Rating: as indicated.

.4 Cubicles: wall mounted, or free standing, size as indicated.

.5 Barrier metering section from adjoining sections.

.6 Provision for installation of power supply authority metering in barriered section.

.7 Manitoba Hydro metering.

.8 Distribution section.

.9 Access panels with captive screws.

.10 Bus bars and main connections: 99.3% copper.

.11 Cable from load terminals of main breaker to metering section and cable from metering section to lugs of distribution section.

.12 Identify phases with colour coding.

.13 Panel cover shall be hinged. Doors on covers shall be lockable.

2.2 MOULDED CASE CIRCUIT BREAKERS

.1 Refer to section 26 28 21.

2.3 GROUNDING

.1 Copper ground bus extending full width of cubicles and located at bottom.

.2 Lugs at each end for size #4/0AWG grounding cable.

2.4 TVSS Unit

.1 Provide TVSS unit with digital indication and 200kA rating.

2.5 POWER SUPPLY AUTHORITY METERING

.1 Separate cubicle compartment and metal raceway for exclusive use of power supply authority metering.

.2 Mounting accessories and wiring for metering supplied by Electrical Subcontractor in accordance with power supply authority:

.1 Potential transformers.

.2 Current transformers.

.3 Watthour meter.

.4 Demand meter with kW.h register.

2.6 FINISHES

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

.1 Service entrance board exterior: grey.

2.7 EQUIPMENT IDENTIFICATION

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

.2 Nameplates:

.1 White plate, black letters, size 7.
.2 Complete board labelled: "347/600V."
.3 Main disconnect labelled: "Main Breaker".
.4 Branch disconnects labelled: as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Locate service entrance board and fasten to wall and/or floor as applicable.

.2 Connect main secondary service to line terminals of main breaker.

.3 Connect load terminals of distribution breaker's to feeders.

.4 Check factory made connections for mechanical security and electrical continuity.

.5 Run a #4/0AWG AWG bare copper grounding conductors in conduit from the main distribution’s ground bus to the CSTE ground bus and then to the grounding electrodes.

.6 Check trip unit settings against co-ordination study to ensure proper working and protection of components.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 The Electrical Subcontractor shall furnish and install the panelboards as specified and as shown on the Contract drawings.

1.2 RELATED SECTIONS

.1 Section E3 – Shop Drawings.

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

.3 Section 26 28 21 – Moulded Case Circuit Breakers

1.3 REFERENCES

.1 The panelboards and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of EEMAC and CSA.

.1 CSA C22.2 No.29, Panelboards and enclosed panelboards.

1.4 SUBMITTALS – FOR REVIEW/APPROVAL

.1 The following information shall be submitted to the Contract Administrator in accordance with Section E3 – Shop Drawings:

.1 Breaker layout drawing with dimensions indicated and nameplate designation

.2 Component list

.3 Conduit entry/exit locations

.4 Assembly ratings including:

.a Short-circuit rating

.b Voltage

.c Continuous current

.5 Cable terminal sizes

1.5 SUBMITTALS – FOR CONSTRUCTION

.1 The following information shall be submitted in accordance with Section E5 – Additional Submittals for record purposes:

.1 Final as-built drawings and information for items listed in Paragraph 1.4, and shall incorporate all changes made during the manufacturing process

.2 Installation information

1.6 QUALIFICATIONS

.1 The manufacturer of the panelboard shall be the manufacturer of the major components within the assembly, including circuit breakers and fusible switches.

.2 For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

.3 The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Contract Administrator, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.8 OPERATION AND MAINTENANCE MANUALS

.1 Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

Part 2 Products

2.1 MANUFACTURERS

.1 Eaton

.2 Square D

.3 Siemens

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Contract Administrator seven (7) days prior to bid date.

2.2 RATINGS

.1 Panelboards rated 240 Vac or less shall have short-circuit ratings as shown on the drawings or as herein scheduled, but not less than 10,000 amperes RMS symmetrical.

.2 Panelboards rated 600 Vac shall have short-circuit ratings as shown on the drawings or as herein scheduled, but not less than 14,000 amperes RMS symmetrical.

.3 Panelboards shall be labeled with a CSA short circuit rating. When series ratings are applied with integral or remote upstream devices, a label shall be provided. Series ratings shall cover all trip ratings of installed frames. It shall state the conditions of the CSA series ratings including:

.1 Size and type of upstream device.

.2 Branch devices that can be used.

.3 CSA series short circuit rating.

2.3 CONSTRUCTION

.1 Interiors shall be completely factory assembled. They shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.

.2 Trims for branch circuit panelboards shall be supplied with a hinged door over all circuit breaker handles. Doors in panelboard trims shall not uncover any live parts. Doors shall have a semi flush cylinder lock and catch assembly. Door-in-door trim shall be provided. Both hinged trim and trim door shall utilize three point latching. No tools shall be required to install or remove trim. Trim shall be equipped with a door-actuated trim locking tab. Equip locking tab with provision for a screw such that removal of trim requires a tool, at the City's option. Installation shall be tamper resistant with no exposed hardware on the panelboard trim.

.3 Distribution panelboard trims shall cover all live parts. Switching device handles shall be accessible.

.4 Surface trims shall be same height and width as box. Flush trims shall overlap the box by 3/4 of an inch on all sides and shall be constructed to allow trim contact on all sides with box when mounted in flush wall.

.5 A directory card with a clear plastic cover shall be supplied and mounted on the inside of each door.

.6 All locks shall be keyed alike.

2.4 BUS

.1 Main bus bars shall be copper sized in accordance with CSA standards to limit temperature rise on any current carrying part to a maximum of 65 degrees C above an ambient of 40 degrees C maximum.

.2 A bolted ground bus shall be included in all panels.

.3 Full-size (100%-rated) insulated neutral bars shall be included for panelboards shown with neutral. Bus bar taps for panels with single-pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral busing shall have a suitable lug for each outgoing feeder requiring a neutral connection. 200%-rated neutrals shall be supplied for panels designated on drawings with oversized neutral conductors.

2.5 BRANCH CIRCUIT PANELBOARDS

.1 The minimum short-circuit rating for branch circuit panelboards shall be as specified herein or as indicated on the drawings. Panelboards shall be fully rated.

.2 Bolt-on type, heavy-duty, quick-make, quick-break, single- and multi-pole circuit breakers of the types specified herein, shall be provided for each circuit with toggle handles that indicate when unit has tripped.

.3 Circuit breakers shall be thermal-magnetic type with common type handle for all multiple pole circuit breakers. Circuit breakers shall be minimum 100-ampere frame and through 100-ampere trip sizes shall take up the same pole spacing. Circuit breakers shall be CSA listed as type SWD for lighting circuits.

.1 Circuit breaker handle locks shall be provided for all circuits that supply exit signs, emergency lights, and fire alarm panels.

.4 Circuit breakers shall have a minimum interrupting rating of 10,000 amperes symmetrical at 120/208 volts, and 14,000 amperes symmetrical at 600 volts, unless otherwise noted on the drawings.

2.6 DISTRIBUTION PANELBOARDS – CIRCUIT BREAKER TYPE

.1 Distribution panelboards with bolt-on devices contained therein shall have interrupting ratings as specified herein or indicated on the drawings. Panelboards shall be fully rated. Panelboards shall have molded case circuit breakers as indicated below.

.2 Where indicated, provide circuit breakers CSA listed for application at 100% of their continuous ampere rating in their intended enclosure. All breakers listed for 100% continuous load shall be clearly labeled “100% Rated” on their name plates.

.3 Provide shunt trips, bell alarms, and auxiliary switches as shown on the Contract drawings.

2.7 ENCLOSURE

.1 Enclosures shall be at least 20 inches wide made from galvanized steel. Provide minimum gutter space in accordance with the Canadian Electrical Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.

.2 Enclosures shall be provided with one (1) blank end and one end with knockouts.

.3 Where indicated on the drawings, branch circuit panelboards shall be column width type.

2.8 NAMEPLATES

.1 Provide an engraved nameplate for each panel section.

2.9 LUGS AND TERMINALS

.1 All lugs and terminals in electrical distribution equipment shall be listed for a minimum of 75°C conductors. Terminations listed for only 60 °C conductors are not permitted.

2.10 FINISH

.1 Surfaces of the trim assembly shall be properly cleaned, primed, and a finish coat of gray ANSI 61 paint applied.

Part 3 Execution

3.1 FACTORY TESTING

.1 The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of EEMAC and CSA standards.

3.2 INSTALLATION

.1 The Electrical Subcontractors shall install all equipment per the manufacturer's recommendations and the Contract drawings.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 The Munsell System of Colour Notation.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 26 05 00 – Common Work Results – Electrical.

Part 2 Products

2.1 MATERIALS

.1 Enclosure constructed with 2.7 mm thick minimum steel, with weather and corrosion resistant finish, Munsell Notation 7.5GY3.5/1.5, size as indicated.

.2 Entire enclosure capable of withstanding maximum impact force of 86 MN/m^2 area without rupture of material.

.3 Removable enclosure panels with formed edges, galvanized steel external fasteners removable only from inside enclosure.

.4 Enclosure equipped with hot dipped galvanized mounting rails 1 m adjustable horizontally and vertically to enable mounting of equipment at any location within housing.

.1 Rails: 14 mm holes and 50 x 14 mm slots on 100 mm centres for horizontal adjustment.

.2 Holes in side panel flanges in 60 mm increments for vertical adjustment.

.5 Cover: tamperproof, bolt-on, domed to shed water.

.6 Door: minimum 1 m wide, hinged, 3 point latching, with padlocking means.

.7 Ventilation panel constructed to allow air circulation yet preventing entry of foreign objects, wild life, vermin.

.8 Door interlocks: as required.

.9 Enclosure construction such as to allow any configuration of single or ganged enclosures.

.10 Enclosure capable of being shipped in knocked-down condition.

Part 3 Execution

3.1 INSTALLATION

.1 Assemble enclosure in accordance with manufacturer's instructions and mount on concrete pad.

.2 Mount equipment in enclosure.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

.1 Section E3 – Shop Drawings.

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

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

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

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

.3 CSA-C22.2 No.55-M1986, Special Use Switches.

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

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with E3 – Shop Drawings.

Part 2 Products

2.1 SWITCHES

.1 Manually-operated general purpose AC switches

.1 15 or 20 A, 120 V, single pole, three-way, or four-way switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111.

.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 moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 White toggle.

.6 Framed toggle

.7 0-10VDC Dimmer where indicated

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

.2 Ceiling Mounted Day Light / Occupancy Sensor

.1 15 or 20 A, 120 V, single pole to: CSA C22.2: No. 184.1.

.2 Ceiling mounted 120VAC occupancy sensors shall have the following features:

.1 Dual Technology (PIR and ultrasonic)

.2 Day Light Sensor

.3 Contact Rating: 1200VA at 120 V Electronic Ballast, 800W at 120V INC

.4 Single pole relay

.5 Adjustable Time Delay: 30s, 5min, 10min, 20min, 30min

.6 During commissioning set to 20min

.7 White

.8 5 year warranty

.9 Zero-Cross Relay switches

.10 Field of view to suit the application provide masking as required

.3 Devices to be of one manufacturer throughout project.

.4 Acceptable materials: Specification Grade.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R 5-20R and 6-50R, 125/250V V, 15/20/50 A, U ground, to: CSA-C22.2 No.42 with following features:

.1 White urea moulded housing for normal switches. Co-ordinate with Contract Administrator for all unique coloured receptacles.

.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 riveted grounding contacts.

.6 Nylon face

.2 Other receptacles with ampacity and voltage as indicated.

.3 Receptacles of one manufacturer throughout project.

.4 Acceptable materials: Specification Grade.

2.3 COVER PLATES

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

.2 Cover plates from one manufacturer throughout project.

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

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

.5 In-use weatherproof receptacle covers for exterior convenience receptacles.

2.4 SPECIAL WIRING DEVICES

.1 Special wiring devices:

.1 IPLC Receptacles (Model M210), 15 A, 125 V, 3 wire, grounding type, suitable for No. 10 AWG for installation in FS or FD outlet box.

.1 Three year warrantee

.2 LED indicator lights

.3 Weatherproof spring closing specification grade cover

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 00 - Common Work Results - Electrical.

.2 Receptacles:

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

.2 Mount receptacles at height in accordance with Section 26 05 00 - Common Work Results - Electrical.

.3 Test all receptacles with a circuit analyzer to verify wiring.

.4 Arrange for field testing of GFCI receptacles using both external and internal test tripping mechanism.

.3 Cover plates:

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

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

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

.1 Section E3 – Shop Drawings.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).

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

1.4 SUBMITTALS

.1 Submit product data in accordance with Section E3 – Shop Drawings.

.2 Include time-current characteristic curves for breakers with ampacity of 100 A and over or with interrupting capacity of 14 kA symmetrical (rms) and over at system voltage.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers, arc-fault circuit-interrupters and ground-fault circuit-interrupters: 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 with interchangeable trips as indicated.

.6 Circuit breakers shall clearly indicate fault current withstand ratings.

.7 Provide lock-on devices for the following systems.

.1 Fire Alarm System

.2 Intrusion Alarm System

.3 Exit Lights

.4 Night Lights

.8 All circuit breakers feeding fire alarm equipment shall be Red in color.

.9 Circuit breakers to have minimum 14kA symmetrical rms interrupting capacity rating at 600V and a 10kA symmetrical rms interrupting capacity rating at 120/208V.

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.

2.3 SOLID STATE TRIP BREAKERS [DESIGN D]

.1 Moulded case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time, short time and instantaneous tripping for phase and ground fault short circuit protection.

2.4 OPTIONAL FEATURES

.1 Include:

.1 Shunt trip.

.2 Auxiliary switch.

.3 On-off locking device.

.4 Handle mechanism.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated on drawings.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

.1 Section E3 – Shop Drawings.

.2 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, Enclosed Switches.

.2 CSA C22.2 No.39-M89, Fuseholder Assemblies.

1.4 SUBMITTALS

.1 Submit product data in accordance with Section E3 – Shop Drawings.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Heavy-duty, non-fusible, horsepower rated disconnect switch in CSA enclosure, to CAN/CSA C22.2 No.4 sized as per drawings.

.2 Provision for padlocking in off switch position.

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

.4 Weatherproof outdoors.

.5 Quick-make, quick-break action.

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

.7 Where required (For VFDs) provide an auxiliary contact to break prior to main contacts and interlock with the VFD emergency stop.

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.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

.1 Section E3 – Shop Drawings.

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

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.14-95, Industrial Control Equipment.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 1, Industrial Control and Systems: General Requirements.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section E3 – Shop Drawings.

.2 Include schematic, wiring, interconnection diagrams.

1.5 QUALITY ASSURANCE

.1 Submit to Contract Administrator one copy of test results.

Part 2 Products

2.1 AC CONTROL RELAYS

.1 Control Relays: to CSA C22.2 No.14 and NEMA ICS 1.

.2 Convertible contact type: contacts field convertible from NO to NC, electrically held solid state. Contact rating: as required.

2.2 RELAY ACCESSORIES

.1 Standard contact cartridges: normally-open - convertible to normally-closed in field.

2.3 OPERATOR CONTROL STATIONS

.1 Enclosure: CSA Type 4, flush mounting:

2.4 PUSHBUTTONS

.1 Illuminated, heavy duty oil tight. Operator flush type, as indicated. With 1-NO and 1-NC contacts rated at as required.

2.5 EMERGENCY STOP PUSHBUTTONS

.1 Illuminated, heavy duty oil tight. Operator flush type, as indicated. With 1-NO and 1-NC contacts rated at as required ,operator and contact block included.

.2 Jumbo Red Operator.

.3 Push to operate, key only to reset.

.4 Lamicoid, large white letters on red background stating “Equipment Emergency Stop”.

2.6 SELECTOR SWITCHES

.1 Maintained 3 position labelled as indicated heavy duty oil tight, operators standard, contact arrangement as indicated.

2.7 INDICATING LIGHTS

.1 Heavy duty Oil tight, full voltage, LED type, as indicated.

2.8 CONTROL AND RELAY PANELS

.1 CSA Type sprinklerproof sheet steel enclosure with hinged padlockable access door, accommodating relays timers, labels, as indicated, factory installed and wired to identified terminals.

2.9 CONTROL CIRCUIT TRANSFORMERS

.1 Single phase, dry type.

.2 Primary: 208 V, 60 Hz ac.

.3 Secondary: 24 or 120 V, AC. As required

.4 Rating: VA rating as required.

.5 Secondary fuse: rated as required.

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

Part 3 Execution

3.1 INSTALLATION

.1 Install as required.

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 OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 SCOPE OF WORK

.1 Supply and install starters, motors and disconnects as indicated on drawings, stated herein and as required.

.2 Electrical Subcontractor shall wire and connect all motors, starters, disconnects, controls and appliances that form a part of the buildings heating, ventilation, and/or air conditioning systems and other such items which form a part of the construction documents including; door operators, elevators, City supplied equipment, etc. Prior to bid confirm and co-ordinate with other divisions exact requirements.

.3 Additional control information and wiring diagrams may be available at a later date when the exact type of equipment being supplied is established. Supply and install wiring and equipment in accordance with wiring diagrams.

.4 The Electrical Subcontractor shall co-ordinate with trades and ensure that all motor and controls which form a part of, or function with, the particular apparatus, or motorized equipment, are installed in conjunction with mechanical plans and specifications.

.5 Prior to bids closing the Electrical Subcontractor must coordinate with trades and ensure that all motor wiring and control thereof is allowed for in Electrical Subcontractors bid.

1.3 DIVISION OF RESPONSIBILITY

.1 Electrical Subcontractor shall supply and install the line voltage service to all equipment provided by Division 21, 22 and 23. Low voltage control wiring is generally included in Division 21, 22 and 23. See Mechanical Specification for reference.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with Section E3 – Shop Drawings.

.2 Indicate:

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

1.5 EXTRA MATERIALS

.1 Provide listed spare parts for each different size and type of starter:

.1 3 contacts, stationary.
.2 3 contacts, movable.
.3 1 contacts, auxiliary.
.4 1 control transformer.
.5 1 operating coil.
.6 2 fuses.
.7 10% indicating lamp bulbs used.

Part 2 Products

2.1 ENCLOSURES

.1 All products shall be complete with CSA type enclosures suitable for installation location. Unless otherwise noted, or required, CSA Type 2 shall be used as a minimum standard required.

2.2 STARTERS

.1 Three-phase motors shall be controlled with combination magnetic starters except where specifically noted on the plans or otherwise specified.

.2 Single phase manual motor protection switches to be either toggle and/or key operated complete with pilot light. Flush and/or surface mounted as indicated, key operated where indicated.

.3 Single phase motors running at not more than 120 volts shall be controlled and protected with manual motor starting switches overload and over-current protection except where otherwise specified.

.4 Magnetic starting switches shall be of EEMAC sizes to suit the horsepower rating of the motor which they control and protect. Contactors shall be of sizes as specified. Half size starters will not be allowed.

.5 Each magnetic motor starter shall incorporate the following facilities:

.1 Contactor with three overload relays.
.2 120 volt holding coil with under voltage protection.
.3 Pilot light and cover, red LED type.
.4 Reset button, HOA switch in cover, field convertible to off/auto or start/stop push-button as indicated.
.5 Two sets of normally open auxiliary contacts in addition to the standard auxiliary contacts supplied with each starter. One set of auxiliary contacts, convertible to normally closed.

.6 Control transformer 600 or 208/120 Volt of sufficient VA to handle operating coil and associated controls.

2.3 OVERLOADS

.1 Overloads to be coordinated with the name plate rating of the motor. Failure to do so renders the Electrical Subcontractor liable for any damage that may occur to the motors.

2.4 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with secondary fuse, installed in with starter as indicated.

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

2.5 MANUFACTURERS

.1 Pre-approved Manufacturers: Eaton Cutler Hammer, Square D and Siemens.

2.6 FINISHES

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

2.7 EQUIPMENT IDENTIFICATION

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

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

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

Part 3 Execution

3.1 CONNECTIONS

.1 Use flexible hanging feeder loop for connection to motors.

3.2 CO-ORDINATION

.1 Consult with Mechanical Subcontractor for actual locations of units, starters, controls, etc., and provide all connections and devices as required.

3.3 INSTALLATION

.1 Confirm final connections, load and locations of all motors prior to installation.

.2 Motors for mechanical equipment to be installed under Division 21, 22 and 23. Locations of motors conduit and connection points indicated for equipment supplied are for

estimating purposes only. Refer to shop drawings of the actual equipment for exact connection points, feeder size and over-current protection.

.3 Provide line voltage power supply connections for all mechanical equipment motors.

.4 Label and identify all junction boxes, controls, wiring, etc., as per Section 26 05 00.

.5 Select overloads to suit full load current of motors installed. Refer to shop drawings and/or actual nameplate data for full load current of each motor.

.6 Magnetic motor starters shall be installed where indicated on the drawings.

.7 Conduit, wire and connections for control low voltage wiring for mechanical equipment motors generally is unless otherwise specified the responsibility of Division 21, 22 and 23.

3.4 FIELD QUALITY CONTROL

.1 Operate switches, contactors to verify correct functioning.

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

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

END OF SECTION

Part 1 General

1.1 REFERENCES

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

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

.2 ASTM International Inc.

.1 ASTM F1137, Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.3 Canadian Standards Association (CSA International)

.4 ICES-005, Radio Frequency Lighting Devices.

.5 Underwriters' Laboratories of Canada (ULC)

1.2 RELATED SECTIONS

.1 Section E3- Shop Drawings.

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

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with Section E3 – Shop Drawings.

.2 Product Data:

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

.2 Provide complete photometric data prepared by independent testing laboratory for luminaires where specified, for approval by Contract Administrator.

.3 Quality assurance submittals:

.1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence, and cleaning procedures.

Part 2 Products

2.1 LED LIGHTING

.1 LED Fixtures.

.1 Rating: Voltage shall be 120 to 277 VAC, 60 Hz or as indicated on the luminaire schedule.

.2 A minimum of 50,000 operating hours before reaching the L70 lumen output degradation point without catastrophic failure, or as indicated on the luminaire schedule.

.3 Colour Temperature shall be 4000K or as indicated on the luminaire schedule.

.4 Minimum five (5) year warranty.

.5 Minimum CRI: >70 or as indicated on the luminaire schedule.

.2 LED Driver

.1 Must operate input voltage between 120 to 277 VAC, or as indicated on the luminaire schedule.

.2 Operating frequency must be 60 Hz.

.3 Must be rated to operate between -40C and +50C.

.4 Must have a minimum efficiency of 85%.

.5 Self protected, including short circuit protection.

2.2 EXTERIOR STEEL LIGHT POLES

.1 Steel poles: to CSA C22.2 No.206 designed for underground wiring and:

.1 Mounting on concrete anchor base.

.2 Style: minimum 3.0 mm thick, tapered octagonal.

.3 Access handhole 457 mm above pole base for wiring connections, with welded-on reinforcing frame and bolted-on cover.

.4 Size: 15.24 m [50’]

.5 Anchor bolts: minimum four steel with shims, nuts and covers.

.6 Finish: galvanized steel.

.7 Grounding lug.

.8 Manufacturer: Nova Pole NST 50 or equivalent in accordance with B7.

2.3 INTERIOR LIGHTING CONTROLS

.1 The lighting in the office and staff room shall be controlled using a wall mounted 0-10VDC line voltage switch and a ceiling mounted day light / occupancy sensor. The remaining indoor lights shall be controlled using line voltage switches.

2.4 EXTERIOR LIGHTING CONTROLS

.1 Provide a control panel to control the exterior lighting as indicated on drawings complete with NEMA 4 enclosure (sized to suit the enclosed equipment), hand/off/auto selector switch, red pilot light, time clock, exterior photocell and contactor.

2.5 LUMINAIRES

.1 As per design basis material specified.

2.6 LUMINAIRE ACCESSORIES

.1 Provide all luminare accessories including trim rings, stems, canopies, cords, mounting hardware, restraints, etc., necessary to mount the fixture in a complete and approved method.

.2 Provide any seismic bracing and / or restraints required by the authority having jurisdiction.

.3 Provide chain hangers for all suspended channels supporting luminaires and / or strip lights in unfinished areas.

.4 Provide drywall frames for all luminaires that are recessed into drywall ceilings

.5 Provide extensions for recessed luminaires where required by the ceiling thickness.

.6 Provide IC-rated luminaires where luminaires are recessed into insulated ceilings. If the luminares cannot be provided with an IC rating provide ceiling boxes to maintain minimum clearances from ceiling insulation

.7 Where required provide fire-rated luminaire covers for luminaires installed in fire-rated ceiling assemblies or provide fire-rated boxes around each lumainre.

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.

3.3 LUMINAIRE SUPPORTS

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

.2 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors (Nylon shields not acceptable) or as recommended by Anchor Construction Industrial Building Products Ltd for the specific surface & equipment being installed.

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

.4 If there is potential of Asbestos Electrical Subcontractor must use a proper collection boot and HEPA vacuum whenever drilling of holes in facility.

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 PROTECTION OF FINISHED WORK

.1 Protect installed products as needed until completion of project.

.2 Repair or replace damaged products before Substantial Completion.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for emergency lighting systems.

1.2 RELATED SECTIONS

.1 Section E3 – Shop Drawings.

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

.3 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, Unit Equipment for Emergency Lighting.

1.4 SUBMITTALS

.1 Submit product data in accordance with Section E3 – Shop Drawings.

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

1.5 LABELLING

.1 Label battery units with 5” X 3” lamacoid. Mount lamacoid on the face of the battery unit where it is visible. The lamacoid label shall contain the following information: battery bank number, AC circuits monitored by voltage sensing relays, power source and date of installation.

.3 Label each emergency remote head with a Brady label, using “Brady” Globemark tape, indicating which battery bank it is fed from and fused DC circuit it is connected to on the unit. Install tape on canopy of fixture.

Part 2 Products

2.1 EQUIPMENT

.1 Battery Unit

.1 As per design basis material specified.
.2 Emergency lighting equipment: to CSA C22.2 No.141.
.3 Supply voltage: 120 VAC
.4 Output voltage: 12 VDC
.5 Operating time: 30 min
.6 Battery: sealed, maintenance free.
.7 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, reverse polarity protected, modular construction.

.8 Solid state transfer circuit.

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

.10 Automatic Self Testing Feature that test once a month, every 6 months and 12 months c/w visual and audible alarm and should indicate the following at a minimum:

.1 Battery Failure

.2 Battery Disconnect

.3 Charger Failure

.4 Lamp Failure

.5 Service Alarm

.6 AC on

.7 Charger on

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

.12 Options required:

.1 Line cord and twist lock plug

.2 AC / DC Terminal block capable of accepting #10 AWG CU Wire

.3 Four (4) AC circuit voltage sensing relays internal to battery

.4 Sealed dust-proof transfer relay, test switch and LED indicators

.2 Remote Lamp Heads

.1 Impact Resistant

.2 Double heads

.3 Canopy shall be provided to fit a 4” octagon box

.4 Color: As per design basis material.

2.2 WIRING OF REMOTE HEADS

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

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

Part 3 Execution

3.1 INSTALLATION

.1 Install emergency remote heads and battery pack as indicated on the drawings.

.2 Direct heads.

.3 Connect remote heads to the emergency battery pack.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No.141, Unit Equipment for Emergency Lighting.

.2 CSA C860, Performance of Internally-Lighted Exit Signs.

.2 National Fire Protection Association (NFPA) requirements

1.2 SUBMITTALS

.1 Submit product data in accordance with Section E3 – Shop Drawings.

.2 Submit product data sheets for exit lights. Include product characteristics, performance criteria, physical size, limitations and finish.

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

Part 2 Products

2.1 STANDARD UNITS

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

.1 Housing: Steel housing, white finish

.2 Lamps: LED

.3 AC Supply Voltage: 120VAC

.4 DC Supply Voltage: 12VDC

.5 Operation: designed for over 100,000 hours of continuous operation without relamping.

.6 Pictogram: Green Running Man Pictogram

.7 Faces / Mounting: Universal

.8 Warranty: 5 Year

Part 3 Execution

3.1 INSTALLATION

.1 Locate and install exit lights as indicated.

.2 Connect fixtures to exit lights both AC and DC circuits.

.3 Connect emergency lamp sockets to emergency circuits.

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

END OF SECTION