PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)
- .1 CSA C22.1-12, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
- .2 CAN/CSA-C22.3 No. 7-10, Underground Systems.
- .3 CAN3-C235-83(R2010), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 Electrical and Electronic manufacturer's Association of Canada (EEMAC)
- .1 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC).
- .2 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.
- .3 Installation to be in accordance with National Building Code of Canada (NBCC) and Local Regulations.

1.2 DEFINITIONS

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

1.3 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

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

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

.4 Electrical permit required. Pay all associated fees.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Shop drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Prince Edward Island and Nova Scotia, Canada.

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

.3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.

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

.1 Provide CSA certified equipment and material.

.2 Where CSA certified equipment and material is not available, submit such equipment and material to inspection authorities for special approval before delivery to site.

.3 Submit test results of installed electrical systems and controls/instrumentation.

.4 Permits and fees:

.1 Submit to local inspection authority the necessary number of drawings and specifications for examination and approval prior to commencement of Work.

.2 Pay all associated fees.

.3 Notify Departmental Representative of changes required by local Electrical Inspection Authority prior to making changes.

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

1.4 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd)

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

1.5 QUALITY ASSURANCE

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

.2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Territorial Act respecting manpower vocational training and qualification.
.1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
.2 permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

.3 Site Meetings:
.1 In accordance with Section 01 32 16.07 - Construction progress Schedule - Bar (GANTT) Charts.
.2 Site Meetings: as part of Manufacturer's Field Services described herein, schedule site visits, to review Work, at stages listed.
.1 After delivery and storage of products, and when preparatory Work is complete but before installation begins.
.2 Once during progress of Work at 60% complete.
.3 Upon completion of Work, after cleaning is carried out.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Departmental Representative with schedule within 4 weeks after award of Contract.

1.6 DELIVERY, STORAGE AND HANDLING (Cont'd)

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

1.7 SYSTEM STARTUP

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

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

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

1.8 OPERATING INSTRUCTIONS

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

.2 Operating instructions to include following:
.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
.2 Start-up, proper adjustment, operating, lubrication, and shutdown procedures.
.3 Safety precautions.
.4 procedures to be followed in even of equipment failure.
.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

.4 Post instructions where directed.

1.8 OPERATING INSTRUCTIONS (Cont'd)

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

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

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

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

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

.3 Factory assemble control panels and component assemblies. Full assembly shall be certified, component certification only will not be accepted.

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 05 21 and 26 05 34 - Wires and Cables (0 - 1000V) and Conduits, Conduit Fastenings and Conduit Fittings, respectively.

2.3 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of authority having jurisdiction inspection authorities Departmental Representative.

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

2.4 WIRING TERMINATIONS

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

2.5 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:
.1 Nameplates: plastic laminate lamicoid 3 mm thick plastic engraving sheet melamine, black matt white finish face, black white core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.
.2 Sizes as follows:

NAMEPLATE SIZES

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

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

.3 Wording on nameplates and labels to be approved by Departmental Representative 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 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. XX " as directed by Departmental Representative.

2.5 EQUIPMENT IDENTIFICATION (Cont'd)

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

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

2.6 WIRING IDENTIFICATION

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

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

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

2.7 CONDUIT AND CABLE IDENTIFICATION

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

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

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

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	

2.8 FINISHES

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

.1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-2.

2.8 FINISHES (Cont'd)

.1 (Cont'd)
.2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

PART 3 - EXECUTION

3.1 INSTALLATION

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

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 Surface mount cables, conduits and fittings.

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.

.3 Install electrical equipment at following heights unless indicated otherwise.
.1 Instrumentation Equipment including junction box/termination junction boxes: 1200 mm.

3.5 FIELD QUALITY CONTROL

.1 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
.1 Circuits originating from branch distribution panels.
.2 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
.3 Insulation resistance testing:
.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

3.5 FIELD QUALITY CONTROL (Cont'd)

.1 (Cont'd)

.3 (Cont'd)

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.2 Carry out tests in presence of Departmental Representative.

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

.4 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.6 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 REQUIREMENTS

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

1.2 REFERENCES

.1 CSA International
.1 CAN/CSA-C22.2 No. 18.4-04(R2013), Hardware For The Support Of Conduit, Tubing and Cable.
.2 CAN/CSA-C22.2 No.65-03(R2010), Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).

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

.3 National Electrical Manufacturers Association (NEMA)

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Materials and Equipment and with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

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

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

.3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
.1 Connector body and stud clamp for stranded copper conductors.
.2 Clamp for copper bar.

2.1 MATERIALS (Cont'd)

.3 (Cont'd)
.3 Stud clamp bolts.
.4 Bolts for copper bar.
.5 Sized for conductors and bars as indicated.

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

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connectors installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

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

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
.1 Leave Work area clean at end of each day.

3.3 CLEANING
(Cont'd)

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

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).
.1 CSA C22.2 No. 0.3-09, Test Methods For Electrical Wires and Cables.
.2 CAN/CSA C22.2 No. 131-07(2012), Type TECK 90 Cable.

1.3 PRODUCT DATA

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

1.4 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: remove for reuse packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 BUILDING WIRES

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

.2 Copper conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE and RWU90 XLPE. Use RWU90 for outdoor installations.

2.2 TECK 90 CABLE

.1 Cable: in accordance with Section 26 05 00 - Common Work Results for Electrical and to CAN/CSA C22.2 No. 131. Rated for hazardous location in areas classified as hazardous.

.2 Conductors:
.1 Grounding conductor: copper.
.2 Circuit conductors: copper, size as indicated.

2.2 TECK 90 CABLE (Cont'd)

.3 Insulation:
.1 Cross-linked polyethylene XLPE.
.2 Rating: 1000 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall jacket: thermoplastic polyvinyl chloride, low flame spread/low gas emission (LFS/LGE), fire retardant to CSA C22.2 No. 0.3.

.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 1200 mm centers, unless noted otherwise, and as required by Local Authority.
.3 Threaded rods: 6 mm diameter to support suspended channels.

.8 Connectors:
.1 Watertight, approved for TECK cable.
.2 Rated for hazardous location in areas classified as hazardous.

2.3 ARMOURED CABLES

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

.2 Type: TECK-90.

.3 Armour: interlocking type fabricated from aluminum strip.

.4 Type: ACWU90 PVC flame retardant jacket over armour for this project wet locations.

.5 Connectors: anti short connectors.

PART 3 - EXECUTION

3.1 GENERAL CABLE INSTALLATION

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

3.1 GENERAL CABLE INSTALLATION (Cont'd)

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

.3 Conductor length for parallel feeders to be identical.

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

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

.6 All branch circuits to have dedicated neutral conductors, common neutrals not permitted.

3.2 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:
.1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
.2 Provide dedicated neutral for each branch circuit.

3.3 INSTALLATION OF TECK90 CABLE (0-1000 V)

.1 Group cables wherever possible on channels.

.2 Group cables, on surface mounted channels where possible.

.3 Do not secure cable to equipment pertinent to other trade.

.4 Terminate cables and provide suitable connectors, as specified herein, where required.

.5 Install cable, securely supported by cable clamps.

3.4 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible on channels.

.2 Install for short (less than 3 meters) length to lighting luminaires.

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 837-02, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

.2 CSA International
.1 CSA Z466-15, Workplace Electrical Safety.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Materials and Equipment and with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Grounding conductors: bare stranded copper, soft annealed, size as indicated.

.2 Insulated grounding/bonding: green, copper conductors, RW90, size as indicated. Minimum size #12 AWG.

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

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for grounding equipment installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, conductors, connectors, accessories. Run insulated ground wire in each conduit.

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

.3 Protect exposed grounding/bonding conductors from mechanical injury.

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

.5 Soldered joints not permitted.

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

.7 Install flexible ground straps as required.

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

3.3 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list; duct systems, frames of motors, motor control centres, starters, control panels, distribution panels.

3.4 FIELD QUALITY CONTROL

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

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

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
.1 Leave Work area clean at end of each day.

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

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

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

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

1.2 WASTE MANAGEMENT AND DISPOSAL

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

PART 2 - PRODUCT

1.3 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended.

.2 Hot dip galvanized (after fabrication) material for outdoor and in wet areas installation.

.3 All site applied interior paints, coatings, adhesives, sealants, sealant primers, concrete curing compounds, etc.

PART 3 - EXECUTION

2.1 INSTALLATION

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

.2 Secure equipment to poured concrete with expandable inserts.

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

.4 Fasten exposed conduit or cables to building construction or support system using straps.
.1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.

2.1 INSTALLATION (Cont'd)

.4 (Cont'd)
.2 Two-hole steel straps for conduits and cables larger than 50 mm.
.3 Beam clamps to secure conduit to exposed steel work.

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

.6 For surface mounting of two or more conduits use channels at spacing in accordance with CSA C22.1 - latest edition.

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

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

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

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

.11 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 RELATED REQUIREMENTS

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

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CSA C22.1-12, Canadian Electrical Code, Part 1.

1.3 DELIVERY, STORAGE AND HANDLING

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

PART 2 - PRODUCTS

2.1 JUNCTION AND PULL BOXES

.1 Construction: welded steel enclosure. Enclosure to provide a degree of environmental protection equal to or higher than CSA Type 2 for indoor and 4X for outdoor.

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

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

PART 3 - EXECUTION

3.1 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

3.2 IDENTIFICATION

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

3.2 IDENTIFICATION (Cont'd)

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

.3 All junction boxes: indicate panel and circuit number.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CSA C22.1-12, Canadian Electrical Code, Part 1.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Materials and Equipment.

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

PART 2 - PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

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

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

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

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

2.2 GALVANIZED STEEL OUTLET BOXES

.1 One-piece electro-galvanized construction.

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

2.3 MASONRY BOXES

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

2.4 CONCRETE BOXES

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

2.5 CONDUIT BOXES

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

2.6 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

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

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

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

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

3.1 INSTALLATION (Cont'd)

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

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

.5 Identify systems for outlet boxes as required.

.6 Use FS or FD boxes for outdoor and in wet areas installation.

.7 Conduit fittings (condulets) shall be accessible (not concealed).

.8 Each receptacle to have its panel and circuit number identified on lamicoid nameplate above device.

.9 Dedicated neutrals required for all circuits.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

.2 Section 26 05 29 - Hangers and Supports for Electrical Systems.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)
- .1 CAN/CSA C22.2 No.18.1-13(R2013), Metallic Outlet Boxes.
- .2 CSA C22.2 No.45.1-07(R2012), Rigid Metal Conduit.
- .3 CSA C22.2 No.56-04(R2009), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .4 CSA C22.2 No.83-M1985(R2013), Electrical Metallic Tubing.
- .5 CSA C22.2 No.211.2-06(R2011), Rigid PVC (Unplasticized) Conduit.
- .6 CAN/CSA No.18.3-12, Conduit, Tubing and Cable Fittings.
- .7 CSA C22.2 No.211.1-06(R2011), Rigid Types EB1 and DB2/ES2 PVC Conduit.

1.3 WASTE MANAGEMENT AND DISPOSAL

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

PART 2 - PRODUCTS

2.1 CONDUITS

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

2.2 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 53 mm and smaller.
- .1 Two hole steel straps for conduits larger than 53 mm.

2.2 CONDUIT FASTENINGS (Cont'd)

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

.3 Channel type supports for two or more conduits in accordance with Section 26 05 29 - Hangers and Supports For Electrical Systems.

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

2.3 CONDUIT FITTINGS

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

.2 Ensure factory "ells" (condulets) where 90 degrees bends for 27 mm and larger conduits, except for communications systems.

.3 Conduit fittings (condulets) are not permitted for communications systems.

.4 EMT:
.1 Set-screws are not acceptable.
.2 Steel with insulated throat.
.3 All fittings for installation in Hazardous locations to bear marking of approval for the area classification.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.

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

2.5 FISH CORD

.1 Polypropylene.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

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

.2 Conceal conduits except in unfinished areas.

.3 Use rigid hot dipped galvanized steel threaded conduit where specified or subject to mechanical injury and in hazardous location areas.

.4 Use epoxy coated conduit in corrosive areas.

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

.6 Minimum conduit size for power circuits: 21 mm. Minimum conduit size for communications systems: 27 mm.

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

.8 Mechanically bend steel conduit over 21 mm diameter.

.9 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.10 Install fish cord in empty conduits.

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

.12 Dry conduits out before installing wire.

.13 Do not secure conduits to mechanical systems piping or ducts, suspended ceiling, etc.

3.2 INSTALLATION (Cont'd)

.14 Provide minimum #12 AWG insulated "green" bonding conductor in all conduits. Provide suitable means to bond ends of metallic conduit.

3.3 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

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

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended or surface channels.

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

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

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
.1 CSA C22.2 No. 248.8-11 (R2015), Low Voltage Fuses - Part 8: Class J Fuses.
.2 CSA C22.2 No. 248.14-00 (R2010), Low Voltage Fuses - Part 14: Supplemental Fuses.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Ship fuses in original containers.

.2 Store fuses in original containers in moisture free location.

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

1.4 EXTRA MATERIALS

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

.2 Three (3) spare fuses of each type and size installed.

PART 2 - PRODUCTS

2.1 FUSES - GENERAL

.1 Fuses: product of one manufacturer.

.2 Low-voltage Fuses, types as specified, and to be CSA certified in accordance with CSA Standard C22.2 No. 248.

2.2 FUSE TYPES

.1 All fuses shall be high rupturing capacity (HRC) type, minimum 200kA interrupting rating (momentary RMS symmetrical).

2.2 FUSE TYPES (Cont'd)

.2 Class J:
.1 Fuses rated 1 to 600 amperes, 600 VAC, shall be CSA certified Class J in accordance with Standard C22.2 No.248.8.
.2 Where a time delay characteristic is required, fuses shall carry 500% of the ampere rating for not less than 10 seconds and shall be clearly labeled "time delay".

.3 Class CC:
.1 Fuses rated 1 to 30 amperes, 600 VAC, shall be CSA certified Class CC in accordance with Standard C22.2 No. 248.4.
.2 Where a time delay characteristic is required, fuses shall carry 200% of their ampere rating for not less than 12 seconds.

.4 Standard of Acceptance:
.1 Class J: Ferraz Shawmut type A4J (non-time delay) and AJT (time delay) and HSJ (time delay).
.2 Class CC: Ferraz Shawmut type ATMR 9 (non-time delay) and ADTR (time delay) and ATQR (time delay).

.5 Acceptable Manufactures:
.1 Ferraz Shawmut.
.2 Bussmann.
.3 Littlefuse.

PART 3 - EXECUTION

3.1 INSTALLATION

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

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

.3 Ensure correct fuses fitted to assigned electrical circuit.

.4 Ensure fuse size is correctly identified on equipment.

.5 For feeder circuit fuses, use fast acting Class J fuses unless otherwise noted.

3.1 INSTALLATION (Cont'd)

.6 For full voltage non-reversing motor starters. full voltage reversing motor starters, full voltage multi-speed motor starters and transformers use time delay Class J fuses.

.7 For 600 VAC control circuits, use Class CC type fuses. Use time delay Class CC fuses upstream of control transformers and solenoids.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International
.1 CSA C22.2 No. 5-13, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2013).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

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

.3 Include time-current characteristic curves for provided breakers.

.4 Certificates:
.1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit 3 copies of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.
.1 Production certificate of origin must be submitted to Departmental Representative for approval.
.2 Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.

1.2 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd)

.4 (Cont'd)

.3 Any work of manufacturing, assembly or installation to begin only after acceptance of production certificate of origin by Departmental Representative. Unless complying with this requirement, Departmental Representative reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.

.4 Production certificate of origin must contain:

.1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.

.2 Licensed dealer's name and address and person of distributor responsible for Contractor's account.

.3 Contractor's name and address and person responsible for project.

.4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.

.5 Name and address of building where circuit breakers will be installed:

.1 Project title.

.2 End user's reference number.

.3 List of circuit breakers.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Materials and Equipment and with manufacturer's written instructions.

.2 Packaging Waste Management: remove for reuse and return of packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/ Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers 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 with temperature compensation for 40 degrees C ambient.

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

.4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
.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 to have minimum symmetrical rms interrupting capacity rating same as associated board. Series rating for breakers is not acceptable.

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 MAGNETIC BREAKERS

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

2.4 MOTOR CIRCUIT PROTECTORS (MCP)

.1 Moulded case circuit breaker to operate automatically by means of solid state tripping devices to provide instantaneous tripping for short circuit protection.

2.4 MOTOR CIRCUIT PROTECTORS (MCP) (Cont'd)

.2 MCP tripping range to allow for starting motors direct-on-line. Adjustable range from 700% to 1700% of motor full load amps.

2.5 SOLID STATE TRIP MAIN BREAKERS

.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, long time, short time, instantaneous tripping for phase and ground fault short circuit protection. Breaker with adjustable pickup and the delay values.

.2 Circuit breaker equipped with two sets of auxiliary contacts. Once set of contacts shall close on trip to provide trip status. The second set of contacts shall close when the breaker is in the OFF position to provide OFF status.

2.6 OPTIONAL FEATURES

.1 Include, as indicated on drawings:
.1 Shunt trip.
.2 Auxiliary switch.
.3 On-off locking device.
.4 Handle mechanism.

2.7 ENCLOSURE

.1 Locate and mount in enclosure as indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

3.1 EXAMINATION (Cont'd)

.1 (Cont'd)

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

3.2 INSTALLATION

.1 Install circuit breakers as indicated.

3.3 CLEANING

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

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

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

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

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

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 26 28 13.01 - Fuses - Low Voltage.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA C22.2 No.4-04 (R2009), Enclosed and Dead-Front Switches (Tri-National Standard With ANCE NMX-J-162-2004 and UL 98).

.2 CSA C22.2 No.39-13, Fuseholder Assemblies.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 WASTE MANAGEMENT AND DISPOSAL

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

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

.1 Fusible, non-fusible, horsepower rated disconnect switch in CSA Enclosure Type 2 for indoor application and Type 4x for outdoor application, to CAN/CSA C22.2 No.4, size as indicated.

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

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

.4 Fuses: size as indicated, in accordance with Section 26 28 13.01 - Fuses - Low Voltage.

2.1 DISCONNECT SWITCHES (Cont'd)

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

.6 Quick-make, quick-break action.

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

2.2 EQUIPMENT IDENTIFICATION

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

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

2.3 WARNING SIGNS

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

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable, where required by CEC - latest edition and where indicated on the drawings.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 26 29 10 - Motor Starters to 600 V.

1.2 REFERENCES

.1 CSA International
.1 CSA C22.2 No.14-13, Industrial Control Equipment.

.2 National Electrical Manufacturers Association (NEMA)
.1 NEMA ICS 2-2000 (R2005), Controllers, Contactors and Overload Relays Rated 600 V.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for contactors and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

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

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

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Materials and Equipment and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

1.5 DELIVERY, STORAGE AND HANDLING (Cont'd)

.3 (Cont'd)
.1 Store materials off ground indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect contactors from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return of packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/ Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 CONTACTORS

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

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

.3 Breaker combination contactor as indicated.

.4 Complete with at least two (2) normally open and two (2) normally closed auxiliary contacts unless indicated otherwise.

.5 Mount in CSA Enclosure Type 2 unless otherwise indicated.

.6 Include following options in cover:
.1 Red and Green indicating lamp.
.2 Stop-Start pushbutton.
.3 Hand-Off-Auto selector switch.

2.2 EQUIPMENT IDENTIFICATION

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

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

2.3 WARNING SIGNS

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

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install contactors and connect power wires and auxiliary control devices.

.2 Identify contactors with nameplates or labels indicating panel and circuit number.

.3 Test contactors in accordance with 26 05 00 - Common Work Results for Electrical.

3.2 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
.1 Leave Work area clean at end of each day.

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

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.3 PROTECTION

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

.2 Repair damage to adjacent materials caused by contactor installation.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 26 29 01 – Contactors.

1.2 REFERENCES

.1 CSA International
.1 CSA C22.2 No.14-13, Industrial Control Equipment.

.2 National Electrical Manufacturers Association (NEMA)
.1 NEMA ICS 1-2000(R2008), Industrial Control and Systems: General Requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

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

.3 Shop Drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Nova Scotia and Prince Edward Island, Canada.
.2 Include schematic, wiring, interconnection diagrams.

1.4 QUALITY ASSURANCE

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

1.5 CLOSEOUT SUBMITTALS

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

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

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:
.1 Store materials off ground indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect control devices from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return of packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/ Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 PUSHBUTTONS

.1 Heavy duty oil tight. Operator flush type. Black or Green, with 1-NO and 1-NC contacts rated at 120 V, 5 A, AC, labels as indicated. Stop pushbuttons coloured red, labelled "stop".

2.2 SELECTOR SWITCHES

.1 Maintained 2 and 3 position labelled as indicated heavy duty oil tight, operators knob, contact arrangement as indicated, rated 120 V, 5 A AC.

2.3 INDICATING LIGHTS

.1 Heavy duty oil tight, full voltage, LED type, push-to-test, lens colour: as indicated, supply voltage: 120 V AC, lamp voltage: 120 V AC, labels as indicated.

2.4 CONTROL AND RELAY PANELS

.1 Panel to provide a degree of environmental protection equal to or higher than CSA Type 1 for indoor and 4X for outdoor, sheet steel enclosure with hinged padlockable access door, accommodating relays, timers, labels, as indicated, factory installed and wired to identified terminals.

2.5 CONTROL CIRCUIT TRANSFORMERS

.1 Single phase, dry type.

.2 Primary: 600 V, 60 Hz ac.

.3 Secondary: 120 V AC.

.4 Rating: 250 VA, unless noted otherwise.

.5 Secondary fuse: 3 A, unless noted otherwise.

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

2.6 THERMOSTAT (LINE VOLTAGE)

.1 Wall mounted reverse acting thermostat.

.2 Full load rating: 8 A at 120 V AC.

.3 Temperature setting range: 5° to 30°C.

.4 Markings in 5 degrees increments.

2.7 FLOAT SWITCH ASSEMBLY

.1 Mechanical tilt float switch with one form `C' contact rated 5A (minimum) @ 120V. When the liquid level reaches the regulator, the casing will tilt and the mechanical switch will change status.

.2 Corrosion resistant float housing suitably weighted for use in sewage.

.3 Submersible cable: factory assembled to float switch, 3 conductor, flexible control cable with extra hard usage oil and water resistant jacket. Cable and cable connectors to be watertight and mechanically capable of

supporting float switch. Cable length as required plus additional 3 meters.

.4 Float switch to be connected to sewage pump logic controller panel via barrier terminal located in the panel, to provide for intrinsically safe operation of the float switch in Class I, Zone 2, Gr. IIA and IIB, T3 environment.

.5 Mounting Bracket: 316 stainless steel or 316L stainless steel if welded connections are utilized, unless noted otherwise.

2.8 HOUR METER

.1 Electronic tamperproof AC hour meter for recording pumps operating time.

.2 Electromechanical indicator to store accumulated hours, 6 digits display in format 99999,9 accuracy +/-0.02, operating voltage 120 V, front panel mounting.

2.9 GROUNDING FAULT PROTECTION

.1 Ground fault protection to measure the ground leakage current of an electrical installation and interrupt the power supply if the ground fault current exceeds set value.

.2 Solid state ground fault relay with characteristics:
.1 Supply 120 V, 60 Hz.
.2 Fault current detection: selectable in a range of 1 to 30 A.
.3 Time delay: selectable in a range of instantaneous to 4.5 sec.
.4 Auxiliary contacts as indicted, rated 5A 120 V.

.3 Sensor:
.1 Compatible with ground fault relay.
.2 Type: toroids, closed.
.3 Voltage: 208 V.
.4 Ratio: as required.
.5 Short circuit withstand: 65 kA.

2.10 WARNING SIGNS

.1 Provide warning signs (where applicable) in accordance with Section 26 05 00 - Common Work Results - For Electrical.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

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

3.2 INSTALLATION

.1 Install pushbutton stations, control and relay panels, control devices and interconnect as indicated.

.2 Seismic requirements: in accordance with Section 26 05 00 - Common Work Results - For Electrical.

3.3 FIELD QUALITY CONTROL

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

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
.1 Leave Work area clean at end of each day.

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

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 26 29 01 - Contactors.

1.2 REFERENCES

.1 NEMA ICS 2, Industrial Control and Systems.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

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

.3 Shop Drawings:
.1 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.
.1 Provide shop drawings for each type of starter to indicate:
.1 Mounting method and dimensions.
.2 Starter size and type.
.3 Layout and components.
.4 Enclosure types.
.5 Wiring diagram.
.6 Interconnection diagrams.
.7 Certifications and approvals.

1.4 CLOSEOUT SUBMITTALS

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

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

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

1.4 CLOSEOUT SUBMITTALS (Cont'd)

.3 (Cont'd)
.1 (Cont'd)
.2 3 contacts, movable.
.3 1 contacts, auxiliary.
.4 1 control transformers.
.5 1 operating coil.
.6 3 fuses.
.7 Indicating lamp bulbs used, one (1)each Type.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Materials and Equipment.

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

.3 Packaging Waste Management: remove for reuse and return of packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Starters: to NEMA ICS 2. Full size starters (half size are not acceptable).

2.2 FULL VOLTAGE MAGNETIC STARTERS

.1 Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
.1 Contactor solenoid operated, rapid action type. Pick-up voltage minimum 75% of nominal, drop-out voltage less than 70% of nominal.
.2 Motor overload protective device in each phase, manually reset from outside enclosure.
.3 Wiring and schematic diagram inside starter enclosure in visible location.

.2 Combination type starters to include motor circuit interrupter with operating lever on outside of enclosure to control motor circuit interrupter, and provision for:

2.2 FULL VOLTAGE MAGNETIC STARTERS (Cont'd)

.2 (Cont'd)
.1 Locking in "OFF" position with up to 3 padlocks.
.2 Independent locking of enclosure door.
.3 Provision for preventing switching to "ON" position while enclosure door open.
.4 Enclosure to provide a degree of environmental protection equal to or higher than CSA Type 2 for indoor and 4X for outdoor.

.3 Accessories:
.1 Pushbuttons and selector switches: heavy duty oil tight labelled as indicated.
.2 Indicating lights: heavy duty oil tight type and colour as indicated.
.3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

2.3 CONTROL TRANSFORMER

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

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

2.4 ACCESSORIES

.1 Pushbutton: heavy duty, oil tight as required.

.2 Selector switches: heavy duty, oil tight as required.

.3 Indicating lights: heavy duty, oil tight, type and colour as indicated.

2.5 FINISHES

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

2.6 EQUIPMENT IDENTIFICATION

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

2.6 EQUIPMENT IDENTIFICATION (Cont'd)

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

.3 Magnetic starter designation label, white plate, black letters, size 1 engraved as indicated.

2.7 WARNING SIGNS

.1 Provide warning signs (where applicable) in accordance with Section 26 05 00 - Common Work Results For Electrical.

2.8 MODIFICATIONS TO EXISTING STARTERS

.1 Provide and install all required equipment/devices necessary, including new wiring/cabling to complete controls modifications to existing motor starter units as indicated on the drawing(s).

PART 3 - EXECUTION

3.1 INSTALLATION

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

.2 Install and wire starters and controls, including modifications as indicated.

.3 Ensure correct fuses installed.

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

3.2 FIELD QUALITY CONTROL

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

.2 Operate switches and contactors to verify correct functioning.

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

3.2 FIELD QUALITY CONTROL (Cont'd)

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

3.3 CLEANING

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

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

END OF SECTION