

Specification Index

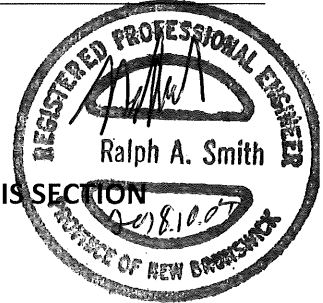
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END OF SECTION



Part 1 General

1.1 THIS SECTION COVERS ITEMS COMMON TO SECTIONS OF DIVISION 26. THIS SECTION SUPPLEMENTS REQUIREMENTS OF DIVISION 01.

1.2 DESCRIPTION OF WORK

Work to be completed under this Contract includes the following and as detailed on the electrical drawings and specifications:

- .1 Supply, install and connect branch circuit wiring for receptacle and lighting in 2-53mm PVC conduits for each light pole location and for receptacles at two (2) service modules in underground concrete duct banks c/w rebar from electrical panel to new marginal wharf and through a concrete encased duct bank under wharf to pole location as concrete deck has only one (1) mat of rebar and is only 250mm thick.
- .2 Supply, install and connect three (3) electrical service modules on new marginal wharf at each pole location (one [1] module with 1-50A 2P and 1-20A 1P receptacle; and two [2] modules with 1-30A 2P and 1-20A 1P receptacle each).
- .3 Supply, install and connect two (2) service modules on new marginal wharf at Shrouds #2 and #4; each with a 30A 2P 240V and 20A 1P 120V receptacle at each shroud.
- .4 Supply, install and connect 3-10 meter galvanized steel light poles each with 3-391W LED light fixtures c/w lighting control at electrical panel and concrete base projecting one (1) meter above the concrete deck.
- .5 Remove O/H NB Power and Aliant service on wood poles along wharf road approach from opposite the start of lay down area behind Harbour Authority (H.A.) building to existing main service entrance panel. Reroute NB Power and Aliant service U/G to new electrical building.
- .6 Provide new electrical building c/w power and telephone distribution to wharf complex to be located beside H.A. building.
- .7 Provide U/G branch circuits from new electrical building to Wharf 404 lighting, receptacles, fuel system.
- .8 Relocate O/H feeder from Wharf 405 to east side of Wharf 405 and then U/G to electrical building.
- .9 Provide new light fixture on existing light pole PO beside H.A. building.

- .10 Electrical construction testing and commissioning, as-built drawings and O&M manuals.

1.3 CODES AND STANDARDS

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Comply with CSA Certification Standards and Electrical Bulletins in force at time of tender submission.
- .3 Do overhead and underground systems in accordance with CSA C22.3 No. 1M except where specified otherwise.
- .4 Abbreviations for electrical terms: to CSA Z85.

1.4 CARE, OPERATION AND START-UP

- .1 Instruct DFO Departmental Representative and operating personnel in the operation, care and maintenance of equipment.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.5 VOLTAGE RATINGS

- .1 Operating voltages: to CAN3-C235-83.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standards. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.6 PERMITS, FEES AND INSPECTIONS

- .1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Pay associated fees.

- .3 DFO Departmental Representative will provide drawings and specifications required by Electrical Inspection – Department and Supply Authority at no cost.
- .4 Notify DFO Departmental Representative of changes required by Electrical Inspection Department prior to making changes.

1.7 MATERIALS AND EQUIPMENT

- .1 Provide materials and equipment in accordance with Division 01.
- .2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.
- .3 Factory assembly control panels and component assemblies.

1.8 ELECTRIC MOTORS EQUIPMENT AND CONTROLS

- .1 Supplier, installer & wiring responsibility is indicated on electrical drawings.
- .2 Coordinate final connection to all equipment and controls.

1.9 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 Y1-1.
 - .2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1.
- .2 Clean and touch up surfaces on shop-painted electrical equipment scratched or marred during shipment or installation, to match original paint.
- .3 Clean, prime and paint exposed painted non-galvanized hangers, racks and fastenings to prevent rusting.

1.10 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates as follows:
- .2 Nameplates:
 - .1 Lamicaid 3mm thick plastic engraving sheet, white face, black core, mechanically attached unless specified otherwise.

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

- .3 Wording on nameplates to be approved by DFO Departmental Representative prior to manufacture.
- .4 Allow for average of twenty-five (25) letter per nameplate/language.
- .5 Identification to be English and French.
- .6 All switchboards, panels, disconnect switches, transformers, control panels, magnetic starters, and time clocks are to be provided with 'lamicoid' nameplates. Nameplates are to be affixed to all metal surfaces with metal type "pop-rivets" if possible.
- .7 Nameplates are to be affixed to other surfaces with contact type cement. Contact type cement is to be applied to complete backside of plate, as opposed to several points or locations on same.
- .8 Nameplates are to be affixed to building exterior surfaces with nylon inserts and self-tapping screws unless specifically indicated otherwise.
- .9 Lamicoid nameplates installed on distribution panelboards, motor control centres, splitter troughs, transformers, shall indicate the following:
 - .1 Designated name of equipment;
 - .2 Overcurrent protection device rating;
 - .3 Voltages, number of phases and wires;
 - .4 Designation of power source.

Example:

**PANEL N - 150A
120/208V - 3PH - 4W
FED FROM MAIN SWITCHBOARD #CDP-A**

- .10 All junction and/or pull boxes shall be marked with an indelible ink marker to designate the circuit number of enclosed wiring, the designated panel name and electrical characteristics where applicable.

- .11 Install an additional 'Lamicoid' nameplate on all, or any piece of electrical equipment, or apparatus, ie. Main Switchboard, CDP panels, panelboards, motor control centres, and fusible switches, etc. that may contain overcurrent devices, i.e. circuit breakers and/or fuses, that have been designed for, and incorporate an interrupting capacity sized "larger" than 10kAIC.

Examples:

Minimum interrupting capacity of breakers installed in this panel is to be not less than 22 kAIC.

Minimum interrupting capacity of fuses installed in this MCC is to be not less than 100 kAIC.

1.11 WIRING IDENTIFICATION

- .1 Identify feeder and branch circuit wiring including neutral conductors at both ends, including in all junction and outlet boxes located in between, with permanent indelible identifying markings, indicating panel and circuit number. (i.e. A1-25).
- .2 Maintain phase sequence and colour coding throughout. (Red, black, blue, white). No colour taping of wires is allowed.
- .3 Colour code: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

1.12 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall or floor, and at 15m intervals.
- .3 Colours to be 25mm wide prime colour and 20mm wide auxiliary colour.

<u>Prime</u>	<u>Auxiliary</u>
up to 250V	yellow
up to 600V	yellow green
Telephone	white

1.13 DEVICE IDENTIFICATION

- .1 All receptacles, light poles, welder/winch and shore power outlets are to have its panel and circuit identified with a lamicoid nameplate. White letters on white background, 6mm high x 25mm long (i.e. A-3 or A-2,4,6). Nameplates to be properly secured to outlet box with screws. Receptacle number, light pole number, shore power and welder/winch number to also be identified (i.e. Recept. #1, Light #1, Shore Power #1, Welder/Winch #1).

1.14 WIRING TERMINATIONS

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

1.15 MANUFACTURERS AND CSA LABELS

- .1 Visible and legible after equipment is installed.

1.16 WARNING SIGNS

- .1 As specified and to meet requirements of Inspection Department and DFO Departmental Representative.
- .2 Use decal signs, minimum 175 x 250mm size.
- .3 "DANGER HIGH VOLTAGE" signs to be installed on each of the new electrical service shrouds and on the door to the electrical building.

1.17 LOCATION OF OUTLETS

- .1 Change location of outlets at no extra cost or credit, providing distance does not exceed 3.0m, and information is given before installation.
- .2 Locate light switches on latch side of doors.

1.18 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not indicated, verify before proceeding with installation.
- .3 Install electrical equipment at the following heights unless indicated otherwise.
 - .1 Receptacles:
 - .1 General: in shrouds.

- .2 Panelboards: 1500mm or as required by Code.
- .3 Local Switches: 1250mm
- .4 Telephone Outlets: 300mm
- .5 Thermostats: 1250mm

- .4 Generally, masonry outlet boxes are to be installed in bottom of concrete blocks to approximate heights indicated.
- .5 Refer to all detail drawings and confirm mounting of outlet boxes prior to roughing-in.

1.19 LOAD BALANCE

- .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
- .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .3 Submit, at completion of work a report listing all phase and neutral currents on panelboards operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

1.20 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit, and sleeves, prior to pouring of concrete. Sleeves through concrete: sheet metal, sized for free passage of conduit, and protruding 50mm.
- .2 Install cables, conduits and fittings to be embedded or plastered over neatly and close to structure so furring can be kept to a minimum.

1.21 FIELD QUALITY CONTROL

- .1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentice program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specified tasks – the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specified duties. The work of this division to be carried out by a contractor who holds a valid Electrical contractor license as issued by the Province of New Brunswick.
- .2 Conduct and pay for tests of the following:
 - .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: communications, etc.
- .3 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
- .4 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350V with a 500V instrument.
 - .2 Megger circuits, feeders and equipment between 350V and 600V with a 1000V instrument.
 - .3 Check resistance to ground before energizing.
- .5 Notify DFO Departmental Representative three days in advance, of equipment and system testing and verification. Carry out tests in presence of DFO Departmental Representative.
- .6 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .7 Submit test results for DFO Departmental Representative's review.

1.22 COORDINATION OF PROTECTIVE DEVICES

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

1.23 SITE VISIT

- .1 Contractor to visit the site and familiarize himself with the job and all conditions which may affect his costs. Ignorance of existing conditions will not be considered as basis for extra claims.

1.24 AS-BUILTS DOCUMENTS

- .1 At completion of project and prior to final inspection, the electrical contractor, at his own expense, shall mark all changes in red on blueprint record drawings and submit the as-built sets to DFO Departmental Representative.

1.25 SHOP DRAWINGS, PRODUCT DATA & SAMPLES

- .1 Submit shop drawings, product data and samples in accordance with Division 01 30 00.
- .2 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.

- .3 Where applicable, include wiring, single line and schematic diagrams.
- .4 Include wiring drawings or diagrams showing interconnection with work of other Sections.

1.26 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for electrical work for incorporation into maintenance manual specified in Section 01 78 00 – Closeout Submittals.
- .2 Include in operations and maintenance data:
 - .1 Details with respect to design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.
 - .2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items and parts lists. Advertising or sales literature not acceptable.
 - .3 Wiring and schematic diagrams and performance curves.
 - .4 Names and addresses of local suppliers for all items included in maintenance manual.

1.27 MAINTENANCE MATERIALS

- .1 Provide maintenance materials in accordance with Division 01.

1.28 PROTECTION

- .1 Protect exposed live equipment during construction for personnel safety.
- .2 Shield and mark all live parts "LIVE 120 VOLTS" or with appropriate voltage in English & French.

1.29 CLEANING

- .1 At time of final cleaning, clean lighting reflectors, lenses and other lighting surfaces that have been exposed to construction dust, dirt and fingerprints.

1.30 COORDINATION WITH OTHER TRADES

- .1 The Electrical Contractor shall totally review all architectural, structural and mechanical drawings and specifications to coordinate and determine work associated with electrical work prior to submitting tender price. Also, review all Addendums associated with all trades.
- .2 After review of all documents associated with other trades, forward any questions and obtain answers by Addendum, prior to tender submission.

- .3 Submission of tender by Electrical Contractor acknowledges coordination with other trades as part of these contract documents

1.31 PROJECT WASTE MANAGEMENT

- .1 Contractor must adhere to project waste management guidelines as detailed in Section 01 77 00 – Closeout Procedures.

1.32 PROJECT RECORD DOCUMENTS

- .1 Provide Project Record Documents to Division 01.

1.33 SCHEDULE

- .1 Overtime work and work outside normal work hours as deemed necessary to accomplish scheduling are the responsibility of the contractor and must meet the requirements of the Department of Labour. All costs resulting from such overtime must be included in the contractor's estimated total tender price.

1.34 COORDINATION OF EXISTING AND NEW

- .1 In order to install new services while maintaining existing, coordination between old and new must be provided. This may restrict installation of new services and how the work is carried out.
- .2 All costs for this coordination must be included in the total tendered price.

1.35 MEASUREMENT FOR PAYMENT

- .1 Measurement for payment for Division 26 is lump sum.

1.36 SINGLE LINE ELECTRICAL DIAGRAMS

- .1 Provide single line electrical power riser diagram in metal frame with clear polycarbonate glazing as follows:
 - .1 Electrical distribution systems: locate in main electrical room.
- .2 Drawings: 600 x 600mm minimum size.

1.37 ELECTRICAL CONSTRUCTION RED SEAL CERTIFICATION

- .1 The electrical contractor bidding this project must have industrial electrical experience on at least three previous wharf projects and must have at least three industrial electrician personnel who have been with the company for the past three years and who have a CANB Red Seal Certification in the Electrical trade.
- .2 No more than one apprentice electrician shall work on the project site for every journeyman electrician working on the project site at any time.

END OF SECTION

Part 1 General

1.1 DESCRIPTION OF SYSTEM

- .1 In general, work of this Section consists of the complete removal of all existing electrical equipment and materials on the wharf to be renovated.

1.2 RELATED WORK

- .1 Electrical General Provisions: Section 26 05 00.
- .2 Wharf Removals.

1.3 SITE SURVEY

- .1 Prior to Tender submission, visit the site and survey the extent of the removals/modifications required for this contract and include for all costs in the total tendered price. Any existing conditions information indicated on the drawings is for general guidance only.
- .2 In conjunction with site visit, review structural, mechanical and electrical drawings and include all costs due to existing conditions in total tendered price.

1.4 REFERENCE STANDARDS

- .1 All removal or modification work of electrical construction to be done in accordance with the safety standards outlined in the Canadian Electrical Code.

1.5 PROTECTION

- .1 Be responsible for any damages to existing structure as a result of the work.

1.6 SALVAGE MATERIAL

- .1 Materials and equipment identified on the drawing as being reused are to be taken down, stored, reinstalled, etc. as required to allow for new construction.
- .2 Contractor must identify any damaged equipment or materials intended for reuse prior to demolition and point out deficiencies to the DFO Departmental Representative at that time.

1.7 DISPOSAL

- .1 Prior to demolition DFO Departmental Representative will identify any items of electrical equipment which are to be set aside as directed for future use by DFO Departmental Representative.
- .2 All other materials and equipment removed under work of this Section becomes the property of the Contractor for disposal off of property.
- .3 Comply with all municipal, provincial and federal bylaws and standards when disposing of waste.

1.8 SCHEDULE

- .1 The Contractor is to note that the DFO Departmental Representative intends to carry on business as usual and work activities must be coordinated to maintain electrical services in occupied areas. Provide any required temporary work.
- .2 Overtime work and work outside normal work hours as deemed necessary to accomplish this scheduling are the responsibility of the Contractor and must meet the requirements of the Department of Labour. All costs resulting from such overtime must be included in the Contractor's Estimated Total Tender Price.
- .3 Coordinate with NB Power to remove all equipment, poles, lines, services, etc. from the site.

Part 2 Products

Not applicable.

Part 3 Execution

3.1 GENERAL REMOVALS

- .1 Remove all existing electrical services including exposed wire and conduit, except those designated for reuse.
- .2 Remove electrical services associated with existing systems.

- .3 Coordinate work of this Section with other trades.
- .4 Schedule all removal work with the DFO Departmental Representative. Do not disrupt operations except as permitted by the Schedule.

3.2 CUTTING

- .1 Cutting required for removals and alterations to be to the approval of the DFO Departmental Representative and performed with appropriate power tools.

3.3 CLEANING

- .1 Reused existing equipment to be cleaned in accordance with 26 05 00.

END OF SECTION

Part 1 General

Not applicable.

Part 2 Products

2.1 MATERIALS

- .1 Pressure-type wire connectors: with current-carrying parts of copper sized to fit copper conductors as required. Use twist-on connectors for #14 and smaller.
- .2 In-line insulated compression connectors for #12 conductors and larger.
- .3 Steel clamps or connectors for flexible conduit, as required.
- .4 Crimp style wire connectors, nylon insulated, with current carrying parts of copper alloy, for conductors #16 and smaller.
- .5 Fork tongue, nylon insulated, crimp style terminals for connecting conductors #16 and smaller to screw down terminals.
- .6 Crimp style wire connectors, nylon insulated with current carrying parts of copper alloy, for connecting solid to stranded conductors.
- .7 Heavy wall shrinkable tubing with 600V insulation: 3M "Cold Shrink Splice" or approved equal.
- .8 Use in-line insulated compression connectors for splices in panelboards to reduce from oversize conductors (due to voltage drop) to smaller conductors that will fit on circuit breakers.
- .9 Use watertight electrical tape over all electrical connections if shrinkable tubing is not used.

Part 3 Execution

3.1 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Install mechanical pressure type connectors and tighten. Installation shall meet secureness tests in accordance with CSA C22.2 No. 65.
 - .2 Install fixture type connectors and tighten.
 - .3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

3.2 RESTRICTION

- .1 No splices are allowed in underground cables or panelboards (distribution, lighting and power) or in equipment enclosures, unless indicated otherwise.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

- .1 Submit product data in accordance with Section 26 05 00.

Part 2 Products

2.1 BUILDING WIRES

- .1 Conductors: minimum size 12 AWG (solid) for power and lighting; stranded for size 8 AWG and larger except as noted.
- .2 Copper conductors sized as indicated with 600V insulation of chemically cross-linked thermosetting polyethylene material rated RW90 for all work.

2.2 TECK CABLE

- .1 Conductors:
 - .1 Grounding conductor: copper
 - .2 Circuit conductors: copper size as indicated.
- .2 Insulation:
 - .1 Chemically cross-linked thermosetting polyethylene rated type RW90 1000V.
- .3 Inner jacket: polyvinyl chloride material.
- .4 Armour: flat interlocking aluminium.
- .5 Overall covering: thermoplastic polyvinyl chloride material, FT4 rated.
- .6 Fastenings:
 - .1 One-hole steel straps to secure surface cables 50mm and smaller. Two-hole steel straps for cables larger than 50mm.
- .7 Connectors:
 - .1 Watertight, approved for TECK cable.

2.3 FIXTURE WIRING

- .1 Temperature rating of fixture wiring entering ballast compartment of fixtures to meet manufacturer's recommendations.
 - .1 For 90°C, use R90

- .2 For 105°C, use TEW
- .3 For 125°C, use GTF

2.4 COLOUR CODING

- .1 All conductors to be colour coded in accordance with Section 26 05 00.1.11.

2.5 POLE WIRING

- .1 Wiring from pole hand rail to top of light pole to be 3#12 copper SOW heavy duty service cord.

Part 3 Execution

3.1 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34.
 - .2 In underground ducts in accordance with Section 26 05 44.
 - .3 In trenches in accordance with Section 26 05 41.
 - .4 In surface and lighting fixture raceways in accordance with Section 26 50 00.
 - .5 In wireways and auxiliary gutters in accordance with Section 26 50 00.

3.2 INSTALLATION OF TECK CABLE 0 – 1000V

- .1 Install cables as indicated.
- .2 Group cables wherever possible on channels.
- .3 Install cables in trenches in accordance with Section 26 05 41.
- .4 Terminate cables in accordance with Section 26 05 20.

3.3 WIRE & CONDUIT METHODS

- .1 Use standard building wire and PVC conduits or TECK cables for all branch circuits.
- .2 All wire shall be #12 minimum from panel.

3.4 SITE LIGHTING

- .1 Install conductors in light poles in SOW cable from base to top of pole.

- .2 Fasten at top of pole using suitable wire grip.
- .3 Install conductors from junction box to luminaire as indicated. Use appropriate connectors and secure in place.

3.5 INSTALLATION OF FIXTURE WIRE

- .1 Fixture wire to be installed to ballast compartment unless indicated otherwise where required for temperature rating.

END OF SECTION

Part 1 General

1.1 STANDARDS

- .1 All grounding and bonding requirements shall be in accordance with the Canadian Electrical Code, Part 1.

Part 2 Products

2.1 EQUIPMENT

- .1 Rod electrodes, copper clad steel 19 mm dia. by 3.0m long.
- .2 Plate electrodes for grounding locations on harbour bottom.
- .3 System and circuit, equipment, grounding conductors, bare stranded copper, untinned, soft annealed, size as indicated.
- .4 Insulated grounding conductors: green, to Section 26 05 21.
- .5 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings
 - .2 Protective type clamps
 - .3 Bolted type conductor connectors
 - .4 Thermit welded type conductor connectors
 - .5 Bonding jumpers, straps
 - .6 Pressure wire connectors
- .6 Clamps for grounding of conductor, size as required to electrically conductive underground water pipe.

2.2 MANUFACTURERS

- .1 Acceptable manufacturers or approved equal:
 - .1 Burndy Corp.
 - .2 Erico Inc. Cadweld Division
 - .3 Eaton

Part 3 Execution

3.1 INSTALLATION GENERAL

- .1 Install complete permanent, continuous, system and circuit, equipment, grounding

systems including electrodes, conductors, connectors, accessories, as indicated, to conform to requirements of DFO Departmental Representative and local authority having jurisdiction over installation.

- .2 Install connectors to manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.
- .7 Install an integral bonding wire in all flexible conduit connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw.
- .8 Install separate ground conductor, to outdoor lighting standards.
- .9 Connect building structural steel to ground by welding copper to steel.
- .10 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .11 Bond single conductor, metallic armoured cables to cabinet at supply end and load end.

3.2 ELECTRODES

- .1 Install ground plate electrodes and make grounding connections as indicated.
- .2 Bond separate, multiple electrodes together.
- .3 Use copper conductors for connections to electrodes sized to C.E.C.

3.3 SYSTEM & CIRCUIT GROUNDING

- .1 Install system and circuit grounding connections to neutral of secondary 208V and 600V system.

3.4 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to, the following list: Service equipment, duct systems, control panels, steel work, distribution panels, outdoor lighting.

3.5 COMMUNICATION

- .1 Install grounding connections for telephone system as follows:
 - .1 Telephone: make telephone grounding system in accordance with telephone company's requirements: one size 6 AWG in 12mm conduit to telephone backboard ground bus with 3.0m coil left for telephone company's use.

3.6 FIELD QUALITY CONTROL

- .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 DFO Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.

END OF SECTION

Part 1 General

Not applicable.

Part 2 Products

2.1 SUPPORT CHANNELS

- .1 U shape, size 41 x 41mm, 2.5mm thick, stainless steel, surface mounted, suspended as required.

2.2 CHANNEL FINISH

- .1 All support and fastening devices to be 316 grade stainless steel.

2.3 SPECIFIED PURPOSE SUPPORTS

- .1 Specified purpose stainless, spring steel fasteners, as manufactured by Caddy, B-line or approved equal, for interior support of boxes, conduit and cable from main structures and channels.

2.2 MANUFACTURERS

- .1 Acceptable manufacturers or approved equal:
 - .1 Burndy Ltd.
 - .2 Electrovert Ltd.
 - .3 Unistrut Ltd.

Part 3 Execution

3.1 INSTALLATION

- .1 Secure equipment to poured concrete with expandable inserts.
- .2 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .3 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole stainless steel straps to secure surface conduits and cables 53mm and smaller.
 - .2 Two-hole stainless steel straps for conduits and cables larger than 53mm.

- .4 Provide stainless steel metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .5 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .6 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trades and approval of DFO Departmental Representative.
- .7 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendation.
- .8 For surface mounting of two or more conduits, use channels at 1.5m oc spacing.
- .9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

END OF SECTION

Part 1 General**1.1 SHOP DRAWINGS & PRODUCT DATA**

- .1 Submit shop drawings and product data for cabinets in accordance with Section 26 05 00.

Part 2 Products**2.1 JUNCTION & PULL BOXES**

- .1 PVC waterproof construction with screw-on overlapping covers, complete with gasket, for surface mounting. IPEX Royal, Bundy type JB or equivalent. Use stainless steel screws/bolts for mounting.
- .2 Stainless steel type 316 junction box as indicated complete with stainless screws/bolts for mounting.

2.2 ELECTRICAL SHROUDS

- .1 Two (2) types of aluminium shroud 6mm thick with dimensions as detailed on drawing, made from ASTM 6061 salt water rated aluminium with all seams welded on both sides. A 13mm rubber mat (type SBR-60) is to be installed between concrete deck and shroud. Provide 16mm dia. 316 grade stainless steel adhesive anchors embedded 200mm into drilled holes in the concrete.

2.3 MANUFACTURERS

- .1 Electrical shrouds to be manufactured by the following companies:
 - .1 Atelier PMC Machine Shop, Shippagan - 1-506-336-4205
 - .2 The Panel Shop, Fredericton - 1-506-455-1925
 - .3 LITECO, Moncton - 1-506-857-4171

Part 3 Execution**3.1 JUNCTION, PULL BOXES AND CABINETS INSTALLATION**

- .1 Install pull boxes in inconspicuous but accessible locations. Location must be coordinated with other trades.
- .2 Mount cabinets, with top not higher than 610mm above finished floor.

- .3 Size and install cabinets to CEC requirements.
- .4 Only main junction and pull boxes are indicated. Provide pull boxes so as not to exceed 30.0 m of conduit run between pull boxes.

3.2 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00.
- .2 Install size 2 identification labels indicating system name, voltage and phase.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

- .1 Submit product data in accordance with Section 26 05 00.

Part 2 Products

2.1 OUTLET & CONDUIT BOXES - GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 PVC (150 x 150 x 100)mm and (200 x 200 x 100)mm and (300 x 300 x 200)mm outlet boxes, or sized as required, for special devices and requirements.
- .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 CONDUIT BOXES

- .1 Cast FS or FD feraloy boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles.
- .2 For 20A TL receptacle, 50A 2P receptacle and telephone outlet, use HUBBELL Cat. #HBL60CM83A conduit box.

2.3 FITTINGS - GENERAL

- .1 PVC bushing and connectors (watertight).
- .2 Knockout fillers to prevent entry of foreign materials or water.
- .3 Conduit outlet bodies for conduit up to 32mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.
- .5 Set-screw type steel bushings and connectors for EMT fittings unless indicated otherwise. Nylon insulated throats for 25mm conduits and larger.

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

END OF SECTION

Part 1 General**1.1 LOCATION OF CONDUIT**

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

Part 2 Products**2.1 CONDUITS**

- .1 Rigid PVC conduit: size as indicated.
- .2 Electrical metallic tubing (EMT), with steel set screw couplings and connectors.
- .3 Flexible metal conduit and liquid-tight flexible metal conduit.
- .4 FRE fibreglass duct for run under Wharf 405.

2.2 CONDUIT FASTENINGS

- .1 One-hole PVC straps to secure surface conduits 50mm and smaller. Two-hole PVC straps for conduits larger than 50mm. Use stainless steel screws/bolts for mounting hardware.
- .2 Channel type supports for two or more conduits at 1.5 oc.
- .3 6mm diameter threaded rods to support suspended channels.

2.3 CONDUIT FITTINGS

- .1 Fittings manufactured for use with conduit specified. Coating: same as conduit. "O" ring expansion joints and watertight junction box adapters/couplings. Provide PVC expansion joints at all construction expansion joints and at all locations where PVC conduit exits underground. Ipex-Scepter Cat. #SE-J-35 or sized to fit conduit.
- .2 Factory "ells" where 90 degree bends are required for conduits larger than 40mm.
- .3 Steel set screw connectors and couplings for EMT unless indicated otherwise.
- .4 Steel watertight connectors and couplings for EMT where indicated.

2.4 FISH CORD

- .1 Polypropylene.

Part 3 Execution**3.1 INSTALLATION**

- .1 Install conduits to conserve space in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Use rigid PVC conduit under ground floor slab and in poured concrete unless indicated otherwise. Install an integral ground wire in all PVC conduit.
- .3 Use liquid tight flexible metal conduit for connections to exterior light fixtures unless indicated otherwise and to equipment in damp or wet locations.
- .4 Install fish cord in empty conduits.
- .5 Where conduits become blocked, remove and replace blocked section.
- .6 Dry conduits out before installing wire.
- .7 Conduit sizing, where indicated, is based on copper conductors and PVC conduit. NUAL is not to be used.
- .8 Use EMT for interior feeders and branch circuit work except in poured concrete, underground and where subject to mechanical damage, unless indicated otherwise. When used for panel feeders, install a separate integral ground wire sized in accordance with the CEC.
- .9 Use flexible metal conduit for connection to motors in dry areas and interior light fixtures.
- .10 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .11 Mechanically bend steel conduit over 19mm diameter.
- .12 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

3.2 SURFACE CONDUITS

- .1 Run parallel or perpendicular to construction lines.
- .2 Run conduits in center portion of concrete wharf deck.

- .3 Group conduits wherever possible.
- .4 Do not pass conduits through structural members.

3.3 CONDUITS IN CAST-IN-PLACE CONCRETE

- .1 Locate to suit reinforcing steel. Install in centre one-half of slab.
- .2 Protect conduits from damage where they stub out of concrete.
- .3 Install sleeves where conduits pass through slab or wall.
- .4 Where conduits pass through waterproof membrane, provide oversized sleeve before membrane is installed. Use cold mastic between sleeve and conduit.
- .5 Encase conduits completely in concrete.

3.4 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

- .1 Run conduits 25mm and larger below slab. Provide 50mm of sand over conduits below floor slab.

3.5 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.
- .2 Conduits rising up from below grade to penetrate the floor/wharf at 90° angles. Slanted conduits not permitted.

3.6 CONDUIT SEALANT

- .1 All conduit terminations entering buildings or enclosures, to be sealed to prevent entrance of water and condensation.
- .2 Sealant to be a two-part polyurethane conduit, sealing compound installed as per manufacturer's instructions.
- .3 Standard of acceptance:
 - .1 Multiurethanes Multi-Paste.

END OF SECTION

Part 1 General

1.1 DESCRIPTION OF WORK

- .1 Work included in this section consists of the excavating, backfilling and trenching required to install cables and ducts by general contractor and supply and installation of ducts, spacers and marker tape by Division 26.

1.2 RELATED WORK

- .1 Concrete-encased underground cable duct: Section 26 05 41.

1.3 PROTECTION

- .1 Protect excavated earth to be reused from freezing by approved method.
- .2 Grade around excavations to prevent surface water runoff into excavated area.

1.4 INSPECTION & TESTING

- .1 Testing of materials and compaction will be carried out by testing laboratory designated by DFO Departmental Representative.
- .2 DFO Departmental Representative will pay costs for inspection and testing.

1.5 UTILITY LINES

- .1 Before commencing work, establish location and extent of underground utility lines in area of excavation. Notify DFO Departmental Representative of findings.
- .2 Make good damage to existing utility lines resulting from work.

1.6 PERMITS, FEES & INSPECTIONS

- .1 Obtain prior approval from the Municipality/DFO Departmental Representative for street cuts. Pay any fees required.
- .2 Repairs to meet Municipality/DFO Departmental Representative standards and approval.

Part 2 Products

2.1 BACKFILL MATERIALS

- .1 Bedding sand: clean, washed, coarse bank sand free from clay, shale and organic matter.
- .2 Common backfill materials: excavated soil selected from trench bottom or from other source, free from roots, rocks larger than 75mm and building debris and approved by DFO Departmental Representative before used as fill.
- .3 Granular backfill:
 - .1 Clean, hard, durable, uncoated particles free from clay lumps, cementation, organic or other objectionable material, meeting following gradation limits:

<u>ASTM Sieve Designation</u>	<u>% Passing</u>
50.0 mm	100
31.5 mm	60 -100
16.0 mm	40 - 75
4.75 mm	25 - 60
2.0 mm	20 - 45
425 micrometers	10 - 25
75 micrometers	0 – 10

2.2 CABLE MARKER SHEET

- .1 Polyethylene marker sheet: to be 150mm wide for burial 300mm below grade directly over buried cable.
- .2 Marker sheet to be orange in colour with the following words printed in large black block letters: "CAUTION CAUTION CAUTION - BURIED ELECTRIC LINE BELOW".

The above-described message is to be printed every 914mm minimum of marker sheet.

Part 3 Execution

3.1 EXCAVATIONS

- .1 Excavate to lines, grades, elevations and dimensions as indicated on drawings or as directed.

- .2 Cut edges of asphalt pavement with suitable cutting wheel or jack hammer and saw cut reinforced concrete deck prior to excavation. Cut only to width required to install services.
- .3 Remove unsuitable material from trench bottom to extent and depth directed by DFO Departmental Representative.
- .4 Stockpile suitable excavated materials required for trench backfill in approved location.
- .5 Dispose of surplus and unsuitable excavation material off site.
- .6 Where required due to removal of unsuitable material or unauthorized over excavation, bring bottom of excavation to design grade with common backfill material.
- .7 Compact trench bottom to density at least equal to density of adjacent surrounding soil.
- .8 Excavations require inspection and approval prior to commencement of installation operations.

3.2 BEDDING INSTALLATION

- .1 Place sand bed in trenches where cable ducts are direct buried.
- .2 Ensure that trench has been excavated to the proper required depth.
- .3 Cover bottom of trench with 75mm of sand.
- .4 Lay cable ducts in trench in accordance with Section 26 05 41.

3.3 BACKFILLING & COMPACTION

- .1 Do not proceed with final trench backfilling operations until installation of cable ducts is complete and that DFO Departmental Representative has inspected installations.
- .2 Use approved common backfill material as indicated or directed.
- .3 Backfill around installation as shown.
- .4 Place backfill material in uniform layers not exceeding 150mm in thickness up to sub-grade elevation or top of trench. Compact each layer before placing succeeding layer.
- .5 Compact common backfill materials as follows:

- .1 In non-pavement areas to a density at least equal to density of adjacent, undisturbed soil.
- .2 In pavement areas and sod areas to a minimum of 95% density for ASTM D698-78 maximum density.
- .6 Dispose of surplus backfill material off property after backfilling operations are complete.

3.4 CABLE MARKER TAPE

- .1 Install polyethylene marker tape in trenches where cables are installed in cable ducts.
- .2 Place marker tape 300mm below final grade; continuous over full length of cable run.

3.5 RESTORATION OF EXISTING SURFACES AFFECTED

- .1 The following paragraphs are intended for complete reinstatement of all the existing surfaces disturbed by the excavations of this section.
- .2 Where existing grassed areas are encountered during excavations, stock pile reusable materials for replacement after cable or duct installation and backfilling are completed.
- .3 Where existing asphalt pavement is encountered during excavations, General Contractor to remove all asphalt debris from site and after cable duct installation and backfilling are completed, provide new base coarse and asphalt pavement to match existing.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 Trenching: Section 26 05 40.
- .2 Concrete Forming and Accessories: Section 03 10 00.
- .3 Concrete Reinforcement: Section 03 20 00.
- .4 Structural Concrete: Section 03 30 00.

Part 2 Products

2.1 MATERIALS

- .1 PVC underground telecommunications cable ducting: to CSA B196.3.
- .2 Plastic underground power cable ducting: to CSA B196.1.

2.2 PVC DUCTS

- .1 PVC ducts, type DB2, encased in reinforced concrete, size as indicated for power and telephone.

2.3 PVC DUCT FITTINGS

- .1 Rigid PVC opaque solvent welded type couplings, balloon-end fittings, plugs, caps, adapters as required to make complete installation.
- .2 Expansion joints as indicated.
- .3 Rigid PVC 5° angle couplings as indicated.
- .4 Base and intermediate plastic spacers as required.
- .5 Rigid PVC 90° & 45° bends as required.

2.4 RIGID STEEL CONDUITS

- .1 To Section 26 05 34.
- .2 Couplings, reducers, plugs, caps, adapter and supports as required to make a complete installation.
- .3 Use long sweep bends only.

2.5 CABLE PULLING EQUIPMENT

- .1 6mm stranded polypropylene bare pull rope tensile strength 5kn continuous throughout each duct run with 3m spare rope at each end.

2.6 MARKERS

- .1 Over all underground duct and pipe runs, install continuously, at 300mm below grade, 75mm wide electrical underground polyethylene marking tape with warning "CAUTION CAUTION CAUTION, UNDERGROUND LINES BELOW".

Part 3 Execution

3.1 INSTALLATION - GENERAL

- .1 Install reinforced concrete encased underground duct banks, including form work.
- .2 Build duct bank on undisturbed soil or on well-compacted granular fill not less than 150mm thick, compacted to 95% of maximum proctor dry density.
- .3 Open trench completely before ducts are laid and ensure that no obstructions will necessitate change in grade of ducts.
- .4 Install ducts at elevations and with slope as indicated and minimum slope of 1 to 400.
- .5 Install base spacers at maximum intervals of 1.5m levelled to grades indicated for bottom layer of ducts.
- .6 Lay PVC ducts with configuration and reinforcing as indicated with preformed interlocking, rigid plastic intermediate spacers to maintain spacing between ducts at not less than 75mm

horizontally and vertically. Stagger joints in adjacent layers at least 150mm and make joints watertight. Encase duct bank with 75mm thick concrete cover. Use galvanized steel conduit for sections extending above finished grade level.

- .7 Make transpositions, offsets and changes in direction using 5 degree bends sections, do not exceed a total of 20 degrees with duct offset.
- .8 Terminate duct runs with a duct coupling set flush with the end of the concrete envelope when dead ending duct bank for future extension.
- .9 Cut, ream and taper end of ducts infield to manufacturer's recommendations, so that duct ends are fully equal to factory-made ends.
- .10 Allow concrete to attain 50% of its specified strength before backfilling.
- .11 Use conduit to duct adapters when connecting to conduits
- .12 Use anchors, ties and trench jacks as required to secure ducts and prevent moving during pouring of concrete. Tie ducts to spacers with twine or other non-metallic material. Remove weights or wood braces before concrete has set and fill voids.
- .13 Clean ducts before laying. Cap ends of ducts during construction and after installation to prevent entrance of foreign materials.
- .14 Immediately after pouring of concrete, pull through each duct a mandrel followed by a stiff bristle brush to remove sand, earth and other foreign matter. Avoid disturbing or damaging ducts where concrete has not set completely. Pull stiff bristle brush through each duct immediately before pulling in cables.
- .15 Install four 3m lengths of 15M reinforcing rods, one in each corner of duct bank when connecting duct to buildings.

3.2 INSPECTIONS

- .1 Advise DFO Departmental Representative so that he may inspect ducts prior to pouring and be present during pour of concrete and clean-out.

END OF SECTION

Part 1 General

Not applicable.

Part 2 Products

Not applicable.

Part 3 Execution

3.1 CABLE INSTALLATION IN DUCTS

- .1 Install cables as indicated in ducts.
- .2 Do not pull spliced cables inside ducts.
- .3 Install multiple cables in duct simultaneously.
- .4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
- .5 To facilitate matching of colour coded multi-conductor control cables; reel off in same direction during installation.
- .6 Before pulling cable into ducts and until cables are properly terminated, seal ends of cables with moisture seal tape.
- .7 After installation of cables, seal duct ends with duct sealing compound.
- .8 Install in each empty conduit a 6mm stranded nylon pull rope with tensile strength of 5 kN continuous throughout each duct run with 3m spare at each end.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00.
- .2 Perform tests using qualified personnel. Provide necessary instruments and equipment.
- .3 Check phase rotation and identify each phase conductor of each feeder.

- .4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is no less than 50 megohms.
- .5 Tests:
 - .1 After installing cable, but before splicing and terminating, perform insulation resistance test with 1000V megger on each phase conductor.
 - .2 Check insulation resistance after each termination to ensure that cable system is no Less than 50 megohms.
- .6 Provide DFO Departmental Representative with list of test results showing location at which each test was made, circuit tested and result of each test.
- .7 Remove and replace entire length of cable if cable fails to meet any of the test criteria.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 Excavation and Backfilling: Section 26 05 40.

Part 2 Products

2.1 MATERIALS

- .1 Plastic underground power cable ducting: to CSA B196.1.

2.2 PVC DUCTS

- .1 PVC ducts, size as indicated for power and telephone.

2.3 PVC DUCT FITTINGS

- .1 Rigid PVC opaque solvent welded type couplings, plugs, caps, adapters as required to make complete installation.
- .2 Expansion joints as indicated.
- .3 Rigid PVC 5° angle couplings as indicated.

2.4 FRE CONDUITS AND FITTINGS

- .1 FRE conduits for direct burial.
- .2 FRE couplings, reducers, bell end fittings, plugs, caps, adaptors as required to make complete installation.
- .3 FRE 90° and 45° bends as required.
- .4 FRE 5° angle couplings as required.
- .5 Expansion joints as required.

2.5 CABLE PULLING EQUIPMENT

- .1 6mm stranded nylon pull rope tensile strength 5kn.

2.6 MARKERS

- .1 150mm wide polyethylene marker tape with wording "CAUTION CAUTION CAUTION – UNDERGROUND CABLES BELOW", installed continuously over all underground ducts, 300mm below finished grade.

Part 3 Execution

3.1 INSTALLATION

- .1 Install duct as indicated and in accordance with manufacturer's instructions.
- .2 Clean inside of ducts before laying.
- .3 Ensure full and even support every 1.5m throughout duct length.
- .4 Slope ducts as indicated with 1 to 400 minimum slope.
- .5 During construction, cap ends of ducts to prevent entrance of foreign materials.
- .6 Pull through each duct a steel or wooden mandrel not less than 300mm long and of a diameter 6mm less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter. Pull stiff bristle brush through each duct immediately before pulling in cables.
- .7 In each duct, install pull rope continuous throughout each duct run with 3.0m spare rope at each end.

END OF SECTION

Part 1 General

1.1 REFERENCE

- .1 Read and be governed by Section 26 05 00.

1.2 RELATED WORK

- .1 Comply with relevant Sections of this and other Divisions of this Specification.

Part 2 Products

2.1 CUSTOMER'S METERING

- .1 Secondary instrument transformers:
 - .1 Current transformers: to CSA C13, dry type, epoxy moulded, for indoor use with the following characteristics:
 - .1 Nominal voltage class: 600V.
 - .2 Rated frequency: 60Hz.
 - .3 Basic impulse level: 10kV.
 - .4 Metering accuracy rating: 10kV.
 - .5 Rated primary and secondary current: 600/5.
 - .6 Continuous-current rating factor: 1.5.
 - .7 Short-time mechanical current rating 90 times primary rating.
 - .8 Short-time thermal current rating 80 times primary rating.
 - .9 Positive action automatic short-circuiting device in the secondary terminals.
- .2 Integral digital meter capable of measuring, calculating and directly displaying on the front panel display the following information in user programmable groups:
 - .1 Voltage line-to-neutral and line-to-line for each phase and average of all three phases.
 - .2 Current and voltage for each phase and average of all three phases including current and voltage % phase unbalance.
 - .3 Neutral or ground current, Frequency kW, kVAR, kVA, Power Factor, Harmonic distortion for each phase and total of all three phases.
 - .4 Demand kW, demand kVA, demand THD.
 - .5 Power factor for each phase and total of all three phases.
 - .6 Voltage readings for auxiliary voltage inputs, and current readings for auxiliary current inputs.
 - .7 Positive sequence, negative sequence, and zero sequence components for all three-phase voltage and 3-phase current signals.

- .3 The meter shall:
 - .1 Perform continuous true RMS measurement based on 256 samples-per-cycle sampling on all voltage and current signals. Both 1-cycle and 1-second readings to be calculated.
 - .2 Require no PTs on voltage inputs for Wye (Star) systems up to 347/600 VAC.
 - .3 Have eight optically isolated, self-excited, dry contact digital (status) inputs to remotely monitor breaker status, ground fault relay status, or any other dry contact input.
 - .4 Provide relay control, as well as 24 programmable setpoint control of internal recording mechanisms and all digital output relays for applications such as demand, power factor, or load control.
 - .5 Provide 512kB of non-volatile memory (NVRAM). The following to be stored in non-volatile memory: data recorders; time-stamped event log of at least 500 events; programmable oscillographic waveform recorders; All setup data.
 - .6 Include an XPRESS Card with 2xRS485 115kBaud serial ports and a 10BaseT Ethernet port.
 - .7 Have a modular serial communications port which can be programmed to communicate using RS-232C or RS-485; and supports addressable polling of multiple units at speeds from 1200 to 19,200 bits per second including ION and Modbus protocols.
 - .8 Support a configurable Modular Graphics Terminal (MGT) as the front panel.
- .4 The Digital Meter must be CSA & ULC approved.

2.2 WARRANTY AND SERVICE

- .1 The manufacturer warrants the products it supplies for a period of three (3) years from the acceptance date.
- .2 Warranty Service may be performed by the manufacturer or authorized representative.

2.3 ACCEPTABLE MATERIALS

- .1 Power Measurement Ltd. 7550 ION model: P7550A0C0B6E0A0A.
- .2 Siemens
- .3 Eaton (Cutler-Hammer)

2.4 POWER SUPPLY AUTHORITY METERING

- .1 Mounting accessories and wiring the following, supplied by supply authority:
 - .1 Three (3) potential transformers.
 - .2 Three (3) current transformers.
 - .3 Demand meter with kWh register.
- .2 Separate compartment and metal raceway for exclusive use of utility company metering. Utility approval of metering compartment required prior to manufacture.

- .3 Meter cabinet connected to meter compartment with 35mm conduit.

Part 3 Execution

3.1 SHOP INSTALLATION

- .1 Install meter and instrument transformers in separate compartment in switchboard, as required, such that meter is between 1.5m and 1.8m above the floor.
- .2 Install meter on the face of switchboard.
- .3 Ensure adequate spacing between current transformers installed on each phase.
- .4 Verify correctness of connections, polarities of meters, instruments, potential and current transformers, transducers, signal sources, electrical supplies.

3.2 METER INSTALLATION

- .1 Install meters and instrument transformers.
- .2 Make connections in accordance with diagrams.
- .3 Install meters in location free from vibration and shock.
- .4 Do not connect other instruments, relays, devices to metering circuits.

END OF SECTION

Part 1 General

1.1 RELATED STANDARDS

- .1 NB Service Entrance Standard.

1.2 COORDINATION WITH POWER SUPPLY AUTHORITY

- .1 Coordinate and meet requirements of local power supply authority. Ensure availability of power when required.
- .2 Arrange for primary line extensions, utility installation and energization.
- .3 Arrange with Utility for removal of existing aerial services from the old wharf.

1.3 UTILITY COST

- .1 The installation of the primary and secondary service to be included in the Contract Price.
- .2 Any fees or costs required by the Utility to remove existing and provide new service is to be paid for by the Contractor as part of the Contract Price.

Part 2 Products

2.1 MATERIALS

- .1 Service: overhead 7200V, 1Ø service by NB Power to one (1) pole mounted transformer by NB Power with 400A, 120/240V, 1Ø, 3W underground feeder from pole transformer to main electrical building by Electrical Contractor.
- .2 PVC conduit, necessary fittings: to Section 26 05 34.
- .3 Meter sockets: to NB Power requirements.
- .4 Electrical contractor to carry lump sum amount of \$10,000.00 in his tendered price to pay for all charges by NB Power based on NB Power invoice amount with no contractor mark-up. Unused amount will be returned to the DFO Departmental Representative. Also includes any charges from Aliant.
- .5 The above lump sum amount will also be used to have NB Power disconnect and reconnect power to Wharf 405 and any pole relocations, replacements, etc.

Part 3 Execution

3.1 INSTALLATION

- .1 Fit-up service pole to NB Power Standard Construction Practice. Terminate communications and power ducts on opposite sides of pole.
- .2 Install primary ducts as indicated.
- .3 Install meter sockets.
- .4 Install secondary ducts, conduit and wire as indicated.
- .5 Allow adequate conductor length for connection to supply by power supply authority.
- .6 Make grounding connections in accordance with Section 26 05 28.
- .7 Install secondary conduits as indicated.
- .8 Install cables in underground ducts and conduit as indicated.

END OF SECTION

Part 1 General

1.1 RELATED STANDARDS

- .1 Complete service entrance to conform to NB Power Service Entrance Standards and as detailed on drawings.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 26 05 00.

Part 2 Products

2.1 SUPPLY DATA

- .1 Service equipment suitable for incoming power supply:
 - .1 400A, 120/240V, 1Ø, 3W, 60Hz grounded neutral as indicated on drawings.

2.2 EQUIPMENT

- .1 Combination service entrance panel to Section 26 24 02.
- .2 Meter socket cabinet for utility revenue metering to Utility Standards.

Part 3 Execution

3.1 INSTALLATION

- .1 Install service equipment as indicated.
- .2 Connect to incoming service as indicated.
- .3 Connect to outgoing load circuits as indicated.
- .4 Make grounding connections in accordance with Section 26 05 28 and Utility Service Entrance Standards.
- .5 Make provision for power supply authority's metering to meet their requirements.

END OF SECTION

Part 1 General

1.1 DESCRIPTION OF EQUIPMENT

- .1 Service entrance board incorporates service entrance wireway in one vertical section; main breaker, metering transformer compartment, and full distribution panelboard in one vertical section, factory assembled in a two-section enclosure.

1.2 UTILITY METERING

- .1 Utility shall supply current metering transformers.
- .2 All costs for factory or field installation of metering transformers to be paid by Utility. Advise Utility immediately upon order of name, address and telephone number of supplier so arrangements can be made for factory installation if desired.

1.3 SHOP DRAWINGS & PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 26 05 00.
- .2 Indicate:
 - .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 characteristics for circuit breakers and fuses rated 100A and higher.

1.4 MAINTENANCE DATA

- .1 Provide maintenance data for service entrance board for incorporation into maintenance manual specified in Section 26 05 00.
- .2 Submit three copies maintenance data for complete assembly including components.

1.5 MAINTENANCE MATERIALS

- .1 One set spare parts as recommended by manufacturer.

1.6 SOURCE QUALITY

- .1 Submit three copies of certified test results.

Part 2 Products

2.1 POWER SUPPLY

- .1 Power Supply: 400A, 120/240V, 1 phase, 3 wire, grounded neutral, 60 Hz, short circuit current 22 kA rms symmetrical.

2.2 SERVICE ENTRANCE BOARD

- .1 Rating: as indicated.
- .2 Cubicles, self-supporting, dead front, as indicated.
- .3 Barrier metering section from adjoining sections.
- .4 Provision for installation of supply authority and customer metering.
- .5 Distribution section.
- .6 Hinged access panels with captive knurled thumb screws.
- .7 High conductivity copper bus.
- .8 Bus from load terminals of main breaker via metering section to main lugs of distribution section.
- .9 Identify phases with colour coding.

2.3 SOLID STATE TRIP CIRCUIT BREAKERS (MAIN BREAKER)

- .1 Moulded case circuit breaker CSA rated for 100% current-carrying-capacity to operate by means of a 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, tripping for phase.

2.4 MOULDED CASE CIRCUIT BREAKERS (DISTRIBUTION BREAKERS)

- .1 Bolt-on moulded case circuit breaker: quick-make, quick-break for manual and automatic operation, with temperature compensation for 40°C ambient.
- .2 Common trip with single handle for multi-pole operations.
- .3 Magnetic instantaneous trip elements trip settings on breakers with adjustable trips to range from 10-12 times current rating.

- .4 Circuit breakers with interchangeable trips on units over 100A.

2.5 GROUNDING

- .1 Copper ground bus extending full width of cubicles and located at bottom.
- .2 Lugs at each end for size 1 grounding cable.
- .3 Bond non-current-carrying metal parts to ground bus.

2.6 POWER SUPPLY AUTHORITY METERING

- .1 Mounting accessories and wiring the following, supplied by supply authority:
 - .1 Two (2) current transformers.
 - .2 Two (2) potential transformers.
 - .3 Demand meter with kWh register.
- .2 Separate compartment and metal raceway for exclusive use of utility company metering. Utility approval of metering compartment required prior to manufacture.
- .3 Meter cabinet connected to meter compartment with 32mm conduit.
- .4 See Section 26 09 23 for detail requirements.

2.7 FINISHES

- .1 Apply finishes in accordance with Section 26 05 00.
 - .1 Service entrance board exterior grey.
 - .2 Supply 2 spray cans touch-up enamel.

2.8 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00.
- .2 Nameplates:
 - .1 White plate, black letters, size 7.
 - .2 Complete board labelled: "600V".
 - .3 Main disconnect labelled: "Main Breaker".
 - .4 Branch disconnects labelled: "Feeder No 1", "Transformer T-1"; "Feeder No 2", Panel J; "Feeder No 3", MCC #2, etc.

2.9 SHOP FABRICATION

- .1 Assemble and wire complete service entrance board.
- .2 Energize board.
- .3 Prepare board for shipment to site.

2.10 MANUFACTURERS

- .1 Acceptable manufacturers or approved equal:
 - .1 Siemens
 - .2 Cutler-Hammer
 - .3 Schneider Electric

2.11 HOUSEKEEPING PADS

- .1 All freestanding switchboards are to be rigidly secured (bolted) to concrete housekeeping pads.

Part 3 Execution

3.1 INSTALLATION

- .1 Locate service entrance board as indicated and fasten to wall.
- .2 Connect main secondary service to line terminal of main breaker.
- .3 Connect load terminals of distribution breakers to feeders as indicated.
- .4 Connect ground bus to service ground.
- .5 Check factory made connections for mechanical security and electrical continuity.
- .6 Run one grounding conductor 1 AWG bare copper in 25mm conduit from ground bus to building steel.
- .7 Check trip unit settings against coordination study to ensure proper working and protection of components.
- .8 Install meter socket and conduit.
- .9 Program and set up Owner's metering following manufacturer's instruction and as instructed by PSPC Departmental Representative.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 26 05 00.
- .2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.2 PLANT ASSEMBLY

- .1 Install circuit breakers in panelboards before shipment.
- .2 In addition to CSA requirements, manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

Part 2 Products

2.1 PANELBOARDS

- .1 Panelboards: to CSA C22.2 No. 29.
- .2 Panelboards to be product of one manufacturer.
- .3 250V panelboards: bus and breakers rated for 22,000A symmetrical interrupting capacity or as indicated.
- .4 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number.
- .5 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated on drawings.
- .6 Two keys for each panelboard and key panelboards alike.
- .7 Copper bus with neutral of same ampere rating as mains.
- .8 Mains: suitable for bolt-on breakers.
- .9 Trim and door finish: baked grey enamel.
- .10 Panelboards to have a minimum of 33% spare space unless indicated otherwise.

2.2 BREAKERS

- .1 Breakers to Section 26 28 21.
- .2 Breakers with thermal magnetic tripping in panelboards except as indicated.
- .3 Lock-on devices for 10% of 15A to 30A breakers installed as indicated. Turn over unused lock-on devices to DFO Departmental Representative.

2.3 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00.
- .2 Nameplate for each panelboard size 4 engraved as indicated.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.
- .4 Complete circuit directory and typewritten legend showing location and load of each circuit.

2.4 MANUFACTURERS

- .1 Acceptable manufacturers or approved equal:
 - .1 Siemens
 - .2 Cutler-Hammer
 - .3 General Electric

Part 3 Execution

3.1 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Mount panelboards to height given in Section 26 05 00 or as indicated.
- .3 Connect loads to circuits as indicated.
- .4 Connect neutral conductors to common neutral bus with respective neutral identified.
- .5 Commission metering.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS & PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 26 05 00.

Part 2 Products

2.1 SWITCHES

- .1 15A, 120V, single pole, as indicated.
- .2 Manually operated general purpose ac switches as indicated and with the 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 Black toggle.
 - .6 Marine grade.
- .3 Toggle operated fully rated for tungsten filament and fluorescent lamp, and up to 80% of rated capacity of motor loads.
- .4 Switches of one manufacturer throughout project.
- .5 Standard of acceptance:
 - .1 For 15A, 120V almond switches:
 - .1 Arrow Hart
 - .2 Bryant
 - .3 Hubbell #CS115BK c/w HBL1975 coverplate
 - .4 Leviton
 - .5 Pass & Seymour

2.2 RECEPTACLES

- .1 Marine grade duplex 15/20A receptacles as indicated, CSA Type 5-20 R, 125V, 20A, U ground, with the following features used on interior of electrical building and panel enclosures:
 - .1 Yellow urea moulded housing, nylon front.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacle.
 - .4 Eight back wired entrances, four side wiring contacts.
 - .5 Double wipe contacts and riveted grounding contacts.
 - .6 Installed in FS box c/w weatherproof cover plate.

- .2 Acceptable manufacturers or approved equal:
 - .1 Hubbell #HBL53CM62//HBL52CM21/HBL60CM83A
 - .2 Leviton
 - .3 Pass & Seymour
- .3 Single marine grade 20A, 120V receptacle twist lock c/w weatherproof in-use lockable coverplate and backbox:
 - .1 Hubbell #HBL23CM10/MX5280SNC/HBL60CM83A
 - .2 Leviton
 - .3 Pass & Seymour
- .4 Single marine grade 30A, 120/240V receptacle twist lock c/w coverplate and backbox:
 - .1 Hubbell #HBL27105W/FT302W
 - .2 Leviton
 - .3 Pass & Seymour
- .5 Single Marine Grade 50A 120/240V receptacle twist-lock c/w coverplate and backbox:
 - .1 Hubbell # HBL63CM69/HBL77CM74WO/HBL60CM83A
 - .2 Leviton
 - .3 Pass & Seymour

2.3 GFCI SENSING MODULE

- .1 NEMA 3R 20A 120V 1-pole sensing module.
- .2 Acceptable manufacturer or approved equal:
 - .1 Hubbell Cat. #GFM20/CWP26CR/HBL60CM83A
 - .2 Leviton
 - .3 Pass & Seymour

2.4 ELECTRIC BASEBOARD HEATER

- .1 1000W 240V 1Ø c/w integral thermostat.
- .2 1207mm long, 5.1KG, white, epoxy polyester power coat finish.
- .3 Stelpro Cat. #B1002 ERW or equivalent Convect Air, Dimplex.

2.5 MARINE GRADE TELEPHONE OUTLET

- .1 Telephone outlet, cover plate, frame and back box.
- .2 Acceptable manufacturer or approved equal:
 - .1 Hubbell Cat. #NSJ6W/NS6121/NP26W/HBL60800S

- .2 Leviton
- .3 Pass & Seymour

Part 3 Execution

3.1 INSTALLATION

- .1 Switches:
 - .1 Install single throw switches with handles in "UP" position when switch closed.
 - .2 Install switches in gang type outlet box when more than one switch is required in one location.
 - .3 Mount toggle switches at height specified in Section 26 05 00 or as indicated.
- .2 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
 - .2 Mount receptacles at height specified in Section 26 05 00 or as indicated.
- .3 Cover plates:
 - .1 Protect cover plate finish with paper or plastic film until painting and other work is finished.
 - .2 Do not use cover plates meant for flush outlet boxes on surface mounted boxes.
 - .3 Install suitable common cover plates where wiring devices are grouped.
- .4 Use only screw down terminals for connecting wiring devices to circuits.
- .5 Install pin and sleeve receptacles and convenience receptacles as indicated.

3.2 IDENTIFICATION

- .1 Identify all outlets with size 5 nameplate indicating source, circuit number, voltage, ampacity and phasing.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS & PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 26 05 00.

1.2 MAINTENANCE MATERIALS

- .1 Provide maintenance materials in accordance with Section 26 05 00.
- .2 Three spare fuses of each type and size installed up to and including 600A.

1.3 DELIVERY & STORAGE

- .1 Ship fuses in original containers.
- .2 Do not ship fuses installed.
- .3 Store fuses in original containers in storage cabinet.

Part 2 Products

2.1 FUSES - GENERAL

- .1 HRC fuses: to have interrupting capability of 200,000 A symmetrical.
- .2 Fuses: product of one manufacturer.

2.2 FUSE TYPES

- .1 HRC-1 fuses (formerly Class L):
 - .1 Type L2, fast acting, plus two spares.
- .2 Time delay 45A for welder/winch.
- .3 100% rates fuses where indicated (Type J).
- .4 Fuses in junction box at bottom of wood pole to be GEC #CRS30H fuse fitted with 6 Amp Type C fuse for camera disconnect; and GEC #CRS30H fuse fitted with 12 Amp Type C fuse for 2-350W LED light fixtures.

2.3 MANUFACTURERS

- .1 Acceptable manufacturers or approved equal:
 - .1 English Electric
 - .2 GEC Canada Ltd.
 - .3 Gould-Shawmut Company
 - .4 Littelfuse

Part 3 Execution

3.1 INSTALLATION

- .1 Install fuses in mounting devices immediately before energizing circuit.
- .2 Ensure correct fuses fitted to physically matched mounting devices.
- .3 Ensure correct fuses fitted to assigned electrical circuit.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

- .1 Submit product data in accordance with Section 26 05 00.
- .2 Include time current characteristic curves for breakers with ampacity of 400A and over.

Part 2 Products

2.1 BREAKERS GENERAL

- .1 Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.
- .2 Common-trip breakers with single handle for multi-pole applications.
- .3 Magnetic instantaneous trip elements in circuit breakers, to operate only when the value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3 - 10 times current rating.
- .4 Circuit breakers with interchangeable trips as indicated.
- .5 100% rated circuit breakers where indicated on drawings.

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.

2.3 OPTIONAL FEATURES

- .1 Include ground fault interrupting capability (5ma maximum) where indicated.

2.4 MANUFACTURERS

- .1 Acceptable manufacturer or approved equal:
 - .1 Siemens
 - .2 Cutler-Hammer
 - .3 General Electric

Part 3 Execution

3.1 INSTALLATION

- .1 Install circuit breakers as indicated.

END OF SECTION

Part 1 General**1.1 PRODUCT DATA**

- .1 Submit product data in accordance with Section 26 05 00.

Part 2 Products**2.1 DISCONNECT SWITCHES**

- .1 Enclosed manual air break switches in non-hazardous locations: to DSA C22.2 No. 4.
- .2 Fuseholder assemblies to CSA C22.2 No. 39.
- .3 Heavy-duty fusible disconnect switch in CSA type 4X stainless steel enclosure. 60A fusible disconnect switch to be in watertight CSA Type 4X, 316 grade stainless steel enclosure (provide polycarbonate window for winch disconnects).
- .4 Provision for padlocking in ON-OFF switch position complete with heavy-duty padlock.
- .5 Mechanically interlocked door to prevent opening when handle in ON position.
- .6 Quick-make, quick-break action.
- .7 Fuseholders in each fused switch suitable without adapters, for type of fuse as indicated.
- .8 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00.
- .2 Indicate name of load controlled on size 4 nameplate.

2.3 MANUFACTURERS

- .1 Acceptable manufacturers or approved equal:
 - .1 Siemens
 - .2 Cutler-Hammer
 - .3 General Electric

Part 3 Execution

3.1 INSTALLATION

- .1 Install disconnect switches complete with fuses as indicated.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

- .1 Submit product data in accordance with Section 26 05 00.

Part 2 Products

2.1 CONTACTORS

- .1 Contactors: to EEMAC No. 1CS.
- .2 Electrically held controlled by pilot devices as indicated and rated for type of load Controlled, min. 8 pole, 30A rating. Half size contactors not accepted.
- .3 Breakers combination contactor as indicated.
- .4 Complete with normally open and normally closed auxiliary contacts unless indicated otherwise.
- .5 Mount in CSA Enclosure 3R unless indicated otherwise.
- .6 Including following options in cover as indicated.
 - .1 Red indicating lamp
 - .2 HAND-OFF-AUTO selector switch
- .7 Control transformer in contactor enclosure where indicated.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00.
- .2 Size 4 nameplate indicating name of load controlled.

2.3 MANUFACTURERS

- .1 Acceptable manufacturers or approved equal:
 - .1 Siemens
 - .2 Cutler-Hammer
 - .3 General Electric

Part 3 Execution

3.1 INSTALLATION

- .1 Install contactors and connect auxiliary control devices as indicated.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 Electrical General Provisions: Section 26 05 00.

1.2 PROJECT DATA

- .1 Submit project data in accordance with Section 26 05 00.

Part 2 Products

2.1 ELECTRONIC TIME CLOCK

- .1 Six-channel solid-state digital timer, keypad entry, digital LED readout
- .2 7-day control with skip-a-day feature
- .3 Contacts rated 30A tungsten per pole up to 120V
- .4 Contacts independent of load switches
- .5 8-hour battery carryover
- .6 CSA 1 enclosure
- .7 120V, 60Hz
- .8 Manual "ON-OFF-REVIEW-SET" selector
- .9 Astrodial
- .10 Seasonal programming
- .11 Acceptable manufacturers or approved equal:
 - .1 Intermatic
 - .2 Paragon
 - .3 Tork #k400Z 120VAC

Part 3 Execution

3.1 INSTALLATION

- .1 Install time switch controls as indicated.

END OF SECTION

Part 1 General**1.1 RELATED WORK**

- .1 Lighting Equipment: Section 26 50 00.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with Section 26 05 00.

Part 2 Products**2.1 PHOTOELECTRIC LIGHTING CONTROL**

- .1 Swivel pipe nipple box mounting.
- .2 Capable of switching 1500W of lighting at 120V.
- .3 Voltage variation: + or – 10%.
- .4 Temperature range: -40°C to 70°C.
- .5 Switching on lights at 12 lx.
- .6 Switching on lights at 110 lx maximum.
- .7 Rated for 5000 operations.
- .8 Options:
 - .1 Lighting arrestor
 - .2 Fail-safe circuit completed when relay de-energized.
 - .3 Twist-lock type double pole receptacle switch.
 - .4 Terminal strip.
- .9 Switching time delay of 30 s.
- .10 Wall mounting bracket, stainless steel.
- .11 Colour coded leads: size 10 AWG 460mm long.
- .12 Standard of acceptance:
 - .1 Paragon #CW-201-00
 - .2 Tork #2101
 - .3 Intermatic #K4221

Part 3 Execution

3.1 INSTALLATION

- .1 Install photoelectric controls as indicated.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 26 05 00.
- .2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by DFO Departmental Representative.

1.2 EQUIVALENT MANUFACTURERS

- .1 The manufacturer and catalogue numbers used herein are to establish an acceptable standard of quality. Equivalent products by the listed luminaire manufacturers may be used as alternatives subject to verification of photometric data and construction material at the shop drawing stage.
- .2 Acceptable materials:
 - .1 Holophane
 - .2 Appleton
 - .3 Crouse-Hinds
 - .4 Lithonia

Part 2 Products

2.1 LED LIGHT ENGINE

- .1 Light engine to have 391W of high powered LED's with nine (9) modules.
- .2 CRI to be 70 with colour temperature of 4000K.
- .3 LED driver to be rated for 100,000 hours.
- .4 Delivered lumens to be 47,154 with current of 1050ma @ 120V.
- .5 BUG rating of B3-U3-G3.
- .6 Acceptable materials:
 - .1 Holophane Cat. #PLLED-9-4K-10A-AH-66-5-L-GP-05-23-08657-GP
 - .2 Cree
 - .3 Crouse-Hinds

2.2 FINISHES

- .1 Baked enamel finish:
 - .1 Conditioning for metal before painting:
 - .1 For corrosion resistance conversion coating to CGSB 31-GP-103M.
 - .2 For paint base, conversion coating to CGSB 31-GP-105M, CGSB 31-GP-106A.
 - .2 Metal surfaces of luminaire housing and reflectors finished with high gloss baked enamel to give smooth, uniform appearance, free from pinholes or defects.
 - .3 Inside surfaces finished as follows:
 - .1 White, minimum reflection factor 85%.
 - .2 Colour fastness: yellowness factor not above 0.02 and after 250 hr. exposure in Atlas fadeometer not to exceed 0.05.
 - .3 Film thickness, not less than 0.3mm average, and in no areas less than 0.025mm.
 - .4 Gloss not less than 80 units as measured with Gardner 60 deg. glossmeter.
 - .5 Flexibility: withstand bending over 12mm mandrel without showing signs of cracking or flaking under 10 times magnification.
 - .6 Adhesion: 24mm square lattice made of 3mm squares cut through film to metal with sharp razor blade. Adhesive cellulose tape applied over lattice and bulled. Adhesion satisfactory if no coating removed.
- .2 Alzak finish:
 - .1 Aluminium sheet fabricated from special aluminium alloys and chemically brightened, subsequently anodically treated to specifications established by Alcoa, to produce:
 - .1 Finish for mild commercial service, minimum density of coating 0.8 mg/sq.cm., minimum reflectivity 83% for specular and 75% for diffuse.
 - .2 Finish for regular industrial service, minimum density of coating 1.2 mg/sq.cm., minimum reflectivity 82% for specular and 73% for diffuse.
 - .3 Finish for heavy duty service, minimum density of coating 1.5 mg/sq.cm. minimum reflectivity 78% for specular 65% for diffuse.

2.3 LUMINAIRES

- .1 Luminaire Type A:

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>LED</u>	<u>MOUNTING</u>
1.	ROADWAY LIGHT WITH 391 WATTS OF LED'S RATED FOR 120V	NINE (9) LED MODULES 4000°K 10 AMPS	1. MOUNTED ON 3 BULL HORN GALVANIZED STEEL SECTION ON 10 METER GALVANIZED STEEL POLE 203mm DIA. AND 3mm THICK TAPERED SHAFT. SUPPLY AND INSTALL STAINLESS STEEL BIRD SPIKES ON TOP OF FLOOD LIGHT AND ARM. BIRD SPIKES TO BE BIRD-X TYPE C/W EPOXY ADHESIVE IN CASES WHERE S/S BANDING OR S/S NAILS/SCREWS ARE NOT PRACTICAL.

(Cont'd)

ITEM	DESCRIPTION	LED	MOUNTING
2.	SEALED OPTICAL SYSTEM IP67 SALT/FOG RATED		
3.	EPA RATED AT 0.125 SQ. METERS		
4.	WEIGHT 19.1 KG		
5.	REDUCED GLARE WITH REFLECTOR AND INTERNAL PRISM REFRACTORS		
6.	LED's TO HAVE INDIVIDUAL PRE- ORIENTED LENS TO PROVIDE TYPE 6 x 6 DISTRIBUTION		
7.	LUMINAIRE TO BE CUSTOM PAINTED WITH CLEAR COAT		
8.	ACCEPTABLE MATERIALS: .1 HOLOPHANE CAT. #PLLED-9-4K- 10A-AH-66-5-L-GP-05-23-08657- GP .2 CREE .3 CROUSE-HINDS		ANCHOR BOLTS TO BE 32mm DIA X 1300mm LONG WITH 134mm THREADED END AND 150mm HOOK AT END WITH 279mm BOLT CIRCLE

- .2 Luminaire Type B: 1220mm surface wraparound ceiling mounted LED light fixture.
Lithonia Cat. #LBL448L-EOHN-LP840
- .3 Luminaire Type C: Exterior LED pole light mounted on existing wood pole by H.A. building.
Night Falcon Cat. #CPRNFFLDC40S (NFFLD-C40-S-128W LED) c/w photocell

2.4 BIRD SPIKES

- .1 Stainless steel bird spikes are to be installed on the top of the light fixtures and arms with epoxy adhesive in cases where S/S banding or S/S nails/ screws are not practical.

2.5 LIGHT POLE AND BULL HORN

- .1 Galvanized tapered round steel pole to have reaction sheer force of 6.9KN, axial force of 2.3KN and overturning moment of 50KNm. Pole to be 10.0m high with weight of 164kg, base OD of 203mm, top OD of 97mm and wall thickness of 3.04mm. Base plate to be 291mm square with a bolt circle diameter of 219mm with a base plate thickness of 25mm.

- .2 The anchor bolts to be 32mm diameter and 1220mm long with a 150mm hook at the end. Threaded projection to be 138mm.
- .3 Handhole to be 100 x 178mm and located 305mm above bottom of pole. Tenon at top of pole to be 127mm long x 60mm diameter with 6.35mm thick round tenon plate.
- .4 Pole design standard to be CAN/CSA S6-06 and all welding to be to CSA W59 2003.
- .5 Light pole acceptable manufacturer or approved equal:
 - .1 Valmont West Coast Engineering
 - .2 Pole-Lite
 - .3 Pole Co.
- .6 Three arm bull horn to have arms at 180° with 63mm ID and 73mm OD tenon section with two (2) 9.5mm threaded nuts and set screws to fasten bull horn to pole. Bull arms to be 970mm apart and 432mm high made of 60mm tubes. All components to be galvanized or S/S. Acceptable manufacturer or approved equal to be Valmont Cat. #DWG C17-BH2-01.01; Pole-Lite or Pole Co.
- .7 Bottom of light pole to have 150mm high x 350mm square two-piece polycarbonate shroud to cover anchor bolts and be secured in place with S/S bolts through into pole base plate on all four sides.

Part 3 Execution

3.1 INSTALLATION

- .1 Locate and install light pole, bull horn and luminaires as indicated.
- .2 Supply and install all material required for proper mounting of all luminaires including all wiring and fuses.

3.2 WIRING

- .1 Connect luminaires to lighting circuits.

3.3 LUMINAIRE ALIGNMENT

- .1 Align luminaires mounted individually parallel or perpendicular to building grid lines.
- .2 Align luminaires at night-time under direction of DFO Departmental Representative. Allow for four hours' time with three men and bucket truck so that alignment can be made to satisfaction of client.

END OF SECTION