

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:**
- .1 PHASE 2 – PROJECT NO. R.097242.003.
    - .1 Remove existing electrical service from existing Wharf 405 (new Wharf 408E). Have items including junction box, TECK cable, pole P13 c/w all devices and navigational light shipped to DFO's Tracadie office storage area.
    - .2 Supply, installation and connection of new circuit breakers and wiring in existing Panel 'B' in Electrical Building for ES10, ES11, ES12, and ES13 electrical service shrouds.
    - .3 Supply and installation of new wiring in existing conduit from existing Electrical Building to start of Wharf 408E for electrical service shrouds ES11, ES12, ES13, and supply and installation of new wire and conduit in Wharf 408E deck to ES10, ES11, ES12, and ES13 electrical service shrouds.
    - .4 Supply and installation of electrical service shrouds ES10, ES11, ES12, and ES13 c/w 2-20A 1P TL and 2-30A 1P TL receptacles.
    - .5 Supply and installation of 1 – 10.7 meter galvanized steel light pole and 2 – 391W LED light fixtures at electrical service shrouds ES10 and ES12.
    - .6 Electrical Contractor 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 | <u>Care, Operation and Start-Up</u>  | .1 | Instruct PSPC 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 | <u>Voltage Ratings</u>               | .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 | <u>Permits, Fees and Inspections</u> | .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 | PSPC Departmental Representative will provide drawings and specifications required by Electrical Inspection - Department and Supply Authority at no cost.  |
|     |                                      | .4 | Notify PSPC Departmental Representative of changes required by Electrical Inspection Department prior to making changes.   |
|     |                                      |    |  |
| 1.7 | <u>Materials and Equipment</u>       | .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 Lamicoid 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 PSPC 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:

<p><b>PANEL N - 150A</b> <b>120/208V - 3PH - 4W</b> <b>FED FROM MAIN SWITCHBOARD #CDP-A</b></p>
---

- .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 PSPC 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.

Electrical General Provisions

- .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 PSPC Departmental Representative three days in advance, of equipment and system testing and verification. Carry out tests in presence of PSPC Departmental Representative.
- .6 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .7 Submit test results for PSPC 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-Built 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 PSPC Departmental Representative.
- 1.25 Shop Drawings, Product Data and 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 Division 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 | <u>Protection</u>                     | .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 | <u>Cleaning</u>                       | .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 | <u>Coordination with Other Trades</u> | .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 | <u>Submission of tender by Electrical Contractor acknowledges coordination with other trades as part of these contract documents.</u>  |
|      |                                       |    |  |
| 1.31 | <u>Project Waste Management</u>       | .1 | Contractor must adhere to project waste management guidelines as detailed in Section 01 74 21 – Construction/Demolition Waste Management and Disposal.   |
|      |                                       |    |  |
| 1.32 | <u>Project Record Documents</u>       | .1 | Provide Project Record Documents to Division 01.   |
|      |                                       |    |  |
| 1.33 | <u>Schedule</u>                       | .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 | <u>Description of System</u> | .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 | <u>Related Work</u>          | .1 | Electrical General Provisions: Section 26 05 00.   |
|     |                              | .2 | Wharf Removals.  |
| 1.3 | <u>Site Survey</u>           | .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 | <u>Reference Standards</u>   | .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 | <u>Protection</u>            | .1 | Be responsible for any damages to existing structure as a result of the work.  |
| 1.6 | <u>Salvage Material</u>      | .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 PSPC Departmental Representative at that time.  |

- 1.7 Disposal
- .1 Prior to demolition PSPC Departmental Representative will identify any items of electrical equipment which are to be set aside as directed for future use by PSPC 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.
  - .4 Existing pole light fixture will be removed by NB Power. Contractor to remove existing wood poles off the wharf for pick-up by NB Power.
- 1.8 Schedule
- .1 The Contractor is to note that the PSPC 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**

- 2.1 N/A

**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 PSPC 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 PSPC 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

1.1 N/A

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 connecting solid to stranded conductors.
  - .5 Heavy wall shrinkable tubing with 600V insulation: 3M “Cold Shrink Splice” or approved equal on all splices and wrapped with waterproof electrical tape.
  - .6 Use in-line insulated compression connectors for splices in junction boxes and panelboards to reduce from oversize conductors (due to voltage drop) to smaller conductors that will fit on circuit breakers.
  - .7 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 handhole connection to top of light pole to be 5#12 + GND 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 and 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 | <u>Site Lighting</u>                | .1 | Install conductors on light poles in PVC conduit 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 | <u>Installation of Fixture Wire</u> | .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 316 grade stainless steel 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 aluminum shroud or galvanized steel.

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 PSPC Departmental Representative and local authority having jurisdiction over installation.

Grounding - Secondary

- .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, shrouds and winches.
  - .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 and 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 PSPC Departmental Representative and local authority having jurisdiction over installation.  
.3 Perform tests before energizing electrical system.

**END OF SECTION**

PART 1 - GENERAL

1.1 N/A

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.

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

PART 2 – PRODUCTS

- 2.1 Junction and Pull Boxes .1 PVC waterproof construction with screw-on overlapping covers, complete with gasket, for surface mounting. IPEX, Royal, Burndy 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 Aluminium shroud 6mm thick on front and back, 9mm thick on sides and top and 13mm thick on bottom with dimensions as detailed on drawing, made from ASTM 6061-T6 salt water marine rated aluminium with all seams fully sealed and welded with 4mm fillet welds on inside corners and 4mm joint welds on outside corners. A 6mm x 1032mm x 550mm door c/w stainless steel piano hinge full length on one side and 3-point latch on the other side. A 13mm rubber mat (type SBR-60) is to be installed between concrete deck and shroud and 2 x 13 mm thick rubber pad (type SBR-60) is to be installed between the shroud and concrete pole base. Use high strength waterproof bonding adhesive to fasten pad to concrete and aluminum. Provide 16mm dia. galvanized steel anchors embedded 200mm into 19mm drilled holes in the concrete filled with epoxy grout. Install with neoprene gasket, 6mm galvanized washers and galvanized nuts.
- 2.3 Bollards .1 Bollards to be 178mm inside diameter and 194mm outside diameter. Schedule 40 steel pipe 1435mm long welded with 6mm fillet weld to 19mm thick by 350mm square steel base plates. Baseplate to have 4-22mm diameter bolt holes as detailed on drawing E7.

- .2 Bollard and baseplate to be galvanized after fabrication.
  - .3 Bollard to be filled with concrete after installation c/w domed concrete top. Provide yellow 6mm thick PVC cover over entire length of bollard with domed top.
  - .4 Bollard to be fastened to concrete deck with 4-19mm diameter galvanized anchor rods 200mm long c/w 6mm thick washer and nut. Drill 22mm diameter hole in concrete deck, fill with epoxy grout and insert anchor bolt.
- 2.4 Manufacturers .1 Electrical shrouds and bollards to be manufactured by metal fabrication companies having 10 years-experience constructing similar components.

**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 Size and install cabinets to CEC requirements.
- .3 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.
- 3.3 Shrouds and Bollards .1 Install electrical shroud as detailed on drawings.
- .2 Install bollard as detailed on drawings.

**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 and 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 ferrous boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles.
  - .2 For 20A 1-pole/30A 1-pole TL receptacle, and 50A 2P receptacle, use HUBBELL Cat. #HBL60CM83A and Hubbell Cat. #HBL60CM84A conduit boxes respectively to coordinate with existing conduit boxes on site.
- 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 show all conduits in diagrammatic form only.

PART 2 – PRODUCTS

- 2.1 Conduits .1 Rigid PVC conduit: size as indicated.
- .2 Rigid steel conduit, hot dipped galvanized after fabrication.
- .3 Electrical metallic tubing (EMT), with steel set screw couplings and connectors.
- .4 Flexible metal conduit and liquid-tight flexible metal conduit.
- 2.2 Conduit Fastenings .1 One-hole rigid PVC straps to secure surface conduits 50mm and smaller. Two-hole rigid 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 1.2 meters on centre.
- .3 13mm diameter threaded rods to support suspended channels. Drill 3mm larger hole in concrete to a 200mm depth and fill with approved epoxy grout.
- 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 rigid PVC expansion joints at all structural expansion joints and at all locations where PVC conduit exits underground, 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.
  - .5 Supports and protective rod sleeves for FRE conduits to be supplied as recommended by FRE conduit supplier.
- 2.4 Fish Cord .1 6mm diameter with tensile strength of 5 kN.

### 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 rigid 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 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.
  - .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 rigid PVC conduit. NUAL is not to be used.
  - .8 Use rigid steel conduit for exterior exposed above grade work.
  - .9 Use FRE conduit for underground wharf services, unless indicated otherwise.
  - .10 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.

- .11 Use flexible metal conduit for connection to motors in dry areas and interior light fixtures.
- .12 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .13 Mechanically bend steel conduit over 19mm diameter.
- .14 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 Related Work .1 Concrete Reinforcement: Section 03 20 00 (in deck).  
.2 Cast-in-place Concrete: Section 03 30 00 (in deck).

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 Rigid PVC Ducts .1 Rigid PVC ducts, 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.

### PART 3 – EXECUTION

- 3.1 Installation – General .1 Install ducts at elevations as indicated.
- .2 Lay rigid PVC ducts with configuration and reinforcing as indicated to maintain spacing between ducts at not less than 75mm horizontally and vertically.
- .3 Make transpositions, offsets and changes in direction using 5 degree bends sections, do not exceed a total of 20 degrees with duct offset.
- .4 Terminate duct runs with a duct coupling set flush with the end of the concrete envelope when dead ending duct bank for future extension.
- .5 Cut, ream and taper end of ducts infield to manufacturer's recommendations, so that duct ends are fully equal to factory-made ends.
- .6 Use conduit to duct adapters when connecting to conduits
- .7 Use anchors and ties as required to secure ducts and prevent moving during pouring of concrete.
- .8 Clean ducts before laying. Cap ends of ducts during construction and after installation to prevent entrance of foreign materials.
- .9 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.

- 3.2 Inspections .1 Advise PSPC 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

1.1 N/A

PART 2 – PRODUCTS

2.1 N/A

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 PSPC 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 Shop Drawings and Product Data .1 Submit shop drawings and product data in accordance with Section 26 05 00.

PART 2 – PRODUCTS

- 2.1 Receptacles .1 Marine grade duplex receptacles as indicated with the following features:  
.1 Yellow urea moulded housing, nylon front.  
.2 Suitable for No. 10 AWG wiring.  
.3 Double wipe contacts and riveted grounding contacts.  
.4 To be same manufacturer as currently on site.  
.2 Single marine grade 20A, 120V L5-20 receptacle twist lock c/w spring-loaded flip-up weatherproof coverplate and surface backbox:  
.1 Hubbell #HBL23CM10/HBL74CM25WOA/HBL60CM83A  
.3 Single marine grade 30A, 125V receptacle twist lock c/w spring-loaded flip-up weatherproof coverplate and surface backbox:  
.1 Hubbell #HBL26CM10/HBL74CM25WOA/HBL60CM83A
- 2.2 GFCI Sensing Module .1 NEMA 3R 20A 120V 1-pole sensing module.  
.2 Hubbell Cat. #GFM20/HBL5226/HBL60CM83A

PART 3 – EXECUTION

- 3.1 Installation .1 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.

Wiring Devices

- .2 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.
  - .3 Use only screw down terminals for connecting wiring devices to circuits.
- 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 | <u>Shop Drawings and Product Data</u> | .1 | Submit shop drawings and product data in accordance with Section 26 05 00.  |
| 1.2 | <u>Maintenance Materials</u>          | .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 | <u>Delivery and Storage</u>           | .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 | <u>Fuses – General</u> | .1 | Fuses: product of one manufacturer to be same as fuses currently on site.   |
| 2.2 | <u>Fuse Types</u>      | .1 | 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. |

PART 3 – EXECUTION

- |     |                     |    |  |
|-----|---------------------|----|--|
| 3.1 | <u>Installation</u> | .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 Manufacturers .1 Acceptable manufacturer is Eaton to match existing Eaton panel detailed on drawing.

PART 3 – EXECUTION

3.1 Installation .1 Install circuit breakers as indicated.

**END OF SECTION**

PART 1 - GENERAL

- 1.1 Related Sections .1 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- 1.2 Related Documents and Standards .1 Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- .2 Section 26 05 00 – Electrical General Requirements.
- .3 CSA International:
- .1 CSA C22.2 No.9.0-96 (R2006), General Requirements for Luminaires.
- .2 CSA C22.2 No.9.0S1-97 (R2002), Supplement No. 1 to C22.2 No.9.0-96.
- .3 CSA G40.20/G40.21-04 (R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .4 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .5 CSA W47.1-03 (R2008), Certification of Companies for Fusion Welding of Steel Structures.
- .6 CSA W59-03 (R2008), Welded Steel Construction (Metal Arc Welding).
- .7 CSA CEC 2018, Part 1.
- 1.3 Summary .1 This Section provides general requirements for a complete and fully operational Exterior Lighting System including:
- .1 Exterior Luminaires.
- .2 Accessories.
- .3 LED Arrays.
- .4 Poles, arms and anchor bolts.
- .5 Conduit, wiring and time controls.

**Lighting Equipment**

- 1.4 System Description
- .1 Descriptions indicated are a design reference and do not necessarily represent the exact number, size, voltage, wattage, type of lamp, driver, finish trim, poles, mounting hardware or special requirements as Specified or as required by the particular installations. Provide complete luminaire and pole to correspond with the features, accessories, number of lamps, wattage and/or size Specified in the text description of each luminaire type. Additional features, accessories and options Specified shall be included.
  - .2 Luminaire voltage shall match the voltage of the circuit serving same.
  - .3 The manufacturer and catalogue number used herein are to establish an acceptable standard of quality and to meet the DFO and H.A. requirement that all light fixtures and poles on the wharf complex are the same as the previous Holophane light fixtures and Valmont poles on Wharf 407, 408S, and 408W.
- 1.5 Submittals
- .1 Product Data shall indicate that luminaire, LED arrays, drivers, mounting arms, poles, and anchor bolts fully comply with Contract Documents. Data shall be submitted for each type of luminaire and pole indicated, arranged in order of luminaire designation. For standard catalog luminaires provide original product catalog sheets indicating data on features, accessories, finishes, and the following:
    - .1 Materials and dimensions of luminaires.
    - .2 Photometric data, in IESNA format, based on certified results of laboratory tests of each luminaire type, outfitted with lamps, LED arrays, drivers and accessories identical to those indicated for the luminaire as applied in the Project.
    - .3 Photometric data shall be certified by a qualified independent testing agency.
    - .4 Low voltage transformers.
    - .5 LED power supplies.
    - .6 Types of lamps and LED's, including manufacturer, wattage, and Color Rendering Index (CRI) and color temperature in degrees Kelvin (K).
    - .7 Poles, mounting arms, bird spikes, anchor bolts, etc.
  - .2 Shop Drawings shall:
    - .1 Show details of nonstandard or custom luminaires.
    - .2 Indicate dimensions, weights, method of field assembly, components, features, and accessories.

Lighting Equipment

- .3 This Contractor shall provide the manufacturer with accurate field dimensions where required.
- .4 Include wiring diagrams, power and control wiring.
  
- .3 Wiring Diagrams shall detail wiring for luminaires and differentiate between manufacturer-installed and field-installed wiring.
- .4 Product Certificates shall be signed by manufacturers of luminaires and poles certifying that products comply with requirements.
- .5 Maintenance Data shall be provided for luminaires and equipment to include in emergency, operation, and maintenance manuals Specified in Specifications Section describing Operations and Maintenance Data.
- .6 Field quality control test reports.
- .7 Review of luminaire submittals which indicate voltage, mounting condition, or quantities shall be approval of said voltage, mounting condition, or quantities. This Contractor shall field verify voltage and actual mounting condition and method.
- .8 Product samples complete with housing, trim, specified lamp, and 3m cord with plug shall be submitted if requested.
- .9 Pole and anchor bolt design shall be stamped by a manufacturer's professional engineer licensed in the Province of New Brunswick.
- .10 Indicate vertical and horizontal beam spreads, beam lumens, beam efficiency and complete photometric data as shown in independent laboratory tests.
- .11 Include independent laboratory tests and results of computerized lighting analysis indicating average horizontal and vertical lighting levels and average to minimum for areas designated in accordance with requirements detailed on drawing E9 of 9.
  
- 1.6 Coordination
  - .1 Coordinate layout and installation of luminaires with existing pole configuration. Allow for new pole mounting brackets where required.

Lighting Equipment

- 1.7 Warranty
  - .1 Warranty Period for Luminaires: Five years from date of Substantial Completion.
  - .2 Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
  - .3 Warranty Period for Color Retention: Five years from date of Substantial Completion.
  - .4 Warranty Period for LED arrays/drivers: Five years from date of Substantial Completion.
  - .5 Warranty Period for Poles: Two years from date of substantial completion.
  
- 1.8 Closeout Submittals
  - .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
  - .2 Operation and Maintenance Data: submit operation and maintenance data for floodlighting for incorporation into manual.
  
- 1.9 Delivery, Storage and Handling
  - .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Materials and Equipment.
  - .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, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
    - .2 Store and protect floodlighting equipment from nicks, scratches, and blemishes.
    - .3 Replace defective or damaged materials with new.

PART 2 – PRODUCTS

- 2.1 Manufacturers .1 Products: Subject to compliance with requirements, provide products from one manufacturer.
- 2.2 General Requirements for Luminaires – Type A (14 Required) .1 Flood light in accordance with CSA 22.2 No. 9.0.
- .2 Metal Parts: Free of burrs and sharp corners and edges.
- .3 Housings: Single piece diecast aluminum with 3mm wall thickness, rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Powder coated grey finish with 0.076mm thickness. Custom clear coat to be applied after painting.
- .4 Exposed Hardware Material: Stainless steel (316 grade).
- .5 Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- .6 Optical assemblies: full cutoff with zero uplight, “dark sky” compliant. LED assemblies shall comply with BUG rating system.
- .7 Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
- .1 White Surfaces: 85 percent.
- .2 Specular Surfaces: 90 percent.
- .3 Diffusing Specular Surfaces: 75 percent.
- .8 Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- .9 Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping.
- .10 BUG ratings shall be B3-U3-G3 and light distribution shall be type 5 x 5.
- .11 Light fixtures to be mounted (two [2] at 0 degrees) on bull horn c/w two (2) tenon bull horn on top of steel pole as detailed on drawings.
- .12 Luminaire and finish endurance tested to withstand 5,000 hours of elevated ambient salt/fog conditions as defined in ASTM Standard B 117. Luminaire to meet UL Standard 1598A (Salt Water) marine

outside tested. Optical enclosures to be sealed and gasketed to IP66 rating.

- .13 Luminaire to be 638mm long x 470mm wide by 64mm high with a weight of 33 KG at an effective projective wind area of 0.35m squared.
- .14 Reduce glare with refractors and internal prism refractors.
- .15 Each light fixture is to have a 1.5m stainless steel cable with a 33 KG weight limit with a stainless steel gripple device. Make attachment between the light fixture and bull arm yoke and tighten cable after light fixture has been aimed.
- .16 Light fixture 'A' to be Holophane Cat. #PLLED-P1-40K-MVOLT-55-YMS-GYSDP-20KV-MRE-05-43-08657-GR.

2.3 LED Drivers and Arrays

- .1 LED arrays shall produce minimum 145 lumens/watt when operated at 1050mA and 357 watts.
  - .1 Lumen Depreciation Data: At 40 deg C ambient, the L70 hours (per IESNA TM-21) shall be 0.85 at the rated drive current at 100,000 hours.
  - .2 LED color: neutral white, 4000 deg K, CRI of 70.
  - .3 Drivers shall accept 120 through 277 volts, 50/60 Hz.
- .2 The housing shall have an integral thermal management system with extruded aluminum radiation fins and lateral airways.
- .3 Comply with latest edition of IES LM-79 and LM-90 Approved Methods.
- .4 Comply with In-Situ testing for more reliable results.
- .5 LED's shall be Restriction of Hazardous Substances Directive (RoHS) compliant.
- .6 LED's to have individual pre-oriented lens to provide type 5 x 5 distribution with 52,000 lumens.

Lighting Equipment

- 2.4 Bird Spikes .1 Stainless steel Bird-X type 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 Fuses and Fuseholders .1 Fuse holders, “in-the-line” type, 2-pole for fuses at each pole controlling each circuit with:
- .1 Waterproof enclosure of moulded plastic.
  - .2 Line side and load side sections.
  - .3 Terminals: sized to accept indicated conductors.
- 2.6 Light Pole and Bull Horn .1 Galvanized tapered round steel pole to have reaction shear force of 8.1 KN, axial force of 4.1 KN and overturning moment of 75 KN. Pole to be 10.7m high with weight of 262 kg, base OD of 250mm, top OD of 112mm and wall thickness of 3.0mm. Base plate to be 355mm square with a bolt circle diameter of 343mm with a base plate thickness of 32mm.
- .2 The anchor bolts to be 32mm diameter and 1500mm long with a 150mm hook at the end. Threaded projection to be 150mm. ASTM F1554-04 Grade 55, low alloy with S1 supplement. Carbon equivalent – 45% max. Yield strength – 55 KSI min. (0.2% offset). Anchor bolts – ASTM A153, Class C. Nuts – ASTM A563, Grade ANSI B18.2.2. Threads – ANSI B1.1, Class 2A. Washers – ASTM F-436.
  - .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. CCTV festoon outlet 75mm wide by 125mm high to be 600mm from top of pole.
  - .4 Pole design standard to be CAN/CSA S6-06 and all welding to be to CSA W59 2003. Acceptable manufacturer Valmont Cat. #DWG-71211GB-RT-T-35.
  - .5 Two-arm bull horn to have arms at 180 degrees 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 stainless steel. Acceptable manufacturer Valmont Cat. #DWG-C17-BH2-01-01.

- .6 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 Luminaire and Pole Installation .1 Fasten luminaire, bull horn and pole to indicated structural supports, concrete base.
  - .1 Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
  
- 3.2 Wiring .1 Connect luminaires to lighting circuits.
  
- 3.3 Luminaire Alignment .1 Align luminaires mounted perpendicular to wharf edge.
  - .2 Align luminaires at night-time under direction of Departmental Representative. Allow for four hours' time with three men and bucket truck so that alignment can be made to satisfaction of Client.
  
- 3.4 Grounding .1 Connect luminaire to building grounding system. Ground metal poles and support structures according to Section 26 05 28 "Secondary Grounding."
  - .1 Install grounding conductor in the base for connecting luminaire to grounding system.
  - .2 Install fuse in pole handhole on all wire phases.
  
- 3.5 Controls .1 Install contractor's controlling circuits as indicated.
  - .2 Connect coil circuit to manual bypass toggle switches.
  - .3 Mount photocell control devices as indicated with sensing eye facing the north sky.

- 3.6 Fuses and Fuse Holders .1 Install fuse holder for each circuit inside each pole and locate at hand-hole near bottom of pole.
- .2 Install fuses, size as indicated.
- 3.7 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.
- 3.8 Field Quality Control .1 Inspect each installed luminaire for damage. Replace damaged luminaires and components.
- .2 Replace all burned out or inoperative LED arrays at the end of construction.
- .3 Advance Notice: Give dates and times for field tests.
- .4 Provide instruments to make record of test results.
- .5 Test as follows:
- .1 Verify proper operations, switching and phasing of each luminaire after installation.
- .2 Ensure time clock, photocell and bypass-switch are working properly. Allow time for re-programming the time clock to final operation and sequence of Harbour Authority requirements.
- .3 Turn on all LED wharf lights on Phase 2 for 48 hours. Subsequently turn on all LED wharf lights and demonstrate operation of photocell to run light 'ON' at dusk and 'OFF' at dawn. Demonstrate operation of time clock to turn 'ON' and 'OFF' circuit C1 (partial lighting) and circuit C2 (full lighting) at sequences requested by Harbour Authority. Demonstrate operation of bypass-switch.
- .6 Malfunctioning Luminaires and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

- .7 Illumination Tests:
  - .1 Measure light intensities at night. Use photometers with calibration reference to NIST standards. Comply with the following IESNA testing guide(s):
    - .1 IESNA LM-64, "Photometric Measurements of Parking Areas."
    - .2 IESNA LM-72, "Directional Positioning of Photometric Data."
- .8 Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

**END OF SECTION**