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| <u>1 Related Work</u>        | <ul style="list-style-type: none"><li>.1 Refer to other specification sections for related work.</li><li>.2 Refer to Section 01 33 00 for Shop Drawings/Submission requirements.</li></ul>  |
| <br>                         |   |
| <u>2 Codes and Standards</u> | <ul style="list-style-type: none"><li>.1 Do complete installation to CSA C22.1-2015 except where specified otherwise.</li><li>.2 CSA Electrical Bulletins in force at time of tender submission, while not identified and specified by number in this Division, are to be considered as forming part of related CSA Part II standard and must be complied with.</li></ul>   |
| <br>                         |   |
| <u>3 Permits, Fees</u>       | <ul style="list-style-type: none"><li>.1 Submit to Electrical Supply Authority the necessary number of drawings and specifications for examination and approval prior to commencement of work.</li><li>.2 Pay all fees levied by the Supply Authority for upgrade and extension of power to the site and/or connection of the project to their system; for existing redundant overhead power cable removals; for pole adjustments and removals, and all other costs levied by utility for completion project.</li><li>.3 Co-ordinate and meet requirements of power supply authority. Ensure availability of power when required.</li></ul> |
| <br>                         |   |
| <u>4 As-Built Drawings</u>   | <ul style="list-style-type: none"><li>.1 During progress of the work keep a record of all variations from the working drawings. At completion of the project submit a set of prints showing variations neatly marked in red to the Departmental Representative. Refer to Section 01 33 00 for more specific requirements.</li></ul>   |
| <br>                         |   |
| <u>5 Work Included</u>       | <ul style="list-style-type: none"><li>.1 Provide all labour and materials and everything that is required for a complete electrical installation, all in accordance with but not necessarily restricted to the following items, specification, and the accompanying drawings.</li><li>.2 The work is to include but not necessarily be limited to the:<ul style="list-style-type: none"><li>.1 Removal of existing Teck cables on the breakwater marginal wharf.</li><li>.2 Supply and installation of a grade level pull</li></ul></li></ul>   |

box.

.3 Supply, installation and construction of an above grade junction box.

.4 Supply and installation of direct buried rigid PVC conduits.

.5 Supply and installation of new wiring.

.6 Splicing and reconnection of new wiring to existing Teck cable in grade level pull pit and the above grade junction box.

## 6 Minimum Standards

- .1 The standard established by the drawings and specifications shall not be reduced by any of the codes referred to in 2, and in no instance, will a standard be accepted lower than that established by the Canadian Electrical Code.
- .2 As a "standard of quality" "acceptable manufacturers" catalogue designations are included in portions of this specification and on plans. These catalogue designations and descriptions are not necessarily listed in order of preference and all manufacturer's meeting this "standard of quality" may not be listed.

## 7 Supervision

- .1 The Contractor shall provide supervision and a sufficiently qualified foreman to insure that the job proceeds in a proper and efficient manner. If in the opinion of the Departmental representative, such personnel are not competent to carry out their work, the Contractor shall replace these men immediately upon written request of the DEPARTMENTAL REPRESENTATIVE.

## 8 Materials and Equipment

- .1 All material shall be new unless designated existing to be reused, of the best available quality and CSA/ULC approved for their respective use.
- .2 Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from the local Inspection Department.

## 9 Tests

- .1 Test all wiring, included in the contract, to ensure there are no shorts or grounded conductors and that insulation values are as required by the Canadian Electrical Code.
- .2 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .3 Submit test results for DEPARTMENTAL REPRESENTATIVE

review.

- .4 Megger line voltage circuits, feeders and equipment up to 350 V with 500 V instrument; feeders and equipment to 600 V with 1000 V instruments.
- .5 Replace conductors that fail insulation test.

#### 10 Protective Devices

- .1 Ensure circuit protective devices such as over-current trips, relays, and fuses are installed to values and settings as indicated, or required by the Canadian Electrical Code, Part I.

#### 11 Nameplates

- .1 Lamacoid nameplates shall be permanently fixed to junction and pull boxes, enclosures and receptacles.
- .2 Nameplates:
  - .1 Lamacoid 2 mm thick plastic engraving sheet, black face, white core, mechanically attached.
- .3 Identification to be English and French. Provide one nameplate for each language.
- .4 Size 2 nameplates for pull boxes and junction boxes to indicate circuit numbers contained within.

#### 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

#### 12 Removals and Relocations

- .1 Unless designated otherwise equipment designated for removal other than equipment belonging to the local utility, will become the property of the Contractor and be promptly removed from the site.

#### 13 Cutting, Patching & Painting

- .1 The Contractor shall perform all cutting, patching, and painting necessary for the proper installation of the work and shall repair any damage done, employing

only the services of skilled workmen.

<u>14 Wiring Identification</u>	.1	Maintain phase sequence and colour coding throughout.
	.2	Colour code to CSA C22.1 1998.
<u>15 Wiring Terminations</u>	.1	Lugs, terminals, screws used for termination of wiring to be suitable for copper conductors.
	.2	All splices to be made in cast PVC junctions boxes. These splices are to be made using mechanical split bolt connectors and covered with heat shrink boots.
<u>16 Manufacturers and CSA Labels</u>	.1	Manufacturers nameplates and CSA labels to be visible and legible after equipment is installed.
<u>17 Completion of Work</u>	.1	On completion of the project, the Contractor shall remove all debris, and equipment made redundant by new work, and leave the site neat and tidy. Equipment shall be checked for proper fitting and alignment, adjusted as required, cleaned and repainted where necessary.

## PART 1 - GENERAL

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| <u>1.1 Related Work</u> | .1 | General requirements: Division 1.                       |
|                         | .2 | Refer to other specification sections for related work. |

## PART 2 - PRODUCTS

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| <u>2.1 Wire &amp; Cable</u> | .1 | Wire and cable shall conform fully to the latest specifications of the Canadian Standards Association (CSA), Electrical & Electronic Manufacturers Association of Canada, (EEMAC) the Insulated Power Cable Engineers Association (IPCEA), and the American Society of Testing Materials (ASTM).   |
|                             | .2 | Wiring on circuits exceeding 50 V to ground shall be of solid copper of 98% conductivity and of full size AWG gauge, minimum #12, unless noted otherwise. Insulation shall be cross linked polyethylene rated 600 V on conductors smaller than No 8 and 1000 volts larger than No. 10. Wiring shall be colour coded as follows:<br>Phase A - Black<br>Phase B - Red<br>Neutral - White<br>Ground - Green |
|                             | .3 | Copper conductors sized as indicated with 600 V insulation of Chemically cross-linked thermosetting polyethylene material rated RW75: to CSA C22.2 No. 75-M1983.   |
| <u>2.2 Wire Connections</u> | .1 | Splices and joints in circuit wiring shall be made using: a) Bolted mechanical connectors Acceptable manufacturers - Burndy , Thomas & Betts.  |
|                             | .2 | Teck Connectors:<br>.1 Stainless steel, liquid tight cable connectors c/w threaded lock nuts for entrance to junction boxes. Sized to suit individual cable diameters.   |
|                             | .3 | Mechanical split bolt connectors covered with heat shrink boots for all spliced circuits. In junction boxes.   |
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### PART 3 - EXECUTION

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| <u>3.1 Installation of Wire &amp; Cable</u> | .1 | Identify wiring with permanent indelible identifying marks, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit.                    |
|   | .2 | Maintain phase sequence and colour coding throughout in accordance with Item 4-036 of the Canadian Electrical Code Part I.  |
|   | .3 | Reconnect teck cable as indicated on the drawings.  |
|   | .4 | Support teck cable as indicated on drawings and according to requirements of the Canadian Electrical Code. Use corrosion resistant cable supports as indicated.                           |
| <u>3.2 Wire &amp; Cable Connection</u>      | .1 | All connections shall be made electrically and mechanically secure. Sizes of connectors shall be according to manufacturer's recommendations for each wire size and combination of wires. |
|   | .2 | Install stainless steel cable glands at all TECK cable termination points.  |

## PART 2 - PRODUCTS

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| <u>2.1 Equipment</u> | .1 | System and circuit, equipment, grounding conductors, bare stranded copper, un- tinned, soft annealed, size as indicated.  |
|                      | .2 | Insulated grounding conductors: green, type RW75.   |
|                      | .3 | Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to: <ul style="list-style-type: none"><li>.1 Grounding and bonding bushings.</li><li>.2 Protective type clamps.</li><li>.3 Bolted type conductor connectors.</li><li>.4 Thermit welded type conductor connectors.</li><li>.5 Bonding jumpers, straps.</li><li>.6 Pressure wire connectors.</li></ul> |

## PART 3 - EXECUTION

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| <u>3.1 Installation General</u> | .1 | Install complete permanent, continuous, system and circuit, equipment, grounding systems including, electrodes, conductors, connectors, accessories, as indicated, to conform to requirements of Departmental Representative, and local authority having jurisdiction over installation. Where EMT is used, run separate ground wire in conduit. |
|                                 | .2 | Install connectors in accordance with manufacturer's instructions.   |
|                                 | .3 | Protect exposed grounding conductors from mechanical injury.   |
|                                 | .4 | Use mechanical connectors for grounding connections to equipment provided with lugs.   |
|                                 | .5 | Soldered joints not permitted.   |
|                                 | .6 | Install an integral bonding wire in all flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw.  |
|                                 | .7 | Bond metal shrouds as shown on drawings.   |
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| <u>3.1 Installation<br/>General<br/>(Cont'd)</u> | .8 | Make connections to ground bar(s) and to ground bus in service board as shown on drawings.  |
| <u>3.2 System and<br/>Circuit Grounding</u>      | .1 | Install system and circuit grounding connections to neutrals of the secondary 120/240 V systems.  |
| <u>3.3 Equipment<br/>Grounding</u>               | .1 | Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, distribution panels and outdoor lighting. |
| <u>3.4 Field Quality<br/>Control</u>             | .1 | Perform tests in accordance with Common works Results Electrical section.   |
|  | .2 | Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.  |
|  | .3 | Perform tests before energizing electrical system.  |



## PART 1 - GENERAL

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| <u>1.1 References</u> | .1 | Canadian Standards Association (CSA)<br>.1 CAN/CSA C22.2 No. 18-98, Outlet Boxes,<br>Conduit Boxes, and Fittings and Associated<br>Hardware. |
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## PART 2 - PRODUCTS

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| <u>2.1 Conduits</u> | .1 | Rigid pvc conduit: to CSA C22.2 No. 211.2. |
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| <u>2.2 Conduit<br/>Fastenings</u> | .1 | PVC coated one hole steel pipe straps for<br>surface conduits less than 50 mm and smaller.<br>Two hole PVC coated steel pipe straps for<br>conduits larger than 50 mm. |
|                                   | .2 | Galvanized fastening hardware.   |
|                                   | .3 | Male and female threaded PVC adapters.   |

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| <u>2.3 Conduit<br/>Fittings</u> | .1 | Factory "ells" where bends are required for 25<br>mm and larger conduits. |
|                                 | .2 | Steel set screw connectors and couplings for<br>EMT.                      |

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| <u>2.4 Expansion<br/>Fittings for Rigid<br/>Conduit</u> | .1 | Weatherproof expansion fittings with internal<br>bonding assembly suitable for 200 mm linear<br>expansion.                             |
|   | .2 | Watertight expansion fittings with integral<br>bonding jumper suitable for linear expansion<br>and 19 mm deflection in all directions. |
|   | .3 | Weatherproof expansion fittings for linear<br>expansion at entry to panel.   |

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| <u>2.5 Fish Cord</u> | .1 | Polypropylene. |
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PART 3 - EXECUTION

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| <u>3.1 Conduit Installation</u>              | .1 | All conduits and cables shall be kept parallel or perpendicular to wharf lines. All conduits shall be securely held in place at intervals and with supports as required by the Canadian Electrical Code.  |
|  | .2 | Conduit openings shall be sealed with plugs or caps to prevent entrance of foreign materials. Where conduits pass through a waterproof membrane an oversize sleeve shall be installed and caulking applied to maintain the waterproof properties of the membrane.       |
|  | .3 | Conduit shall not pass through structural members without the permission of the Departmental Representative.  |
|  | .4 | Sufficient number of fittings shall be used to permit easy pulling of wires. Conduits shall be continuous. To ensure the conduit is clean and dry before conductors are pulled in, the conduit shall be swabbed out by using a drag consisting of tight rubber washers. |
|  | .5 | Touch up all marked surfaces using manufacturer's recommended materials and methods.  |
| <u>3.2 Fastenings and Supporting Devices</u> | .1 | Secure all equipment in a manner, so as to not distort or cause undue stress on any components.   |

PART 1 - GENERAL

<u>1.1 Related Work</u>	.1	Excavation and backfilling:	Section 31 23 10
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PART 2 - PRODUCTS

<u>2.1 PVC Conduits and Fittings</u>	.1	Rigid PVC conduits - schedule 40 for direct burial: with expanded flange ends, with minimum wall thickness at any point of 2.8 mm. Nominal length: 3 m plus or minus 12 mm.	
	.2	Rigid PVC reducers, bell end fittings, plugs, caps, adaptors as required to make complete installation.	
	.3	Rigid PVC 90° and 45° bends as required.	
	.4	Rigid PVC 5° angle couplings as required.	
	.5	Expansion joints as required.	
<u>2.2 Solvent Weld Compound</u>	.1	Solvent weld compound for PVC joints.	
<u>2.3 Cable Pulling Equipment</u>	.1	6 mm stranded nylon pull rope tensile strength 5 kN.	
<u>2.4 Markers</u>	.1	Over all underground conduit install continuously, at 150 mm below grade, 75 mm wide electrical underground polyethylene marking tape with warning "Caution, Caution, Power Lines Below".	
<u>2.5 Geotextile Filter Fabric</u>	.1	Geotextile: non-woven synthetic. Supplied in rolls. .1 Size to be determined by contractor to suit application. .2 Fabric used to negate erosion/dissipation of sand surrounding direct buried conduits.	

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### PART 3 - EXECUTION

- 3.1 Installation
- .1 Install markers as required.
  - .2 Install underground conduit bank.
  - .3 Build conduit bank on undisturbed soil or well compacted granular fill (sand) not less than 150 mm thick, compacted to 95% of maximum proctor dry density.
  - .4 Open trench completely and ensure that no obstructions will necessitate change in grade of conduits.
  - .5 Prior to laying conduits, construct a "mud slab" not less than 75 mm thick extended the entire width of the trench.
  - .6 Roll out and lay down geotextile filter fabric under entire length and width of the conduit bank including both sides. Install as per manufacturer's recommendations.
  - .7 Install conduits at elevations and with slope as indicated and minimum slope of 1 to 400.
  - .8 Install base spacers at maximum intervals of 1.5 m levelled to grades indicated for bottom layer of ducts.
  - .9 Lay conduits with the configuration and reinforcing as indicated with preformed interlocking, rigid plastic spacers to maintain spacing between ducts at not less than the dimensions indicated on the Bench Section Details. Stagger joints in adjacent layers at least 150 mm and make joints watertight.
  - .10 Use anchors, ties and trench jacks as required to secure conduits and prevent moving while backfilling and tamping.
  - .11 Cover conduits with compacted granular fill (sand) not less than 150 mm above top tier of conduits. Fill voids and spaces between conduits by hand tamping with a plank. Fill to extend the full width of the trench.
  - .12 Provide 50 mm (nominal) thick, treated plank on top of the compacted fill, centered over the conduits. Plank to extend 50 mm (minimum) past the conduit array on both sides.
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3.1 Installation  
(Cont'd)

- .13 Clean conduits before laying. Cap ends of conduits during construction and after installation to prevent entrance of foreign material.
- .14 Pull through each conduit a steel mandrel not less than 300 mm long and of a diameter 6 mm less than the internal diameter of the conduit, followed by a stiff bristle brush to remove sand, earth and other foreign matter. Pull stiff bristle brush through each conduit immediately before pulling cables.
- .15 In each conduit install pull rope, continuous throughout each conduit run with 3 m spare rope at each end.
- .16 Install expansion joints in conduit systems in all rises above grade and in all connections to fixed equipment and as required by code.
- .17 Install markers as required.
- .18 After installing and backfilling, restore surface to original condition as directed by Departmental Representative.
- .19 Advise Departmental Representative so that he may inspect conduits prior to backfilling. Allow 10 days advance notice.

## PART 1 - GENERAL

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| <u>1.1 Related Work</u>  | .1 | Excavation and backfilling:   | Section 31 23 10 |
|                          | .2 | Concrete form work:   | Section 03 10 00 |
| <u>1.2 Shop Drawings</u> | .1 | Submit shop drawings for precast pull pits accordance with Section 01 33 00 - Shop Drawings and Other Submittal Procedures. |                  |

## PART 2 - PRODUCTS

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| <u>2.1 Precast Concrete Pullpits</u> | .1 | Precast concrete pull pits sized as indicated on drawings. |  |
|                                      | .2 | High Density Polymer Concrete.                             |  |
|                                      | .3 | To meet ANCI standard 77-2010. Tier 22.                    |  |
|                                      | .4 | Heavy duty cover and stainless steel bolts.                |  |
|                                      | .5 | Acceptable Manufacturer: Synertech or Oldcastle or equal.  |  |

## PART 3 - EXECUTION

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| <u>3.1 Installation General</u> | .1 | Install pull pits including formwork.   |  |
|                                 | .2 | Build pull pits on undisturbed soil or on well compacted granular fill not less than 150 mm thick, compacted to 95% of maximum proctor dry density.       |  |
|                                 | .3 | Open trench completely between pull pits to be connected before ducts are laid and ensure that no obstructions will necessitate change in grade of ducts. |  |
| <u>3.2 Pull Pits</u>            | .1 | Install precast pull pits as indicated.   |  |
|                                 | .2 | Make connection with concrete encased duct bank and direct buried ducts.  |  |
|                                 | .3 | Patch and make good all areas of renovation.  |  |
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- 3.3 Inspections .1 Advise Departmental Representative so that he may inspect ducts prior to placing and be present during placement of concrete and clean out.

PART 3 - EXECUTION

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| <u>3.1 Cable<br/>Installation in<br/>Conduits</u> | <ul style="list-style-type: none"><li>.1 Install cables as indicated in conduits.</li><li>.2 Do not pull spliced cables inside conduits.</li><li>.3 Install multiple cables in conduit simultaneously.</li><li>.4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.</li><li>.5 Before pulling cable into conduits and until cables properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.</li><li>.6 After installation of cables, seal conduit ends with dust sealing compound.</li></ul>   |
| <u>3.2 Field Quality<br/>Control</u>              | <ul style="list-style-type: none"><li>.1 Perform tests in accordance with Section 26 05 01 Common Work Results - Electrical.</li><li>.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.</li><li>.3 Check phase rotation and identify each phase conductor of each feeder.</li><li>.4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.</li><li>.5 Pre-acceptance test(s).<ul style="list-style-type: none"><li>.1 After installing cable but before splicing and terminating, perform insulation resistance test with 500V megger on each phase conductor of the 120 /240 volt system.</li><li>.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.</li></ul></li><li>.6 Provide Departmental Representative with list of test results showing location at which each test was made, circuit tested and result of each test.</li></ul> |
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3.2 Field Quality	.7	Remove and replace entire length of cable if
Control		cable fails to meet any of test criteria.
(Cont'd)		

## PART 1 - GENERAL

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| <u>1.1 Related Work</u> | .1 | Common Work Results - Electrical: Section 260501. |
|                         | .2 | Division 1.                                       |

## PART 2 - PRODUCTS

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| <u>2.1 Junction/Pull Boxes</u> | .1 | Cast PVC. Reinforced junction and/or pull boxes. |
|                                | .1 | With screw down gasketted cover.                 |
|                                | .2 | Stainless steel screws.                          |
|                                | .3 | Conduit hubs.                                    |
|                                | .4 | External mounting feet.                          |
|                                | .5 | Corrosion resistant.                             |
|                                | .6 | Approved for wet marine environments.            |
|                                | .7 | Size as indicated or as per CEC.                 |