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1 GENERAL

1.1 SUMMARY

.1 Documents

.1 This Division 26 Section, together with all other Sections forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts and Divisions.

.2 This Section Includes:

.1 Abbreviations

.2 Brief Summary of Work

.3 Phasing

.4 Codes, Standards, and Regulatory Requirements

.5 Permits, Fees, and Inspection

.6 Quality of Work

.7 Qualification of Tradesmen

.8 Responsibility and Coordination

.9 Protection

.10 Drawings and Measurements

.11 Materials and Equipment

.12 Identification

.13 Approvals

.14 Testing and Adjusting

.15 Cleaning and Repair

.16 Guarantee

.17 Project Documentation: Shop Drawings, Maintenance Manuals, "As-Built" Drawings

.18 Loose Equipment

.19 Substantial Performance Inspection

- .20 Measurement and Payment
- .21 Evaluation of Changes to the Contract

1.2 ABBREVIATIONS

- .1 The following project-specific equipment abbreviations have been used in these specifications:
 - .1 RC: New Receptacle Cabinet with receptacle panel, receptacles, and top light fixture.
 - .2 SCH: Fisheries and Oceans Canada, Small Craft Harbours, the Project Owner.
- .2 Other abbreviations to CSA Z85.

1.3 BRIEF SUMMARY OF WORK

- .1 The work includes but is not limited to:
 - .1 Removal of existing overhead line down the length of the harbour.
 - .2 Installation of new cables and equipment as shown on drawing package, including new BC Hydro connection, Main Distribution Panel, and cable in conduit down the length of the harbour.
 - .3 The provision of shop drawings to Engineer for approval prior to the purchase of electrical equipment to be installed.
 - .4 The provision and assembly of all components required for safe and continuous operation of RC's.
 - .5 Replacement of existing receptacle cabinet 1 (RC1) hinge. Coordinate with owner for existing hinge information if required.
 - .6 All planning, organizing, scheduling, managing and coordinating as required with BC Hydro, SCH Harbour Manager, SCH Project Manager and the Engineer.
 - .7 Completion of the deficiency list as compiled by SCH Project Manager and Engineer.

1.4 PHASING

- .1 Phase the work to minimize service outages.

- .2 Outages shall not exceed 24 hours. Schedule the work to reduce outage duration to less than 24 hours wherever possible.
- .3 Prepare a detailed schedule of proposed shutdown of existing power services giving date, time, duration of each shutdown and the services affected and submit to the Engineer and Owner for comment and necessary changes. Provide 2 weeks' notice of proposed shutdown.
- .4 The Owner reserves the right to insist upon changes to the schedule of shutdowns without penalty or cost.
- .5 Erect barricades and provide temporary signage and lighting as necessary to protect the public during construction activities. Do not leave tripping hazards or loose planks while wharf is unattended.

1.5 CODES, STANDARDS, AND REGULATORY REQUIREMENTS

- .1 Any reference to Codes, Standards, and Regulations in these Specifications shall be taken as the latest or the most current in effect at time of tender.
- .2 Comply with all requirements of the Canadian Electrical Code - Part I, including all Provincial and other amendments, Electrical Bulletins, and any local by-laws or rules regulating the installation of electrical equipment. In no instance, however, shall the standards established by the Contract Documents be reduced by any of these Codes or Regulations.
- .3 All materials shall bear the approval of the Canadian Standards Association and where applicable, the Underwriters' Laboratories of Canada or alternately shall bear local approval from the Electrical Inspection Department having jurisdiction. Include in the Tender all costs associated with obtaining local approvals.
- .4 Operating voltages to CAN3-C235.

1.6 PERMITS, FEES, AND INSPECTION

- .1 Before starting work submit the appropriate quantity of Drawings and Specifications to the Electrical Inspection Department and other authorities having jurisdiction and obtain all necessary approvals and permits. Include all costs of approvals and all permit fees in the tender.
- .2 Engineer will provide Drawings and Specifications required by the Contractor for submission to the Electrical Inspection Department, the Supply Authority, and other authorities having jurisdiction, at no cost.

- .3 Arrange for inspection of the work as the installation progresses and as further required (as well as attendance during verification) by all applicable authorities having jurisdiction.
- .4 Notify Engineer of changes required by Electrical Inspection Department prior to making changes.
- .5 Upon completion, and before final payment will be made, present to the Engineer a certificate of unconditional approval for all electrical work from the Electrical Inspection Department and other authorities having jurisdiction.

1.7 QUALITY OF WORK

- .1 Unless otherwise indicated, all materials supplied shall be new and of the quality indicated in these Specifications. Otherwise, they shall be of the best commercial quality obtainable for the purpose.
- .2 Manufacturers' directions shall be followed in all cases where the manufacturers of equipment or materials used in this work furnish directions covering points not shown on the Drawings or Specifications.
- .3 Unless otherwise directed, all installed materials or equipment exposed to view shall be plumb, true, square, and/or level as the case directs and, where applicable, located symmetrically.

1.8 QUALIFICATION OF TRADESMEN

- .1 The work shall be performed by qualified and certified tradesmen as set out in the Electrical Safety Regulation within the Electrical Safety Act.
- .2 Submit list showing names and qualifications of key supervisory personnel.

1.9 RESPONSIBILITY AND COORDINATION

- .1 Supply all labour, materials, equipment, tools, and incidentals necessary to provide a complete electrical installation as indicated on the Drawings and as set out in these Specifications.
- .2 The Drawings and Specifications complement each other and what is called for by one is binding as if called for by both. If there is any doubt as to the meaning or true intent due to a discrepancy between the Drawings and Specifications, obtain a ruling from the Engineer prior to tender closing. Failing this, the most expensive alternative is to be allowed for.

- .3 Advise the Engineer of any specified equipment, material, or installation of same which appears inadequate or unsuitable or which is in violation of laws, ordinances, rules, or regulations of authorities having jurisdiction. Provide all labour and materials which are obviously necessary or reasonably implied to be necessary to complete the work as if the work was shown on the Drawings and/or described in the Specifications.

1.10 PROTECTION

- .1 Protect exposed live equipment during construction for personnel safety.
- .2 Shield and mark live parts "LIVE XXX VOLTS," or with appropriate voltage.
- .3 Arrange for installation of temporary covers for enclosures containing electrical distribution equipment. Keep these covers locked except when under direct supervision of electrician.

1.11 DRAWINGS AND MEASUREMENTS

- .1 Drawings are generally diagrammatic and are intended to indicate the scope and general arrangement of work. Do not scale the Drawings.
- .2 The Drawings show approximate locations of outlets, equipment, and apparatus but the right is reserved to make such changes in location before installation of the work as may be necessary to meet the exigencies of construction in any way. No extra will be allowed and conversely, no credit shall be expected for such changes unless for each item of work the distance moved exceeds 3 m prior to final installation of same.
- .3 Take field measurements where equipment and material dimensions are dependent upon structure dimensions.

1.12 MATERIALS AND EQUIPMENT

- .1 Equipment and material to be new and CSA-certified. Where there is no alternative to supplying equipment which is not CSA-certified, obtain special approval from Electrical Inspection Department.
- .2 Factory assemble control panels and component assemblies.

1.13 IDENTIFICATION

- .1 Identify all pieces of electrical equipment other than conduits and conductors with engraved nameplates, having black characters on white or light background, mechanically attached.
- .2 Nameplate wording shall be such as to indicate clearly the function of each piece of equipment so identified. Prior to manufacture of nameplates, obtain approval from the Engineer for wording intended.
- .3 Provide laminated plastic nameplates at indoor locations and inside equipment cabinets that normally remain closed.
- .4 Provide 316L polished lamcoid nameplates for all outdoor equipment, minimum 12 mm high engraved text with black baked-on enamel filling and white background. Four threaded studs welded at the back for mechanical attachment to outdoor equipment. Apply Secaflex or equal sealant on rear of nameplate to seal stud holes.

1.14 APPROVALS

- .1 Requests for approval of the substitution of materials pertaining to electrical work prior to awarding of any contract must be submitted to the Contracting Officer at least 10 days before the close of tender. The request will be subject to the review and approval by the Engineer.
- .2 All submissions shall include the following information:
 - .1 Name and identification of specified item.
 - .2 Manufacturer, brand name, and catalogue number of the alternative item proposed.
 - .3 Detailed technical data and characteristics of alternative item such as dimensions, voltage, power requirements, performance characteristics, etc.
 - .4 A list of any and all changes to the installation which may be required as a result of the substitution.
- .3 Review by the Engineer of alternate materials as permitted above is only a general approval in principal and shall not relieve the Contractor of his responsibility to ensure that any approved alternate materials perform in the same manner and with the same intent as the originally specified material would have otherwise performed.
- .4 Where such substitutions alter the design or space requirements indicated on the Drawings, include all material, labour, design, and engineering costs for the

revised design and construction including costs of all other trades affected and those incurred by the Engineer.

- .5 It is the Contractor's responsibility to ensure substituted products are approved and that suppliers have written approval indicating conditions of any such approval. Alternate manufacturers who do not have such approval shall not be used in the work. If requested by the Engineer, the Contractor for Division 26 shall submit for inspection, samples of both the specified and the proposed substitute items on short notice.

1.15 TESTING AND ADJUSTING

- .1 Coordinate and pay for all tests specified herein including further tests as required by authorities having jurisdiction.
- .2 All testing shall be performed after each system installation has been completed and prior to the system being put into continuous operation unless otherwise noted.
- .3 Perform the testing, adjusting, and balancing only when conditions are commensurate with actual operating conditions for the given system.
- .4 Advise the Engineer 48 hours in advance of each test. Carry out tests in the presence of Engineer.
- .5 The Electrical Contractor shall use his own forces for the following tests:
 - .1 Test phase relationships and polarity at all equipment and outlets and devices.
 - .2 Test all circuits originating from branch distribution panels.
 - .3 Provide ground resistance tests for all circuits.
- .6 Submit typed test reports to the Engineer. Include individual insulation resistance results for each feeder utilizing Type G-GC or Teck cable.

1.16 CLEANING AND REPAIR

- .1 At the conclusion of the job and before the project will be accepted by the Owner, all panelboards and other electrical equipment shall be clean and free of dust, plaster, paint, and other foreign materials.
- .2 Repair, at no cost to the Owner, any equipment or structures damaged by the execution of Contract to its original condition.

- .3 Replace, at no cost to the Owner, any equipment or structures damaged by the execution of Contract which is irreparable.
- .4 Openings and cut-outs shall not be burned into panels. Oversized openings shall not be patched up with loose plates or oversized washers. Oversized openings shall be considered damage to the equipment and shall be treated as specified.

1.17 GUARANTEE

- .1 Use of installed equipment during construction shall not shorten or alter the guarantee.
- .2 Unless otherwise noted, the warranty period for all equipment shall commence on the date of Substantial Performance for the entire Construction Contract.
- .3 Within a period of one year from the date of final acceptance of work, replace or repair at own expense any defect in workmanship or material.

1.18 PROJECT DOCUMENTATION

- .1 Shop Drawings
 - .1 Submit one electronic plus three (3) prints of all shop and setting drawings or diagrams to the Engineer 10 working days in advance of requirements to allow time for review and comment. One print will be forwarded to the Owner, one will be retained by the Engineer for their office use, one copy will be marked and returned to the Contractor for correction if necessary, further reproduction, and distribution as required.
 - .2 Shop drawings shall be neatly drafted and shall be complete and detailed. This requirement is mandatory for such items as panelboards and custom-fabricated equipment panels, consoles, or enclosures.
 - .3 Shop drawings shall:
 - .1 Be numbered in consecutive order;
 - .2 Indicate the specific name of the equipment and where it is to be installed;
 - .3 the name of the site/project where installation will occur;
 - .4 the name of the manufacturer, make, model, ratings;
 - .5 date of the drawing including notation of latest revision, if any;

- .6 Indicate details of construction, dimensions, locations of cable terminations, capacities, weights and electrical performance characteristics of equipment and materials.
 - .4 Shop drawings shall be reviewed by the Contractor prior to submission to the Engineer. **Shop drawings not bearing Contractor's approval stamp, approval date, signature**, and project name will be returned without comment.
 - .5 Review of shop drawings by the Engineer is for the sole purpose of ascertaining conformance with the general design intent. The review shall not mean approval of the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents.
 - .6 The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all sub-trades.
- .2 Maintenance Manuals
- .1 Furnish to the Engineer three complete bound sets of blueprinted instructions for operating and maintaining all systems and equipment included in this Contract.
 - .2 Submit all instructions first in draft for approval prior to final issue.
 - .3 Manufacturers' advertising literature or catalogues will not be accepted for operating and maintenance instructions.
 - .4 Manufacturers' parts list shall be included in each Maintenance Manual.
 - .5 Each set shall consist of a 3-ring binder and a flyleaf with the name of the General Contractor, Electrical Subcontractor, and major equipment suppliers, or their local representatives if they are not local manufacturers, together with addresses and telephone numbers of all parties.
 - .6 Each system or piece of equipment shall have its own section separated from the next by a labelled divider. Shop drawings shall be included in the appropriate section. They shall be fastened into the book by means of a tab which will allow the drawings to be unfolded without being removed from the book.

- .7 Include copies of all applicable guarantees, warranties, inspection approval certificates, and test certificates.
- .3 "As-Built" Drawings
 - .1 Refer to Division 1 of these Specifications.
 - .2 Maintain in the job site office in up-to-date condition, one (1) complete set of whiteprints of each of the Electrical Contract Drawings and one (1) set of Specifications, including Revision Drawings, marked clearly and indelibly in red, indicating "As-Built" conditions where such conditions deviate from the original directions of the Contract Documents, and indicating final installation of feeders and branch circuits.
 - .3 "As-Built" drawing markings shall include but shall not be limited to the following:
 - .1 All changes in circuiting
 - .2 Size and routing of all conduits for all branch circuits including power, lighting, and systems. Accurately record on "As-Built" drawings the size and routing of all installed raceways and cables.
 - .3 Number and size of conductors in raceways and cables
 - .4 Location of all junction and pull boxes
 - .5 All changes to electrical installation resulting from Addenda, Change Orders, and Field Instructions
 - .6 Exact location of all services left for future work
 - .7 Location by accurate horizontal and vertical dimensions of the routes and terminations of all raceways and cables installed underground.
 - .4 Each "As-Built" drawing as defined above shall bear the Contractor's identification and signature, the date of record, and the notation: "*We hereby certify that these Drawings represent the condition as built.*"
 - .5 Deliver "As-Built" mark-up drawings to the Engineer at 'Substantial Completion' of the Contract for review and comment and, if necessary, revision. A holdback will be affected by the Engineer until "As-Built" drawing mark-ups are delivered in good order as required herein.

1.19 LOOSE EQUIPMENT

- .1 All loose and portable components and equipment to be provided shall be handed over to the Owner at Substantial Performance of the Contract and receipts obtained.
- .2 Copies of such receipts shall be given to the Engineer, with a copy included in Maintenance Manual.

1.20 SUBSTANTIAL PERFORMANCE INSPECTION

- .1 Before the Engineer is requested to make a Substantial Performance inspection, submit written confirmation that:
 - .1 All equipment is operational, plumb, clean, and correctly labelled
 - .2 All Test Reports have been submitted
 - .3 All certificates of final acceptance from the authorities having jurisdiction have been received and submitted to the Engineer
 - .4 Equipment has been cleaned, touched up, or refinished as necessary to present a new appearance
 - .5 All loose equipment including spare parts and replacement parts have been turned over to the Owner and receipts obtained for same
 - .6 The Maintenance Manual has been submitted
 - .7 The "As-Built" drawing mark-ups have been submitted to the Engineer
- .2 Notwithstanding any other provisions of the Contract, failure to complete all of the above shall give cause to deny the issuance of a Substantial Performance Certificate.

1.21 MEASUREMENT AND PAYMENT

- .1 Notwithstanding any other provisions of this Contract, supply the following general information and any additional information as may be requested by the Engineer, as part of each Monthly Progress Claim. Indicate the labour cost and the material cost separately for each ***Item of Work***.
- .2 ***Items of Work*** includes the supply and installation of, and shall not necessarily be limited to work required to complete the scope of work outlined in clause 1.3 of this specification. Other work may include:
 - .1 Documentation including shop drawings, maintenance manuals and final mark-ups for "As-Built" drawings

- .2 Mobilization and demobilization including clean-up
- .3 Progress claims will not be certified nor payment made beyond 95% before holdback is applied for each item of work as previously defined or on the overall contract until commissioning and verification of the systems have been completed. This procedure is to allow for any necessary deficiency holdbacks on items which do not become apparent until the systems have been fully commissioned and are operational.
- .4 Format for Monthly Progress Draws shall be similar to the sample shown at the end of this section.
- .5 For each Monthly Progress Draw, change orders shall be listed separately.

1.22 EVALUATION OF CHANGES TO THE CONTRACT

- .1 Notwithstanding other provisions of the Contract, this Contractor shall supply detailed information for the valuation of all changes to the Contract. Such information shall include, but not necessarily be limited to, the following:
 - .1 Labour hours per unit of material or equipment to be added, deleted, or altered.
 - .2 Units of material or equipment to be added or deleted.
 - .3 Cost to the Contractor per unit of material, equipment, and labour broken down by category of labour and type of material or equipment.
 - .4 Extensions of the above to arrive at total costs.
 - .5 Other miscellaneous charges as allowed in the General Conditions.
- .2 Include in the valuation of any change to the Contract the cost, if any, of recording such change on the "As-Built" drawings as previously specified.

2 PRODUCTS

- .1 Not used

3 EXECUTION

- .1 Not used

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

- .1 Teck armoured cable, RW90 XLP, G/GC portable power cable.
- .2 Wire connectors
- .3 Box connectors for cable

1.2 RELATED WORK

- .1 Section 26 05 01 - Electrical General Requirements

1.3 REFERENCES

- .1 Wires and Cables
 - .1 CSA C22.2 No. 0.3, Test Methods for Electrical Wires and Cables
 - .2 CSA C22.2 No. 65, Wire Connectors
 - .3 CAN/CSA C22.2 No. 131, Type Teck 90 Cable
- .2 Wire and Box Connectors
 - .1 CAN/CSA-C22.2 No. 18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware
 - .2 CSA C22.2 No. 65, Wire Connectors

2 PRODUCTS

2.1 WIRE AND CABLE - GENERAL

- .1 Unless otherwise directed, wire and cable shall be copper conductors, sized as indicated.
- .2 Except where otherwise directed or required by The Canadian Electrical Code or other applicable regulations, wire and cable insulation shall be Type RW90, cross-linked polyethylene insulated for 600 V and rated not less than 90°C.
- .3 All conductors #8 AWG and larger shall be stranded, Type RW90, cross-linked polyethylene insulated for 1000 V and rated not less than 90°C.

2.2 TECK CABLE

- .1 Conductors
 - .1 Grounding conductor: copper
 - .2 Circuit conductors: copper, size as indicated.
- .2 Insulation: chemically cross-linked thermosetting polyethylene, rated type RW90, 600 V.
- .3 Inner jacket: polyvinyl chloride material.
- .4 Armour: interlocking aluminum.
- .5 Overall covering: polyvinyl chloride material.
- .6 Connectors: watertight, approved for Teck cable installation.

2.3 PORTABLE POWER CABLE

- .1 Approved for wet locations, for extra hard usage, 90°C, 2000 V insulation, ultraviolet-resistant black jacket.
- .2 Type G or Type G-GC, multi-conductor, with separate insulated ground check conductor and separate ground conductors.
- .3 Type W, single-conductor with separate polyester braid reinforcement between the insulation and jacket.

2.4 WIRE AND BOX CONNECTORS AND MISCELLANEOUS MATERIALS

- .1 Connectors for wire and cable splices and taps: Unless otherwise directed, use 3M Co. 'Scotchlok,' Thomas & Betts PT Series, Buchanan 'B,' IDI Electric 'Super Nut,' or approved equal, for conductors #8 AWG or smaller; Burndy 'Servit' Type KSU or approved equal for conductors #1/0 AWG and smaller; and Burndy 'OKlip' Type KVSU or approved equal for conductors 750 MCM or smaller.
- .2 Clamps, glanding connectors, or box connectors for armoured cable as required.
- .3 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.
- .4 Copper, short barrel crimp-on compression type connectors as required, sized for conductors.

2.4 WIRE AND BOX CONNECTORS AND MISCELLANEOUS MATERIALS (cont.)

- .5 Plastic electrical insulation tape: Scotch #88 or approved equal.
- .6 Kellums grips: double-eye, double-weave, stainless steel.

3 EXECUTION

3.1 INSTALLATION - GENERAL

- .1 Unless noted otherwise, perform all installation and provide new materials to match existing.

3.2 INSTALLATION OF WIRES AND CABLES - GENERAL

- .1 Unless specifically indicated otherwise, all wiring to MDP and to RCs on floats shall be Type G or Type G-GC.
- .2 All wire from MDP or from RC to luminaires on float light standards to be Teck 90 600V cable.
- .3 Use no wire smaller than #12 AWG, unless otherwise directed.
- .4 No splices, other than those shown, will be permitted. All splices must be made in junction boxes above water level.
- .5 Between float sections provide a 0.9 meter minimum loop as shown on drawings.
- .6 Coil extra 1.5 meters of cable (mounted at low tide) on landing at bottom of gangway as shown on drawings.
- .7 All cables and cords shall be adequately supported to avoid strain on connections. Where cords and cables are suspended vertically, use stainless steel cable grips (Kellums or equal).

3.3 INSTALLATION OF WIRE AND BOX CONNECTORS

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Install mechanical pressure-type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No. 65.
 - .2 Install fixture type connectors and tighten. Replace insulating cap.
- .2 Wire and cable splices and taps shall be made with approved connectors used in accordance with the manufacturer's instructions.

- .3 Wrap connectors having exposed conductive surfaces after installation, with self-fusing rubber electrical tape, applying enough servings to provide uniform covering not thinner than the insulation of the largest conductor connected and overlapping the insulation of each connected conductor by not less than 12 mm. Protect the rubber tape with a final overwrap of plastic tape.

END OF SECTION

PART 1 GENERAL

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 REFERENCE STANDARDS

- .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
- .2 All grounding conductors to be stranded soft annealed copper unless otherwise noted.
- .3 Install complete grounding and bonding system in accordance with Canadian Electrical Code and local inspection authority requirements.

1.3 TESTING REQUIREMENTS

- .1 Perform ground continuity and resistance tests using method appropriate to site conditions. Measure ground grid resistance.
- .2 Any third-party testing agency costs for the testing and reporting shall be included in the Electrical Division base tender and shall be carried out by a pre-approved testing agency.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Grounding equipment to: CSA C22.2 No.41.

2.2 EQUIPMENT

- .1 Clamps for grounding of conductor, size as required.
- .1 Rod electrodes, copper clad steel 19mm dia. by 3m long or as indicated.
- .2 System and circuit, equipment, grounding conductors, bare stranded copper, soft annealed, sized as indicated. Insulation where specified or required to be green.
- .3 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.

- .4 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.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

- .1 Install complete permanent, continuous bonding to ground system, including conductors, connectors, and accessories. Run bonding wire in every conduit.
- .2 Provide all grounding and bonding to conform with the latest edition of the Canadian Electrical Code and the latest grounding and bonding instructions of the Inspection Authority, with any further requirements as noted herein or on the drawings.
- .3 Bonding to ground and grounding conductors shall be as specified elsewhere and shall be bare copper or have green insulation with identification at all ends.
- .4 Neutral to ground conductors shall be copper conductor of size indicated with white insulation.
- .5 Install connectors in accordance with manufacturer's instructions.
- .6 Protect exposed grounding conductors from mechanical injury.
- .7 Use cable lugs for bonding non-current carrying metallic parts of electrical equipment to ground.
- .8 connections to switchboards, ground buses, and other equipment.
- .9 Soldered joints are not permitted.

3.2 GROUNDING BUSSES

- .1 Provide a ground bus in the main electrical room. Ground bus shall consist of suitable length of 50mm x 6mm [2"x ¼"] copper bus mounted on a 25mm [1"]

insulating standoffs. This bus shall be drilled and tapped to receive all the grounding conductors indicated and an engraved nameplate or tag installed above or below individual conductors indicating their function.

- .2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections size 3/0 AWG or as indicated.
- .3 Copper or bronze lugs required for termination of all copper conductors at ground busses.

3.3 POST MOUNTED LUMINAIRE BONDING

- .1 Provide #10 AWG bonding conductor with green RW90 X-link insulation to luminaire standards. Connect to luminaire corrosion resistant ground stud or ground clamp.

3.4 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 01.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions.
- .3 Measure ground grid resistance with earth test megohmmeter and install additional ground rods and conductors as required until resistance to ground complies with Code requirements and is less than 1 Ω .
- .4 Carry out all tests required by the Electrical Inspection Authority and provide all required reports and copied to the Consultant. Include all associated costs.
- .5 Ensure test results are satisfactory before energizing the electrical system.

END OF SECTION

1 General

2 Products

2.1 SUPPORT CHANNELS

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

3 Execution

3.1 INSTALLATION

- .1 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .2 Fasten exposed conduit or cables to boardwalk, approach and wharf construction or support system using straps.
 - .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 50 mm.
 - .3 Beam clamps to secure conduit to exposed steel work.
- .3 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.
 - .2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.
 - .3 Support cables in galvanized cable tray where indicated.
- .4 For surface mounting of two or more conduits use channels at 1 m oc spacing.
- .5 Provide metal brackets, frames, hangers, clamps, cable tray and related types of support structures where indicated or as required to support conduit and cable runs.
- .6 Ensure adequate support for raceways and cables dropped vertically to equipment.
- .7 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .8 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Consultant.

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

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

- .1 Conduits, conduit fastenings, and conduit fittings

1.2 REFERENCES

- .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware
- .2 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit
- .3 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit

1.3 LOCATION OF CONDUIT

- .1 Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only.

2 PRODUCTS

2.1 CONDUITS

- .1 Rigid PVC conduit: to CSA C22.2 No. 211.2
- .2 Rigid galvanized steel threaded conduit (RGS) to ANSI C80.1.
- .3 Flexible metal conduit: to CSA C22.2 No. 56, aluminium or zinc-coated steel, liquid-tight. "Spec-Flex" or equivalent.

2.2 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified.
- .2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.
- .3 Liquid-tight fittings for liquid-tight flexible conduit: equivalent to T&B 'Super-Tite' 5000 Series. All connectors shall have insulated throats.
- .4 Nylon-Insulated Conduit Bushings: T&B or equal.

2.3 CONDUIT BOXES

- .1 Cast FS or FD aluminum boxes with factory-threaded hubs and external mounting feet for surface wiring.

2.4 PULL CORD

- .1 For 25 mm or larger trade size conduit: 6 mm diameter nylon or polypropylene cord or other approved product.

3 EXECUTION

3.1 INSTALLATION - GENERAL

- .1 Generally, and where permitted by the Canadian Electrical Code, use rigid PVC conduit for all wiring unless otherwise noted.
- .2 Do not install PVC where it may be subject to mechanical injury.
- .3 For any one conduit section, use the maximum possible conduit length. Installations which use partial lengths and/or excessive number of couplings shall not be acceptable and shall be replaced at Contractor's expense.
- .4 Install exposed conduits in close parallel groups wherever two or more conduits running in the same direction would otherwise be within 1800 mm of each other.
- .5 Install all conduits parallel or at right angles to structure lines, as the case directs.
- .6 Do not install conduit through structural members unless specific instructions are given.
- .7 Install a pull cord in all empty conduits.

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

- .1 Luminaires or bulbs
- .2 Fixtures or luminaire housings
- .3 Poles or light standards

1.2 RELATED WORK

- .1 Section 26 05 01 - Electrical General Requirements

1.3 SHOP DRAWINGS

- .1 Submit drawings for product approval prior to purchase:
 - .1 Luminaires used in RC cabinet fixtures and in float light standard fixtures
 - .2 Fixtures used on float mounted light standards
 - .3 Three meter poles used as light standards installed on floats
 - .4 Photocell installed on top of fixture on float light standards

2 PRODUCTS

2.1 LUMINAIRE

- .1 Use luminaire of one manufacturer for all lighting poles.
 - .1 Pole Mounted: WE-EF VFL530-SE LED c/w Pole mounted bracket 111-0044 RF1-530, Asymmetric side throw beam S60, 3000K, 56W, LED-24/48W/830 #108-1287 or equivalent upon approval by the Engineer. Includes built-in photocell for lighting control.
 - .2 Housing: IP66, Class I or Class II. IK08. Marine-grade die-cast aluminium alloy. 5CE superior corrosion protection including PCS hardware. Silicone CCG® Controlled Compression Gasket.
- .2 Photo control with integrated relay.

2.2 LUMINAIRE POLES

- .1 Poles shall be 3 metres c/w 78mm diameter pole top, Marine grade die-cast aluminium alloy or hot dipped galvanized, tapered round poles for float mounted light standards. WE-EF pole or approved equal.
- .2 Tubular steel, one step. Hot dipped galvanised inside and out. Chrome-free conversion coating with superior powdercoat finish in RAL colour to match fixture. Service door with stainless locking screw. Suitable for one cable connecting box. Base plate welded to tubular shaft, flange plate suitable for mounting on floats.

3 EXECUTION

3.1 LUMINAIRE & PHOTOCELL

- .1 Mount as indicated on drawings inside lens.
- .2 As recommended by manufacturer.

END OF SECTION

PART 1 GENERAL

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 26 05 01.
- .2 Shop drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.
- .3 Shop drawings to include matching tub and trim details for factory installed low voltage relay cabinets where specified.

1.3 PLANT ASSEMBLY

- .1 Install circuit breakers in panelboards before shipment from plant.
- .2 Install and prewire low voltage relays assemblies where indicated.
- .3 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .4 All panelboards to be of a common manufacturer.

1.4 FINISH

- .1 Panel finish in electrical and equipment rooms and closets to be standard ASA Grey baked enamel for normal power service. Confirm with Consultant prior to shop finishing panels.

PART 2 PRODUCTS

2.1 PANELBOARDS, DOORS AND TRIMS

- .1 Panelboards: to CSA C22.2 No. 29 and product of one manufacturer.
- .2 Bus and breakers rated for 22 KA symmetrical, minimum, interrupting capacity or as indicated.

- .3 Tin plated aluminum bus with full size neutral.
- .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 Mains, number of circuits and number and size of branch circuit breakers as indicated.
- .6 Provide all necessary connectors and mounting hardware in every space to facilitate installation of future breakers. Provide blank fillers for all spaces.
- .7 Concealed hinges and concealed trim mounting screws, hinged locking door with flush catch.
- .8 Panelboards to have flush doors. (Gasketed where required).
- .9 Provide two keys for each panelboard and key similar voltage panelboards alike.
- .10 Panel tubs to be typically 600mm [20"] wide.
- .11 Provide door within door trims where indicated to facilitate ease of service maintenance. Each tub trim cover to be hinged and self-supporting and to swing out to expose breaker cable terminations and wireways. Hinged trim shall be secured with cover screws on opening side by concealed machine screws. Hinged breaker cover shall be recessed into the hinged overall tub cover. Breaker cover shall have latch type closures. Submit details on shop drawings prior to manufacturing.

2.2 BREAKERS

- .1 All breakers to be bolt on type, moulded case, non-adjustable and non-interchangeable trip, single, two and three pole, 120/208 (240)V and with trip free position separate from "On" or "Off" positions.
- .2 Two and three pole breakers to have common simultaneous trip and able to be located in any circuit position within the panelboard. Minimum interrupting rating of breakers to be as follows:
 - .1 120/240V panelboards - 10,000 Amps at 250 volts.
- .3 Main breaker to be separately mounted at top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .4 Provide circuit breakers with indicated trip ratings as shown in the panelboard schedules.

- .5 Provide at least 10% spare 15 Amp single pole breakers whether indicated or not.
- .6 Provide GFI type breakers as indicated.

2.3 PANELBOARD IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 01.
- .2 Nameplate for each panelboard size 5 (2 line) engraved as indicated and include panel designation and voltage/phase.
- .3 Complete circuit directory with typewritten card(s) located in slide-in plastic pocket(s) fixed to the back of the related door. Directory card to indicate the panel designation, mains size, voltage/phase and the location and load controlled of each circuit. Include a "letter sized" paper copy of each directory in the project maintenance manual.
- .4 Provide a plasticized typewritten information card fixed to the back of the each panel door. Information card to indicate the panel designation and location, feeder type and size and locations of any controlling contactors and feeder pullboxes. Include a "letter sized" paper copy of each information card in the project maintenance manual.

2.4 STANDARD OF ACCEPTANCE

- .1 Cutler Hammer Type PRL Door within door trim where indicated.
- .2 Schneider, Type NQOD Door within door trim where indicated.
- .3 Siemens Canada.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb true and square, to adjoining surfaces.
- .2 Panelboards located in service rooms, mechanical rooms, and electrical rooms to be mounted on unistrut supports.
- .3 Mount panelboards to height given in Section 26 05 01 or as indicated.

- .4 Connect loads to circuits as indicated.
- .5 Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION

1 GENERAL

1.1 REFERENCES

- .1 CSA C22.2 No. 5, Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE)
- .2 Section 26 24 16 – Panelboards Breaker Type

1.2 PLANT ASSEMBLY

- .1 Assemble panelboard interior and install circuit breakers before shipment.
- .2 Panelboards to fit available space within electrical kiosk enclosures.

2 PRODUCTS

2.1 MAIN DISTRIBUTION PANEL (MDP) ENCLOSURE

- .1 Enclosure (kiosk) shall be sized to fit the 120/240V, 400A panelboard, main breaker or safety switch (if separate components), gutter box or wireway, isolated neutral and ground busses and all required conduit and cable connections.
- .2 Kiosk shall be 12-gauge stainless steel or 3.2mm marine grade aluminium 5052-H32 powder coated ASA grey, rated NEMA 3R:
 - .1 bullet style grease-able hinges;
 - .2 drip edge on top and sides of doors;
 - .3 weather strip around all doors.
 - .4 roof overhang on front;

- .5 gutter box for bottom cable entry & exit;
 - .6 corrosion proof 3-point latch on each door with 9mm pad lock loop and hasp;
 - .7 all hardware shall be stainless steel.
-
- .3 Submit shop drawing of kiosk and all components to Engineer for approval prior to procurement.
 - .4 Panelboard, main breaker or safety switch, and other components mounted to backboard inside kiosk. Ground bus and neutral bus mounted to backboard on insulated standoffs.
 - .5 Kiosk shall be bolted to wharf deck with minimum 19mm galvanized bolts. Gutter box to extend beyond wharf edge for cable access under wharf.
 - .6 Nameplate is 100 x 200mm black lamacoid with white lettering, machine-screw fixed to kiosk door.
 - .7 Supplier shall be Valid Manufacturing Ltd. or approved equal.

2.2 MAIN DISTRIBUTION PANELBOARD

- .1 Panelboard shall be rated 120/240V, 400A with a 225A main breaker, branch breakers, 100% neutral and lugs to fit cables from service entrance supply and to loads.
- .2 Panelboard shall be mounted on backboard inside kiosk and shall be CSA NEMA Type 3R construction. Submit shop drawings to Engineer for approval.
- .3 Panels shall be moulded-case, circuit breaker type, 22 kA interrupting rating.
- .4 Main bus bars shall be of tin-plated copper and equipped with pressure type solderless lugs. All bus work shall be suitably supported to withstand maximum short circuit current of 22 kA RMS amperes symmetrical.

- .5 Unused circuit positions shall be closed with substantial covers which require tools for removal.
- .6 Panelboards shall be fitted with a branch circuit grounding terminal bus firmly bonded to the inside of the panel enclosure consisting of a copper grounding bus with one terminal for each circuit position available in the panel. Branch circuit equipment grounding conductors shall terminate at this ground bus. This ground bus shall be connected to the isolated ground bus mounted outside the panelboard.
- .7 The neutral bus shall be attached but isolated from the panelboard enclosure. Branch circuit neutrals shall terminate on this neutral bus. The neutral bus shall be connected to the isolated neutral bus mounted outside the panelboard.
- .8 All breakers shall be of the same manufacturer.
- .9 Breakers shall be bolt-on. Plug-in type circuit breakers shall not be used.
- .10 Two- and three-pole circuit breakers shall have a common tripping mechanism and single handle. Handle ties are not acceptable.
- .11 Panelboards shall be as manufactured by Cutler-Hammer, Square D, Schneider Group, Moeller Electric, or approved equal.

3 EXECUTION

3.1 INSTALLATION

- .1 Bolt panels securely to backplane inside electrical kiosk.
- .2 Connect the isolated neutral bus to the isolated ground bus mounted outside the panelboard. Connect the isolated ground bus to the earth ground electrode. Identify all ground bus wiring connections.

- .3 Upon completion of testing and commissioning, install permanent engraved circuit directory on the inside face of the panelboard.

END OF SECTION

1 GENERAL

1.1 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data for enclosures and equipment including detailed fabrication drawings showing materials of construction and assembly.

2 PRODUCTS

2.1 EQUIPMENT - GENERAL

- .1 Outdoor weatherproof enclosures constructed of marine grade aluminum and as shown on the drawings.
- .2 Removable enclosure panels with formed edges, external component fasteners removable only from inside enclosure.
- .3 Doors: hinged, with padlocking means.
- .4 Hinges: heavy duty, stainless steel, non-removable pin for secure compartments.

2.2 MDP ENCLOSURE

- .1 Provide enclosure with cable entry, wireway, panelboard, isolated neutral bus, isolated ground bus and all fittings required for a safe and functioning main distribution panel with neutral grounding and bond-to-ground systems.

3 EXECUTION

3.1 INSTALLATION

- .1 Verify that components are assembled inside enclosure in accordance with reviewed shop drawings. Adjust or revise assembly if required.
- .2 Obtain local CSA approval of completed assembly.
- .3 Install equipment in locations as per drawings.

END OF SECTION

1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 05 01 - Electrical General Requirements

2 PRODUCTS

2.1 RECEPTACLES

- .1 All receptacles shall be twist-lock, marine grade, yellow colour.
- .2 Receptacles in RC interiors shall be single, twist-lock, marine grade, with melamine body and nylon face. Receptacles shall be as follows:
 - .1 20 A, L5-20R, Hubbell HBL 23CM10 or approved equal
 - .2 30 A, L5-30R, Hubbell HBL 26CM10 or approved equal
 - .3 50 A, L6-50R, Hubbell HBL 63 CM70 or approved equal.

3 EXECUTION

3.1 RECEPTACLES

- .1 Mount receptacles securely within RC's as indicated.

END OF SECTION