

**FUNDY OCEAN RESEARCH CENTER FOR ENERGY
HALIFAX, NOVA SCOTIA**

**IN STREAM TIDAL POWER GENERATING PLANT
INTERTIE SUBSTATION DEVELOPOMENT**

**MANUFACTURE, TESTING AND DELIVERY OF
ONE (1) 125VDC STATION BATTERY BANK AND
ONE (1) 125VDC STATION BATTERY CHARGER**

APRIL, 2011

**SPECIFICATION No.
023-478-5-11**

SPECIFICATION

**FUNDY OCEAN RESEARCH CENTER FOR ENERGY
HALIFAX, NOVA SCOTIA**

**IN STREAM TIDAL POWER GENERATING PLANT
INTERTIE SUBSTATION DEVELOPMENT**

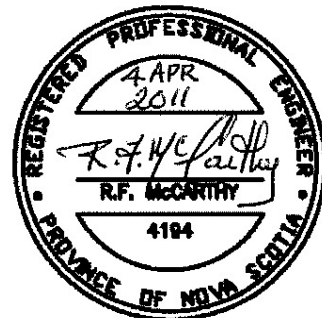
**MANUFACTURE, TESTING AND DELIVERY OF
ONE (1) 125VDC STATION BATTERY BANK AND
ONE (1) 125VDC STATION BATTERY CHARGER**

SPECIFICATION No: 023-478-5-11

SIGNED AND SEALED:



**R. McCARTHY, P. ENG.
SENIOR ELECTRICAL ENGINEER**



SIGNED:



**R. O'FLAHERTY, P. ENG.
QA/QC ENGINEER**

STRUM ENGINEERING ASSOCIATES LTD.

APRIL, 2011

SPECIFICATION

CONTENTS

- A. INFORMATION AND GENERAL REQUIREMENTS**
- B. TECHNICAL REQUIREMENTS**
- C. SCHEDULES**

SPECIFICATION

SECTION A

INFORMATION AND GENERAL REQUIREMENTS

CONTENTS

| | <u>Page</u> |
|---|--------------------|
| 1. GENERAL | A-1 |
| 2. DESCRIPTION OF PROJECT | A-1 |
| 3. DEFINITIONS | A-2 |
| 4. ERRORS AND OMISSIONS | A-2 |
| 5. MATERIAL AND WORKMANSHIP | A-3 |
| 6. GUARANTEE/WARRANTY | A-3 |
| 7. MANUFACTURER'S DRAWINGS | A-4 |
| 8. OPERATION AND MAINTENANCE MANUALS | A-6 |
| 9. WITNESSING OF TESTS AND TEST REPORTS | A-7 |
| 10. PACKAGING AND SHIPPING | A-7 |
| 11. SIGNING AND SEALING OF MANUFACTURER'S DRAWINGS | A-7 |
| 12. CORRESPONDENCE | A-7 |
| 13. SCHEDULE | A-8 |

SPECIFICATION

SECTION B

TECHNICAL REQUIREMENTS

CONTENTS

| | <u>Page</u> |
|--|-------------|
| 1. SCOPE OF WORK | B-1 |
| 2. ENVIRONMENTAL DATA | B-1 |
| 3. 125Vdc STATION BATTERY | B-2 |
| 3.1 STANDARDS | B-2 |
| 3.2 DESIGN AND CONSTRUCTION OF VRLA BATTERIES | B-2 |
| 3.3 STATION BATTERY IDENTIFICATION | B-3 |
| 3.4 STATION BATTERY ACCESSORIES | B-3 |
| 3.5 STATION BATTERY CAPACITY | B-4 |
| 3.6 STATION BATTERY FACTORY TESTS | B-5 |
| 3.7 STATION BATTERY INSTRUCTION MANUALS | B-5 |
| 3.8 STATION BATTERY TECHNICAL DATA SHEET | B-6 |
| 4. 125Vdc BATTERY CHARGER | B-7 |
| 4.1 STANDARDS | B-7 |
| 4.2 DESIGN AND CONSTRUCTION OF BATTERY CHARGER | B-8 |
| 4.3 BATTERY CHARGER IDENTIFICATION | B-9 |
| 4.4 BATTERY CHARGER ACCESSORIES | B-9 |
| 4.5 BATTERY CHARGER CAPACITY | B-10 |
| 4.6 BATTERY CHARGER FACTORY TESTS | B-10 |
| 4.7 BATTERY CHARGER INSTRUCTION MANUALS | B-10 |
| 4.8 BATTERY CHARGER TECHNICAL DATA SHEET | B-11 |
| 5. PACKING AND SHIPPING | B-12 |

SPECIFICATION

SECTION C

SCHEDULES AND DRAWINGS

CONTENTS

| | <u>Page</u> |
|---|-------------|
| 1. INSTRUCTIONS | C-1 |
| 2. SCHEDULES | |
| SCHEDULE No. 1 - TECHNICAL INFORMATION | C-2 |
| SCHEDULE No. 2 - DOCUMENTS TO BE SUBMITTED WITH TENDER | C-4 |
| SCHEDULE No. 3 - TENDERED VARIATIONS FROM THE SPECIFICATION | C-5 |
| SCHEDULE No. 4 - ERECTION SUPERVISOR | C-6 |
| SCHEDULE No. 5 - COMMENCEMENT AND COMPLETION DATES | C-7 |
| SCHEDULE No. 6 - SPARE PARTS LIST | C-8 |
| SCHEDULE No. 7 - ACCESSORIES AND SPECIAL TOOLS LIST | C-9 |
| SCHEDULE No. 8 - PRICE LIST | C-10 |
| SCHEDULE No. 9 - FORM OF TENDER | C-11 |

SPECIFICATION

SECTION A

INFORMATION AND GENERAL REQUIREMENTS

April, 2011

023-478-5-11

SPECIFICATION

SECTION A

INFORMATION AND GENERAL REQUIREMENTS

1. GENERAL

- 1.1 This Technical Specification, prepared by Strum Engineering Associates Ltd. on behalf of Fundy Ocean Research Center for Energy, consisting of the Information and General Requirements, the Technical Requirements, together with all Schedules, Drawings, and Addenda issued with and subsequent to the "Invitation to Tender", shall become a part of any Contract or Purchase Order to perform the work involved. In case of discrepancies between the work tendered to be performed and the work specified to be performed, the Technical Specification shall be final and binding unless there be mutual agreement to the contrary between Fundy Ocean Research Center for Energy and the Vendor.

2. DESCRIPTION OF PROJECT

- 2.1 The scope of work of this aspect of the intertie substation development project consists of the manufacture, delivery to site and warranty for one (1) 125Vdc substation battery bank and one (1) 125Vdc station battery charger complete with intercell battery terminal links and rack system, as specified herein.
- 2.2 The battery bank shall be sealed (or valve-regulated) lead-acid (VRLA) storage batteries using either lead antimony or lead calcium electrodes. Battery bank shall be complete with all auxiliary equipment and spare parts as described in this Specification. The battery bank shall be used for stand-by float operation and as a protection and control systems power supply in the Owner's substation.
- 2.3 The battery charger shall be used to maintain the 125Vdc station battery bank at optimum capacity. The battery charger shall be designed for and compatible with the quantity and type of batteries provided, i.e. charging voltage, charging rate per specific electrolyte and plate design.

SPECIFICATION

3. DEFINITIONS

- 3.1 The **Owner's Engineer** shall mean:

Strum Engineering Associates Ltd.

80 Eileen Stubbs Avenue
Dartmouth, Nova Scotia, B3B 1Y6

Contact: Mr. Richard McCarthy, P. Eng.

Telephone: (902) 468-7325

Fax: (902) 468-1908

E-Mail: r.mccarthy@strumengineering.ca

- 3.2 The Vendor shall mean the Tenderer as defined in Fundy Ocean Research Center for Energy Terms and Conditions.

- 3.3 The **Owner's** information and contact will be:

Fundy Ocean Research Center for Energy

53 Prince Street
Hantsport, Nova Scotia
B0P 1P0

Contact: Mr. Frank LeBlanc, P.Eng.

Telephone: (902) 443-4690

Fax: (902) 468-1908

E-Mail: frank.lebanc@fundyforce.ca

4. ERRORS AND OMISSIONS

- 4.1 Should any details necessary for a clear and comprehensive understanding be omitted or any errors appear in the tendering documents, it shall be the duty of the Tenderer to obtain clarification from the Engineer before submitting his tender. All additions or corrections to the Technical Specification will be issued in writing to all Tenderers as addenda thereto. Tenderers shall list in their tenders all the addenda that were received and considered when their tender was prepared.

SPECIFICATION

5. MATERIAL AND WORKMANSHIP

- 5.1 All materials shall be new. Workmanship and material shall be of the best quality.
- 5.2 Design shall be in accordance with the best engineering practice and shall be such as has been proven suitable for the intended purpose.
- 5.2 Equipment of the same type shall be interchangeable. Listed spare parts shall be identical and inter-changeable with parts in service that they are intended to replace.

6. GUARANTEE/WARRANTY

- 6.1 The Vendor shall warrant that all materials, equipment, and workmanship furnished in accordance with the purchase documents shall comply in all respects with the Technical Specification, and shall guarantee in writing that the equipment will give successful and efficient service.
- 6.2 The Vendor shall, to the satisfaction of the Owner, rectify any defects which may appear in the equipment, or of which he shall receive notice from the Owner and for which he may have been responsible in the opinion of the Owner, for a period of twelve months after start-up or eighteen months after shipment, whichever occurs first.
- 6.3 Any equipment which fails to perform in accordance with the requirements of the Specification during this period may be rejected by the Owner. The Vendor shall proceed at once to make alterations or furnish new equipment, as may be necessary.
- 6.4 Costs of supplying any replacement equipment, or of modifications or alterations to equipment, in order to meet specified requirements shall be borne by the Vendor, including the costs, if any; of any work or materials provided by the Owner, and of any shipping charges incurred by the Owner.
- 6.5 Operation by the Owner of the equipment or any part thereof shall not constitute any waiver of the Owner's rights under this agreement.
- 6.6 The Vendor agrees that the 125Vdc station battery and the battery charger shall meet the requirements set out in the Specification and all relevant standards listed herein.
- 6.7 The Owner's purchase order terms and conditions shall prevail.

SPECIFICATION

7. MANUFACTURER'S DRAWINGS

7.1 General

7.1.1 Drawings shall be clear and legible and have a title block including the name of the Project, and the number and title of the drawing.

7.1.2 All drawings shall be prepared on Metric A1 size sheets, 594 mm by 841 mm. Use of other size sheets shall be approved by the Engineer.

7.2 System of Units

7.2.1 All dimensions shall be in the Metric system.

7.3 Title Block

7.3.1 Drawing title blocks shall include the following information:

.1 Name of the Project as follows:

**IN STREAM TIDAL POWER GENERATING PLANT
SUBSTATION DEVELOPMENT**

Manufacture, Testing, Delivery and Warranty of
One (1) 125Vdc Station Battery Bank and
One (1) 125Vdc Station Battery Charger

Owner's Purchase Order No.

.2 Provide a 100 mm x 100 mm space to accommodate the Engineer's review stamp.

.3 Issue date and the drawing number.

.4 Space allotted for revisions including the number, description, and date.

SPECIFICATION

7./

7.4 Review of Drawings

- 7.4.1 Drawings made by the Tenderer or his sub-contractors defining the work shall be provided at appropriate times within the program of work as defined in the Specification.
- 7.4.2 Five prints of all drawings shall be submitted to the Engineer, who shall return, within 14 days after receipt, one copy of the reviewed drawings stamped as follows:

STRUM ENGINEERING ASSOCIATES LTD.

Date Received: _____ By: _____.

This drawing has been reviewed for the sole purpose of determining conformance with the general requirements of the Contract Documents.

The Contractor shall remain responsible for all damages resulting from errors and/or omissions contained in this drawing and shall satisfy all obligations and liabilities connected therewith and with the Contract Documents.

- Reviewed - Manufacturing May Proceed. ()
- Reviewed - Submit Final Drawing. Manufacturing May Proceed. ()
- Reviewed - Make Changes As Noted. Submit Final Drawing. ()
Manufacturing May Proceed.
- Reviewed - Correct and Resubmit. ()
- Review Not Required - Manufacturing May Proceed. ()

Date Review Completed: _____ By: _____.

All drawings checked other than, "Reviewed - Manufacturing May Proceed", shall be corrected and recycled for review within 14 calendar days, and this procedure continued until final review is obtained.

SPECIFICATION

7./

7.4.3 Before proceeding with construction, submit for review to the Engineer, assembly drawings, foundation and base plate details, layout and drilling details, drawings covering construction, complete control schematic diagrams, and other pertinent data for the equipment under consideration. Do not start construction until instructed by the Engineer.

7.4.4 Do not revise those drawings or portions of drawings which have been reviewed and stamped during the review process unless these drawings or portions are affected by comments made or revisions requested.

7.5 Final Drawings

7.5.1 These drawings shall incorporate any changes made during the construction and testing stages of the work, shall be exact drawings of the equipment as supplied, and shall be of such quality to enable electronic scanning without loss of detail.

7.5.2 Do not revise drawings that have been reviewed and stamped “Reviewed – Manufacturing May Proceed” by the Engineer except by his prior written consent.

7.5.3 Submit six (6) prints and the electronic ACAD file (xxx.dwg format) of each final drawing.

8. OPERATION AND MAINTENANCE MANUALS

8.1 Prepare comprehensive instruction manuals describing in detail the construction and recommended procedures for assembling, dismantling, maintaining and operating all equipment and listing all replacement parts. These shall include copies of all pertinent bulletins and instructions prepared by the manufacturers of component parts of the equipment, properly catalogued for easy reference.

8.2 Two (2) copies of the manuals shall be submitted in draft form to the Owner’s Engineer for review at least one (1) month before the equipment is to be delivered. Five (5) copies of the final Operation and Maintenance Manual shall be submitted at the time the equipment is shipped.

SPECIFICATION

9. WITNESSING OF TESTS AND TEST REPORTS

- 9.1 Advise the Engineer 14 days prior to the tests so that tests may be witnessed by the Engineer and Owner.
- 9.2 Submit six copies of duly certified test reports, to be forwarded by courier prior to equipment shipment.

10. PACKAGING AND SHIPPING

- 10.1 All parts shall be thoroughly cleaned to remove oil, grease, dust, and other foreign material and all equipment openings shall be capped to prevent entry of foreign materials or damage.
- 10.2 Equipment shall be suitably prepared and packed so as to prevent damage occurring during storage, transportation, and unloading operations and to ensure that the equipment is in perfect working condition, has suffered no damage, and that all parts are intact on arrival at the destination.
- 10.3 Packaging and crating shall include suitable weather protection, moisture control, temporary bracing, blocking straps, skids, etc.

11. SIGNING AND SEALING OF MANUFACTURER'S DRAWINGS

- 11.1 Execute design under the supervision of a licensed Engineer. The Engineer shall sign and seal:
 - 11.1.1 Shop fabrication drawings and specifications;
 - 11.1.2 Site erection drawings and specifications; and,
 - 11.1.3 Assembly and schematic diagrams.

12. CORRESPONDENCE

- 12.1 In view of the urgency attached to this project, the tender submission shall be by courier or electronic mail (E-Mail). All other correspondence shall be by courier, facsimile or E-Mail.
- 12.2 The Vendor shall allow for this requirement in the prices quoted herein.

SPECIFICATION

13. SCHEDULE

- 13.1 All equipment associated with this specification is required on site not later than 1 July 2011. Refer to Schedule No. 5, Page C-7, for the specific schedule requirements.

SPECIFICATION

SECTION B
TECHNICAL REQUIREMENTS

April, 2011

023-478-5-11

SPECIFICATION

SECTION B

TECHNICAL REQUIREMENTS

1. SCOPE OF WORK

- 1.1 Manufacture and deliver to FORCE, at the substation location in Black Rock, Nova Scotia, 10km west of the town of Parrsboro, Nova Scotia, and provide a written warranty for one (1) 125Vdc substation battery bank and one (1) 125Vdc station battery charger complete with intercell battery terminal links and rack system.
- 1.2 Offloading, erection, testing and commissioning of the 125Vdc station battery and battery charger will be carried out by others and does not form part of this Contract.

2. ENVIRONMENTAL DATA

- 2.1 Design and manufacture the 125Vdc station battery and battery charger to be suitable for operation under the following conditions:

| | | |
|-----------------------------|----|----|
| Elevation above sea level | m | 65 |
| Maximum ambient temperature | °C | 40 |
| Minimum ambient temperature | °C | 10 |
- 2.2 The intended location of the 125Vdc station battery and battery charger is classified as an indoor, climate controlled environment.

SPECIFICATION

3. 125Vdc STATION BATTERY

3.1 Standards

3.1.1 Unless otherwise specified herein, manufacture and test the valve regulated lead acid (VRLA) batteries in accordance with the latest issue of the following standards:

IEEE Std. 485-1997 Practice for sizing lead-acid batteries for stationary applications.

IEEE Std. 1188-2005 Practice for Maintenance, Testing and Replacement of Valve Regulated Lead-Acid (VRLA) Batteries for Stationary Application.

CAN3-Z234.1-00 Metric Practice Guide

CAN3-Z299.2-85 Quality Assurance Program – Category 2.

3.1.2 Apply all reference publications and amendments listed within the above standards.

3.1.3 In case of conflict between any of the publications listed above, the governing standard shall be one which requires the highest quality of work and materials and afford the highest degree of safety to personnel as interpreted by the Engineer.

3.1.4 Other alternative standards may be used if approved by the Owner's Engineer.

3.2 Design and Construction of VRLA Batteries

3.2.1 Sealed cell batteries shall be Absorbent Glass Mat (AGM) type only.

3.2.2 Battery containers shall:

3.2.2.1 Be impact and vibration resistant.

3.2.2.2 Be leak and spill proof.

3.2.2.3 Contain junctions between the terminal post and cover.

3.2.2.4 Have sealed cover and jar.

SPECIFICATION

3.2/

- 3.2.3 Positive plates shall have a minimum thickness of 6.35mm (0.25 inches).
- 3.2.4 Maximum floor space dimension: 60”W x 60” H x 36” D.
- 3.2.5 Battery bank shall conform to all design features outlined in the Data Sheets.

3.3 Station Battery Identification

- 3.3.1 Serial and model numbers shall be permanently and legibly illustrated on each individual cell.
- 3.3.2 All cells shall have individual identification numbers permanently stamped into all battery posts.
- 3.3.3 The polarity shall be permanently and legibly marked on or immediately adjacent to each terminal.
- 3.3.4 Acid resistant cell identification labels shall be supplied for each cell.
- 3.3.5 The following information shall be permanently and legibly marked on each cell cover if space permits, otherwise on the end of each cell:
 - 3.3.5.1 Consecutive cell number
 - 3.3.5.2 8-hour rated capacity (ampere hours)
 - 3.3.5.3 Manufacturer’s name
 - 3.3.5.4 Year and month of manufacture
 - 3.3.5.5 Cell base impedance and tolerance range

3.4 Station Battery Accessories

- 3.4.1 Battery racks shall be painted with an acid resistant paint, and shall be a two-step design with suitable rubber insulated rail covers to isolate the cells from the rack.
- 3.4.2 The inter-cell and inter-modular connections shall be of solid bar lead plated copper construction with stainless steel bolts, nuts and washers. The terminal lugs shall be able to accommodate conductors ranging from 3/0 AWG to 250 MCM or copper bus links of compatible rating. Inter-cell connector covers shall be provided for burned-on or bolted-on connectors.

SPECIFICATION

3.4/

- 3.4.3 Three (3) spare connectors and fasteners shall be supplied for the 125V battery banks to accommodate field loss or spoilage.
- 3.4.4 Lead plated connector lugs for positive and negative terminals, including fasteners for the Owner's outgoing cables shall be supplied with the battery bank.
- 3.4.5 Batteries shall be equipped with cell lifting straps for convenient handling.
- 3.4.6 Appropriate warning and/or caution stickers shall be provided.
- 3.4.7 Connector bolt wrenches shall be provided.
- 3.4.8 Manufacturer shall provide two (2) cans of non-oxide grease with each battery bank.
- 3.4.9 All other mechanical hardware required to place the batteries in service shall be supplied with the battery bank.

3.5 Station Battery Capacity

- 3.5.1 Batteries shall be rated at the eight-hour rate to 1.75 – 2.0 volts per cell at 25°C. Ratings shall be as specified in the Data Sheets.
- 3.5.2 At the moment of interruption of charger supply, the batteries are to be rated for the eight-hour duty cycle, as specified. The battery bank shall be guaranteed to be capable of servicing this duty cycle for its entire life.
- 3.5.3 The battery bank shall be able to recover from a full discharge, i.e. the battery bank shall be able to return to normal operating tolerances after being completely depleted.
- 3.5.4 Initial battery capacity shall not be less than 100% of the rated capacity.
- 3.5.5 The battery bank shall be designed to operate within the temperature range specified in the Data Sheets.

SPECIFICATION

3.5/

3.5.6 Tenderer shall provide a completed cell sizing worksheet per IEEE Standard 485-1997, assuming the following load profile during the 8 hour discharge period:

3.5.6.1 A continuous load of 5Adc @ 125Vdc

3.5.6.2 A periodic load of 15Adc @ 125Vdc for a duration of 10 seconds every 10 minutes for an 8 hour discharge period. The Tenderer may also model the periodic loads as a single load of 20A lasting 8 minutes, provided that this method would produce the same result as analyzing a periodic load of 20A placed on the system for 10 seconds every 10 minutes for 8 hours.

3.6 Station Battery Factory Tests

3.6.1 Tenderer shall perform a capacity and service test at the manufacturing facility in accordance with IEEE Std. 1188-2005. Cells shall be pressure tested with gas to test for leakage.

3.6.2 The Owner reserves the right to witness any and all factory tests.

3.6.3 Tenderer shall submit an itemized list of factory tests to be conducted. This list shall also reference the applicable codes and standards for such tests. A copy of this list shall be forwarded for approval by the Owner before the equipment is shipped.

3.6.3 Immediately following completion of factory tests, the results shall be forwarded to the Owner for review. A copy of the final factory test results shall be included in the Instruction Manuals.

3.6.4 All test data shall clearly show individual cell performance using individual identification numbers permanently stamped into the battery posts.

3.7 Station Battery Instruction Manuals

3.7.1 All text shall be in English.

3.7.2 One (1) draft copy of the instruction manual shall be submitted to the Owner one (1) month prior to the shipping date.

SPECIFICATION

3.7/

- 3.7.3 Two (2) copies of the instruction manuals shall be supplied with each battery bank. They shall contain installation, operating, maintenance instructions and renewal parts.
- 3.7.4 All external dimensions, weights and quantities shall be given in SI units in accordance with the Canadian Metric Practice Guide-CAN3-Z234.1-00.
- 3.7.5 Without restricting the generality of the foregoing, the instruction manual shall include the following:
 - 3.7.5.1 Title of equipment and Tenderer's reference number
 - 3.7.5.2 Table of contents and list of drawings by title and number
 - 3.7.5.3 Technical performance and design data including the mass of all major components
 - 3.7.5.4 Complete instructions and drawings for installation
 - 3.7.5.5 Operating instructions, operating limits including complete sketches or drawings to illustrate
 - 3.7.5.6 Maintenance and repair instructions complete with sketches or photographs that may facilitate ease of maintenance
 - 3.7.5.7 Guide to recommended inspection frequency
 - 3.7.5.8 Renewal parts lists with Tenderer's part number suitably identified by illustration or by assembly and sub-assembly drawings, including standard part number and name of original manufacturer if available
 - 3.7.5.9 Copy of all factory tests, including any test certificates
 - 3.7.5.10 Other details specifically requested in the equipment Specification

3.8 Station Battery Technical Data Sheet

| | | |
|---|---|---|
| 1 | Number of battery banks required | 1 |
| 2 | Battery type | Sealed Valve-Regulated (VRLA) |
| 3 | Electrode | Lead Antimony or Lead Calcium |
| 4 | Delivery Date and location | 1 July 2011 In Stream Tidal Power Generating Plant FORCE Substation, Black Rock, NS |
| 5 | Nominal DC system voltage | 125V |
| 6 | Minimum battery operating voltage | 105V |
| 7 | Maximum battery operating voltage | 140V |
| 8 | Minimum Capacity per IEEE Std. 485-1983 | 100A-h @ 1.75V per cell |

SPECIFICATION

| | | |
|----|---|-------------------------|
| 9 | Temperature correction factor/18.3°C | 1.08 |
| 10 | Design margin | 1.15 |
| 11 | Aging factor | 1.25 |
| 12 | Guaranteed minimum life of battery bank | 20 years |
| 13 | Nominal operating temperature | 20°C |
| 14 | Operating temperature range | 10°C-40°C |
| 15 | Maximum floor space dimensions | 60''W x 60'' H x 36'' D |

4. 125Vdc BATTERY CHARGER

4.1 Standards

4.1.1 Unless otherwise specified herein, manufacture and test the battery charger in accordance with the latest issue of the following standards:

IEEE Std. 1188-2005 Practice for Maintenance, Testing and Replacement of Valve Regulated Lead-Acid (VRLA) Batteries for Stationary Application.

CSA C22.2 No. 107.2-01 Battery Chargers

CAN3-Z234.1-00 Metric Practice Guide

CAN3-Z299.2-85 Quality Assurance Program – Category 2

4.1.2 Apply all reference publications and amendments listed within the above standards.

4.1.3 In case of conflict between any of the publications listed above, the governing standard shall be one which requires the highest quality of work and materials and afford the highest degree of safety to personnel as interpreted by the Engineer.

4.1.4 Other alternative standards may be used if approved by the Owner's Engineer.

SPECIFICATION

4./

4.2 Design and Construction of Battery Charger

- 4.2.1 The charger will operate from a 120Vac, single-phase, or 240Vac single phase, 60 Hz power supply.
- 4.2.2 The charger shall be designed to operate in a solidly grounded 240/120Vac single phase power supply.
- 4.2.3 The charger shall meet the requirements of this Specification under the following ambient conditions:
- | | |
|----------------------|--------------|
| Ambient temperature: | 10°C to 40°C |
| Relative humidity: | 20% to 90% |
- 4.2.4 The charger shall have Temperature Compensation circuitry and come complete with a remote temperature probe.
- 4.2.5 The charger shall be equipped with a filter circuit to reduce output ripple to less than 2% RMS.
- 4.2.6 The rectifier systems and the control circuits shall be completely shielded against the effects of radio frequency interference. The unit shall not emit radio frequencies by radiation or conduction.
- 4.2.7 The charger shall return to service automatically when power is restored after a power failure.
- 4.2.8 A manual control circuit is required. This circuit shall be capable of operating the charger over the entire float and equalize range.
- 4.2.9 The charger shall be provided with an analogue or digital ammeter and voltmeter for the output current and voltage minimum accuracy of 2% of full scale.
- 4.2.10 A single pole ac circuit breaker, rated per the Canadian Electrical Code, shall protect the ac power supply feed from the new 240/120V distribution panelboard. The circuit breaker shall be sized to allow for the maximum expected inrush to the rectifier circuit transformer during energization. The circuit breaker shall be accessible from outside the cabinet.

SPECIFICATION

4.2/

- 4.2.11 A 2-pole dc circuit breaker, rated per the Canadian Electrical Code, shall protect the dc output of the charger. The circuit breaker handle shall be accessible from outside the cabinet.
- 4.2.12 The charger shall automatically shut down if the output voltage exceeds an adjustable limit.
- 4.2.13 The charger shall be equipped with a ground detector alarm circuit with adjustable sensitivity, to monitor the dc circuit.
- 4.2.14 The charger shall be equipped with a high and low dc voltage alarm circuit with automatic reset.
- 4.2.15 The charger shall have an ac failure alarm circuit.
- 4.2.16 The charger shall be equipped with a fully automatic equalize timer for manual equalize situations 0-24 hours every 28 days.
- 4.2.17 The charger shall have a dc failure alarm circuit.
- 4.2.18 The charger shall have all other design features outlined in the Data Sheets.

4.3 Battery Charger Identification

- 4.3.1 The serial and model number shall be permanently and legibly illustrated on the charger case.
- 4.3.2 The polarity shall be permanently and legibly marked on or immediately adjacent to each lead.
- 4.3.4 The year of manufacture and manufacturer's name shall be permanently and legibly marked on each charger.

4.4 Battery Charger Accessories

- 4.4.1 The charger shall be mounted in a wall-mounted cabinet.
- 4.4.2 Appropriate warning and/or caution stickers shall be provided.

SPECIFICATION

4.4/

- 4.4.3 All other mechanical hardware required to place the charger in service shall be supplied.

4.5 Battery Charger Capacity

- 4.5.1 The 125Vdc battery charger shall be designed for and be compatible with the quantity and type of batteries provided, i.e. charging voltage, charging rate per specific electrolyte and plate design.
- 4.5.2 The charger shall float, equalize or completely recharge the 125Vdc station battery in eight (8) hours while simultaneously supplying the load current.
- 4.5.3 The charger shall be designed to operate within the temperature range specified in the Data Sheets.

4.6 Battery Charger Factory Tests

- 4.6.1 The Owner reserves the right to witness any and all factory tests.
- 4.6.2 Tenderer shall submit an itemized list of factory tests to be conducted. This list shall also reference the applicable codes and standards for such tests. A copy of this list shall be forwarded to the Owner for approval before the equipment is shipped.
- 4.6.3 Immediately following completion of factory tests, the results shall be forwarded to the Owner for review. A copy of the final factory test results shall be included in the Instruction Manuals.

4.7 Battery Charger Instruction Manuals

- 4.7.1 All text shall be in English.
- 4.7.2 Two (2) copies of the manuals shall be submitted in draft form to the Engineer for review at least one month before the equipment is to be delivered.
- 4.7.3 Five (5) copies of the completed manual shall be submitted at the time the equipment is shipped. They shall contain installation, operating, maintenance instructions and renewal parts.

SPECIFICATION

4.7/

- 4.7.4 All external dimensions, weights, and quantities shall be given in SI units in accordance with the Canadian Metric Practice Guide-CAN3-Z234.1-00.
- 4.7.5 Without restricting the generality of the foregoing, the instruction manual shall include the following:
 - 4.7.5.1 Title of equipment and Tenderer's reference number
 - 4.7.5.2 Table of contents and list of drawings by title and number
 - 4.7.5.3 Technical performance and design data including the mass of all major components
 - 4.7.5.4 Complete instructions and drawings for installation
 - 4.7.5.5 Operating instructions, operating limits including complete sketches or drawings to illustrate
 - 4.7.5.6 Maintenance and repair instructions complete with sketches or photographs that may facilitate ease of maintenance
 - 4.7.5.7 Guide to recommended inspection frequency
 - 4.7.5.8 Renewal parts lists with Tenderer's part number suitably identified by illustration or by assembly and sub-assembly drawings, including standard part number and name of original manufacturer if available
 - 4.7.5.9 Copy of all factory tests, including any test certificates
 - 4.7.5.10 Any other detail specifically requested in the equipment Specification.

4.8 Battery Charger Technical Data Sheet

| | | |
|---|------------------------------------|---|
| 1 | Number of chargers required | 1 |
| 2 | Delivery Date and Location | 1 July 2011 In Stream Tidal Power Generating Plant FORCE Substation, Black Rock, NS |
| 3 | Nominal DC system voltage | 125V |
| 4 | Float voltage adjustment range | 125V-135V |
| 5 | Maximum equalize voltage | 140V |
| 6 | Maximum output ripple (rms) | 2% |
| 7 | Guaranteed minimum life of charger | 20 years |
| 8 | Nominal operating temperature | 20°C |
| 9 | Operating Temperature Range | 10°C-40°C |

SPECIFICATION

5. PACKING AND SHIPPING

- 5.1 All crating for the individual battery cells and the support rack system shall be adequately designed and constructed to permit safe delivery and acceptable receipt of the station battery components.
- 5.2 The battery charger shall be supplied fully assembled.

SPECIFICATION

SECTION C

SCHEDULES

SPECIFICATION

SCHEDULES

SPECIFICATION

SECTION C

SCHEDULES

1. INSTRUCTIONS

- 1.1 Complete and submit with the tender and schedules contained in this section.
- 1.2 Incomplete schedules may render the tender inadmissible.

SPECIFICATION

SCHEDULE No. 1

TECHNICAL INFORMATION

1. 125Vdc STATION BATTERY

| Item | Tenderer Information |
|--|-----------------------------|
| Battery type and model designation | |
| Delivery date | |
| Rated ampere-hour capacity when: a) New b) At end of life | A-h A-h |
| Rated capacity in amperes at eight-hour rate | A |
| Rated capacity in amperes at one-minute rate | A |
| Rated capacity in amperes that can be applied after discharge at eight-hour rate | A |
| A-h capacity required to meet specified duty cycle | A-h |
| Type of electrolyte | |
| Guaranteed battery life | Years |
| Recommended battery float voltage | V |
| Recommended battery equalize voltage | V |
| Typical cell impedance | Ω |
| Type of plate material | |
| Positive plate thickness | mm |
| Minimum oxygen index number of container | |
| Location of manufacturing facility | |

SPECIFICATION

SCHEDULE No. 1 (CONT'D)

TECHNICAL INFORMATION (CONT'D)

2. BATTERY CHARGER

| Item | Tenderer Information |
|---|-----------------------------|
| Charger type and model designation | |
| Nominal ac system voltage / ampere rating | Vac / Aac |
| Nominal dc system voltage / ampere rating | Vdc / Adc |
| Float voltage adjustment range | Vdc |
| Maximum equalize voltage | Vdc |
| Maximum output ripple (rms) | % |
| Guaranteed minimum life of charger | Years |
| Nominal operating temperature | °C |
| Operating Temperature Range | °C |
| Panelboard metering type and models | |
| Alarm Functions | |
| Location of manufacturing facility | |

SPECIFICATION

SCHEDULE No. 2

DOCUMENTS TO BE SUBMITTED WITH TENDER

| | <u>Drawing or Document Ref. No.</u> |
|---|--|
| Completed Schedules | _____ |
| Outline dimensions and layout of equipment and enclosures | _____ |
| Bills of Material | _____ |
| Catalogues | |
| Instruction Pamphlets | _____ |
| Certified "Type Test" Reports (including list of Type Tests to be performed) | _____ |
| List of Recommended Spare Parts (Include prices for each item) | |
| - readily available | _____ |
| - long delivery | _____ |
| List of required Special Tools | _____ |
| Bar chart progress schedule showing manufacture, delivery, issue of drawings, and all phase of the work | _____ |
| Transportation method and route (including details of trailer and wheel loading) | _____ |

SPECIFICATION

SCHEDULE No. 3

TENDERED VARIATIONS FROM THE SPECIFICATION

The Tenderer shall detail hereunder, any variations from the terms and conditions of this Specification:

Signature: _____

Date: _____

SPECIFICATION

SCHEDULE No. 4

ERECTION SUPERVISOR

State the daily rate for the provision of a qualified person to supervise the erection and commissioning of the equipment being supplied.

The daily rate shall cover all costs such as salary, subsistence, local traveling within 30 kilometres of the jobsite, communications and the supply of any special tools he/she requires to properly perform the work.

Daily Rate for Erection Supervisor: \$ _____

Also provide details of any terms and conditions applicable to each supervisor:

SPECIFICATION

SCHEDULE No. 5

COMMENCEMENT AND COMPLETION DATES

| | <u>Required Dates</u> | <u>Tendered Dates</u> |
|---|-----------------------|-----------------------|
| 1. Issue of Purchase Order | 21 April 2011 | |
| 2. Submit Bills of Material and Planning Schedule for approval. | 6 May 2011 | |
| 3. Submit assembly drawings, foundation and base plate details, layout and drilling details, wiring diagrams, control schematics, and drawings for review. | 20 May 2011 | |
| 4. Submit performance curves and other supporting documentation. | 20 May 2011 | |
| 5. Submit final copies of shop drawings | 1 June 2011 | |
| 6. Submit draft copies of Operation and Maintenance Manuals. | 1 June 2011 | |
| 7. Delivery of 125Vdc Station Battery And Charger, DDP per Incoterms to Fundy Ocean Research Center for Energy Substation Site, Black Rock, Nova Scotia (approximately 10km west of Parrsboro, Nova Scotia) | 1 July 2011 | |

SPECIFICATION

SCHEDULE No. 6

SPARE PARTS LIST

| | <u>Recommended Spare Parts</u> | <u>Quantity</u> | <u>Price (Cdn \$)</u> |
|----|---------------------------------------|------------------------|------------------------------|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |

Total Price Carried to Schedule 8: \$ _____

SPECIFICATION

SCHEDULE No. 7

ACCESSORIES AND SPECIAL TOOLS LIST

| <u>Recommended Accessories and Special Tools</u> | <u>Quantity</u> | <u>Price (Cdn \$)</u> |
|---|------------------------|------------------------------|
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |
| 5. | | |

Total Price Carried to Schedule 8: \$ _____

SPECIFICATION

SCHEDULE No. 8

PRICE LIST

| <u>Item</u> | <u>Description</u> | <u>Qty</u> | <u>Price (Cdn \$)</u> |
|--------------------|---|-------------------|------------------------------|
| 1. | Manufacture, deliver and provide a written guarantee for one (1) 125Vdc station battery bank and one (1) 125Vdc station battery charger complete with intercell battery terminal links and rack system. | lot | \$ _____ |
| 2. | Accessories and Special Tools (from Schedule No. 7) | lot | \$ _____ |
| | Total Equipment Supply (Items 1 & 2) | | \$ _____ |
| | Transportation DDP per Incoterms to Fundy Ocean Research Center for Energy Substation Site, Black Rock, Nova Scotia (approximately 10km west of Parrsboro, Nova Scotia) | lot | \$ _____ |
| | Canadian Customs Duty | lot | \$ _____ |
| | Harmonized Sales Tax (HST) | 15% | \$ _____ |
| | Total Supply & Deliver Fundy Ocean Research Center for Energy Substation Site, Black Rock, Nova Scotia | | \$ _____ |
| 3. | Tenders shall provide a separate Price for the following optional item: | | |
| | Spare Parts List (from Schedule No. 6) | lot | \$ _____ |

SPECIFICATION

SCHEDULE No. 9

FORM OF TENDER

**Item: One (1) 125Vdc Substation Battery Bank and
 One (1) 125Vdc Station Battery Charger
 complete with Intercell Battery Terminal Links and Rack System**

Vendor Ref. No.: _____

1. Total Supply and Deliver (From Schedule No. 8): **\$** _____

2. Terms of Payment: _____

3. Customs Clearance by: _____

4. Point of Shipment: _____

5. Promised Shipping Date: _____

6. INCOTERMS 2000 Definition: _____

7. Recommended Methods of Shipment: _____

8. Estimated No. of Packages: _____

 - Shipping Weight Each Package: _____

 - Shipping Dimensions Each Package: _____

9. Conditions of Guarantee: _____

10. Other: _____

Prepared by: _____

Date: _____