OCEAN ENGINEERING DIVISION
UNITED STATES COAST GUARD
WASHINGTON, D.C.

DECEMBER 1997

SPECIFICATION FOR 9X35 LR BUOY POWER DISTRIBUTION BOX AND BATTERY WIRING KIT SPECIFICATION NO. 397A

1. SCOPE.

1.1 General. This specification encompasses the requirements for the construction of a U.S. Coast Guard power distribution box with wave activated generator (WAG) controller and battery wiring kit. These components in addition to solar panels, wave activated generator, batteries and battery rack comprise the power system of the Coast Guard 9x35 LR exposed location buoy. The buoy is a large environmentally powered offshore buoy that supports various aids to navigation equipment.

1.1.1 Power Distribution Box. The power distribution box contains the WAG controller, input and output connections and power distribution for the system.

1.1.2 Wave Activated Generator (WAG) Controller. The WAG controller consist of a three-phase rectifier, a dummy load, a solid state relay, and a printed circuit card (PCB) for a combination of overcharge and overvoltage protection circuit.

1.1.3 Battery Wiring Kit. The battery wiring kit consists of four (4) interconnecting harnesses, ten (10) parallel wiring straps, two (2) terminal connecting straps, forty (40) 3/8" 316 stainless steel flat washers, twenty (20) 3/8" 316 stainless steel split ring lock washers and twenty (20) 3/8-16 316 stainless steel nuts.

1.2 Precedence. Any ambiguity or conflict between this specification and applicable documents shall be resolved by utilizing the following documents in the precedence shown:

a. The basic contract, its amendments and modifications
b. This specification
c. Drawings
d. Other applicable documents

2. APPLICABLE DOCUMENTS.

2.1 Issue Documents. The following documents in effect on the date of solicitation form part of this specification to the extent specified herein:

STANDARDS

COMMERCIAL

IPC J-STD-001	Requirements for Soldered Electrical and Electronic Assemblies

SPECIFICATIONS

MILITARY

MIL-S-83731	Switches, Toggle, Unsealed and Sealed Toggle, General Specification For

MIL-T-55164	Terminal Boards, Molded, Barrier, Screw Type
MIL-T-7928	Terminals, Lug: Splices, Conductors: Crimp Style, Copper, General Specification for
MIL-S-19622	Stuffing tubes, Nylon: General Specification

2.1.1 Modification to Government Documents. Substitute United States Coast Guard for all other Government activities referred to in any of the Government documents that form a part of this specification.

2.2 Drawings. The following United States Coast Guard drawings forms part of this specification to the extent specified herein:

G-SEC Drawing No. 140954	9x35 LR Buoy Wiring
G-EOE Drawing No. 121060	9x35 LR Battery Wiring Kit

2.3 Source of Government Documents. Any difficulty in obtaining the applicable documents should be referred to the Contracting Officer. All request for copies should include both title and identifying number for each document. All documents referenced in this specification, except drawings which are part of this specification, may be ordered from the following source:

Commanding Officer
U.S. Naval Publications and Forms Center
5801 Tabor Avenue
Philadelphia, PA 19120

3. REQUIREMENTS.

3.1 General. The power distribution box with wave activated generator (WAG) controller and battery wiring kits shall be fabricated in accordance with G-SEC Drawing Number 140954 and G-EOE Drawing Number 121060 (hereafter referred to as the drawings) and shall meet the requirements of this specification.

3.2 Parts Substitution. The contractor may propose to the Contracting Officer in writing, the substitution of parts equivalent in design, performance, quality and construction accompanied by data substantiating the claim for equivalency. The contractor shall allow the Government 30 calendar days after receipt for review and approval of such proposed substitutions prior to installation of the components. No substitutions shall be made without written approval of the Contracting Officer.

3.3 Wire. Wire in the power distribution box shall be AWG-16 stranded copper wire. Wire in the battery wiring kit shall be as specified in G-EOE Drawing Number 121060 (AWG-12 single and two conductor). Wire shall have a temperature rating of -55 degrees C to +105 degrees C and voltage rating of 600 volts.

3.3.1 Wire Color Code. Black wire shall be used for positive connections and white wire for negative connections.

3.3.2 Wiring Panel Plate. All wires shall be terminated with pre-insulated compression (crimp & solder) type connectors with firmly and completely grip the conductor and the wire insulation. Connectors shall be ring tongue type constructed of fine grade, high conductivity copper, and shall be tin plated. Connectors and tooling shall meet all requirements of MIL-T-7928.

3.3.2.1 Wiring WAG Controller. Connections within the WAG controller shall be soldered where required. All solder connections shall conform to IPC J-STD-001.

3.3.3 Wiring Battery Wiring Kit. All wires shall be terminated as shown in the drawing, connectors shall be crimped and soldered.

3.4 Terminal Boards. All terminal boards shall be MIL-CLASS Type with a current rating of 15 amps or greater and conform to MIL-T-55164.

3.4.1 Terminal Board Jumpers. All jumper connections on the terminal boards shall be made with jumpers supplied by the terminal board manufacturer.

3.5 Switch. The switch shall be a two (2) position, double pole, single throw, ON/OFF, standard lever, sealed toggle switch with screw lug terminals. The switch shall have a minimum contact rating of 15 amps at 28VDC and conform to MIL-S-83731.

3.5.1 Switch Mounting Bracket. The switch mounting bracket shall be made of 16 gauge, #316 stainless steel and shall be fastened to the panel plate with four (4) 6-32 screws as shown in the drawings.

3.6 Mounting of Components. All components shall be mounted on the front of the panel plate using #316 stainless steel threaded inserts and lock and flat washers; this will allow the replacement of components without removing the panel plate.

3.7 Stuffing Tubes. Stuffing tubes shall provide a water-tight seal for the power distribution box, and conform to all requirements of MIL-S-19622. The packing glands for the stuffing tubes shall provide a water-tight seal for the following size cables:

a. Solar panel cable - .125 - .250 inch diameter
b. Wave activated generator - .558 inch diameter
c. Cable to battery pocket - .599 inch diameter

Straight nylon, panel mount styles stuffing tubes with an O-ring seal (M19622/1-001 with a M19622/16-0005 packing for solar panel cables, and M19622/1-005 with a M19622/19-0004 or M19622/19-0005 packing for the larger size cables) shall be used.

3.8 Input and Output Connections. All input and output terminal boards shall be equipped with additional spade tongue type terminal lugs for connecting the input and output cables. Lugs shall be sized for AWG-12 wire and 6-32 or 8-32 screws whichever is appropriate.

3.9 Dummy Load Resistor. The dummy load resistor (R-1) shall be attached using #316 stainless steel screws to the inside top of the power distribution box and shall not interfere with the installation or removal of the panel plate or any of the components mounted on the panel plate. To assure maximum heat transfer electrical heat sink compound shall be used between the contact surface of the resistor and the box. See the drawings.

3.10 Box. The power distribution box shall be a NEMA-4X type, #316 stainless steel, 12x16x6 inches. It shall be equipped with an internal panel and shall be completely water-tight. All screws, stuffing tubes, etc. Shall be sealed with O-rings or gaskets to assure complete water-tightness of the box.

3.11 WAG Controller. The printed circuit board (PCB) shall be fabricated according to Drawing 140954, Sheet 2, and fit inside the Compac case (item 19 of Drawing 140954). The PCB can be attached to the solid state relay as part of the circuit. The WAG controller is designed as a self-contained, replaceable unit.

3.12 Test Point Receptacle. A female receptacle shall be added to the back of the box as specified in G-SEC Drawing No. 140954. The receptacle shall be installed with the specified gaskets to ensure a water resistant seal. Captivated cap and chain assemblies, its mounting plate and screws shall be #316 stainless steel. They are used to protect the receptacle from water intrusion and corrosion.

3.13 Hardware. All hardware, screws, nuts, bolts, washers, etc. shall be #316 stainless steel.

3.14 Labeling. All terminals, terminal boards, strips and blocks shall be marked in a clear and permanent manner so as to identify individual terminals using a screen printing or engraving method. All markings shall remain clearly visible even after all components are installed on the mounting panel.

3.14.1 Labeling of Panel. The input and output terminals shall be labeled as follows:

a. Solar panel input terminal boards item #20 - “Solar Panel -1” “Solar Panel -2” “Solar Panel -3” “Solar Panel -4”
b. Wave activated generator input terminal item #21 - “Wave generator”
c. Battery power input terminal item #24 lower left side terminal board - “Battery” “+” “-“
d. Switch leg output terminal item #24 upper left side terminal board - “Switch Leg”

3.14.2 Labeling of Switch. The power ON/OFF switch shall be labeled as follows: “System Power”. In addition the ON/OFF positions shall be appropriately labeled as shown in the drawings.

3.14.3 Labeling of WAG Controller. The input and output connections of the WAG controller shall be labeled as follows:

a. Wave activated generator input item #26 - "WAG Input"
b. Dummy load terminal board item #25 - "Dummy Load"
c. Output terminal board item #26 - "+" and "-" and "TP" as appropriate.

4. QUALITY ASSURANCE PROVISIONS.

4.1 General. The Contractor shall maintain an inspection system which shall insure that each item offered to the Coast Guard for acceptance or approval conforms to contract requirements. The inspection system shall be documented and available for review by the Contracting Officer.

4.1.1 Records. The Contractor shall maintain records of all inspections and tests. The records shall indicate the nature and number of observations made, the number and type of deficiencies found and the corrective action taken.

4.1.2. Contractor's Calibration System. The contractor shall maintain a calibration and maintenance system to control the accuracy of measurement and test equipment used in the fulfillment of this contract. The system shall include, as a minimum, prescribed calibration intervals, source of calibration and a monitoring system to insure adherence to calibration schedules. Objective evidence of conformance to this paragraph shall be readily available to the Coast Guard Inspector.

4.1.3 Responsibility for Inspection and Testing. Unless otherwise specified, the Contractor is responsible for performance of all quality assurance, inspection and testing requirements as specified herein. Except as otherwise specified, the Contractor may utilize his own as well as any other inspection and testing facilities and services acceptable to the Coast Guard Contracting Officer. The Coast Guard reserves the right to verify or have performed any of the inspections and tests set forth in this specification where the inspections and tests are deemed necessary to assure supplies and services conform to prescribed requirements. The Contractor shall notify the Contracting Officer in writing in 15 days prior to the scheduled commencement of any test required by this specification.

4.2 Quality Conformance Inspections. An inspection for quality conformance shall be made on each WAG controller, battery wiring kit and power distribution box shall be inspected and tested to verify that construction is in accordance with the applicable requirements set forth herein. The Contractor shall provide certification to the Coast Guard that these inspections and tests were performed prior to Coast Guard acceptance. The following inspections and tests are the minimum required and are not intended to supplant any examinations, inspections or tests normally employed by the Contractor to assure the quality of the equipment:

a. Visual - section 4.2.2
b. Functional Test - section 4.2.3

4.2.1 Failure Responsibility. If any WAG controller, battery wiring kit or power distribution box fails to pass any inspection or test required by this specification, the Contractor shall take corrective action on the materials or process, or both as warranted, on all items which were similarly manufactured and which are subject to the same cause of failure. Inspection and testing shall be discontinued until all corrective action has been taken. After all corrective action has been taken, the inspections shall be continued or repeated, depending upon the reason for which the inspection or test was interrupted, at the option of the Coast Guard. Acceptance shall be withheld until reinspection or retesting has shown that the corrective action was successful and the equipment satisfactorily passes all inspections and tests.

4.2.2 Visual Inspection. All deliverables shall be examined where applicable to ensure compliance with the requirements listed below:

a. Construction (3.1)
b. Wiring (3.3)
c. Terminal Boards (3.4)
d. Switch (3.5)
e. Component Mounting (3.6)
f. Stuffing Tubes (3.7)
g. Box (3.10)
h. Test Point Receptacle (3.11)
i. Labeling (3.13)

4.2.3 Functional Test. Each WAG controller and power distribution box shall be tested to ensure proper operation prior to delivery to the Coast Guard. Each WAG controller and power distribution box must pass the following applicable tests before acceptance.

4.3 Functional Test Power Distribution Box.

4.3.1 Equipment Required.

a. Discharging device (3 ohm, 250 watt resistor is suitable).
b. 100 amp hour lead acid, 12 volt battery.
c. 3 phase, 15 volt AC power source current limited to 8 amps.
d. 12 volt lamp
e. Bi-directional, DC ammeter 10-0-10 amps full scale. (M-1)
f. DC voltmeter, 0-20 volts full scale. (M-3)
g. 20 volt (6 amp) DC power supply current limited to 4 amps.

4.4 Test Procedure.

1. Connect the AC power source to the wave generator input terminals in the power distribution box.
2. Connect the 12 volt lamp across the dummy load in the power distribution box.

3. Connect the negative terminal of the lead acid battery to the negative battery terminal in the power distribution box.
4. Connect the bi-directional DC ammeter (M-1) between the positive terminal of the lead acid battery and one side of the switch leg terminal in the power distribution box.
5. Connect the positive battery terminal in the power distribution box to the remaining switch leg terminal in the power distribution box.
6. Connect a DC voltmeter (M-3) across the positive and negative terminals of the battery.
7. Short all the WAG input terminals together. Turn the system power switch in the power distribution box to the ON position. There shall be no current flow from the battery to the distribution box (M-1). Remove the short.
8. Turn off the system power switch. Using the discharging device (A) discharge the battery until the voltage is approximately 12.5 $\pm$ .2 volts (M-3).
9. Remove the discharging device (A).
10. Connect the 12 volt DC power supply to the solar panel #1 terminal (protect power supply with appropriate size diode).
11. Energize the DC power supply and the system power switch. The battery should start to charge (M-1).
12. Turn off the system power switch and the DC power supply.
13. Repeat steps 10 through 12 for solar panels #2, #3 and #4.
14. Turn on the AC power source and the system power switch. Allow the battery to charge. When the voltage reaches 14.2 $\pm$ .3 volts relay K-1 should close, shunting current through the dummy load, turning on the lamp.
15. Reconnect the discharging device (A) to the battery. The battery should start to discharge. When the battery voltage reaches 13 $\pm$ .3 volts (M-3), relay K-1 should open (lamp off) and the battery should start to charge (M-1).
16. Disconnect the discharging device (A) and repeat steps 14 and 15.
17. If readings are NOT within specified ranges, adjust potentiometer R1 (a small, rectangular, blue box with a screw) and repeat steps 15 through 17. The potentiometer will raise or lower the setpoints. Small increments (1/8 of a turn) will change the voltage by about 0.1 volt. The "voltage window" is set by a precision resistor in the circuit. Clockwise adjustment of R1 will connect the dummy load at a higher voltage. Clockwise raises the setpoint and counterclockwise lowers it.

5. Preparation for Delivery.

5.1 Marking. Each Power Distribution Box and Battery Wiring Kit shall be marked for shipment in accordance with commercial standards. Each Power Distribution Box or Battery Wiring Kit shall be marked with at least the following information:

1. Power Distribution Box (or Battery Wiring Kit);
2. One each;
3. Contract Number (to be provided to contractor upon award of contract);
4. NSN: 6110-01-356-2578 (or 6150-01-355-8165 for Battery Wiring Kit).

5.2 Packing. The contractor shall preserve, pack, and package in such a way to ensure complete delivery at destination without damage or deterioration of the supplies due to the hazards of shipping, handling or storage. Standard commercial preservation, packing, and packaging practices shall be employed to satisfy this requirement. Each power distribution box and battery wiring kit are to be packed and shipped separately.

5.3 Material Inspection and Receiving Report (Form DD-250). A form DD-250 shall be used as Certification of Production Quality Assurance (PQA), packing list, and certification of acceptance. A separate DD-250 shall be prepared by the Contractor for each shipping lot. Upon the completion of successful testing of each power distribution box, the Contracting Officer's Technical Representative (COTR) will certify PQA. The certification is authorization for the Contractor to ship the lot as required by the contract. One (1) copy of the signed DD-250 shall be given to the COTR. One (1) copy shall be included with each shipping list and one (1) copy shall be forwarded to the Contracting Officer.

6. Note. All correspondence, except as otherwise specified, shall be directed to the Contracting Officer.

SPECIFICATION FOR 9X35 LR BUOY POWER DISTRIBUTION BOX AND BATTERY WIRING KIT

SPECIFICATION NO. 397A

DECEMBER 1997

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