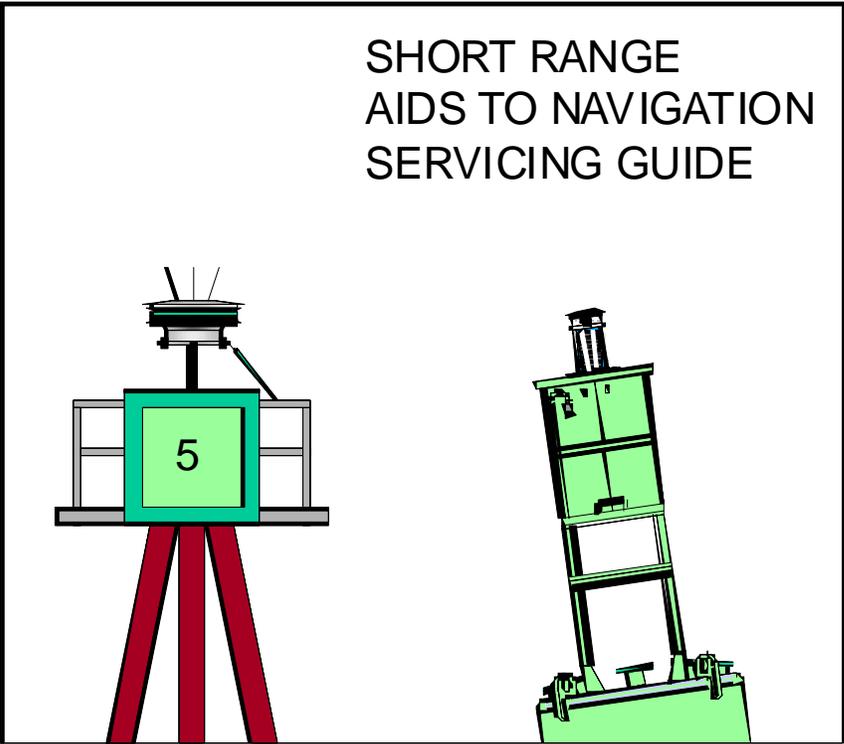


U. S. DEPARTMENT  
OF HOMELAND SECURITY

**UNITED STATES  
COAST GUARD**



COMDTINST M16500.19C

## FOREWARD

The Short Range Aids to Navigation Servicing Guide was prepared by the Ocean Engineering Division (Commandant (CG-432A)) with assistance from the National Aids to Navigation School. Its purpose is to provide a "field" manual for the servicing of the short range aids to navigation system of the United States by U.S. Coast Guard personnel. It should be closely adhered to by servicing personnel unless changed by subsequent guidance.

This servicing guide is intended only for the internal guidance of U.S. Coast Guard personnel. It creates no duties or obligations to the public to comply with the procedures described herein. The U.S. Coast Guard retains the discretion to deviate or authorize deviation from these procedures.

**Mariner Expectations:** The mariner expects each aid to navigation encountered will be operating in accordance with the Light List description. It's a matter of navigation safety, of legal necessity and of professional and personal pride to properly inspect, service and maintain all assigned Aids to Navigation.

**CICA Disclaimer:** Although equipment references employ make and model nomenclature, all acquisitions of ATON equipment comply with the requirements of the Competition in Contracting Act, 10 U.S.C. § 2304.



COMDTINST M16500.19C  
APRIL 18, 2011

COMMANDANT INSTRUCTION M16500.19C

Subj: SHORT RANGE AIDS TO NAVIGATION SERVICING GUIDE

1. PURPOSE. This Manual is a field guide for U.S. Coast Guard personnel who service minor aids to navigation hardware powered by direct current (DC).
2. ACTION. All Coast Guard unit commanders, commanding officers, officers-in-charge, deputy/assistant commandants, and chiefs of headquarters staff elements shall comply with the provisions of this Manual. Internet release is authorized.
3. DIRECTIVES AFFECTED. Short Range Aids to Navigation Servicing Guide, COMDTINST M16500.19B is hereby canceled.
4. DISCUSSION. This Manual provides field units with a pocket-sized guide for installing, maintaining and troubleshooting DC powered minor aids to navigation. Changes from the previous issue include the addition/deletion of Light Emitting Diode (LED) lanterns and updated wiring schematics and flowcharts.
5. CHANGES. Recommendations for the improvement of this Manual shall be submitted to Commandant (CG-432A) at jon.t.grasson@uscg.mil.
6. ENVIRONMENTAL ASPECT AND IMPACT CONSIDERATIONS. Environmental considerations were examined in the development of this Manual and have been determined to be not applicable.
7. FORMS/REPORTS. None.

T. P. OSTEBOS/  
Assistant Commandant for Engineering and Logistics

DISTRIBUTION – SDL No. 158

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## CHAPTER 1. GENERAL

- A. Introduction. This guide provides servicing personnel the information needed to install, maintain and troubleshoot 12-volt minor aids to navigation.
1. Personnel using this guide are expected to have completed at least the Basic Minor Aids to Navigation Course at the National Aids to Navigation School or instruction by a district training team.
  2. The following three chapters provide information on: Power, Signals and Hardware. Consult with the appropriate sections when ***installing, maintaining*** or ***troubleshooting*** hardware.
- B. Maintenance. Aids to navigation must be properly maintained to ensure proper performance. The team leader must identify what equipment is used at the aid and what service is required. Each chapter details each piece of equipment and what maintenance is required. In general, most minor aids consist of a single solar panel, one or more secondary batteries, a lantern and associated hardware. These aids will have the following *maintenance* performed either annually, biennially or triennially, depending on its scheduled visit:

Solar Panel - *Visual inspection, clean;*  
Secondary Batteries - *Visual inspection, load test;*  
Power Cable - *Visual inspection;*  
Lantern - *Visual inspection, clean;*  
Minor Aid Hardware - *Relamp, minor aid quick check.*  
Self-Contained LED Lanterns - *Visual inspection, clean.*

Aids with self contained lanterns require less maintenance. Other aids will require more detailed maintenance. Consult with all the sections in this guide that apply.

C. Configurations.

1. Minor Aids. With the addition of the appropriate lantern, the components shown in Figure 1-1 are used on buoys, structures and nighttime ranges with single lights. Rotating beacons and high intensity nighttime ranges will have the same lighting equipment; however larger batteries and more solar panels may be used.

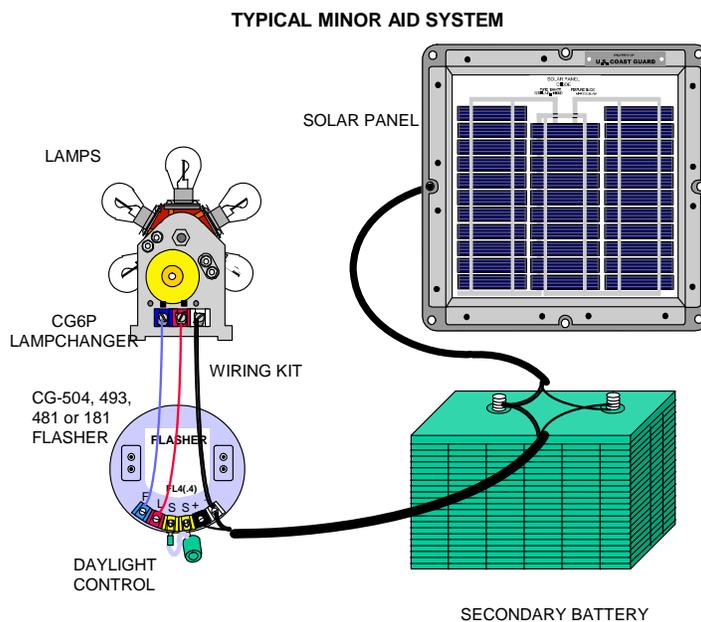


Figure 1-1

In most cases, these components can be replaced by a self contained LED lantern. Other sites may have a LED lantern in place of the lampchanger and flasher, and retain the legacy solar power system.

2. Day/Night Ranges. Day/night ranges generally use more power than a typical minor aid. Multiple solar panels are terminated into a Local Terminal Box (LTB). Overcharge protection, disconnects and low voltage cutoff are provided by the Range Power Box (RPB). Batteries are multiple 2-volt cells wired in series (Exide Classic, Absolyte II, Dryfit) or, for small systems, up to 4 minor aid batteries wired in parallel. The Range Switch Box (RSB) controls which light (day or night) operates. With the exception of the day/night lanterns, the power and control system is shown in Figure 1-2.

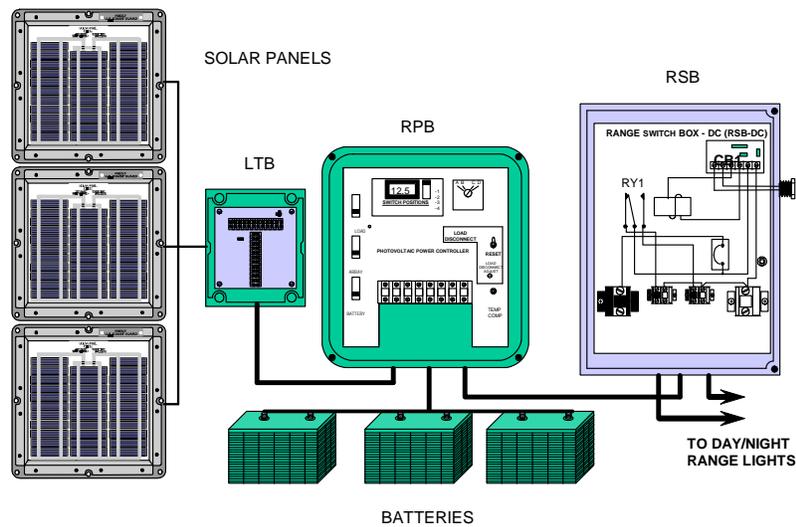


Figure 1-2

The RPB may also be used at a solar powered lighthouse with relatively small system loads (small wattage lamps or high intensity LED lanterns). With exception to the RSB-DC, the layout depicted in Figure 1-2 is the same.

D. Safety Requirements. The following shall be worn and performed at the aid site:

1. Hard hats, safety toe boots, gloves and eye protection.
2. Coast Guard Approved PFD, as required.
3. Personal fall protection equipment, as required by the Aids to Navigation Manual – Structures, COMDTINST M16500.25 (series).
4. Equipment shall be deenergized (when possible) while installing or replacing components.

E. Wire Color Coding. Wires are color-coded and shall be installed such that BLACK is "Positive (+)" (12VDC) and WHITE is "Negative (-)" (0 VDC). Some lanterns use the European color coding; BROWN is Positive (+) and BLUE is Negative (-).

F. Equipment.

1. The following equipment shall be carried to the aid site:
  - a. Fluke 77 meter or equivalent.
  - b. Small and medium tipped flathead screwdrivers.
  - c. Small and medium tipped Phillips screwdrivers.
  - d. Needle nose pliers.
  - e. 12 AWG, 10" jumper wire, and 6 feet of 12/2 SO cable.
  - f. Crimping tool (see Technical Data Sheet TD-10-02).
  - g. Solderless terminal assortment.
  - h. Crescent wrench.
  - i. 9" torpedo level.
  - j. Flashlight.
  - k. Stainless hardware assortment.
  - l. Focus fixture.
  - m. Glass cleaner.
  - n. Medicinal swabs or denatured alcohol.

- o. Clean rags.
  - p. Daylight Control Cover (wire nut, Ideal Mfg #30-415).
  - q. Splash proof apron (also used for solar panel test).
  - r. No-ox grease (all batteries).
  - s. Stopwatch.
  - t. Small paper clip (to clean drain holes).
  - u. LED lantern programmer (for installed lantern)
2. The following equipment, where appropriate, shall be carried to the aid:
- a. Lampchanger (CG-6P or CG-6PHW).
  - b. Flasher (CG-181, CG-493, CG-481 or CG-504).
  - c. Daylight control (Type L, C or R).
  - d. Lantern accessories (screws, stuffing tubes, etc.)
  - e. Lamps.
  - f. Spare LED lantern (appropriate type).
  - g. Spare Parts Kits (Lighthouse, Range, VRB-25).
  - h. 5/32", 1/4" drive hex bit socket, 18" extension, "T" handle, 5/64" Allen wrench and 7/16" open end wrench to service the VRB-25.
  - i. Torque wrench & socket set (stationary batteries).
  - j. Cordless drill & hole saw (stuffing tubes in RPB, etc.)
  - k. Distilled water (stationary batteries).
  - l. Baking soda & bucket (stationary batteries).
  - m. Bristle brush (stationary batteries).
  - n. Denatured alcohol (stationary batteries).
  - o. 12 AWG and 18 AWG wires (see VRB section).
- G. Stuffing Tubes. Stuffing tubes shall be installed in all AtoN equipment when the wire or cable passes through a bulkhead. It provides strain relief for the connections inside the apparatus and maintains weather tight protection from the environment. A drip loop of wire just outside of the stuffing tube prevents excess water from following the wire into the bulkhead. Technical Data Sheet TD-05-02 on <http://www.uscg.mil/hq/cg4/cg432/products.asp> describes stuffing tubes in detail.

1. Inspection. Replace the stuffing tube if cracked or deteriorated.
2. To prevent twisting of the packing, assemble stuffing tubes as shown in Figure 1-3. Note the difference between a bulkhead stuffing tube (hole with no threads) and a NPT stuffing tube.
3. Be sure wire is arranged to provide a drip loop.

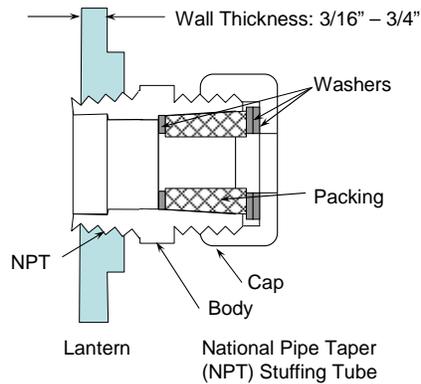
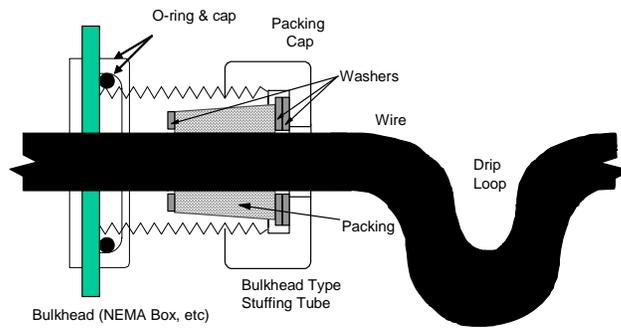


Figure 1-3

## CHAPTER 2. POWER SYSTEMS

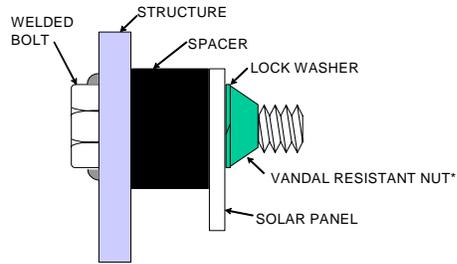
### A. Solar Panels.



1. Notes. Solar panels are used on most minor aids to navigation to charge batteries that operate the light. Depending on the power requirements of the aid, a 10, 20 or 40 watt solar panel will be used. Some minor aids may use multiple solar panels mounted on an array, or around the superstructure or lantern stand of a buoy.

2. Installation.

- a. Solar Power Installation Kits, available from SFLC Baltimore, are used to isolate and protect the solar panel from the mounting frame. The kits contain plastic bushings, stainless steel hardware, zip ties, bird springs and stuffing tubes.
- b. Solar panels mounted on structures must face the equator.
- c. The tilt angle of the array may depend on the specific project. Otherwise, minor aid structures have a tilt angle with respect to horizontal of 60 degrees in CONUS, 75 degrees in Alaska, and 30 degrees in Hawaii, Guam and Puerto Rico. Tilt angles on buoys are 0 degrees (single flat mount above lantern), 60 degrees (tripod), 90 degrees (dual or quad mount on superstructure), or 15 or 45 degrees (dual mount).
- d. Mount the solar panel to the array stand using stainless steel hardware and isolation spacers as shown in Figure 2-1. Vandal resistant nuts should be used in areas that have a history of theft. The nut is installed on a welded bolt and torqued until the hex head breaks off leaving a conical fastener that is difficult to remove.



\* USE A STANDARD NUT ON BOLTS NOT WELDED TO STRUCTURE

Figure 2-1

- e. Measure the tilt angle of solar panels, as shown in Figure 2-2 when installed on structures, and adjust if necessary.

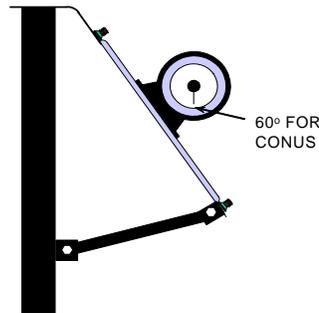


Figure 2-2

- f. The solar panel may be wired at the flasher, LED junction box or battery, as shown in Figure 2-3 whichever is convenient.

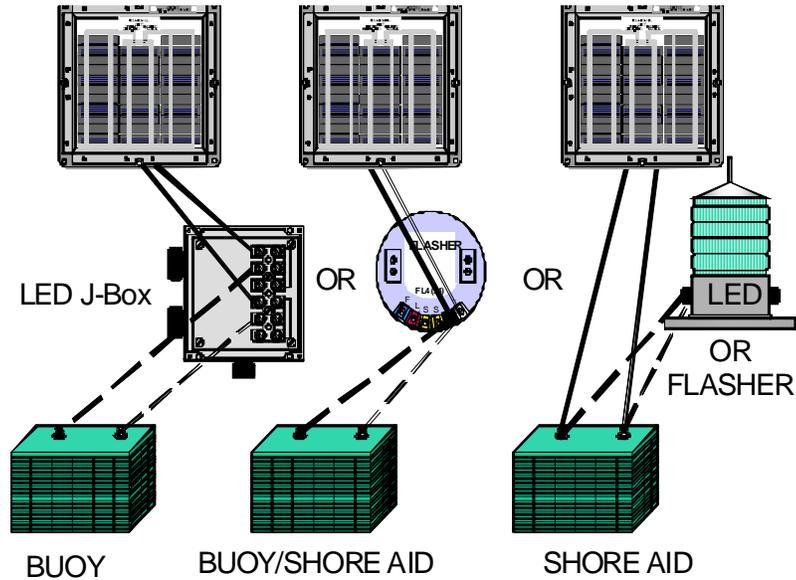
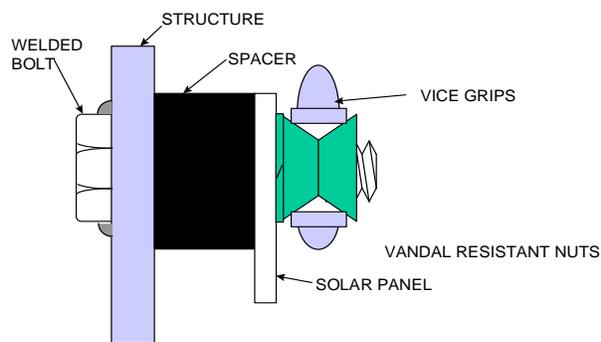


Figure 2-3

- g. If wired to the flasher, install the stuffing tube in an unused threaded entrance in the lantern. Do not try to install two wires in one stuffing tube.
- h. Secure solar panel cable to structure using zip ties. Do not shorten this cable (the panel may be used at another site).
- i. Areas of high bird fouling may install bird deterrent devices like bird springs or Nixalite ([www.nixalite.com](http://www.nixalite.com)) on the top row of mounting bolts by screwing the compressed end of the spring on a stud. Bend springs up when mounted on structures to prevent shadowing.

3. Maintenance. Perform the following procedures during every visit.
  - a. Check to be sure that tilt angle is properly set for aid.
  - b. Check panel orientation – Northern hemisphere: panels face due south.
  - c. Check solar panel for evidence of water intrusion (around edges of glass). Discoloration of the solar cells and potting are typical signs of water intrusion. Replace if necessary.
  - d. Inspect wiring for cuts and abrasions. Replace panel if necessary. Panel wires are not field replaceable.
  - e. Clean solar panel with glass cleaner.
  - f. To remove vandal nuts, screw a *used* vandal nut onto bolt and remove both with vice grips, as shown in Figure 2-4.



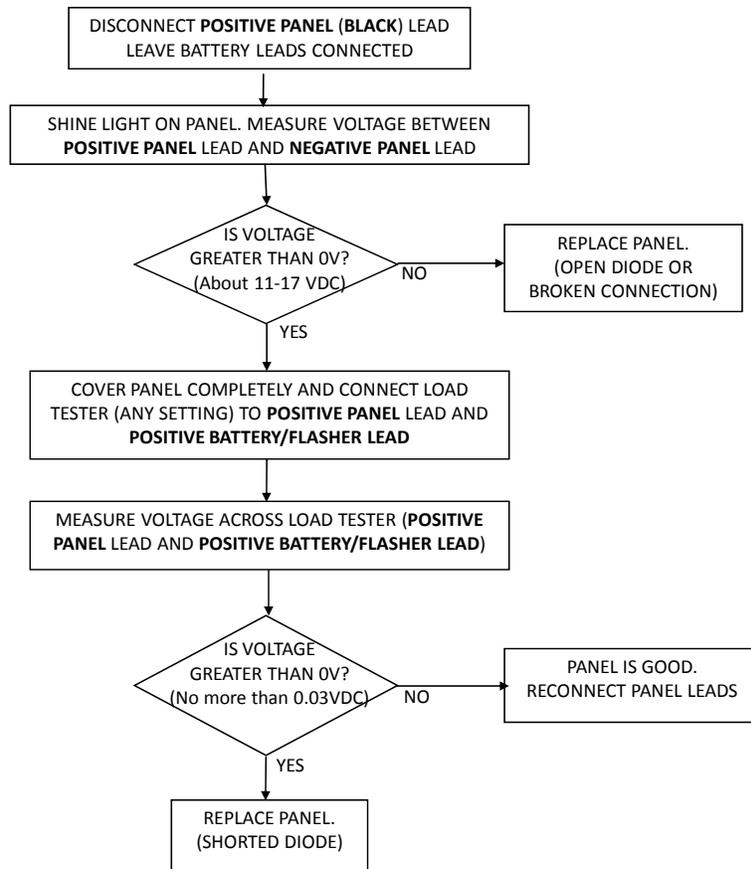
VANDAL NUT REMOVAL PROCEDURE

Figure 2-4

4. Troubleshooting Procedures. If the aid is discrepant or the battery fails the load test, perform the maintenance procedures outlined in section 3 and the following tests:

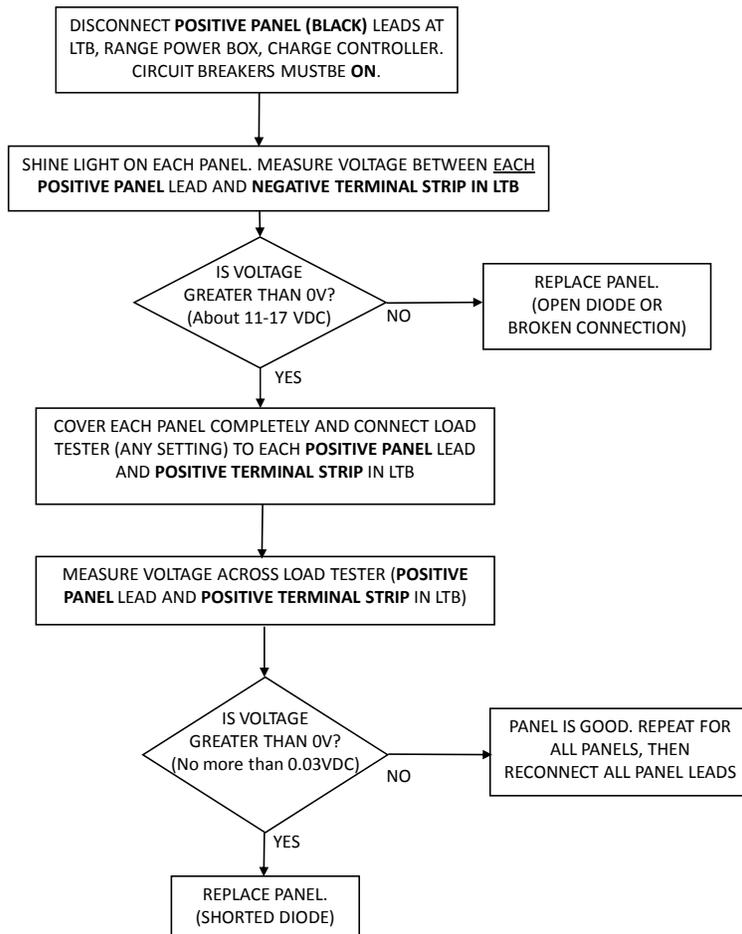
a. Power output/diode test:

SOLAR PANEL SERVICING FLOWCHART

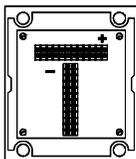


- b. If the aid has multiple solar panels or uses a Local Terminal Box, perform the following procedure:

MULTIPLE SOLAR PANEL SERVICING FLOWCHART



## B. Local Terminal Box (LTB).



1. Notes. Local Terminal Boxes (LTBs) are used on fixed aids to navigation requiring multiple solar panels. The LTB provides a convenient place to terminate the panels and step-up to a larger wire size. Up to ten solar panels may be terminated in one LTB.

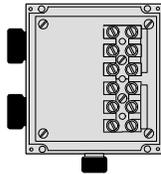
There is a version of the Local Terminal Box with diodes for use with high density solar panels which do not contain blocking diodes. This version is designated LTB-D and has an additional vertical terminal strip with diodes installed across the terminal strips. LTBs are available from Commandant (CG-432A).

2. Installation.
  - a. The LTB is installed on the solar array structure so that the solar panel leads do not have to be extended.
  - b. Install the appropriate number of stuffing tubes in the box using a hole saw or knockout punch. See TDS 05-02 at <http://www.uscg.mil/hq/cg4/cg432/> for diameters. Do not install stuffing tubes on top of the box where rainwater can collect.
  - c. Route each solar panel lead through a stuffing tube. Leave enough slack inside the box to allow attachment to the terminal strip.
  - d. Attach the provided ring lugs (or substitute locking spade lugs) to the solar panel leads.
  - e. Attach the **black** lead to the “+” terminal strip and the **white** lead to the “-“ terminal strip. Be sure that the leads are connected to the strip opposite the jumpers.

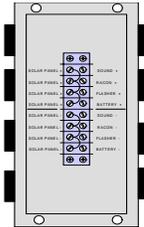
- f. Wire up to 6 AWG may be installed between the LTB and Battery/Range Power Box. Consult with your District or Civil Engineering Unit for assistance in choosing the correct wire size. Failure to install adequate wiring will result in excessive voltage drop in the charging system.
- 3. Maintenance. Inspect terminations for corrosion. Clean or replace if necessary. Lugs may be moved to unused terminals if necessary. Replace desiccant bag if saturated (if used).
- 4. Troubleshooting Procedures.
  - a. Consult with the Multiple Solar Panel Servicing Flowchart in section 2.A.4.b.
  - b. For LTB-D, the positive solar panel leads may be disconnected and each diode checked using the “Diode Test” feature on your Fluke 77 or equivalent.

### C. Junction Boxes (Buoy and LED).

#### 1. Notes.



- a. The LED Junction Box is used on buoys where a self-contained LED lantern is not viable, but a conventional LED lantern can be used. Conventional LED lanterns do not have provisions to terminate the solar panel, so an external junction box is used.



- b. The Buoy Mounted Junction Box is a larger version of the LED junction box and can be used on buoys with conventional lanterns and LED lanterns that require an external power source. The box has provisions to connect up to 4 solar panels, a bank of batteries, lantern, sound signal and racon.

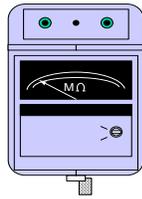
#### 1. Installation.

- a. The boxes contain templates for drilling holes in the radar reflector on a buoy. The preferred location is under the closed portion of the radar reflector with the stuffing tubes facing down or out to either side. The vent must be facing down or to the side; never up. Alternatively, the box may be mounted next to the lantern on top of the radar reflector, but water intrusion may be a problem at this location.
- b. Stuffing tubes are sized for standard solar panel cables and 12/2 SO cable. If a different packing is needed, consult TD-05-02 at <http://www.uscg.mil/hq/cg4/cg432/products.asp> for the proper size. Packings must be tight to prevent water intrusion. Packing plugs are provided for unused stuffing tubes.
- c. Route each lead through a stuffing tube. Leave enough

slack inside the box to allow attachment to the terminal strip.

- d. Attach the provided locking spade lugs to the leads, except when using the LED junction box. The bare wire is inserted in the Eurostrip terminal block.
  - e. Attach the **black** lead to the “+” terminal strip and the **white** lead to the “-” terminal strip.
  - f. Place desiccant bag inside box prior to securing cover.
3. Maintenance. Inspect terminations for corrosion. Clean or replace if necessary. Lugs may be moved to unused terminals if necessary. Replace desiccant bag when servicing.
4. Troubleshooting Procedures. None

D. Megohmmeter (Megger) or Insulation Tester.



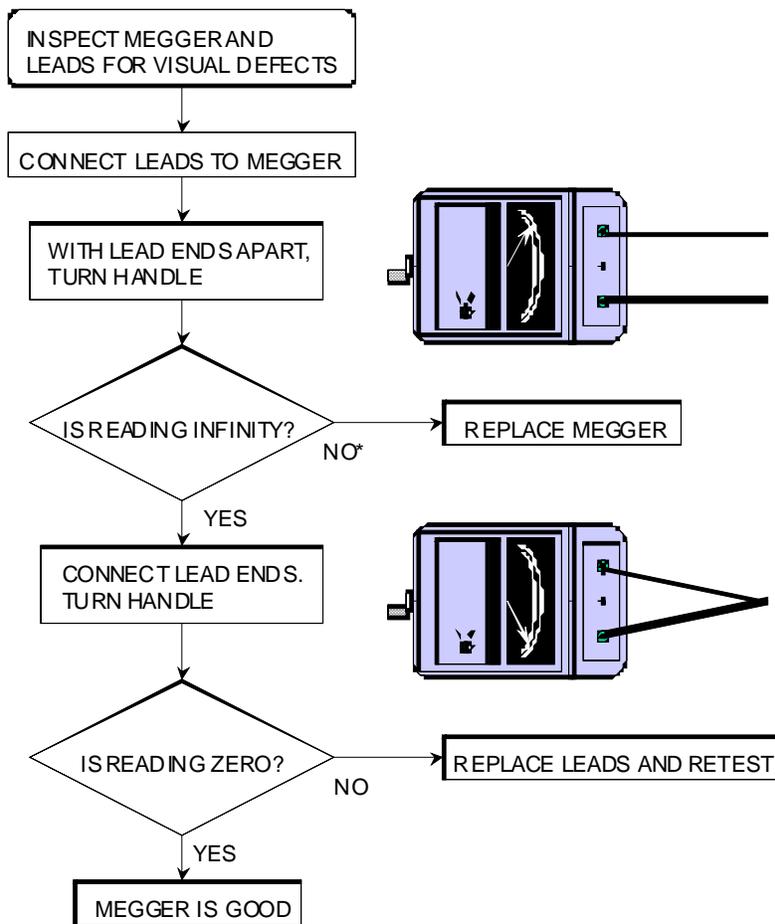
1. Notes. The Megger is used to inspect power cables used on fixed and floating aids to navigation. This generator develops 500 volts DC to check for damaged conductors and insulation. The older, hand cranked version is slowly being replaced by the versatile Fluke 1577 or 1587 multipurpose VOM and insulation tester. On the Fluke 1577/1587, pay careful attention to the letter “M” in the display. This indicates that the reading is greater than 1 megohm. Lack of this letter indicates a reading under 1 megohm. Use the 500 volt setting for all tests as the insulation is generally rated at 600 volts.

2. Safety.

- a. This device will produce 500 volts DC. Be sure equipment (flashers, battery, etc.) is disconnected from the cable being tested otherwise damage may occur.
- b. Be sure personnel are clear of cable being tested. While the current generated is not lethal, the shock can be unpleasant.

3. Equipment Test. The megger should be tested as described below prior to use to ensure that it is functioning correctly.

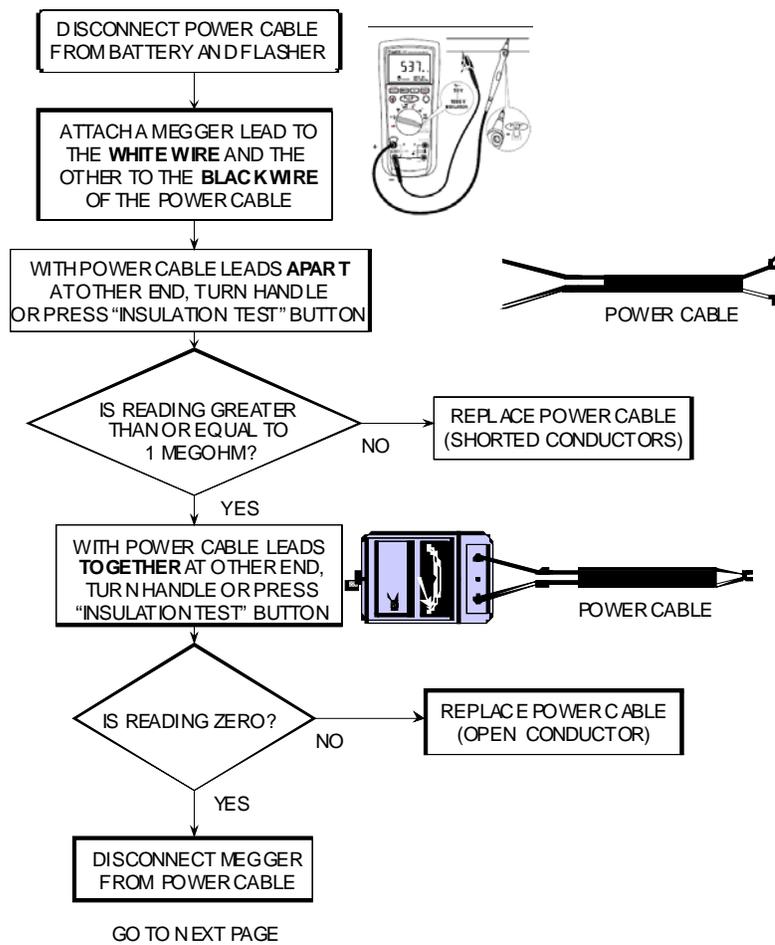
### MEGOHMETER EQUIPMENT TEST



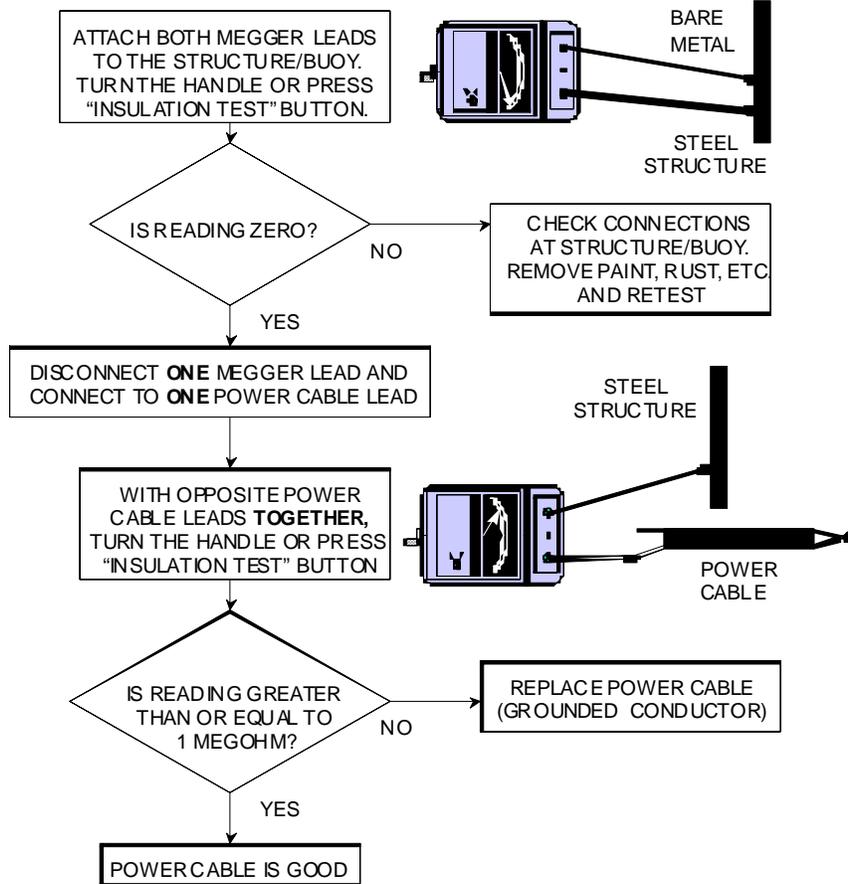
\*DIGITAL INSULATION TESTERS LIKE THE FLUKE 1577/1587 WILL NOT READ INFINITY. THE VALUE WILL BE IN THE MEGOHM RANGE, WHICH IS ACCEPTABLE.

4. Troubleshooting an Aid. Perform the following test on SO power cable when troubleshooting an aid because of a discrepancy.

### POWER CABLE MEGOHMMETER TEST



### POWER CABLE MEGOHMMETER TEST (CONTINUED)



## E. 12 Volt Secondary Batteries.

### 1. Notes.



- a. 12 volt secondary batteries are used to power solar powered aids to navigation. The solar panel(s) recharge the battery during the daytime and the battery operates the load at night. Secondary batteries are also used as Hot Packs.
- b. Three sizes of batteries are used: for minor aid aids, like the Delco-2000 pictured, large stationary batteries used at some day/night ranges and lighthouses (Section F) and small batteries used in self-contained LED lanterns (see each lantern section).
- c. Three types of batteries are available: Wet, absorbed and gelled electrolyte. Each has advantages and disadvantages. A complete listing of the types, their use and sources of supply is provided in the Solar Design Manual, COMDTINST M16500.24 (series).
- d. All aids to navigation batteries must be disposed of in accordance with the Hazardous Waste Management Manual, COMDTINST M16478.1 (series). Chapter 7 of the manual gives instructions for disposal of various types of batteries used by Coast Guard units. If any questions should arise about appropriate disposal procedures, contact the Hazardous Waste Disposal Manager at your nearest Civil Engineering Unit (CEU) or the Environmental Management Division at Commandant (CG-49).

### 2. Safety.

- a. Secondary lead-acid batteries contain electrolyte (dilute sulfuric acid). Wear chemical goggles and rubber gloves

when handling batteries. If electrolyte comes into contact with the skin, wash immediately with water. If electrolyte comes into contact with the eyes, flush with water for 15 minutes and consult a physician immediately.

- b. Secondary batteries may vent hydrogen when charging. Allow the battery pocket, battery box or battery enclosure to air out for 5 minutes before entering or servicing battery.
- c. Secondary batteries are a source of virtually unlimited current. The battery should be the last connection made at an aid. Do not allow "+" and "-" wires to touch as the current is high enough to melt wiring, possibly damage the battery or cause personal injury.

3. Installation.

- a. Batteries shall be charged no more than two months prior to installation. Multiple battery installations shall be of the same type (i.e., Delco, Sunlyte, etc.) and preferably with the same date code. All batteries shall be load tested prior to installation (section 5.a.).
- b. Batteries must be installed in a battery pocket or battery box on buoys, in a battery box or indoors on fixed structures. Use 10/2 or 12/2 SO cable (or larger wire as specified by your District) between the battery and load. Wires are terminated at the battery using ring lug terminals. **Bare wires shall not be wrapped around the battery terminals.**
- c. Fixed aid installations are limited to 4 minor aid batteries in parallel, otherwise six 2 volt Classic, Absolyte IIP or Sonnenschein stationary batteries shall be used (Section E). Buoy installations may use up to 10 minor aid batteries in parallel.

- d. Multiple battery installations are wired in parallel (+ to + and - to -) to increase capacity (ampere-hours). Power leads are connected to opposite corners of the batteries to reduce the effects of voltage drop in the jumper wires, as shown in Figure 2-5.

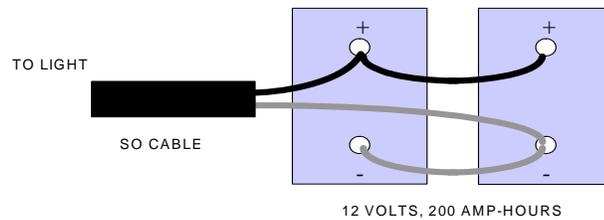
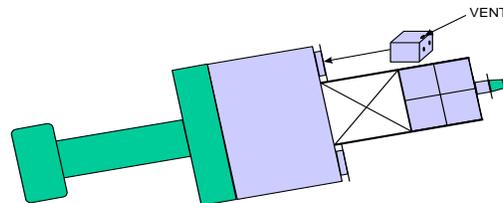


Figure 2-5

- e. When installing Delco 2000 batteries in tube type buoy hulls, the battery vent must face “up” towards the lifting bail with the terminals facing the pocket cover; otherwise electrolyte will drip out of the battery when it is serviced on deck, as shown in Figure 2-6. Bell-stand battery boxes may have to



be remounted to achieve the proper battery orientation.

Figure 2-6

- f. Do not over tighten terminals. Apply No-Ox grease to connections to prevent corrosion.
- g. The battery may be wired, as shown in Figure 2-7, whichever is convenient.

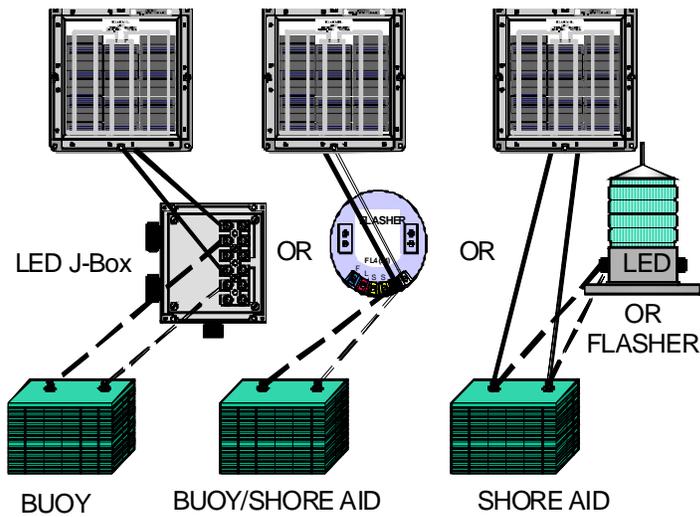


Figure 2-7

4. Hot Packs.

- a. Secondary batteries may be used as Hot Pack batteries as long as the following conditions are met:
  - (1) Sealed (Delcos are acceptable).

- (2) Permanently marked "For discrepancy use only".
  - (3) Derated to one-half of the advertised capacity.
  - (4) Protected from rain, sun and salt spray if possible.
  - (5) Recharged as soon as it is removed from the aid.
- b. The following Rated Battery Discharge Time (RBDT) table provides the number of days one battery (derated) will operate a given daylight controlled lamp/flasher combination.

**Hot Pack\* RBDT in Days**

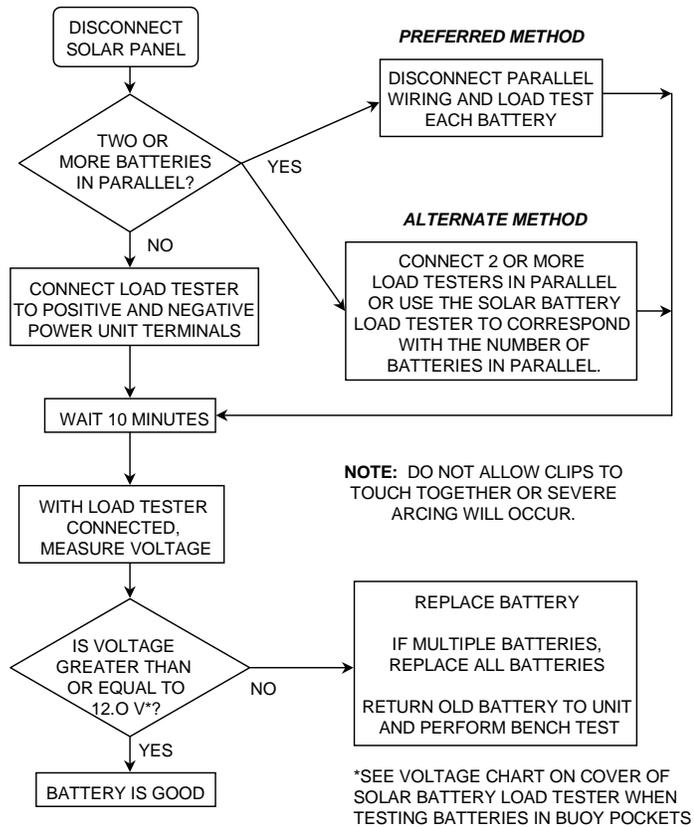
<b>Flash Rhythm</b>	<b>Lamp Size</b>		
	<b>0.55</b>	<b>0.77</b>	<b>1.15</b>
FI 6(.6)	36	28	20
FI 4(.4)	35	27	20
FI 2.5(.3)	31	23	16
FI (2+1)6	26	20	14
FI (2)5	25	19	13
FI 4(1.0)	19	14	10
MO A	16	12	8
FI (2)6	15	11	8
Q	15	11	7
Iso 6	11	8	5
Occ 4	7	5	4

\*Using one 12 volt, 100 AH secondary battery

5. Maintenance.

a. Load test the battery, as shown below:

**BATTERY LOAD TEST**



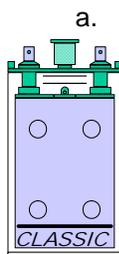
- b. Inspect wiring for cuts or abrasions. Replace if necessary.
- c. Inspect connections for corrosion. Clean and replace if necessary. Reapply No-Ox grease to terminals.

6. Troubleshooting Procedures.

- a. If the aid is found discrepant, perform the solar panel troubleshooting flowchart (section 2.A.4.a).
- b. Inspect wiring for cuts, abrasions, dirt or loose connections. Clean and replace as necessary.
- c. Meg SO power cable (section 2.D.4).
- d. If battery is replaced, perform the Bench Test Procedure detailed in the Aids to Navigation Manual – Technical, COMDTINST M16500.3 (series) on the discrepant battery if you desire to retain it as a Hot Pack.

## F. Large Stationary Batteries.

### 1. Notes.



- a. Large stationary batteries are 12 volt secondary batteries used in solar powered aids to navigation that have loads higher than a typical minor aid. An example is a VRB-25 rotating beacon with fixed burning lamps or day/night ranges. The battery is comprised of six individual 2 volt cells that are wired in series to achieve 12 volts.
- b. Large stationary batteries are available in three types, wet (Exide, Fulmen and Classic), absorbed (GNB Absolyte IIP) and gelled electrolyte (Sonnenschein Dryfit). Wet batteries require semiannual watering. Absorbed and gelled batteries are maintenance-free.
- c. All aids to navigation batteries must be disposed of in accordance with the Hazardous Waste Management Manual, COMDTINST M16478.1 (series). Chapter 7 of the manual gives instructions for disposal of various types of batteries used by Coast Guard units. If any questions should arise about appropriate disposal procedures, contact the Hazardous Waste Disposal Manager at your nearest Civil Engineering Unit (CEU) or the Environmental Management Division at Commandant (CG-49).

### 2. Safety.

- a. Secondary lead-acid batteries contain electrolyte (dilute sulfuric acid). Wear chemical goggles and rubber gloves when handling/servicing batteries. If electrolyte comes into contact with the skin, wash immediately with water. If

electrolyte comes into contact with the eyes, flush with water for 15 minutes and consult a physician immediately.

- b. Secondary batteries may vent hydrogen when charging. Allow the battery pocket, battery box or battery enclosure to air out for 5 minutes before entering or servicing battery.
- c. Secondary batteries are a source of virtually unlimited current. The battery should be the last connection made at an aid. Do not allow "+" and "-" wires to touch as the current is high enough to melt wiring, possibly damage the battery or cause personal injury.
- d. These large secondary batteries can be very heavy. Some cells are over 300 pounds each. Weight handling equipment is required to safely transport these batteries to the aid site.  
**Batteries shall not be lifted by their posts.**

3. Installation.

- a. The battery shall receive a freshening charge prior to service. The battery may be charged on-site using the portable diesel engine-generator, or using the array with no load connected. Maximum charge currents, stated in the instruction manual provided with the battery, shall not be exceeded.
- b. Batteries must be installed in a protected environment. Additionally, they should not be exposed to direct sunlight or installed close to vents as it could cause uneven cell heating. Wires are terminated at the battery using ring lug terminals. **Bare wires shall not be wrapped around the battery terminals.** Interconnections between cells shall be made with the supplied buss bars.

- c. Batteries installed on offshore platforms shall be anchored to the floor and wall to prevent tipping. A containment system beneath wet batteries shall be installed and filled with either absorbent pads or limestone to neutralize spilled acid.

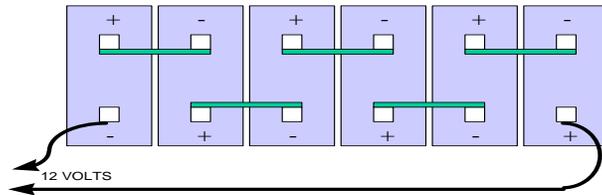


Figure 2-8

- d. All large secondary batteries are wired in series, (+) to (-), to add cell voltages. Six 2 volt cells wired in series will provide a nominal 12 volts, as shown in Figure 2-8.
  - e. Cell connections shall be covered with No-Ox grease or other suitable protective coating to prevent corrosion.
  - f. Intercell connectors shall be protected with insulated covers to prevent accidental shorting.
  - g. Due to the differences in battery types and because they come with detailed installation instructions, refer to the manual enclosed with the battery.
4. Maintenance.
- a. Open battery box or battery enclosure and allow venting for 5 minutes before entering or working on any components.
  - b. Measure the charge voltage of each cell in the battery (the cells do not have to be disconnected) with Array and Battery circuit breakers in the Range Power Box (RPB) ON (solar

panels connected) and the Load circuit breaker OFF. Record the voltages in the aid log. The voltages should be 2.30 to 2.50 volts per cell, however in this test they may be low if it's cloudy. Cell to cell variation should be within  $\pm 0.02$  volts.

- c. Disconnect the solar array and loads by turning the Array and Load circuit breaker in the RPB OFF and wait at least 10 minutes. Measure the voltage of each cell and record the readings in the aid log. The voltages should be 2.05 to 2.14 volts per cell with a maximum permissible variation of  $\pm 0.02$ .
- d. With the solar panels still disconnected, turn the Load circuit breaker in the RPB ON so that the daytime light comes on (cover daylight control if nighttime only light). Measure the voltage of each cell and record the readings in the aid log. The voltages should be 1.96 to 2.13 volts per cell with a maximum permissible variation of  $\pm 0.02$ . **Remove the cover on the daylight control (if covered).**
- e. Measure the specific gravity of each cell (Exide/Classic/Fulmen only) by removing the corner caps on the top of each cell and extending the tube of the hydrometer halfway into the cell to withdraw electrolyte. Record the electrolyte temperature (as read on the hydrometer) and specific gravity readings in the aid log. Find the appropriate specific gravity correction, listed on the next page, and record in the aid log. Do not add water to the cells prior to taking the specific gravity; low readings will result. Be sure hydrometer is clean and has not been used in NiCads or it will damage these batteries.

**TEMPERATURE CORRECTION POINTS**

Temperature Deg., F (C)	Correction Points	Temperature Deg., F (C)	Correction Points
20 (-6.7)	-.024	70 (21.1)	-.004
25 (-3.9)	-.022	75 (23.9)	-.002
30 (-1.1)	-.020	80 (26.7)	0
35 ( 1.7)	-.018	85 (29.4)	+0.002
40 ( 4.4)	-.016	90 (32.2)	+0.004
45 ( 7.2)	-.014	95 (35.0)	+0.006
50 (10.0)	-.012	100 (37.8)	+0.010
55 (12.8)	-.010	105 (40.6)	+0.012
60 (15.6)	-.008	110 (43.0)	+0.014
65 (18.3)	-.006	115 (46.1)	+0.016

- f. The estimated state of charge can be found by either the corrected specific gravity (preferred method) or the open circuit voltage. The system is designed so that the state of charge never falls below 80%, however extended cloudy conditions may cause it to fall as low as 60%. If the state of charge is any lower than 60% and system checks indicate no apparent cause, contact your district training team chief with this information. Additional panels may be added to the array to correct this problem. Any modification to the system should only be undertaken after consultation with District (dpw) and your Civil Engineering Unit (CEU).

### BATTERY STATE OF CHARGE

Open Circuit Voltage	<b>(Absolyte/Dryfit/Exide)</b>		<b>(Classic/Fulmen)</b>	
	Specific Gravity	State of Charge	Specific Gravity	State of Charge
12.7	1.300	100%		
12.6	1.265	90%		
12.5	1.244	80%	1.240	100%
12.4	1.218	70%		
12.3	1.194	60%	1.200	75%
12.2	1.170	50%		
12.1	1.148	40%		
12.0	1.122	30%	1.165	50%
11.9	1.098	20%		
11.8	1.073	10%	1.130	25%
11.7	1.040	0%	1.095	0%

- g. Check each cell for sediment buildup (wet batteries only). This is a sign of the amount of cycling or overcharge that a battery has received. It is also an indication of end of life. A battery that has one-half of its sediment space full will continue to perform for a number of years. When the sediment space fills up, shorts develop between the plates causing low voltage cells.
- h. Add distilled water to the cells (we batteries only) to bring the electrolyte level to the HIGH mark on the cell jar. To add water, remove the dust cap from the arrestor. Record the amount of water added to all 6 cells in the aid log.
- i. Remove accumulation of dust or other contaminates from the cell covers and jars with a cloth dampened with clean potable water. Do not use cleaning solutions (solvent, detergent, etc.) as these will damage the plastics used in the

cell jars. Isopropyl alcohol may be used to dampen the cloth for stubborn dirt and is the only other approved cleaning solution. Dirty intercell connections are a common cause of excessive cell to cell voltage variations. Clean intercell connections, if necessary, with a cloth dampened in bicarbonate of soda (1 pound of baking soda mixed with 1 gallon of water). Do not get solution into cell; it will neutralize acid and ruin the cell. Severe corrosion requires removal of intercell connectors, neutralization with a solution of bicarbonate of soda and cleaning with a nonmetallic, stiff bristled brush. Before removing intercell connectors, disconnect the battery from both the load and solar array by turning off all circuit breakers in the RPB. Be careful not to damage the lead plating on the connectors as the copper beneath it will corrode rapidly. Apply No-ox grease to contact surfaces. Retorque connector bolts to the appropriate torque (see instruction manual).

- j. Electrical resistance of a loose connection is significantly higher than one that is properly tightened. Loose connections may cause cell-to-cell voltage variations, post heating and accelerated corrosion. Before tightening connections, disconnect the battery from both the load and solar array by turning off all circuit breakers in the RPB. If the connections exhibit corrosion, disassemble, and clean as described in paragraph i, above. Use an insulated inch-pound torque wrench to ensure that all intercell and post connections are torqued (see instruction manual). Recoat the terminals and connections with No-Oxide grease when complete. **Turn on the breakers in the RPB, reconnecting the array and loads.**
- k. The battery should be charged onsite if either a scheduled or unscheduled visit to the aid reveals that the state of charge falls below 60 percent. The cause of the low state of charge must be corrected prior to returning the aid to normal

operation. Charging may be done with the portable genset, any commercial unit capable of charging 12-volt batteries or by securing the main loads and allowing the array to recharge the battery (7-14 days). Cell temperature shall be monitored during the charging process (genset only) to ensure that it does not rise above 110 degrees F. Should this occur, the charging should be terminated and the battery permitted to stand open circuit until it cools down to 90 degrees F, at which time charging may resume. The thermometer may be inserted in the first cell through the funnel in the flame arrestor (wet batteries only).

NOTE: rinse thermometer thoroughly with distilled water before inserting into cell jar. Charging voltage shall be 15 volts, which should be reduced if this causes electrolyte flooding out onto the cover, if the cell temperature exceeds the above limitations, or if this voltage exceeds the manufacturer's fast-charge voltage/current limit. The current limit is 5 amps per 100 AH of capacity or the manufacturer's predetermined maximum charge current (example: a 500 AH battery can be charged at 25 amps). Charge voltages may be adjusted to meet these values to promote fast recharging of the battery. All circuit breakers in the RPB shall be **OFF** during the charging process.

- I. Report all readings and problems that are not within these guidelines to your Training Team Chief.

5. Troubleshooting Procedures.

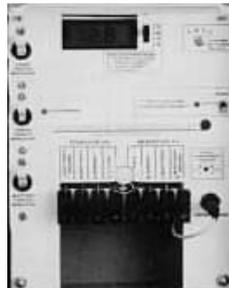
- a. If the aid is found discrepant due to low voltage, perform the Multiple Solar Panel Servicing Flowchart (section 2.A.4.b).
- b. Inspect wiring for cuts, abrasions, dirt or loose connections. Clean and replace as necessary.
- c. Check torque on all intercell connectors. Clean if dirty.

- d. If fault is found in the charging system, charge battery if lower than 60 percent state of charge or if cells are imbalanced (cell to cell voltage variation exceeds limits).
- e. If no obvious fault is found (end of life), identify the bad cell(s) by performing maintenance procedures listed in section 4 and replace either the bad cell(s) or entire battery rack.

G. Range Power Box (RPB).

1. Notes.

- a. The Range Power Box (RPBs, Figure 2-9) is a commercially available photovoltaic power controller used on ranges and small lighthouses to protect lead-acid batteries from overcharge.
- b. The RPB contains circuits to disconnect the solar array, battery and load from it and each other. The RPB contains a charge regulator with adjustable setpoints or a battery type selector switch to prevent the battery from overcharging. It also contains circuitry that disconnects the load from the battery to protect it from deep discharge. This feature is adjustable and can be disabled (SCI PPC-50 only).



SCI PPC-50



ProStar-30

Figure 2-9

## 2. Installation.

- a. The RPB should be installed near the battery as the temperature compensation cable is only 10 feet (33 ft for the ProStar-30) long and should be attached to the battery. The RPB is housed in a rain-tight box suitable for installation outdoors, if necessary. Attach the temperature compensation probe to the outside of the battery with the foam pad (SCI PPC-50). The probe must be placed about halfway up the side of the battery case out of direct sunlight and away from drafts that could affect its operation. The ProStar-30 version is attached directly to either battery terminal.
- b. All wires may be terminated at the Euro-style terminal strips without lugs as they readily accept bare copper wire up to 6 AWG.
- c. Installations with multiple solar panels should be combined at a Local Terminal Box (LTB) or other suitable junction box with one pair of 6 AWG wires connected to the RPB.
- d. The jumpers between the BATTERY VOLTAGE SENSE and BATTERY terminals must remain connected (SCI PPC-50 only). The jumpers may be moved to the top row of terminals if they interfere with wire terminations. The jumpers should be removed and an extra pair of wires (18 AWG is sufficient) connected between the battery sense and the lead-acid battery terminals if the battery is more than 8 feet from the controller (applies to SCI PPC-50 and ProStar-30).
- e. Attach leads from the battery, array and load(s) to the terminal strip in the RPB (in that order). All circuit breakers should be OFF during this period. In the ProStar-30 controller push the button for 2 seconds to disconnect the array and load. Push the button again to reconnect the

array and battery after the leads are attached. Additionally, the leads at the battery must be disconnected to prevent accidental shorting while routing through stuffing the tube  
**(NOTE: LARGE BATTERY SYSTEMS ARE A SOURCE OF UNLIMITED CURRENT, CAPABLE OF MELTING COPPER WIRE, AND POSSIBLY CAUSING AN EXPLOSION).**  
Attach leads to battery with the circuit breakers in the RPB OFF.

- f. Be sure CHARGE SET-POINT SELECTOR is in the “B” position which corresponds to 14.8 volt charge termination for the SCI PPC-50 version. This setting should be used for all batteries, unless directed otherwise. The ProStar-30 has three settings, gelled, sealed and flooded. Flooded batteries have liquid electrolyte like the Delco and Classic batteries, Sunlyte and Absolyte are sealed, and the Sonnenschein Dryfit is gelled.
- g. The LOAD DISCONNECT switch should be in the AUTO LVD position, unless directed otherwise. This corresponds to 11.5 volt load disconnect for the SCI PPC-50 (11.4 for ProStar-30). The load will automatically reconnect when the battery voltage reaches 13.0 volts (12.6 for ProStar-30).
- h. Indicators – The SCI PPC-50 controller has a “charging light” displayed when the array is charging the battery. The ProStar-30 controller has a series of LEDs that display the following information:

Charging – Green when array is charging battery

Battery Status:

- Green – Full charge,
- Yellow – middle capacity,
- Red Blinking – Low state of charge,
- Red ON – Load has been disconnected.

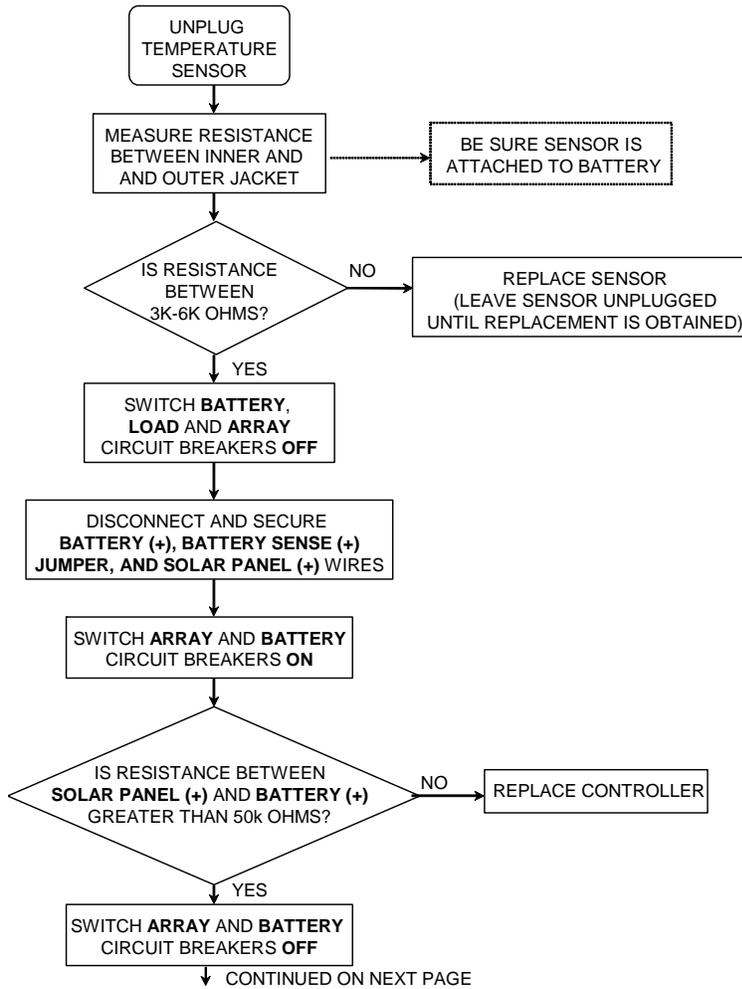
- i. Turn on all circuit breakers, close and latch door and check aid for proper operation.

3. Maintenance.

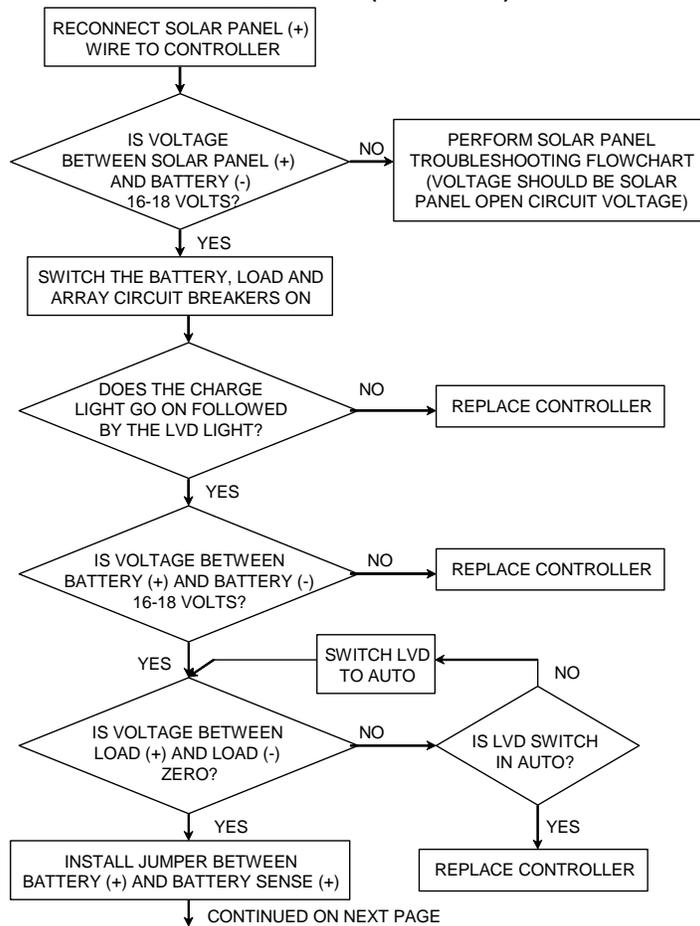
- a. If there is evidence that the batteries have been overcharging (excessive water usage, boiling of electrolyte onto cell jars, excessive heat in cells), perform the troubleshooting procedure detailed in Section 4.
- b. Be sure the terminals are tight and inspect for evidence of corrosion. Clean or replace as necessary.
- c. Be sure temperature sensor lead is attached to the controller and the sensor is attached to the battery.
- d. Confirm that the correct battery type/switch setting is selected.
- e. Check LED status of ProStar-30 controller (see previous page)

4. Troubleshooting.

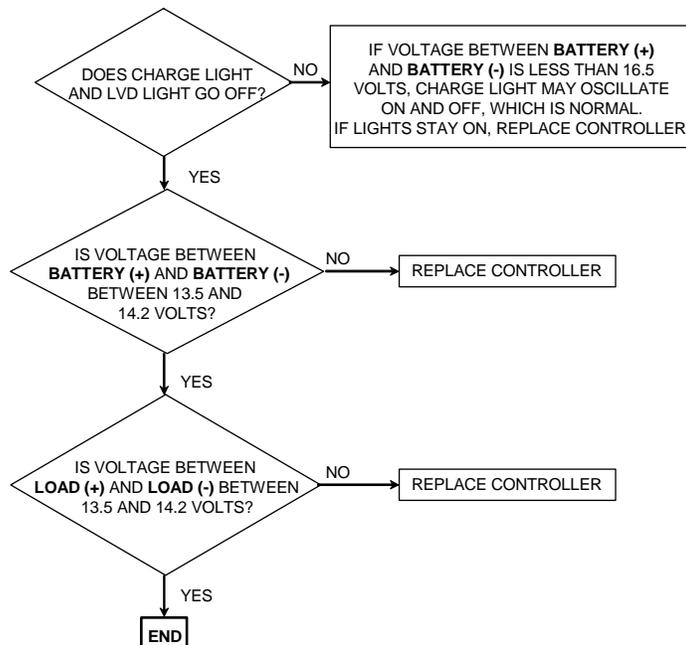
**RPB TROUBLESHOOTING  
FLOWCHART (SCI Version)**



**RPB TROUBLESHOOTING  
FLOWCHART (SCI - CONT'D)**

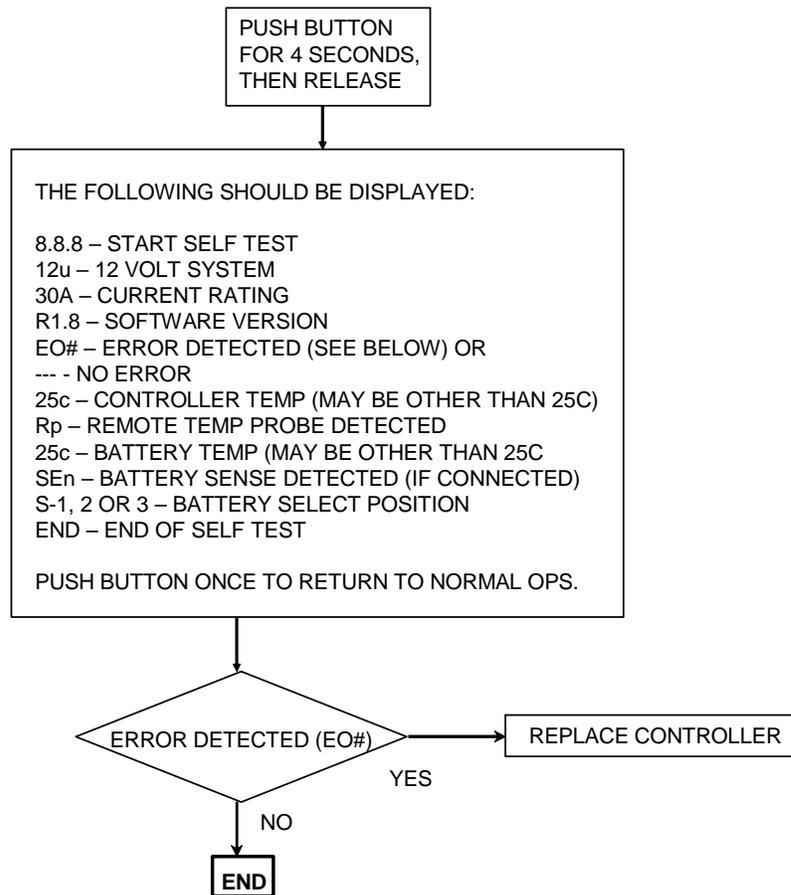


**RPB TROUBLESHOOTING  
FLOWCHART (SCI – CONT'D)**



- a. If the controller fails any of these tests, it is defective and should be replaced. Install rotational spare, if available.
- b. If the aid is reported out and no problem is found, the LVD could be disconnecting the load at night and reconnecting during the day when the battery is charging. In this case, the battery is operating at a lower state of charge than anticipated or there is excessive voltage drop in the system. Contact your CEU with this information to determine if additional solar panels or larger conductors are necessary. Leave the LVD in the "NO LVD" position until the problem is resolved.

## RPB TROUBLESHOOTING FLOWCHART (ProStar)



H. Range Switch Box-DC (RSB-DC).

1. Notes.

- a. The RSB-DC (Figure 2-10) is used on DC powered ranges to switch between daytime and nighttime lights. The device is comprised of a circuit breaker, type-L daylight control, relay driver circuit card and a single pole, double throw (SPDT) relay.
- b. Relay RY1 is energized during the day disabling the nighttime signal and enabling the daytime signal. Failure of the relay driver circuit card causes the nighttime light to operate 24 hours a day.

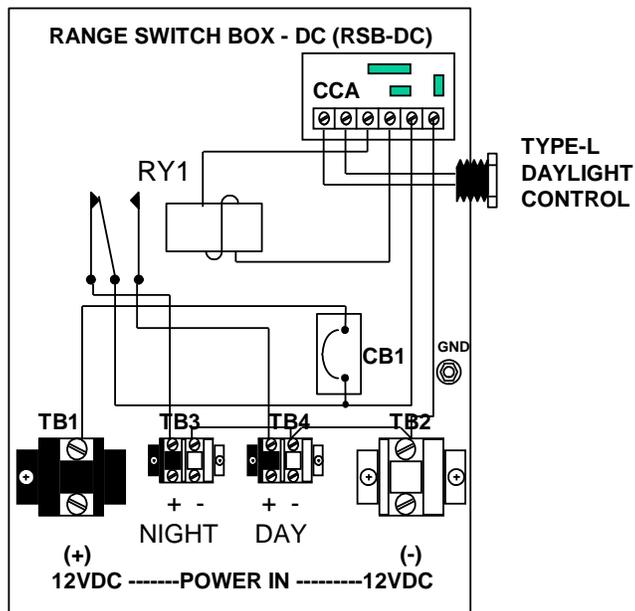


Figure 2-10

2. Installation.

- a. The RSB-DC is typically installed near the day and night range optics. It is housed in a raintight box suitable for installation outside. Power is provided by the Range Power Box (RPB) or AtoN power supply, and depending on the loads, may be fed with up to 1/0 AWG wire.
- b. All wires may be terminated at the compression terminal strips without lugs as they readily accept bare copper wire.
- c. Flashers installed in the range lights are wired to the day and night terminal strips using either 12/2 or 10/2 SO cable.

3. Maintenance. Perform the following system status check when arriving at the range in the daytime:

- a. Note if the daytime light is on.
- b. Cover daylight control and determine if the daytime light turns off and nighttime light turns on.
- c. Check components for frayed wiring and corrosion. Replace or repair as necessary.

4. Troubleshooting.

- a. The RSB-DC is simple in operation. During the daytime, the type-L daylight control causes the relay driver card to power the coil of the relay turning off the nighttime light and turning on the daytime light. The relay is an open model type that allows visual and audible indication that it is working. Voltage checks at various points (Figure 2-11) can be used to detect the cause of discrepancies:

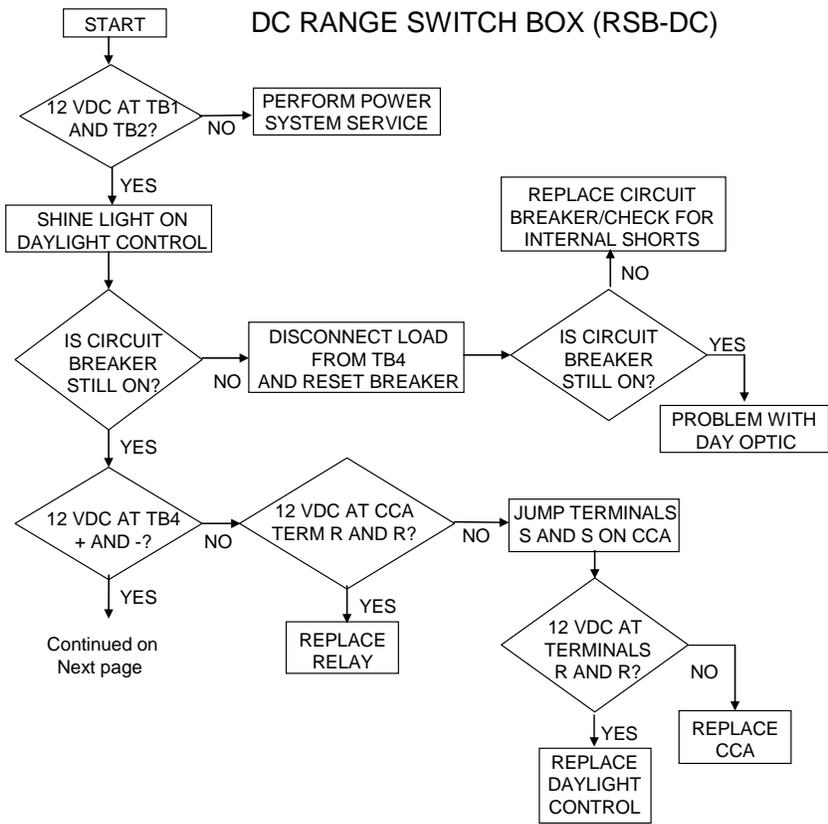


Figure 2-11

### DC RANGE SWITCH BOX (RSB-DC) (cont'd)

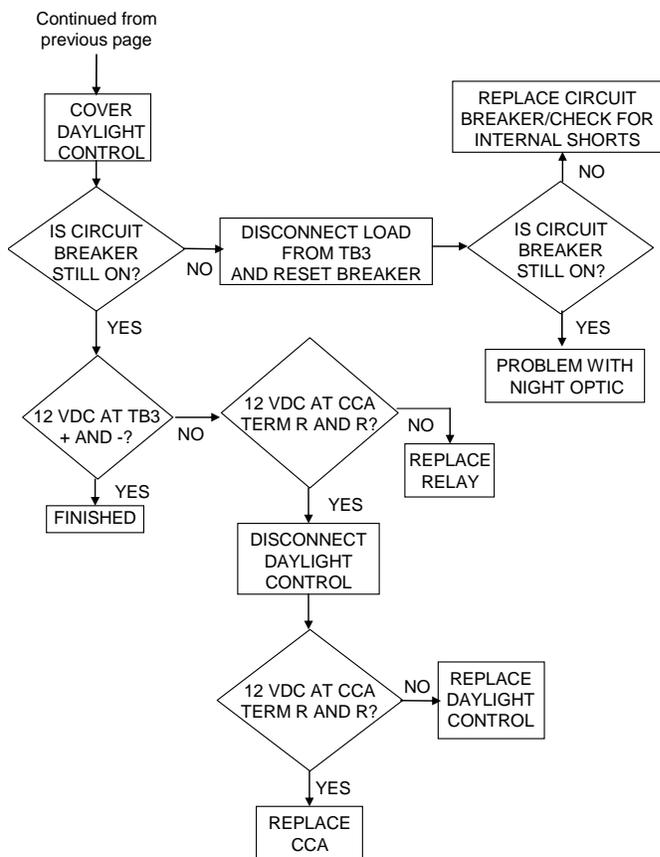


Figure 2-11 (cont'd)

## CHAPTER 3 - SIGNALS

### A. 155mm Lanterns.



1. Notes. The 155mm lantern is used on buoys and structures. This omnidirectional lantern is prefocused but requires precision leveling on structures to ensure proper operation. The lens is replaceable and available in clear, yellow, red and green.

2. Installation.

- a. Buoys.

- (1) Align lantern base with holes in buoy plate.
    - (2) Place a ½" threaded stainless steel bolt and flat washer through each of the aligned holes in the lantern base.
    - (3) Place a stainless steel Nylock nut on each bolt and tighten.
    - (4) Note: Lanterns installed on buoys are not leveled. Go to Paragraph c.

- b. Structures.

- (1) Install three ½" stainless steel threaded rods or bolts on the platform as shown in Figure 3-1. Add the leveling nut and flat washer at this time.

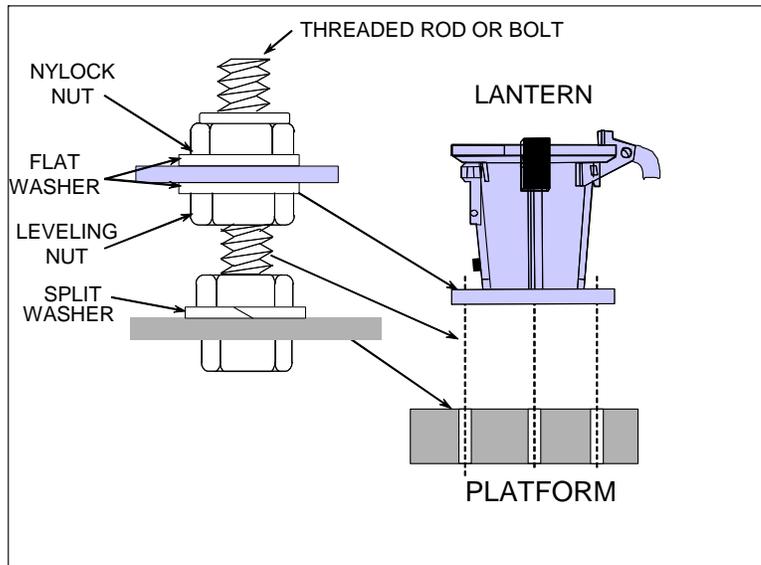


Figure 3-1

- (2) Position lantern over threaded rods. Place a flat washer and Nylock nut on each rod but do not tighten completely.
- (3) With lens open, place a level on the flange of the lantern base. Use the "T" method shown in Figure 3-2 so that adjustment of one leveling bolt won't affect the other adjustment.
- (4) Adjust the leveling nuts up or down until level.

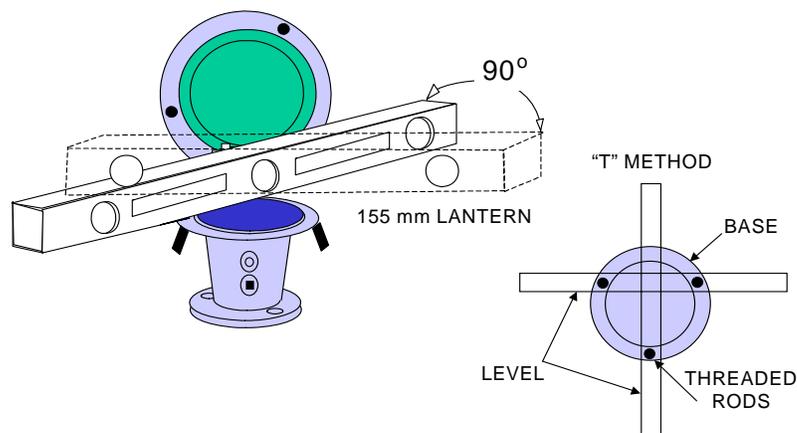


Figure 3-2

- (5) Move the level ninety (90) degrees from your first position and readjust. See Figure 3-2.
  - (6) Repeat steps until the lantern is level in both positions.
  - (7) Tighten top nuts on mounting studs/bolts and recheck levelness of lantern. **DO NOT OVERTIGHTEN.**
  - (8) Obtain a tested CG-6P lampchanger and CG-181/493/504 flasher with the appropriate hardware (see Chapter 4).
- c. Attach the mounting bracket between the base of the CG-6P lampchanger and flasher with **four** 10-32x1" screws supplied so that the dip in the bracket is down (see Figure 3-3). The wires from the WK-681 wiring kit must pass **under** the bracket. Attach the bracket to the screws in the base. **Note:** The lock washer must be on top of the bracket or the focal height of the lamp will be affected.

- d. Wiring will normally be 12/2 SO cable through a watertight stuffing tube, or individually insulated wires installed in conduit (Liquid-Flex near lantern). Wires shall have insulated spade lugs and terminated at the Black (+) and White (-) terminals of the CG-181 flasher.

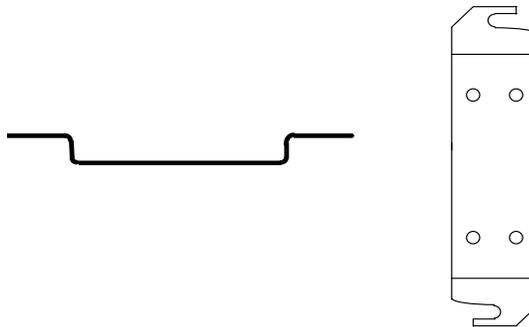


Figure 3-3

- e. Install a focus fixture in the first lamp position.
3. Focusing.
- a. The lantern is prefocused, however it should be checked to ensure that components are installed correctly and that the bracket and base are not bent or distorted.
  - b. Secure each of the lens clamping screws/clamps.
  - c. Sight through the sighting marks on the lens. The focus fixture should appear centered in the sight marks, as shown in Figure 3-4.
  - d. Verify proper focus through second set of sight marks.

- e. If lantern is not focused, check for proper installation of lampchanger bracket (dip down), bent bracket, broken standoffs in base. Replace or modify as necessary to ensure lantern is focused.

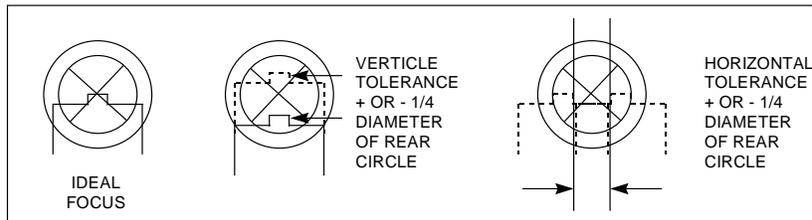


Figure 3-4

#### 4. Maintenance.

- a. Visually inspect the lens and base for cracks, crazing, holes, etc. Replace if necessary.
- b. Open lantern and swing lens open against stops. Inspect drain holes in base. Clean if necessary with a paper clip.
- c. Place a level on the base and check levelness in both directions (structures only). Use the "T" method.
- d. Install a focus fixture in the first lamp position and check focus as discussed in section 3.
- e. Advance unused lamps forward and install new lamps in the remaining positions.
- f. Check O-ring gasket in the base and replace if necessary.
- g. Perform the quick aid test outlined in Chapter 4.
- h. Rotate turret to the first position. CAUTION - LAMPS AND

TURRET MAY BE HOT.

- i. Close and secure the lens assembly.
- j. Clean the lens, if necessary, with a soft bristle brush, rags and mild soap and water.

5. Troubleshooting.

- a. If the light is reported burning dim, perform the following system checks:
  - (1) Load test the battery (Chapter 2).
  - (2) Check focus of lantern (Section 3). Be sure correct lamps are installed.
  - (3) Clean lens cover if necessary.
- b. If the light is reported out, perform the following system checks:
  - (1) Load test the battery (Chapter 2).
  - (2) Meg power cable (Chapter 2).
  - (3) Perform the Minor Aid Troubleshooting Test (Chapter 4).

B. Carmanah 700 Series Self Contained LED Lanterns.



1. Notes. The Carmanah 700 series self contained LED lanterns are available in three versions; the 701/701-5, 702/702-5, 704-5 and the 708. The first version has multiple power system sizes, but only one intensity setting. The 704-5 and 708 have two and three intensity settings, respectively but only one power system size. Proper selection of the intensity and solar system sizing must be made by District (dpw) prior to installation.

2. Programming.

- a. Lanterns shall be programmed and fully charged at the Unit prior to installation. Consult the LED instructions at: <http://www.uscg.mil/hq/cg4/cg432/products.asp> for the procedures prior to transporting the lantern to the aid.
- b. Quick Programming Guide (see above link for more complete instructions):

**Step 1.** Transition the lantern (day/night or night/day):

**Step 2.** Enter Security Code: **POWER 7 5 3 CHAN^**

**Step 3.** Enter programming instructions as appropriate:

<b>POWER 0 4 9 CHAN^</b>	to select FL 2.5 (.3)
<b>POWER 1 7 4 CHAN^</b>	to select FL 4 (.4)
<b>POWER 0 7 3 CHAN^</b>	to select FL 6 (.6)
<b>POWER 1 2 9 CHAN^</b>	to select Quick Flash
<b>POWER 0 2 2 CHAN^</b>	to select FL (2+1) 6
<b>POWER 1 7 5 CHAN^</b>	to select FL (2) 5
<b>POWER 1 7 6 CHAN^</b>	to select Mo(A)
<b>POWER 0 8 1 CHAN^</b>	to select Iso 6
<b>POWER 1 1 8 CHAN^</b>	to select Occ 4

**POWER 8 0 0 CHAN^** to turn ALC off.  
**Required for all lanterns.**

For 701-5 & 702-5 only:  
**POWER 9 8 0 CHAN^** to lock ALC off

*For 704-5 Only:*  
**POWER 5 0 1 CHAN^** to select HIGH light intensity  
**POWER 5 0 0 CHAN^** to select LOW light intensity

*For 708 Only:*  
**POWER 5 9 8 CHAN^** to select HIGH light intensity  
**POWER 5 0 1 CHAN^** to select MED light intensity  
**POWER 5 0 0 CHAN^** to select LOW light intensity

For all Lanterns:  
**POWER 0 0 0 CHAN^** to TURN OFF the lantern

3. Installation.

- a. The top solar panel on the 701-5, 702-5 and 704-5 lanterns is not designed to support the full weight of the lantern.  
**Never use the top solar panel to lift the lantern.**
- b. On steel buoys, install three ½" stainless steel bolts and flat washers through the lantern mounting holes, three flat washers between the lantern and buoy top plate and finally three split lock washers and nuts to secure the lantern. **The lantern vents through a hole in the bottom of the lantern's base, so the lantern CAN NOT be mounted flush with the buoy's mounting plate.** The flat washers provide this air-space. Avoid tall bolts that could shadow the solar panels. Nylock nuts can replace split washers and nuts. See Figure 3-5.

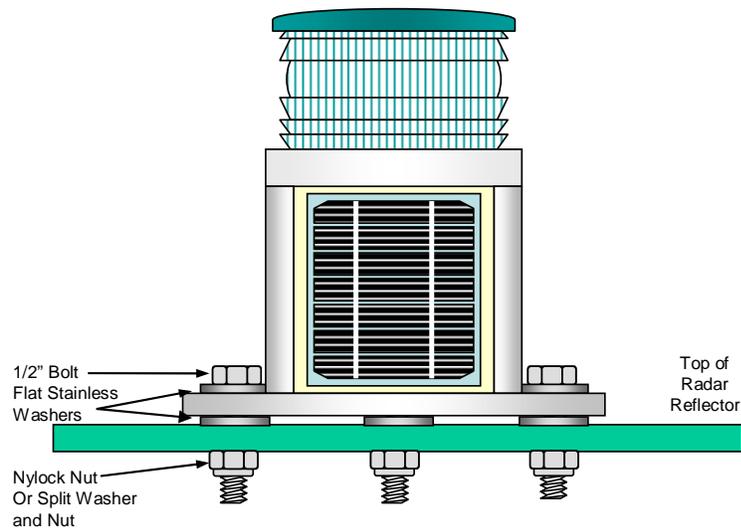


Figure 3-5

- c. Secure three 1/2" stainless steel bolts (or all-thread) to the structure's mounting plate as shown in Figure 3-6. Install three jam nuts on the bolts so that about 1" of thread is exposed. Place the lantern on top of the leveling nuts, then drop on the split washers and position the uppermost nuts at the very upper end of the thread. Do not tighten these uppermost nuts – they are positioned at this time to ensure that the lantern doesn't fall off. Level the lantern on structures by adjusting the leveling nuts (use a torpedo level on the top of the lens or base plate of the lantern - use the "T" method. When the lantern is level, tighten the uppermost nuts.
- d. Cover the lantern with a jacket, box or blanket and determine if it turns on and flashes on-rhythm. Remove the cover and the lantern should turn off in the daytime.

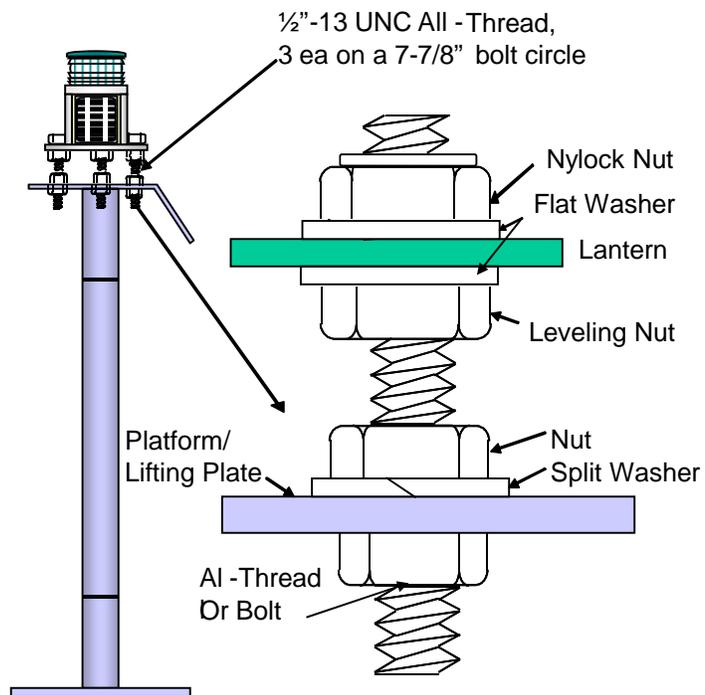


Figure 3-6

4. Servicing.

- a. Servicing should be performed in accordance with the standard cycle established for the aid.
- b. Ensure that the lens and solar panels are clean. Wipe with a cloth dampened with mild soap and water, if necessary.
- c. Cover the lantern with a shroud, jacket, box, blanket, etc., to

simulate darkness. The lantern should flash on rhythm after a few seconds. It should stop flashing after the cover is removed in the daytime. While covered, observe the LEDs through the lens. Dark sectors indicate that a LED cluster is not operating, necessitating replacement of the optic head.

d. Uncover the lantern. It should stop flashing.

5. Troubleshooting.

a. If the lantern flashes once per minute, the battery state of charge is unacceptably low. Be sure solar panels are clean and confirm the solar sizing for the aid. Replace the lantern and recharge/replace the battery at the CG base. If the lantern does not flash at all, replace the lantern.

b. If the lantern is reported discrepant but operates normally when tested, determine the battery's state of charge:

Transition the lantern	Night/day or day/night
Enter the security code	<b>POWER 7 5 3 CHAN^</b>
Battery status code	<b>POWER 8 1 0 CHAN^</b>

The lantern will flash 3 times indicating that it received the instruction and then after 2 seconds emit a series of up to 10 flashes. Each flash represents 10% state of charge. This series is repeated once more. If the battery state of charge is below 60% (5 flashes or less), determine the cause (guano, shadowing, wrong solar sizing, battery at end of service life).

c. Observe the LEDs when flashing to ensure all LEDs are lit (do not look directly into the lantern). If dark areas are noted, replace the lantern.

d. Confirm that the lantern turns off in the daytime. If not, replace the lantern.

C. Vega VLB-36 Self Contained LED Lanterns.



1. Notes. The VLB-36 self contained LED lanterns contain three solar panels (some early versions used on fixed aids have two solar panels) and a lead-acid battery. There are three power system sizes, small, medium and large with multiple intensity settings. Proper selection of the intensity and power system sizing must be made by District (dpw) prior to installation.

2. Programming.

- a. Lanterns shall be programmed and fully charged at the base prior to transport and installation at the aid. Consult the Commandant (CG-432A) website prior to transport to the aid: <http://www.uscg.mil/hq/cg4/cg432/products.asp> .
- b. Quick Programming Guide (see above link for more complete instructions and to program early lanterns with a tap switch):

**Standard CG Flash Rhythms**

Rhythm	Code	Rhythm	Code
FL2.5 (0.3)	<b>310</b>	Q	<b>601</b>
FL4 (0.4)	<b>321</b>	Mo(A)	<b>801</b>
FL6 (0.6)	<b>337</b>	Iso 2	<b>100</b>
FL (2+1) 6	<b>472</b>	Iso 6	<b>104</b>
FL (2) 5	<b>406</b>	Oc 4	<b>205</b>
FL (2) 6	<b>416</b>		

Intensity Codes*			
21 cd	<b>0021</b>	77	<b>0077</b>
29	<b>0029</b>	83	<b>0083</b>
39	<b>0039</b>	131	<b>0131</b>
54	<b>0054</b>	150	<b>0150</b>
66	<b>0066</b>	161	<b>0161</b>
		205	<b>0205</b>
		220	<b>0220</b>
		240	<b>0240</b>

\*Some colors/flash rhythms do not use all of these codes.

A sample programming session might include the following steps:

Press and hold the standby/program/power button for up to 60 seconds. Four flashes indicates the programming mode:

**1 5 0 0 0 Normal Operating Mode**  
**1 0 3 3 7 FL6(.6) Flash Rhythm**  
**1 1 0 0 7 7 Intensity 77 Candelas**

### 3 Installation.

- a. The lantern has three blind holes in the base drilled to a depth of 2" for a ½" stainless steel bolt or threaded rod.
- b. On steel buoys, loosely install one ½" stainless steel threaded rod or a bolt with the head removed to act as a locating pin for the lantern mount on top of the radar reflector. Install the lantern in one of those holes and swing the base until the other two holes are lined up. Insert two ½" stainless steel bolts with lock washers to secure the lantern. Remove the treaded rod and insert a ½" bolt, or install a lock washer and nut on the rod. Tighten all fasteners. See Figure 3-7.

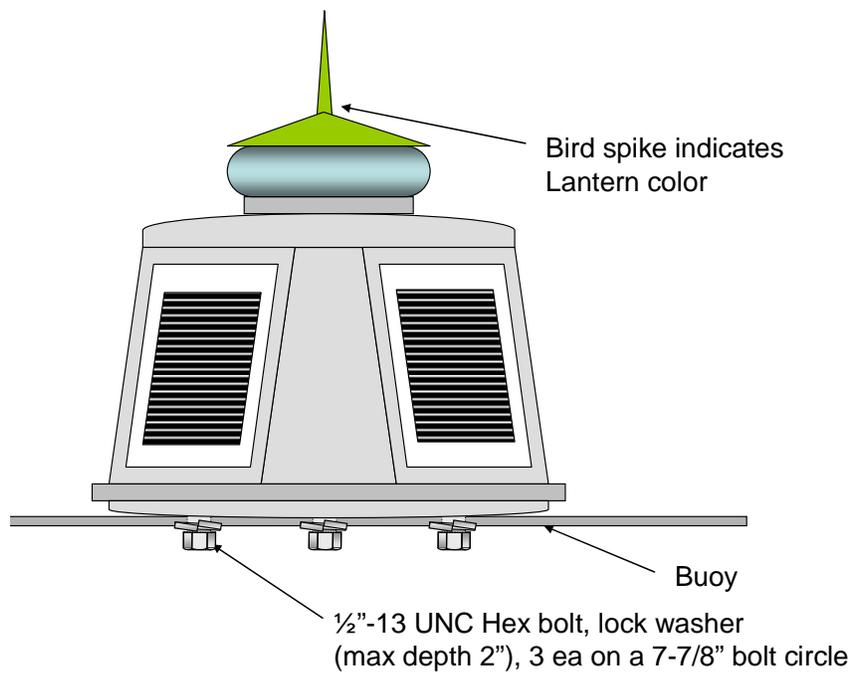


Figure 3-7

- c. On structures, Insert three 6" lengths of stainless steel  $\frac{1}{2}$ "-13 UNC All-Thread in the base of the lantern as far as they will go (about 2"). Thread three  $\frac{1}{2}$ " stainless steel nuts and tighten against the base of the lantern. These act as jam nuts and prevent the All-Thread from loosening in the lantern. Thread three stainless steel  $\frac{1}{2}$ " nuts about half-way up the All-Thread. Place three stainless steel flat washers on the platform, then install the lantern on the platform. See Figure 3-8.

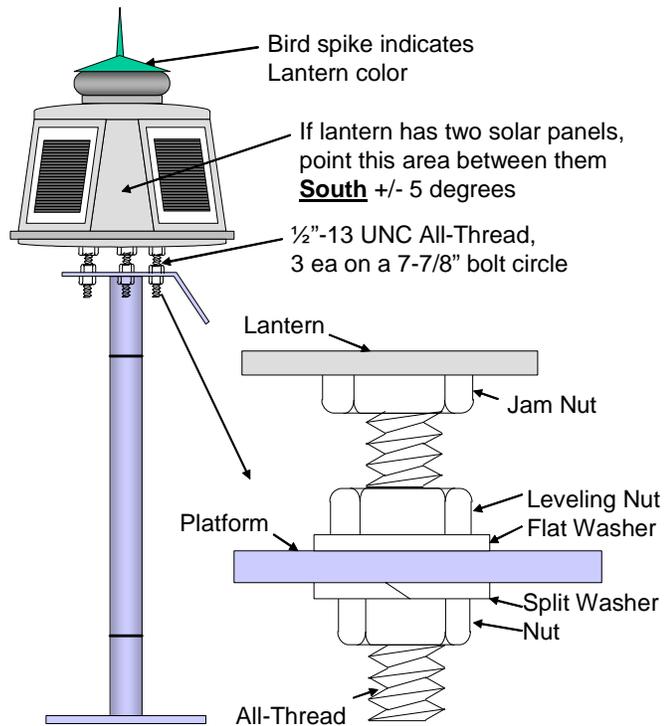


Figure 3-8

- d. Place a torpedo level on the bottom of the lantern (there is a circular pad in the center) in-line with two of the mounting holes. Using the "T" method, level the lantern using one or both of the nuts on top of the platform corresponding to those two mounting holes. Turn the level 90 degrees and level the lantern in that direction by turning the one nut on top of the platform opposite the other two nuts. The lantern should be level in both directions. See Figure 3-9.
- e. Install a stainless steel split lock washer and nut or Nylock nut on the bottom of the All-Thread and secure the lantern to

the platform. If the nothing moved, the lantern should still be level. Check with the torpedo level and adjust, if necessary.

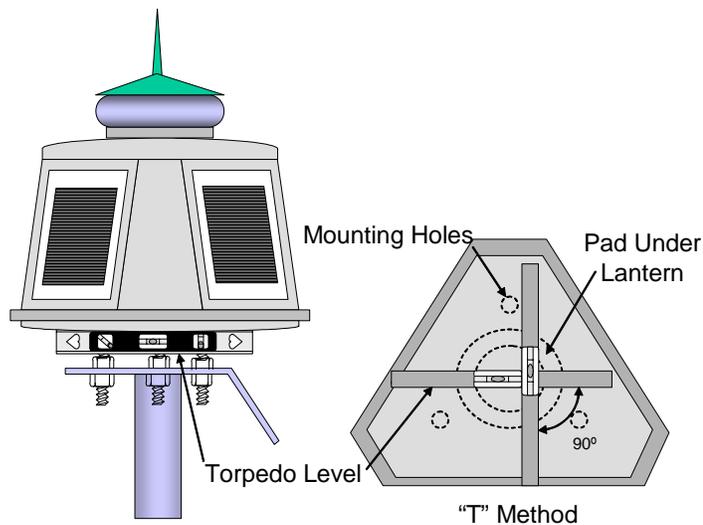


Figure 3-9

- f. Cover the lantern with a jacket and note if it turns on and flashes at the correct rhythm.
  - g. Install the three bird deterrents by pushing the supplied springs into the holes on top of the lantern at approximately a 30 degree angle.
4. Servicing.
- a. Servicing should be performed in accordance with the standard cycle established for the aid.
  - b. Ensure that the lens and solar panels are clean. Wipe with a cloth dampened with mild soap and water, if necessary.

- c. Cover the lantern with a shroud, jacket, blanket, etc., to simulate darkness. The lantern should flash on rhythm after a few seconds. It should stop flashing after the cover is removed in the daytime. While covered, observe the LEDs through the lens. Dark sectors indicate that a LED cluster is not operating, necessitating replacement of the optic head.
- d. Uncover the lantern. It should stop flashing.

5. Troubleshooting.

- a. If the lantern is reported discrepant inspect the lens, housing and solar panels for obvious signs of damage. Replace the lantern if damage is noted. Clean the solar panels if dirty.
- b. Cover the lens and note if the lantern turns on and flashes on rhythm. If no light, open the lantern and load test the battery (see page 2-20). If the lantern lights, cover the solar panels and query the lantern using the remote to determine the battery voltage (lanterns with tap switches do not use a remote. Open the lantern and measure battery voltage).

Press and hold the standby/program/power button for up to 60 seconds. Four flashes indicate the programming mode:

**3**      **System Check**  
**1**      **Battery Voltage**

The lantern will flash the battery voltage as a series of codes; i.e., 12.5 volts is displayed as 1 flash, pause, 2 flashes, pause, 5 flashes. If battery voltage is below 12.2 volts, determine the cause and replace the battery.

- c. Observe the LEDs when flashing to ensure all LEDs are lit (do not look directly into the lantern). If dark areas are noted, replace the lantern.
- d. If the light does not turn off in the daytime, replace the lantern.

D. Vega VLB-67 Stand-Alone & Self-Contained LED Lanterns.



1. Notes. The VLB-67 LED lanterns are available in 4 system sizes; standalone (used with legacy power system), small, large and large with 2 batteries as self-contained LED lanterns. Proper selection of the intensity and power system size must be made by District (dpw) prior to installation.

2. Programming.

- a. Lanterns shall be programmed and fully charged at the base prior to transport and installation at the aid. Consult the Commandant (CG-432A) website prior to transport to the aid: <http://www.uscg.mil/hq/cg4/cg432/products.asp>.
- b. Quick Programming Guide (see above link for more complete instructions):

**Standard CG Flash Rhythms**

Rhythm	Code	Rhythm	Code
FL2.5 (0.3)	<b>310</b>	Q	<b>601</b>
FL4 (0.4)	<b>321</b>	Mo(A)	<b>801</b>
FL6 (0.6)	<b>337</b>	Iso 2	<b>100</b>
FL (2+1) 6	<b>472</b>	Iso 6	<b>104</b>
FL (2) 5	<b>406</b>	Oc 4	<b>205</b>
FL (2) 6	<b>416</b>		

**Intensity Codes**

5 cd	<b>0005</b>	24	<b>0024</b>	37	<b>0037</b>
10	<b>0010</b>	21	<b>0021</b>	54	<b>0054</b>
15	<b>0015</b>	29*	<b>0029</b>	77	<b>0077</b>

\*Max for yellow

A sample programming session might include the following steps:

Press and hold the standby/program/power button for up to 60 seconds. Four flashes indicate the programming mode:

**1 5 0 0 0 Normal Operating Mode**  
**1 0 3 3 7 FL6(.6) Flash Rhythm**  
**1 1 0 0 7 7 Intensity 77 Candelas**  
**1 4 0 0 9 Day/Night Transition Level**

### 3 Installation.

- a. The lantern is drilled for a 3 or 4-hole mount on a 200mm bolt-circle so it is directly interchangeable with the 155mm and 250mm lanterns.
- b. On steel buoys, install three  $\frac{1}{2}$ " stainless steel bolts and flat washers through the lantern mounting holes and three flat washers and Nylock nuts to secure the lantern. Avoid tall bolts that could shadow the solar panels. Split washers and nuts can replace Nylock nuts. See Figure 3-10.

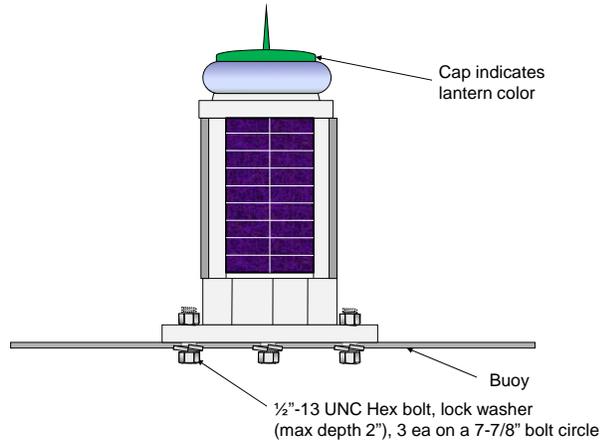


Figure 3-10

- c. On structures, install three  $\frac{1}{2}$ " stainless steel bolts (or all-thread) to the structure's mounting plate as shown in Figure 3-11. Install three jam nuts on the bolts so that about 1" of thread is exposed. Place the lantern on top of the leveling nuts, and then position the uppermost nuts at the very upper end of the thread. Do not tighten these uppermost nuts – they are positioned at this time to ensure that the lantern doesn't fall off.

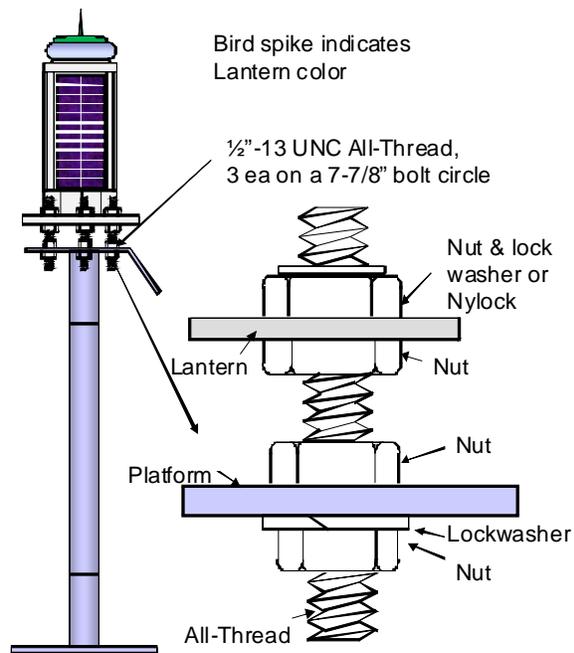


Figure 3-11

- d. Place a torpedo level on top of the lantern base in-line with two of the mounting holes. Using the "T" method (if space permits), level the lantern using one or both of the nuts on

top of the platform corresponding to those two mounting holes. Turn the level 90 degrees and level the lantern in that direction by turning the one nut on top of the platform opposite the other two nuts. The lantern should be level in both directions. See Figure 3-12.

- e. Install a stainless steel nut and lockwasher or Nylock nut on the top of the All-Thread and secure the lantern to the platform. If nothing moved, the lantern should still be level. Check with the torpedo level and adjust, if necessary.

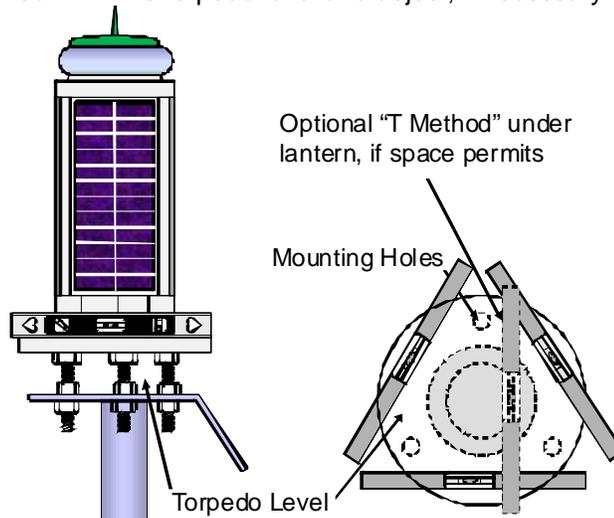


Figure 3-12

- f. Cover the lantern with a jacket and note if it turns on and flashes at the correct rhythm.

#### 4. Servicing.

- a. Servicing should be performed in accordance with the standard cycle established for the aid.
- b. Ensure that the lens and solar panels are clean. Wipe with a

- cloth dampened with mild soap and water, if necessary.
- c. Cover the lantern with a shroud, jacket, blanket, etc., to simulate darkness. The lantern should flash on rhythm after a few seconds. It should stop flashing after the cover is removed in the daytime. While covered, observe the LEDs through the lens. Dark sectors indicate that an LED cluster is not operating, necessitating replacement of the optic head.
  - d. Uncover the lantern. It should stop flashing.

5. Troubleshooting.

- a. If the lantern is reported discrepant inspect the lens, housing and solar panels for obvious signs of damage. Replace the lantern if damage is noted. Clean the solar panels if dirty.
- b. Cover the lens and note if the lantern turns on and flashes on rhythm. If no light replace the lantern. If the lantern lights, cover the solar panels and query the lantern using the remote to determine the battery voltage.

Press and hold the standby/program/power button for up to 60 seconds. Four flashes indicate the programming mode:

<b>3</b>	<b>System Check</b>
<b>1</b>	<b>Battery Voltage</b>

The lantern will flash the battery voltage as a series of codes; i.e., 12.5 volts is displayed as 1 flash, pause, 2 flashes, pause, 5 flashes.

If battery voltage is below 12.2 volts, determine the cause and replace the battery.

- c. Observe the LEDs when flashing to ensure all LEDs are lit (do not look directly into the lantern). If dark areas are noted, replace the lantern.
- d. If the lantern does not turn off in the daytime, replace the lantern.

E. 250 mm Lanterns.

1. Notes. The 250mm lantern is used on stable platforms. This omnidirectional lantern requires precision focusing and leveling to ensure proper operation. The lens and lens cover are replaceable; beam color (white, yellow, red or green) is determined by the lens cover. Color sectored lens covers can be used and condensing panels can be added for range applications.



2. Installation.

- a. Install three ½" threaded rods or bolts on the platform as shown in Figure 3-13 (only three of the four holes in the base are used). Add the leveling nut and flat washer at this time.
- b. Position lantern legs over leveling bolts.
- c. Place a flat washer and Nylock nut on each bolt. **Do not tighten completely.**

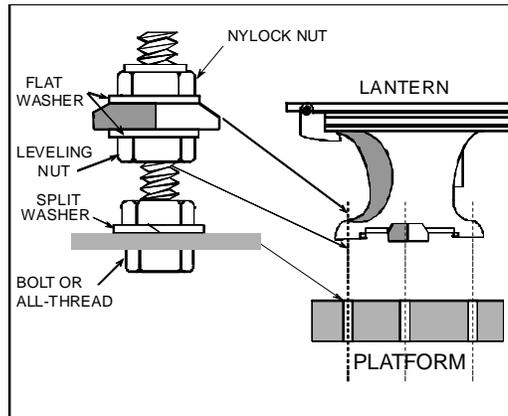


Figure 3-13

- d. With lens open, place a level on the flange of the lantern base. **The bubble level on the lantern shall not be used.** Use the "T" method shown in Figure 3-14 so that adjustment of one leveling bolt won't affect the other adjustment.
- e. Adjust the leveling nuts up or down until level.
- f. Move the level ninety (90) degrees from your first position and readjust.
- g. Repeat the steps until the lantern is level in both positions.

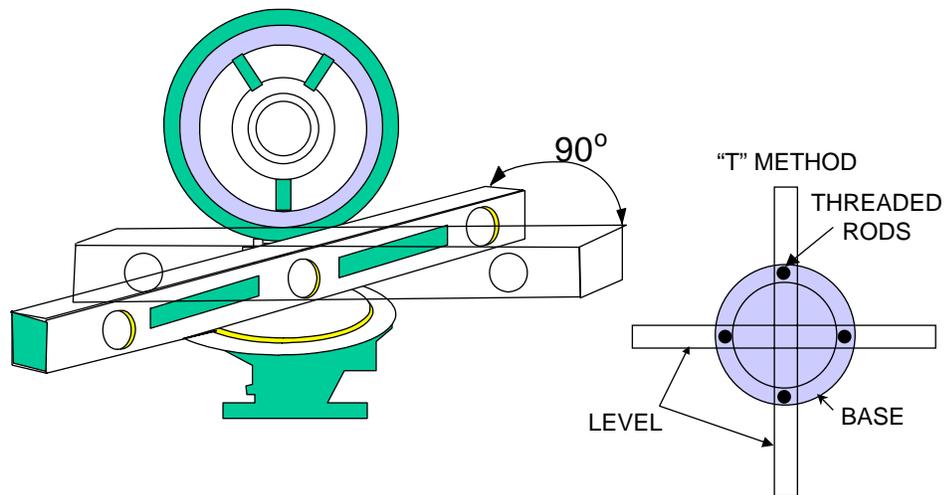


Figure 3-14

- h. Tighten the top nuts securing the lantern. **DO NOT OVERTIGHTEN.**
- i. Recheck levelness of lantern.
- j. Obtain a tested CG-6P lampchanger and flasher with the

appropriate hardware (see Chapter 4).

- k. Attach the mounting bracket between the base of the CG-6P lampchanger and flasher with **four** 10-32x1" screws supplied so that the outer ring of the bracket is above the flasher and the flasher's terminals are not covered, as shown in Figure 3-15. The wires from the WK-681 wiring kit must pass **inside** the bracket ring.

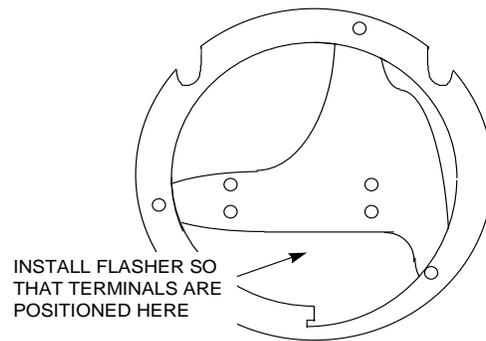


Figure 3-15

- l. Wiring will normally be 12/2 SO cable through a watertight stuffing tube, or individually insulated wires installed in conduit (Liquid-Flex near lantern). Wires shall have insulated spade lugs and terminated at the Black (+) and White (-) terminals of the flasher.
- m. Install a focus fixture in the first lamp position.
- n. Install assembly into lantern by lining up slots with studs in the lantern ring. Insert, rotate and secure wing nuts to secure. **Note:** Mount lampchanger/flasher bracket flush against the arms with the spacers on the studs between the wing nuts and bracket, as shown in Figure 3-16.

3. Focusing.

- a. Loosen (do not remove) all screws on the lens cover clamping ring. See Figure 3-16.

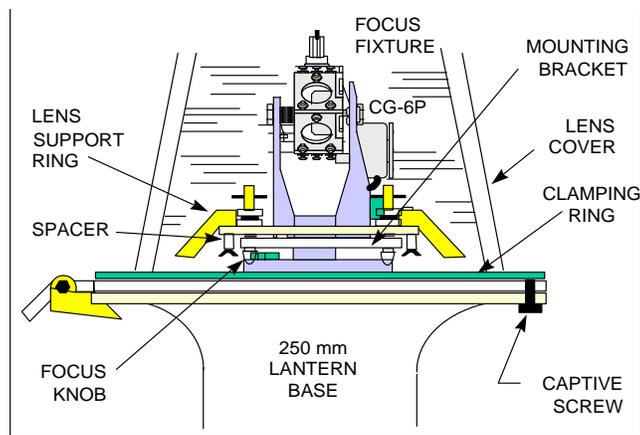


Figure 3-16

- b. With lantern open, look into the lens cover. Check to see if one knob is aligned with sight marks. If not, rotate the lens cover until one of the focus knobs is aligned with one set of sighting marks. See Figure 3-17

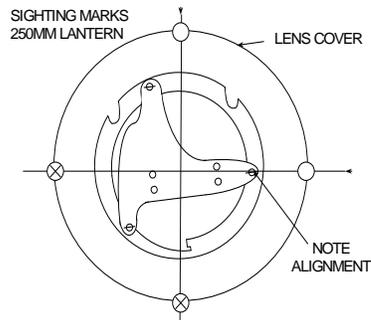


Figure 3-17

- c. Secure the screws on the lens clamping ring
- d. Secure the flasher/lampchanger assembly on studs above the spacers.
- e. Tighten the focus knobs ("D" rings) on the mounting bracket **COUNTER- CLOCKWISE** until the mounting bracket is tight against the mounting ring.
- f. Turn each focus knob **CLOCKWISE** six (6) complete revolutions. You should observe the focus fixture slightly below the sighting marks - if not right on.
- g. Sight through the set of sighting marks (through "O" to "X") that are aligned with the focus knob.

- h. Observe the focus fixture. Is it right or left or low? If so, turn one of the two focus knobs not aligned with the sighting marks you are using until the focus fixture is centered.

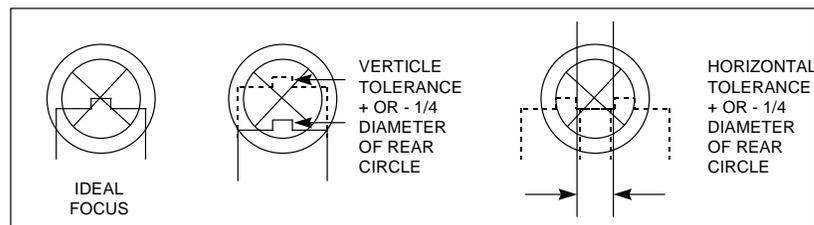


Figure 3-18

- i. If the focus fixture is above the sighting marks, turn all the focus knobs the same amount to lower or raise the focus fixture.
- j. Sight through the other set of sighting marks.
- k. Observe the focus fixture. Is it right or left or low? If so, turn only the third focus knob until the focus fixture is centered See Figure 3-18.
- l. Repeat steps until you observe the focus fixture centered under the sighting marks.
- m. Finally, turn all focus knobs evenly until the focus fixture is centered in the sighting marks.
- o. If you are still unable to focus -- Check for improper mounting, spacers, bent mounting bracket, etc. Then, **REPEAT PROCEDURES.**
- p. Remove lampchanger/flasher assembly by loosening the three wing nuts. **DO NOT TURN THE "D" RINGS ON THE**

BRACKET.

- q. Remove the focus fixture by turning it counterclockwise. Install six lamps in the lampchanger, as described in Chapter 4. Advance the lampchanger to the first position and reinstall in the lantern.

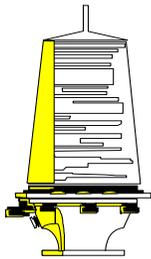
4. Maintenance.

- a. Visually inspect the lens and base for cracks, crazing, holes, etc. Replace if necessary.
- b. Open lantern by loosening four captive screws on base below lantern ring. Swing lens open against stops.
- c. Inspect drain holes in base. Clean if necessary.
- d. Place a level on the base and check levelness in both directions. Correct if not level.
- e. Remove lampchanger/flasher assembly by loosening the three wing nuts. DO NOT TURN THE "D" RINGS ON THE BRACKET.
- f. Remove the operating lamp and any burned out lamps. CAUTION - LAMPS MAY BE HOT. Use a clean rag when removing lamps.
- g. Install the focus fixture in the lampchanger.
- h. Reinstall the lampchanger assembly onto the lantern arms, then the spacers and secure.
- i. Check the focus and adjust, if necessary, as described in Section 4.
- j. Remove the lampchanger assembly from the lantern.

- k. Advance unused lamps to the first positions and install new lamps in the remaining positions, as described in Chapter 4.
  - l. Perform the quick aid test outlined in Chapter 4.
  - m. Rotate turret to the first position. CAUTION - LAMPS AND TURRET MAY BE HOT.
  - n. Reinstall the lampchanger assembly.
  - o. Close and secure the lens assembly.
  - p. Clean the lens cover, if necessary with a soft bristle brush and mild soap and water.
5. Troubleshooting.
- a. If the light is reported burning dim, perform the following system checks:
    - (1) Load test the battery (Chapter 2).
    - (2) Check focus of lantern (Section 3). Be sure correct lamps are installed.
    - (3) Clean lens cover if necessary.
  - b. If the light is reported out, perform the following system checks:
    - (1) Load test the battery (Chapter 2).
    - (2) Meg the power cable (Chapter 2).
    - (3) Perform the Minor Aid Troubleshooting Test (Chapter 4).

F. 300mm Lanterns.

1. Notes. The 300mm lantern is used only on stable platforms. This omnidirectional lantern requires precision focusing and leveling using our legacy lighting equipment to ensure proper operation. The lens is replaceable and available in clear, yellow, red and green.



2. Installation.

- a. Install three 1/2" threaded rods or bolts on the platform as shown in Figure 3-19. Add the leveling nut and flat washer at this time.

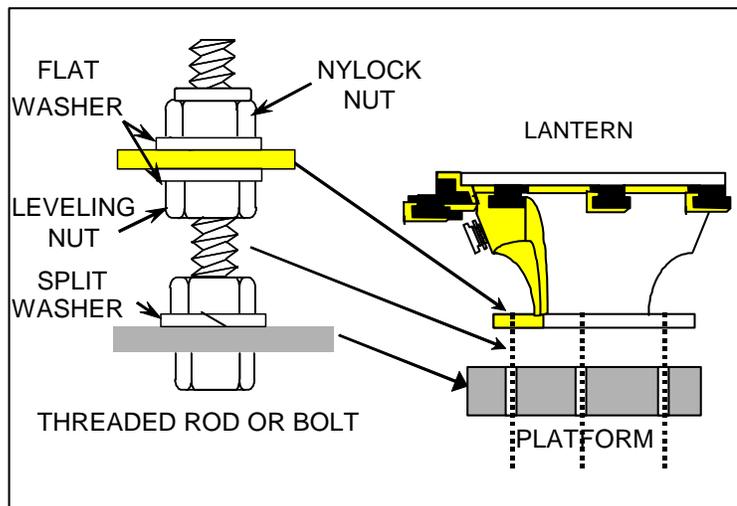


Figure 3-19

- b. Position lantern over threaded rods. Place a Nylock nut and flat washer on each rod but do not tighten completely.
- c. With lens open, place a level on the flange of the lantern base. Use the "T" method shown in Figure 3-20 so that adjustment of one leveling bolt won't affect the other adjustment. **DO NOT USE THE LANTERN BUBBLE LEVELS.**
- d. Adjust the leveling nuts up or down until level.

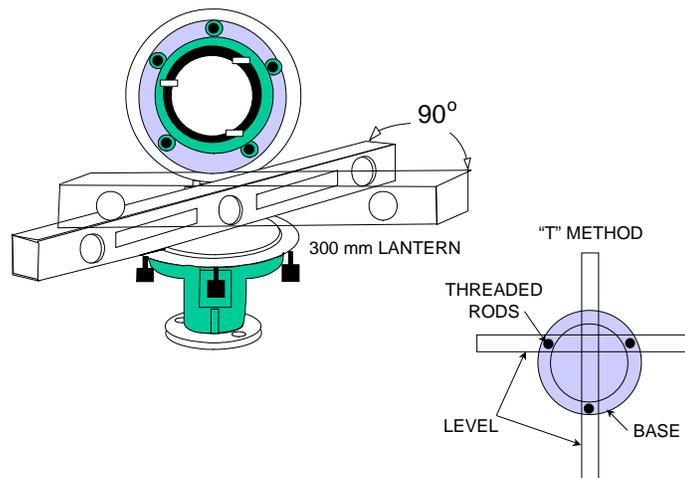


Figure 3-20

- e. Move the level ninety (90) degrees from your first position and readjust. See Figure 3-20.
- f. Repeat steps until the lantern is level in both positions.
- g. Tighten top nuts on leveling bolts and recheck levelness of lantern. **DO NOT OVERTIGHTEN.**

- h. Obtain a tested CG-6P lampchanger and flasher with the appropriate hardware (see Chapter 4).
- i. Attach the mounting bracket between the base of the CG-6P lampchanger and flasher with four 10-32x1" screws supplied so that the dip in the bracket is down, as shown in Figure 3-21. The wires from the WK-681 wiring kit must pass **under** the bracket. Attach the bracket to 300mm tripod by turning the assembly onto the studs, and then tighten the wing nuts.

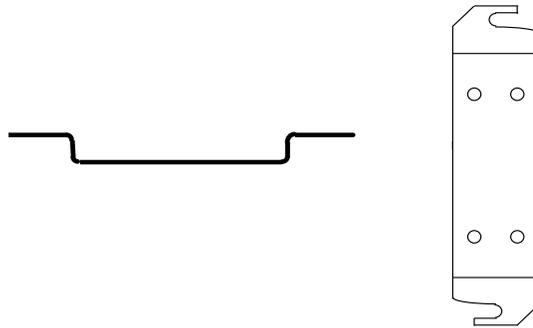


Figure 3-21

- j. Wiring will normally be 12/2 SO cable through a watertight stuffing tube, or individually insulated wires installed in conduit (Liquid-Flex near lantern). Wires shall have insulated spade lugs and terminated at the Black (+) and White (-) terminals of the flasher.
- k. Install a focus fixture in the first lamp position.
- l. Install assembly into lantern by lining up the opposing triangles (><, on most lanterns) on the tripod and lantern ring. Insert, rotate and tighten wing nuts to secure.

3. Focusing.

- a. With lantern open, look into the lens and see if one of the focus screws is aligned with one set of sighting marks. If not, loosen lens clamps and rotate the lens.
- b. Secure each of the lens clamping screws.
- c. Insert a focus fixture in the lampchanger.
- d. Secure tripod flasher/lampchanger assembly on lens support ring. HINT: the bracket can only be installed one way and some lanterns have alignment triangles on the lens support ring and tripod. Tighten the wing nuts.
- e. Tighten focus screws on lens support ring **CLOCKWISE** until tight against the lens base.
- f. Turn each focus screw **COUNTER-CLOCKWISE** nine (9) complete revolutions.
- g. Install the focus prism over one of the focus dots on the lens. You should observe the focus fixture slightly below the sighting marks if not right on. See Figure 3-22.

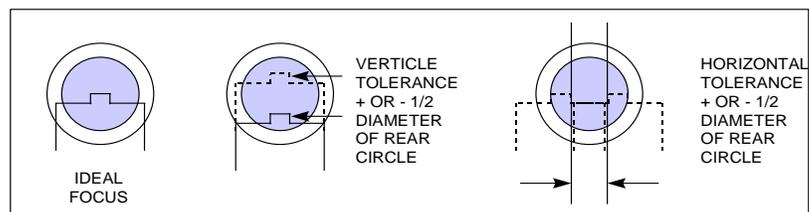


Figure 3-22

- h. Sight through the set of sighting marks using the focus prism that is aligned with the focus knob.
  - i. Observe the focus fixture. Is it right or left or low? If so, turn one of the two focus screws not aligned with the sighting marks until the focus fixture is centered. See Figure 3-22.
  - j. If the focus fixture is above the sighting marks, turn each focus screw two (2) or three (3) more complete turns until it is either below it or right on.
  - k. Sight through the other set of sighting marks using the focus prism.
  - l. Observe the focus fixture. Is it right or left or low? If so, turn only the third focus screw until the focus fixture is centered.
  - m. Repeat steps until you observe the focus fixture centered under the sighting marks.
  - n. Finally, turn all focus screws **CLOCKWISE** until the focus fixture is centered in the sighting marks.
  - o. If unable to focus, check for improper mounting, spacers, bent mounting bracket, etc. Then, repeat above procedures.
  - p. Remove lampchanger/flasher assembly by loosening the three wing nuts.
  - q. Remove the focus fixture. Install six lamps in the lampchanger, as described in Chapter 4.
4. Maintenance.
- a. Visually inspect the lens and base for cracks, crazing, holes, etc. Replace if necessary.
  - b. Open lantern by loosening four screws on base below

lantern ring. Swing lens open against stops.

- c. Inspect drain holes. Clean if necessary.
- d. Place a level on the base and check levelness in both directions. Correct if not level.
- e. Remove lampchanger/flasher assembly by loosening the three wing nuts. **DO NOT TURN THE THREE SCREWS ON THE LANTERN RING.**
- f. Remove the operating lamp and any burned out lamps. **CAUTION - LAMPS MAY BE HOT.** Use a clean rag when removing lamps.
- g. Install the focus fixture in the lampchanger.
- h. Reinstall the lampchanger/flasher assembly onto the lantern ring and secure.
- i. Check the focus and adjust, if necessary, as described in Section 3.
- j. Remove the lampchanger/flasher assembly from the lantern.
- k. Advance unused lamps to the first positions and install new lamps in the remaining positions, as described in Chapter 4.
- l. Perform the quick aid test outlined in Chapter 4.
- m. Rotate turret to the first position. **CAUTION - LAMPS AND TURRET MAY BE HOT.**
- n. Reinstall the lampchanger assembly.
- o. Close and secure the lens assembly.
- p. Clean the lens cover, if necessary with a soft bristle brush

and mild soap and water.

5. Troubleshooting.

- a. If the light is reported burning dim, perform the following system checks:
  - (1) Load test the battery (Chapter 2).
  - (2) Check focus of lantern (Section 3). Be sure correct lamps are installed.
  - (3) Clean lens cover if necessary.
- b. If the light is reported out, perform the following system checks:
  - (1) Load test the battery (Chapter 2).
  - (2) Meg the power cable (Chapter 2).
  - (3) Perform the Minor Aid Troubleshooting Test (Chapter 4).

G. Tideland MLED-120 and Sealite SL125 LED Lanterns.

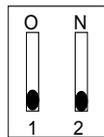
1. Notes. The Tideland MLED-120 and Sealite SL125 (pictured) are similar in appearance, operation and installation. Both will be covered in this section. The Sealite lantern is completely sealed and is equipped with a power cord. The Tideland lantern is accessible for power cable installation and replacement of the daylight control. These lanterns require a legacy power system (solar panel and battery). Proper selection must be made by District (dpw) prior to installation.



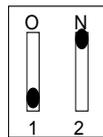
2. Programming.
- a. Lanterns shall be programmed at the base prior to transport and installation at the aid. Consult the Commandant (CG-432A) website prior to transport to the aid: <http://www.uscg.mil/hq/cg4/cg432/products.asp> .
- b. Quick Programming Guide (see above link for more complete instructions):

Access to Sealite lanterns is through plug in base; Tideland- remove locking screw and twist open base.

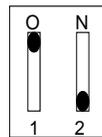
**Intensity Codes (Sealite Only)**



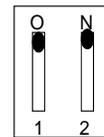
25% Intensity



50% Intensity



75% Intensity



100% Intensity

**Standard CG Flash Rhythm Codes\***

Buoys/Structures			Ranges		
Rhythm	Tideland/Sealite		Rhythm	Tideland/Sealite	
FL2.5 (0.3)	1C	80	Iso 6	55	52
FL4 (0.4)	09	E0	Iso 2	51	12
FL6 (0.6)	1D	91	FL2.5(1)	03	D6
Q	99	83	Oc 4	90	F2
Mo(A)	E6	7B	Fix	00	00
FL (2) 6	23	37			
FL (2+1) 6	4B	2B			
FL (2) 5	8D	4A			

\*Sealite code refers to switches A & B, Tideland code is for switches S1 & S2.

**3 Installation.**

- a. The lanterns are installed on a standard 3-hole mount with a 7-7/8" bolt circle using either 1/2" stainless steel bolts or threaded rod.
- b. On buoys the lantern should be elevated at least 4" so that the lantern ring does not obstruct the light, as shown in Figure 3-23. Spacers are available from the manufacturer or can be fabricated locally.

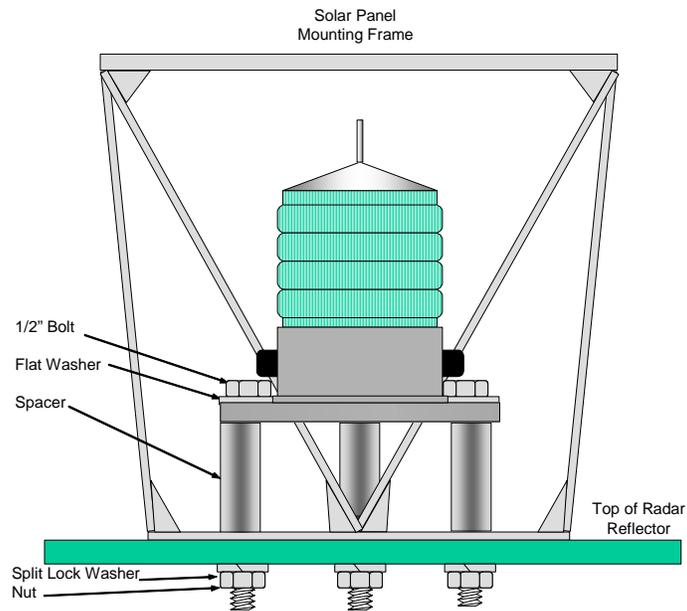


Figure 3-23

- c. On structures, secure three 1/2" stainless steel bolts (or all-thread) to the structure's mounting plate as shown in Figure 3-24. Install three jam nuts and flat washers on the bolts so that about 1" of thread is exposed. Place the lantern on top of the leveling nuts, and then install the flat washer and Nylock nuts at the very upper end of the thread. Do not tighten these uppermost nuts – they are positioned at this time to ensure that the lantern doesn't fall off. Level the lantern on structures by adjusting the leveling nuts (use a torpedo level on the top of the lens or base plate of the lantern, whichever is flat) - use the "T" method. When the lantern is level, tighten the Nylock nuts.

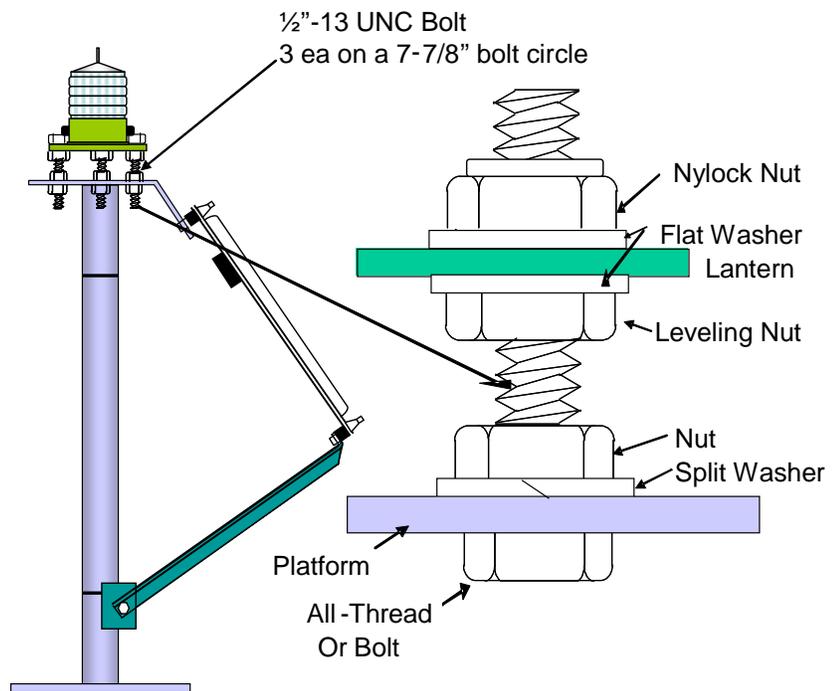


Figure 3-24. Installation – Structure

- d. Route the power cables from the lantern and solar panel to the battery and attach the black to the positive terminal and white to the negative terminal using ring lugs. The Sealite cable is fixed, so if it doesn't reach, use a LED Junction Box or replace the cable. Also, some Sealite lanterns may have European color coding; brown is positive and blue is negative.
- e. Apply power to the lantern, cover the lens with a jacket or

blanket, or the external daylight control and note if the lantern flashes on-rhythm.

4. Servicing.
  - a. Servicing should be performed in accordance with the standard cycle established for the aid.
  - b. Ensure that the lens and solar panels are clean. Wipe with a cloth dampened with mild soap and water, if necessary.
  - c. Load test the battery.
  - d. Cover the lantern with a shroud, jacket, blanket, etc., or the daylight control to simulate darkness. The lantern should flash on rhythm after a few seconds. It should stop flashing after the cover is removed in the daytime. While covered, observe the LEDs through the lens. Dark sectors indicate that an LED cluster is not operating, necessitating replacement of the lantern.
  - e. Uncover the lantern/daylight control. It should stop flashing.
5. Troubleshooting. If the lantern is reported discrepant or is flashing irregularly:
  - a. Load test the battery (Chapter 2).
  - b. Meg the power cable (Chapter 2).
  - c. Replace the lantern and troubleshoot completely at the Unit using the referenced Technical Data Sheets. Corrective action to the lantern should not be performed on-station.

H. Vega VLB-44 LED Lantern.



1. Notes. The Vega VLB-44 is a high intensity LED lantern suitable for use on buoys, structures and lighthouses. This lantern requires a legacy power system (solar panel and battery). It is available in three divergences; 10 degrees for buoys (with a tall base), 5 degrees for structures and 2.5 degrees for lighthouses. LED optic heads may be stacked (up to 8) to increase intensity. Proper selection must be made by District (dpw) prior to installation.

2. Programming.

- c. Lanterns shall be programmed at the base prior to transport and installation at the aid. Consult the Commandant (CG-432A) website prior to transport to the aid:  
<http://www.uscg.mil/hq/cg4/cg432/products.asp>.
- d. Quick Programming Guide (see above link for more complete instructions and to program early lanterns with a tap switch):

**Standard CG Flash Rhythms**

Rhythm	Code	Rhythm	Code
FL2.5 (0.3)	<b>310</b>	Q	<b>601</b>
FL4 (0.4)	<b>321</b>	Mo(A)	<b>801</b>
FL6 (0.6)	<b>337</b>	Iso 2	<b>100</b>
FL (2+1) 6	<b>472</b>	Iso 6	<b>104</b>
FL (2) 5	<b>406</b>	Oc 4	<b>205</b>
FL (2) 6	<b>416</b>	Fixed	<b>000</b>

Intensity Codes*			
21 cd	<b>0021</b>	77	<b>0077</b>
29	<b>0029</b>	83	<b>0083</b>
39	<b>0039</b>	131	<b>0131</b>
54	<b>0054</b>	150	<b>0150</b>
66	<b>0066</b>	161	<b>0161</b>
		205	<b>0205</b>
		220	<b>0220</b>
		240	<b>0240</b>

\*Typical intensities for minor aids. See online instructions for additional values.

A sample programming session might include the following steps:

Press and hold the standby/program/power button for up to 60 seconds. Four flashes indicate the programming mode:

**1 0 3 3 7 FL6(.6) Flash Rhythm**  
**1 1 0 0 7 7 Intensity 77 Candelas**

3. Installation.

- a. Lanterns shall be programmed at the base prior to transport and installation at the aid. Consult the Commandant (CG-432A) website for specific instructions regarding these lanterns.
- b. The lanterns are installed on a standard 3-hole mount with a 7-7/8" bolt circle using either 1/2" stainless steel bolts or threaded rod.
- c. On buoys the lantern should be purchased with the high base or elevated at least 4" so that the lantern ring does not obstruct the light, as shown in Figure 3-25. Spacers can be fabricated locally.

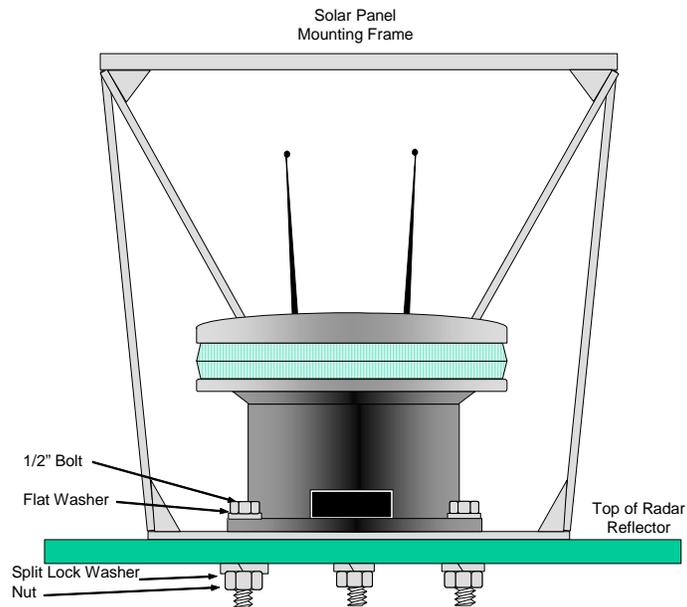


Figure 3-25

- d. On structures, secure three 1/2" stainless steel bolts (or all-thread) to the structure's mounting plate as shown in Figure 3-26. Install three leveling nuts and flat washers on the bolts so that about 1" of thread is exposed. Place the lantern on top of the leveling nuts, and then install the flat washers and Nylock nuts at the very upper end of the thread. Do not tighten these uppermost nuts – they are positioned at this time to ensure that the lantern doesn't fall off. Level the lantern on structures by adjusting the leveling nuts (use a torpedo level on the top of the lens) - use the "T" method. When the lantern is level, tighten the Nylock nuts.

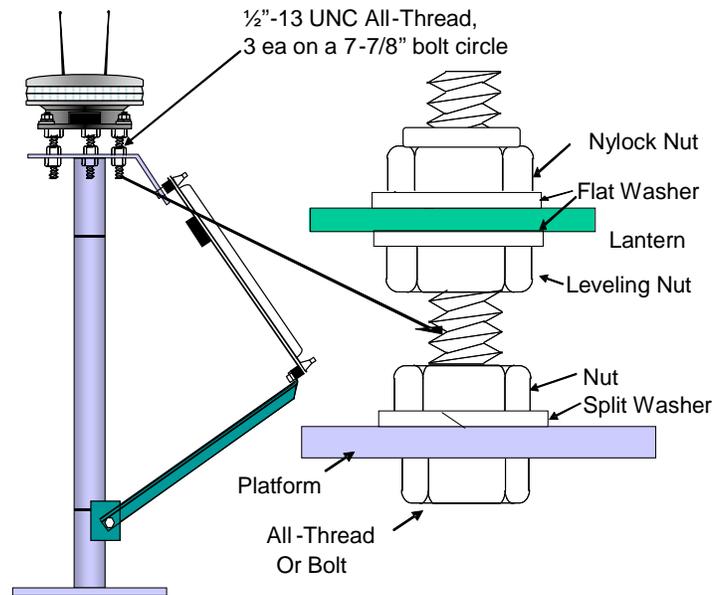


Figure 3-26.

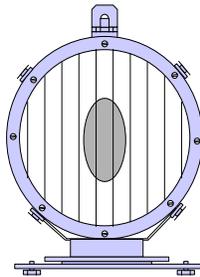
- e. Route the power cables from the lantern and solar panel to the battery and attach the black to the positive terminal and white to the negative terminal using ring lugs. The cable has a molded connector at the lantern, so if it doesn't reach, use a LED Junction Box.
  - f. Apply power to the lantern, cover the window above the label and note if the lantern flashes on-rhythm.
4. Servicing.
- a. Servicing should be performed in accordance with the standard cycle established for the aid.
  - b. Ensure that the lens is clean. Wipe with a cloth dampened

with mild soap and water, if necessary.

- c. Cover the window above the label to simulate darkness. The lantern should flash on rhythm after a few seconds. While covered, observe the LEDs through the lens. Dark sectors indicate that an LED cluster is not operating, necessitating replacement of the optic head.
  - d. Uncover the window. It should stop flashing in the daytime.
5. Troubleshooting. If the lantern is reported discrepant or is flashing irregularly:
- a. Load test the battery (Chapter 2).
  - b. Meg the power cable (Chapter 2).
  - c. Replace the lantern and troubleshoot completely at the base using the referenced Technical Data Sheets. Corrective action to the lantern should not be performed on-station.

I. 14 Inch Range Light (RL-14).

1. Notes.



a. The RL-14 is a 14 inch range light. The beam color can be white, yellow, red or green when using the appropriate colored spread or non-spread lens. All 12 volt lamps may be used in the lantern, however all C-8 filament lamps (0.55, 0.77, 1.15, 2.03, 3.05) must use a spread lens. Two versions of the RL-14 are currently installed in the field: the Tideland Signal RL355 and the Carlisle & Finch RL10668; the latter is considered the Coast Guard standard 14 inch range light. Parts between these beacons are not interchangeable. Additional information can be obtained from the instruction book included with each lantern.

b. RL14s are available from SFLC Baltimore. Spread Lenses are available from Tideland Signal Corporation, Houston, Texas.

**Note:** some lanterns were converted to LED light sources manufactured by BWT lighting, CR Control Systems and the latest version from Tideland Signal (LEDBullets). Consult our website <http://www.uscg.mil/hq/cg4/cg432/> for specific instructions.

2. Installation.

a. The lantern must be installed on a stable platform to ensure that accurate aim is maintained. Secure the lantern to the platform using 3/8" bolts as shown in Figure 3-27.

b. Leveling bushings are provided in the base to assist in

leveling the lantern. Use the spirit levels on top of the beacon to determine if the lantern is level. These levels are certified to be true.

- c. The drum is attached to the base in a manner that allows the beacon to be aimed regardless of the position of the base.

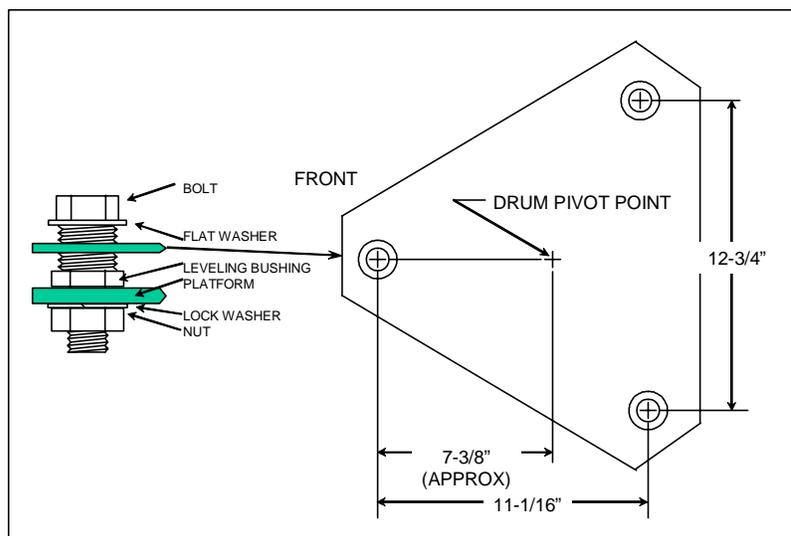


Figure 3-27

- d. Wiring will normally be 12/2 SO cable through a watertight stuffing tube, or individually insulated wires installed in conduit (Liquid-Flex near lantern). Pull enough slack through the lantern to attach to the flasher.
- e. Obtain a tested CG-6P/CG-6PHW lampchanger and appropriate flasher with the proper hardware (see Chapter 4).
- f. Attach the mounting bracket between the base of the CG-6P(HW) lampchanger and flasher with four 10-32x1" screws so that the dip in the bracket is **up** (cover "CG6P" stamped on

bracket with lampchanger). The wires from the WK-681 wiring kit must pass **under** the bracket, shown in Figure 3-28.

- g. Rotate the spacer blocks in the drum of the lantern to the correct lampchanger/lamp combination, as shown in Figure 3-28. Loosen the mounting screw and rotate the block until the selected surface aligns with the threaded hole in the back wall. Gently tighten the mounting screw.

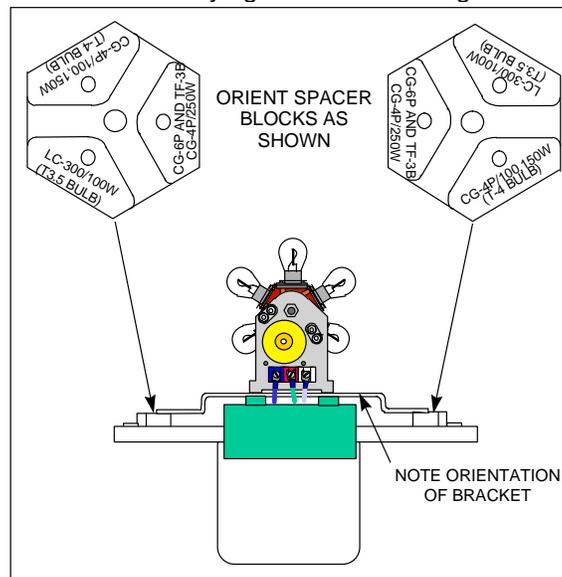


Figure 3-28

- h. Grasp the lampchanger/flasher/bracket assembly and guide into the aluminum can of the drum until the bracket rests against the spacers.
- i. Insert two 10-32x3/4" screws provided in the installation kit through the bracket into the holes in the spacer. Tighten screws.

- j. If a spread lens is used, remove the lens ring and cover glass. Reuse the gasket on the spread lens. Install the spread lens with the flat side **IN** and the lens elements oriented vertically (up & down).
- k. Aim the beacon using the gunsights built into the lift eye and hinge, as shown in Figure 3-29. On long ranges, use an observer in a boat to ensure that the brightest part of the beam is on the channel centerline. A Southfinder may be used to establish aim if the range bearing is known.

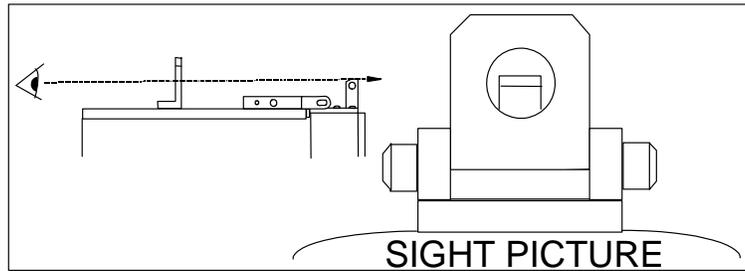


Figure 3-29

- 3. Focusing. The lantern is prefocused and no adjustments are required.
- 4. Maintenance.
  - a. Visually inspect the lens for cracks, crazing, holes, etc. Replace if necessary.
  - b. Loosen the 4 toggle latches and secure the door in an upright position with the supplied pin. Allow the lamps to cool if they were operating.
  - c. Clean the drain hole, if necessary.
  - d. Wearing gloves or using a soft cloth, remove the lamp in the operating position by rotating counter-clockwise. Remove

and discard any burned out lamps at this time. **Note:** it is advisable to secure power when servicing tungsten-halogen lamps.

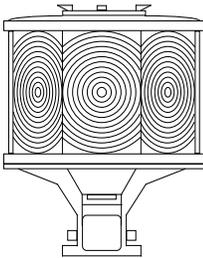
- e. Advance unused lamps to the first positions and install new lamps in the remaining positions, as described in Chapter 4.
- f. Perform the quick aid test outlined in Chapter 4.
- g. Rotate turret to the first position. CAUTION - LAMPS AND TURRET MAY BE HOT.
- h. Close and secure the door assembly.
- i. Clean the lens with a soft cloth and mild soap and water.

5. Troubleshooting.

- a. If the light is reported burning dim, perform the following system checks:
  - (1) Load test the battery (Chapter 2).
  - (2) Be sure correct lamps are installed.
  - (3) Be sure lampchanger bracket is not twisted, is installed correctly and spacer blocks are properly oriented.
  - (4) Clean lens cover if necessary.
- b. If the light is reported out, perform the following system checks:
  - (1) Load test the battery (Chapter 2).
  - (2) Meg the power cable (Chapter 2).
  - (3) Perform the Minor Aid Troubleshooting Test (Chapter 4).

J. VRB-25 Rotating Beacon.

1. Notes.



- a. The VRB-25 is the Coast Guard's standard 12 volt rotating beacon. It is comprised of a direct drive turntable assembly with 6 rotating lens panels, has a user selectable speed range of 0.67 to 15.9 rpm, and is capable of operating up to 110 watt lamps.
  - b. Spare parts are contained in the VRB spare parts kit, which are staged at ANTs with the greatest number of beacons. Additionally, spare parts, red and green lens panels, and blanking panels are available from Commandant (CG-432A) and the manufacturer. Beacons are available from Commandant (CG-432A).
  - c. The beacon is used only on structures not subjected to noticeable vibration (i.e., lighthouses, dolphin type structures and steel structures).
2. Pre-installation. Before bringing the beacon to the site, the following procedures should be performed at the servicing unit:
- a. Ensure that the correct lens panels are installed. The beacon is shipped with 6 clear lens panels. If blanking (black plastic), red or green panels need to be installed, consult with the instruction book supplied with the beacon.
  - b. Ensure that the correct RPM is selected. The beacon is shipped with the rotation rate preset at 1 rpm. If it needs to be changed, consult with the instruction book supplied with the beacon, or see section 7.c (Repair Procedures).
  - c. Two different lampchangers can be used in this beacon. The CG6P for all lamps less than 50 watts (0.77 to 3.05, inclusive). The CG6PHW with lamps 50 watts and greater.

- d. The CG-181/493/504 flasher is used in all beacons with lamps less than 50 watts (0.77 to 3.05, inclusive). Beacons with lamps 50 watts and greater do not use a flasher and must be externally controlled (see below).
  - e. The beacon may be operated in two different modes: internal control and external control. Internally controlled beacons use a Fixed flasher and type "L" daylight control to perform the lampchanging and daylight control functions. Externally controlled beacons are monitored and/or have an emergency light and may contain a flasher (for voltage regulation). If equipped with a flasher, the daylight control function is performed externally with a Solar Aid Controller (SACIII). If no flasher is installed, both lampchanging and daylight control functions are performed externally with a SACIII.
3. Installation.
- a. Install three ½ inch threaded rods or bolts equally spaced on a 7-7/8" bolt circle in the platform as shown in Figure 3-30. Add the leveling nut and flat washer at this time. Note, the beacon is provided with two (2) Nylock and two (2) plain nuts for each mounting rod.

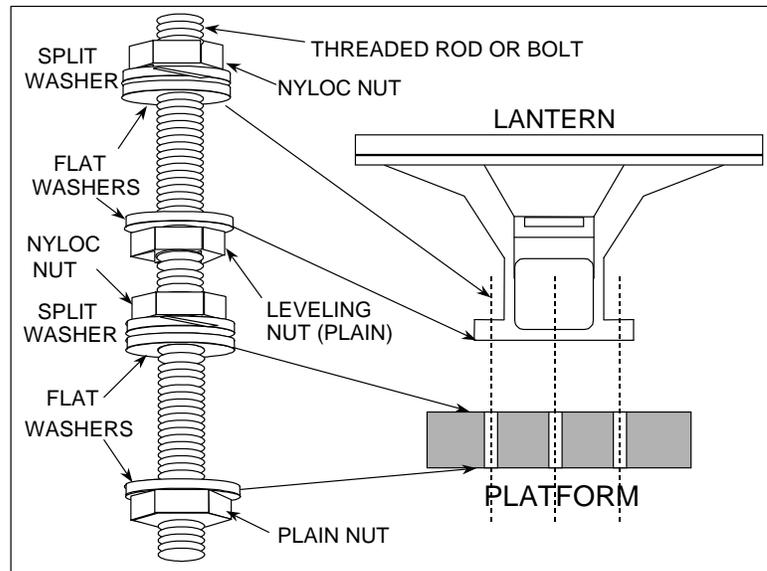


Figure 3-30

- b. Position beacon over leveling bolts. **Do not remove or lose the black bushings in the mounting holes.** Use Army-Navy Grommets (McMaster Carr part number 9307K27, Phone: 908-329-3200) between the flat washers surrounding the beacon base when tower is subject to vibration.
- c. Place a top washer, split washer and nut on each bolt. **Do not tighten completely.**

- d. Use the bubble level on the bottom of the lens cage to level beacon.

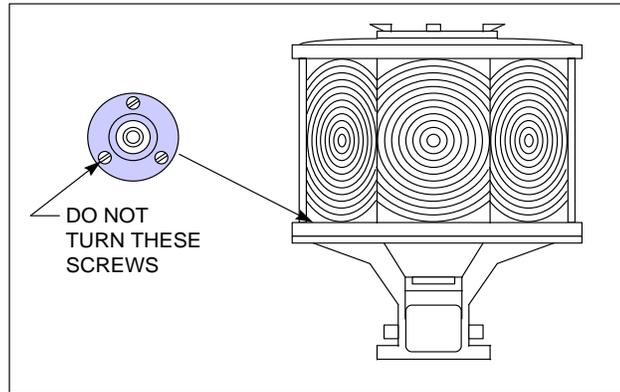


Figure 3-31

- e. Adjust the leveling nuts up or down until the bubble is centered in the circle on the level, as shown in Figure 3-31.
- f. Tighten top nuts on leveling bolts enough to compress the split washer. **DO NOT OVERTIGHTEN.**
- g. Rotate the lens cage and recheck the levelness of the beacon. The bubble should stay centered within the circle through an entire rotation of the lens cage. If not, center it the best you can through an entire rotation.
- h. **Wiring for Internal Control.** (If the beacon is to be wired for External Control, go to Section (i)).
  - (1) Unscrew the 4 capscrews, which secure the terminal plate to the beacon base and tilt the terminal plate down.

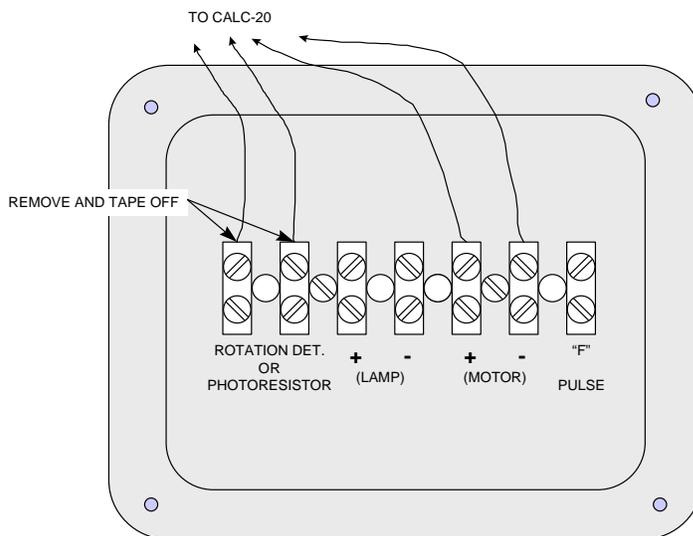
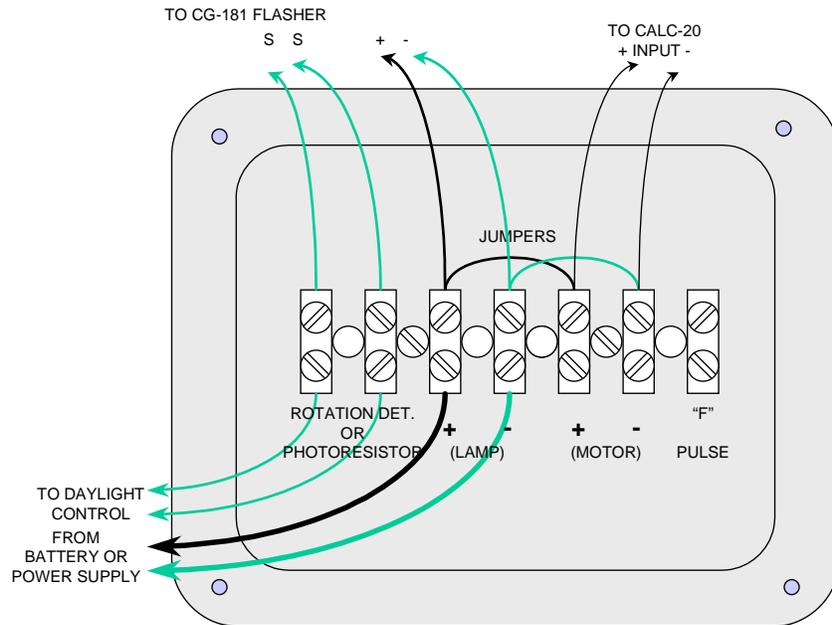


Figure 3-32

- (2) Four wires should already lead from the terminal strip on the cover plate; two for the drive motor and two for the rotation detector. Remove the two for the rotation detector and cover the ends with tape, or remove the wires completely from the CALC-20. They will not be used. See Figure 3-32
- (3) Insert the power cable (12 AWG wires in conduit/liquidflex; wires must be shielded) through the stuffing tube into one of the threaded openings in the base.
- (4) Remove 12 inches of outer jacket and strip  $\frac{1}{4}$  in of insulation from each conductor.



**Wiring for Internal Control**

Figure 3-33

- (5) Install the black wire to the Lamp (+) and the white wire to the Lamp (-) terminals.
- (6) Jumper the Lamp (+) to the Motor (+) on the terminal strip with 18 AWG or larger wire, as shown in Figure 3-33.
- (7) Jumper the Lamp (-) to the Motor (-) on the terminal strip.
- (8) Screw a Type-L daylight control into one of the threaded openings in the base. Cut the lugs off and strip  $\frac{1}{4}$  inch of insulation off each lead. Attach to the Photoresistor input terminals on the terminal strip.

- (9) Release the 8 thumb latches located on the lower ring of the glazing assembly by rotating them 180 degrees. Carefully lift the glazing **straight** up from the beacon and set aside.

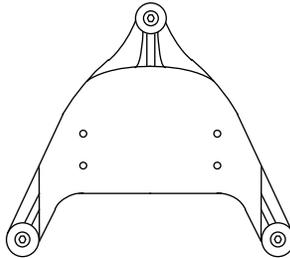


Figure 3-34

- (10) Looking down into the beacon, remove the three capscrews securing the lampchanger plate (Figure 3-34) to the flasher housing. Remove the lampchanger plate.
- (11) Wire the lampchanger with a WK-681 wiring kit. After securing the lugs, bend the lugs out 90 degrees from the terminals.
- (12) Orient the lampchanger on the Lampchanger Plate so that the terminal strip faces away from the opening in the plate, as shown in Figure 3-35.

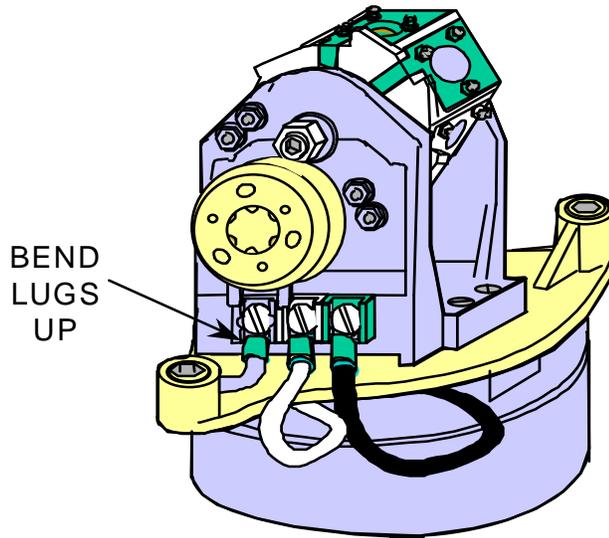


Figure 3-35

- (13) Loop the wires from the lampchanger under the plate and connect to the flasher. Secure the flasher and lampchanger to the lampchanger plate with four 10-32 screws.
- (14) Make up four wires, one black, one white and two yellow each two feet long with lugs attached to **ONE** end. The yellow wires should be 18 AWG, the black and white 12 AWG, all with PVC or Teflon insulation.

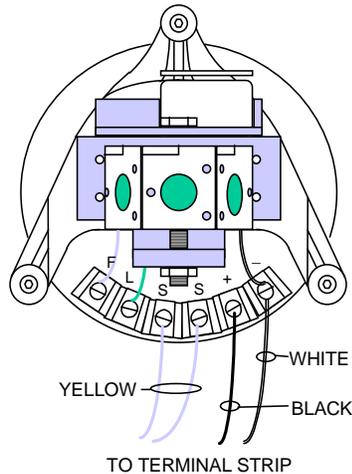


Figure 3-36

- (15) Attach the leads to the flasher as shown in Figure 3-36.
- (16) Make sure the springs are still in place in the flasher housing (inside beacon).
- (17) Pass the four wires from the flasher through the opening in the bottom of the flasher housing and pull the leads in the beacon base as the assembly is lowered, as shown in Figure 3-37.
- (18) Screw the Lampchanger Plate to the Flasher Housing with the 3 capscrews. The filament support shadow should face the non-critical area. Do not tighten capscrews.
- (19) Cut excessive wire from the flasher (leave enough to easily work on the Terminal Plate and strip ¼ inch from each lead.)

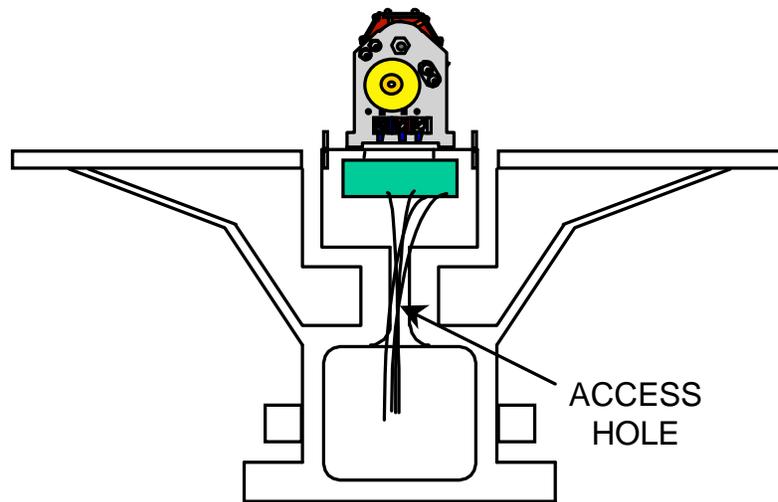


Figure 3-37

- (20) Attach the yellow leads to the daylight control, the black lead to the Lamp (+) terminal and the white wire to the Lamp (-) terminal.
- (21) Install the Terminal Plate on the beacon.
- (22) Go to Section 3, Focusing.
- i. **Wiring for External Control** (If the beacon is to be wired for Internal Control, go to Section h).
  - (1) Unscrew the 4 capscrews which secure the terminal plate to the beacon base and tilt the terminal plate down.

- (2) Four wires should already lead from the terminal strip on the cover plate; two for the drive motor and two for the rotation detector, as shown in Figure 3-38.

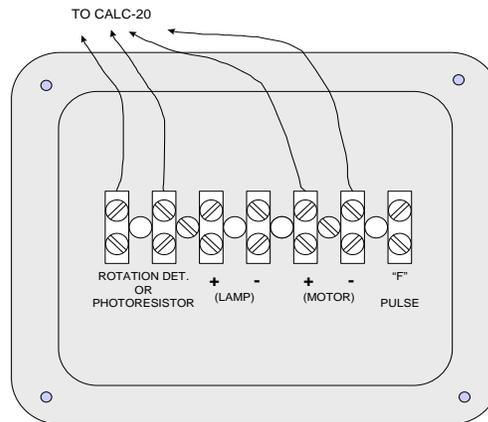
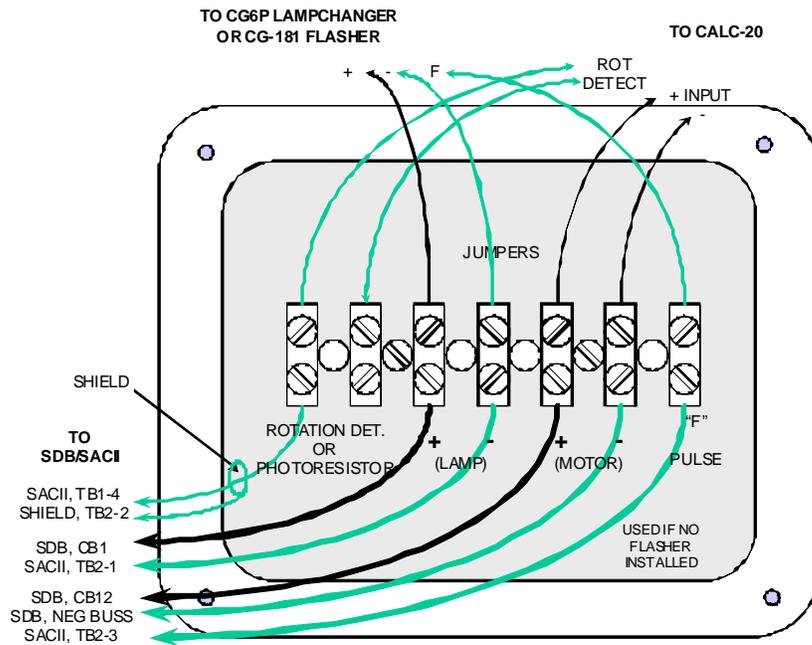


Figure 3-38

- (3) Insert the unswitched power cable (12 AWG wires in conduit or liquidflex; wires must be shielded) through the stuffing tube into one of the threaded openings in the base. Insert four conductors (three 12 AWG black/white/blue and one shielded 18 AWG) through a stuffing tube in the other threaded opening. The black and white wires are switched power leads.
- (4) Remove 12 inches of outer jackets and strip  $\frac{1}{4}$  in of insulation from each conductor.
- (5) Install the unswitched (so the drive motor operates continuously) black wire to the Motor (+), the white wire to the Motor (-) terminals.



**Wiring for External Control**

Figure 3-39

- (6) Install the switched black wire to the Lamp (+), the white wire (from SACII, Load (-)) to the Lamp (-), the Blue wire (from SACII, Lampchanger (F)) to the "F" Pulse and the shield and 18 AWG wires to the Rotation Detector terminals. See Figure 3-39.

**Note:** Some externally controlled beacons use a CG-181/493/504 flasher for voltage regulation. In this case, the "F" pulse from the SACII is not used.

- (7) Jumper the Rotation Detector shield connection to the Motor (-) on the terminal strip (do not use Lamp (-) as it is switched by the SACII).

- (8) Release the 8 thumb latches located on the lower ring of the glazing assembly by rotating them 180 degrees. Carefully lift the glazing **straight** up from the beacon and set aside.

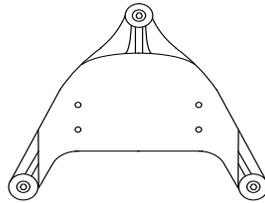


Figure 3-40

- (9) Looking down into the beacon, remove the three capscrews securing the lampchanger plate (Figure 3-40) to the flasher housing. Remove the lampchanger plate.
- (10) If not using a flasher, make up three wires, one black, one white and one blue each two feet long with lugs attached to **ONE** end and attach to the lampchanger. The wires should be 12 AWG with PVC or Teflon insulation. After securing the lugs, bend the lugs out 90 degrees from the terminals.
- (11) Orient the lampchanger on the Lampchanger Plate so that the terminal strip faces away from the opening in the plate (The lampchanger may be installed with the terminal strip over the opening when no flasher is used).
- (12) Secure the lampchanger to the plate using 10-32 machine screws and nuts, as shown in Figure 3-41. Go to paragraph (16).

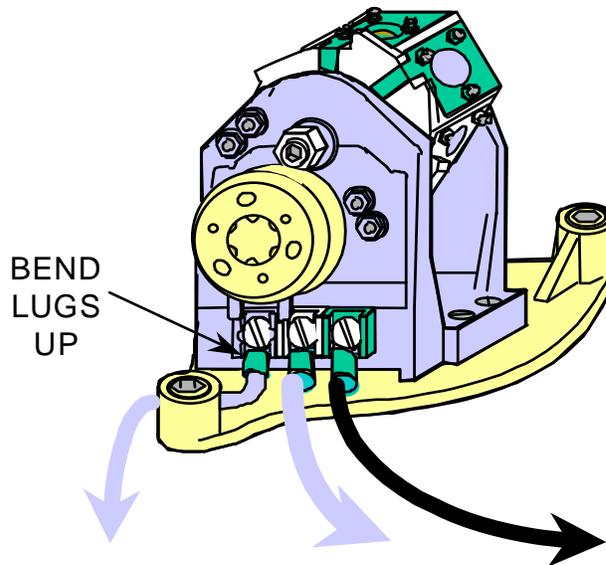


Figure 3-41

- (13) If using a flasher, wire the lampchanger with a WK-681 wiring kit. Loop the wires from the lampchanger under the plate and connect to the flasher. Secure the flasher and lampchanger with four 10-32 screws.
- (14) Make up two wires, one black and one white each two feet long with lugs attached to **ONE** end. The wires should be 12 AWG with PVC or Teflon insulation.
- (15) Attach the black wire to the flasher (+) terminal and the white wire to the flasher (-) terminal.
- (16) Make sure the springs are still in place in the flasher housing (inside beacon).

- (17) Pass the two or three wires through the opening in the bottom of the flasher housing and pull the leads in the beacon base as the assembly is lowered, as shown in Figure 3-42.

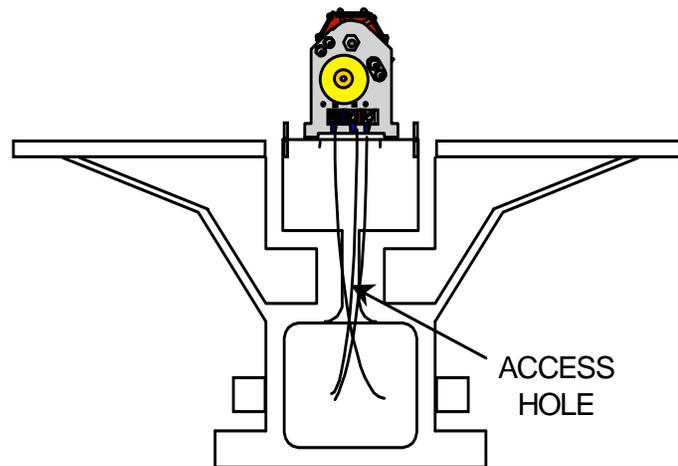


Figure 3-42

- (18) Screw the Lampchanger Plate to the Flasher Housing with the 3 capscrews. Do not tighten.
- (19) Cut excessive wire from the flasher. Leave enough to easily work on the Terminal Plate and strip  $\frac{1}{4}$  inch from each lead.
- (20) Attach the black lead to the Lamp (+) terminal, the white wire to the Lamp (-) terminal and the blue wire (if used) to the "F" Pulse terminal.
- (21) Install the Terminal Plate on the beacon.

4. Focusing.

- a. Remove the glazing assembly by releasing the 8 thumb latches on the base.
- b. Remove the operating lamp and install a focus fixture.
- c. Sight through the center of 3 adjacent lens sections (Figure 3-43) and check to see if the tip of the focus fixture is centered in the sighting marks (a white sheet of paper held behind the lens is helpful if the background is dark). Do not rotate the lens cage to line up sight marks; keep beacon stationary and move around it.

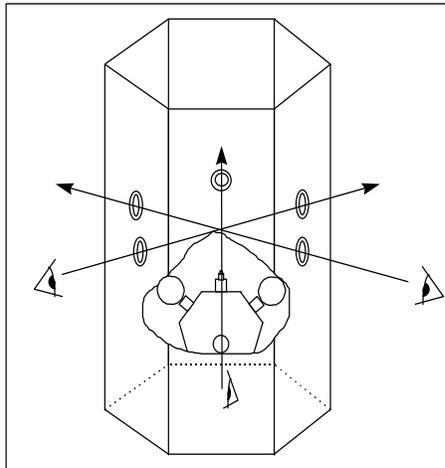


Figure 3-43

- d. Using a 5/32 Allen wrench, adjust the height of the three legs of the Lampchanger Plate until the focus fixture tip is centered in the hole in the lens, as shown in Figure 3-44.

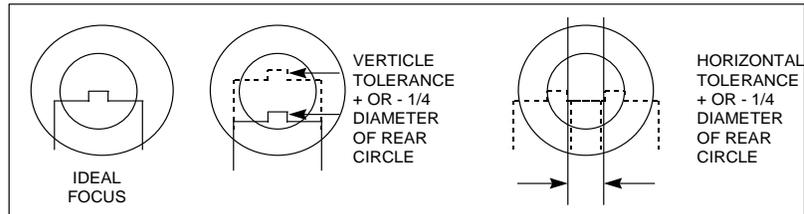


Figure 3-44

- e. Install lamps in all 6 positions in the lampchanger.
  - f. Rotate lampchanger to the first position.
  - g. Reinstall the glazing on beacon and tighten latches.
  - h. Turn on power, cover daylight control and check operation.
  - i. Remove cover on daylight control before departing.
5. Maintenance.
- a. Cover daylight control.
  - b. Note if the light is on and lens is rotating
  - c. Secure power to beacon.
  - d. Visually inspect lens, lens cover, base and external wiring for cracks, crazing, holes, etc. Replace as necessary.
  - e. Clean the outside of the glazing using water with household detergent. Do not use solvent based cleaners.

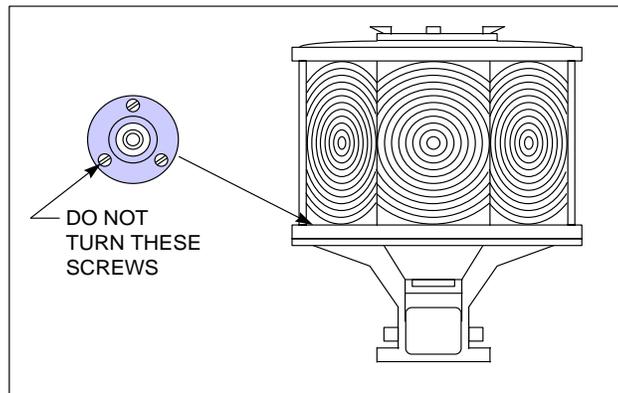


Figure 3-45

- f. Remove the access hatch, rotate the lens cage and recheck the levelness of the beacon. The bubble should stay centered within the circle through an entire rotation of the lens cage, as shown in Figure 3-45. If not, center it the best you can through an entire rotation.
- g. Check the focus and adjust, if necessary, as detailed in Section 4.
- h. Advance unused lamps to the first positions and install new lamps in the remaining positions.
- i. Turn on power to beacon and cover daylight control.
- j. Remove operating lamp (tungsten-halogen lamps operate at high temperature and are prone to explosive failure. Use gloves to remove or handle. Tilt turret until lamp goes out) and ensure that a new lamp ratchets into position.
- k. Secure Power to the beacon and reinstall operating lamp.

- l. Rotate lampchanger to first position.
  - m. Reinstall the hatch on beacon and tighten latches.
  - n. Turn on power, cover daylight control and check operation.
  - o. Remove cover on daylight control before departing.
6. Troubleshooting.
- a. If lamp is burning dim or is extinguished, perform the following system checks:
    - 1. Check operating lamp.
    - 2. Load test the battery (Chapter 2).
    - 3. Meg power cable (Chapter 2).
    - 4. Check focus (Section 4).
    - 5. Clean lens cover, if necessary.
  - b. If the problem is improper, or no rotation, use flowchart A as a starting point for troubleshooting. Figure 3-46 will help you identify the components of a VRB-25. Section 7 contains procedures that detail how to test or replace a component in the beacon.

**VRB-25 COMPONENTS**

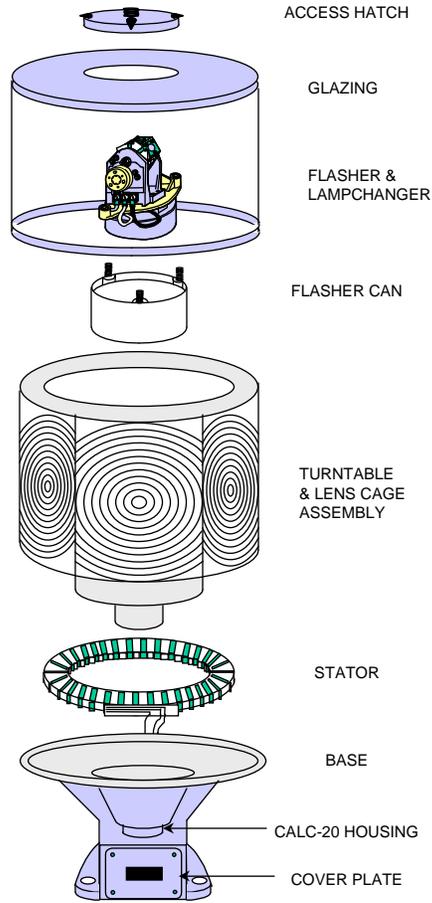
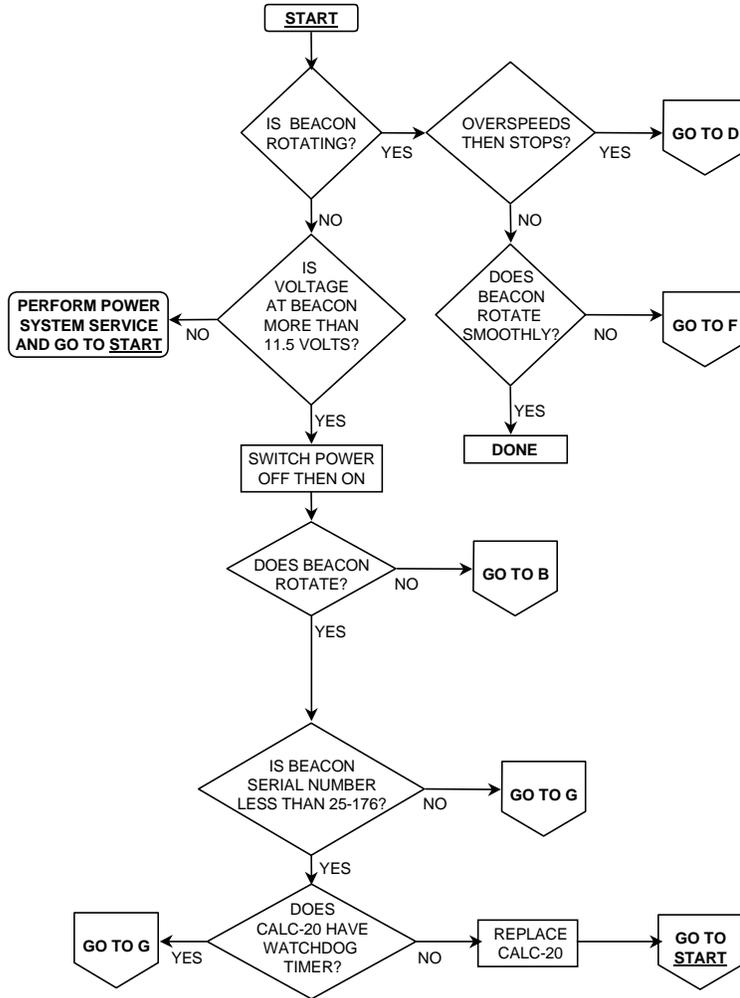
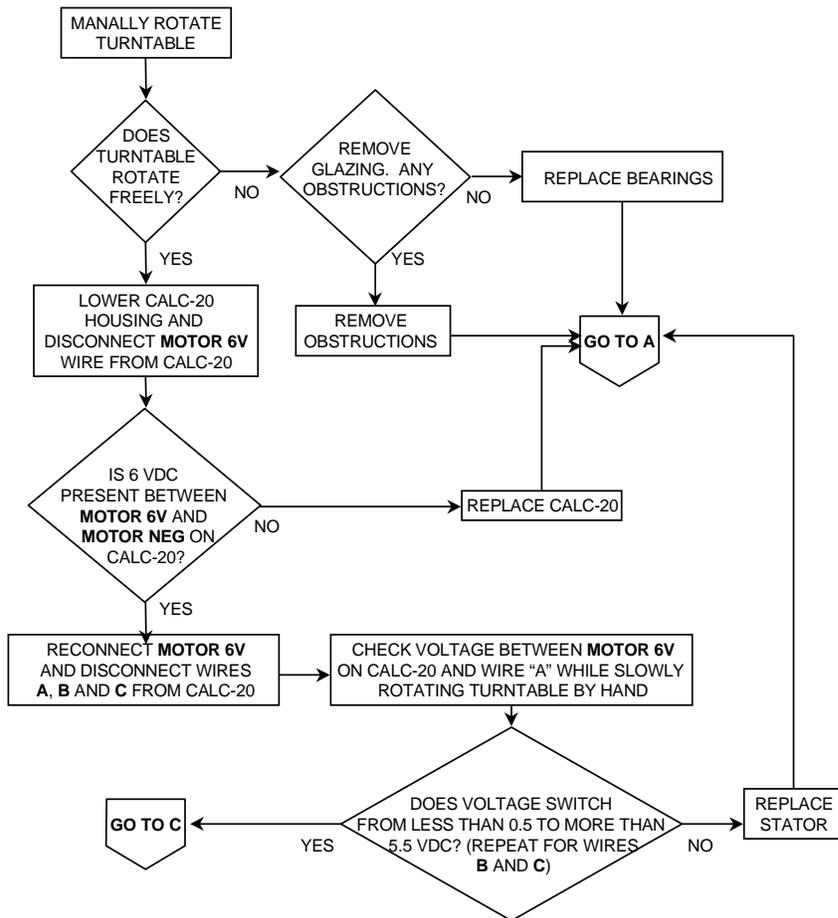


Figure 3-46

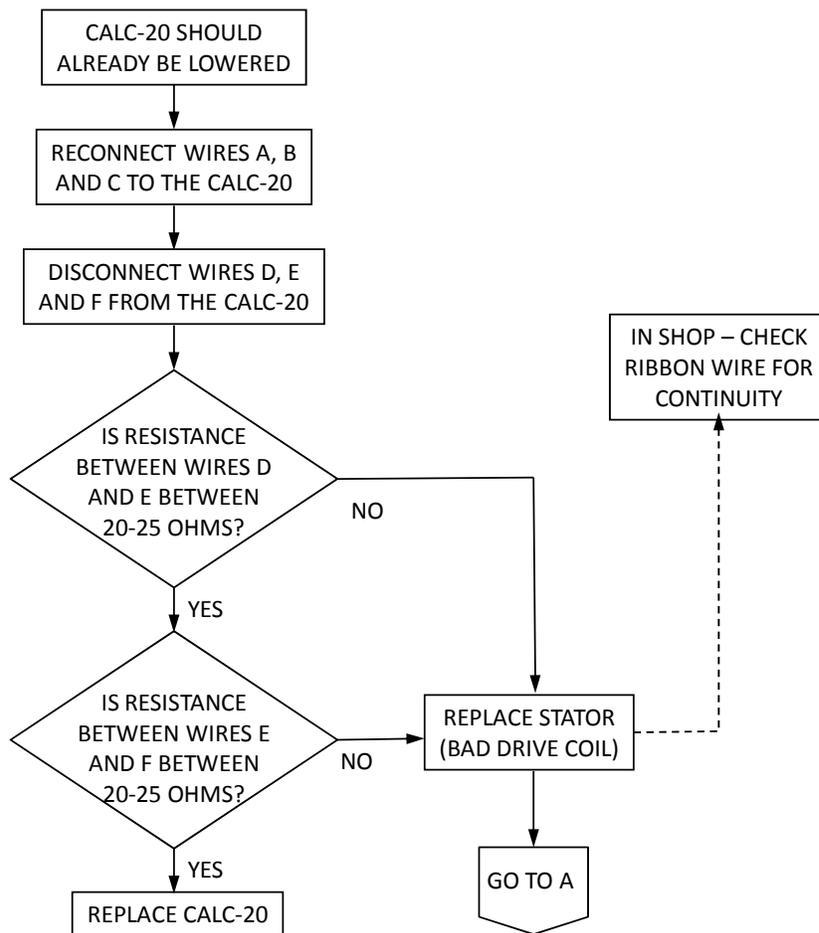
**VRB-25 MOTOR DIAGNOSIS  
PROCEDURE A**



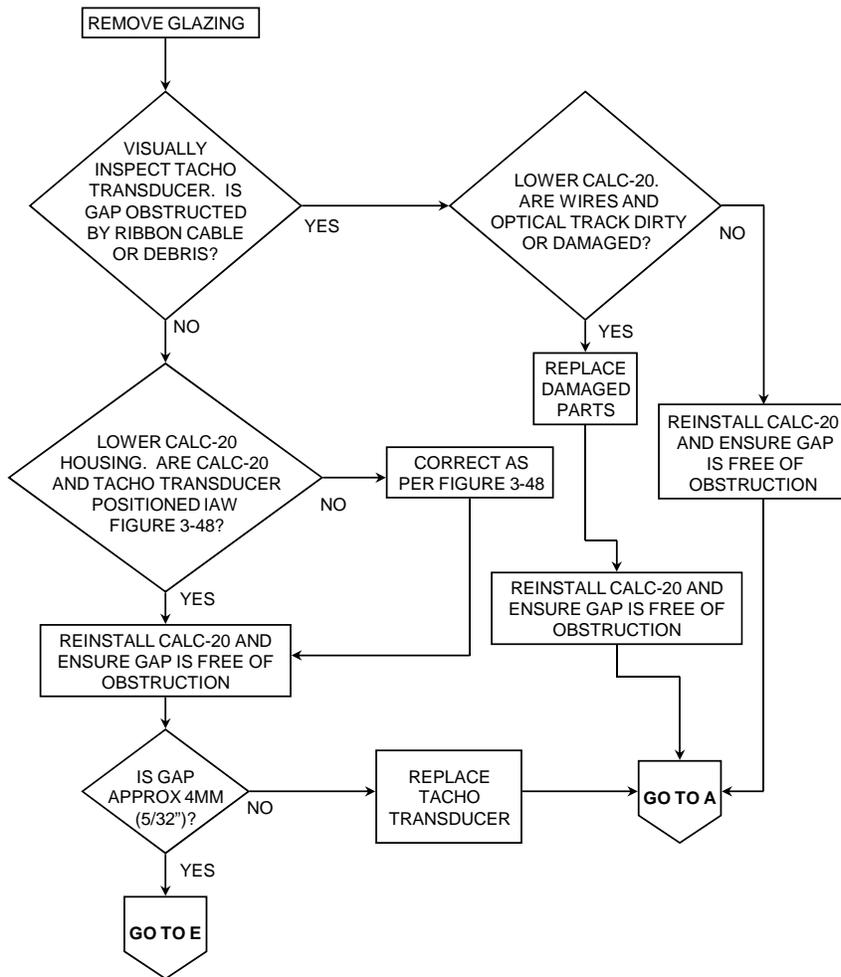
## NO ROTATION PROCEDURE B



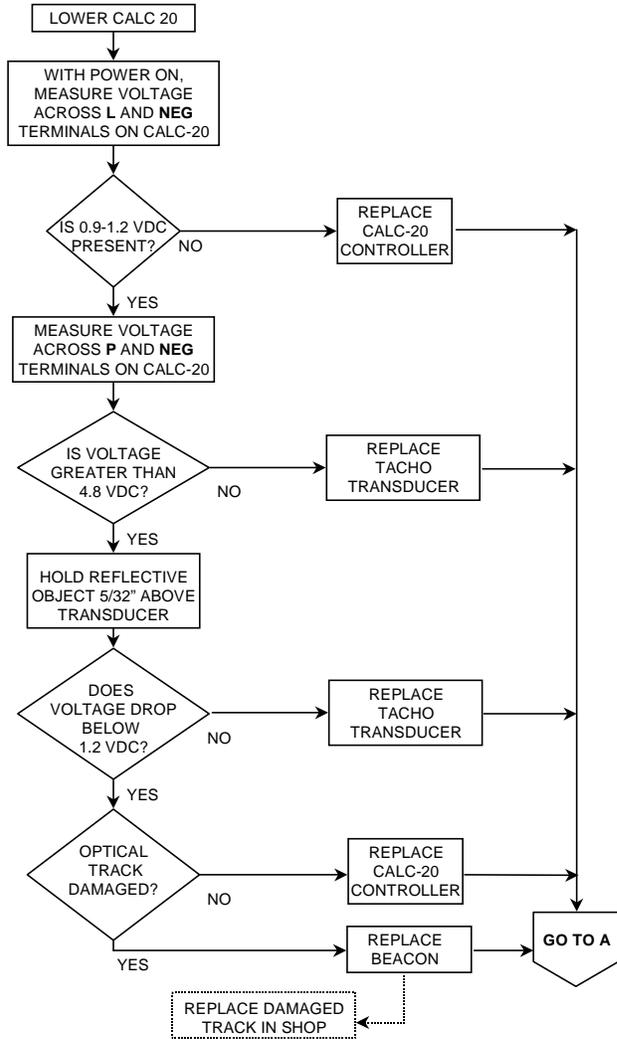
## DRIVE COILS PROCEDURE C



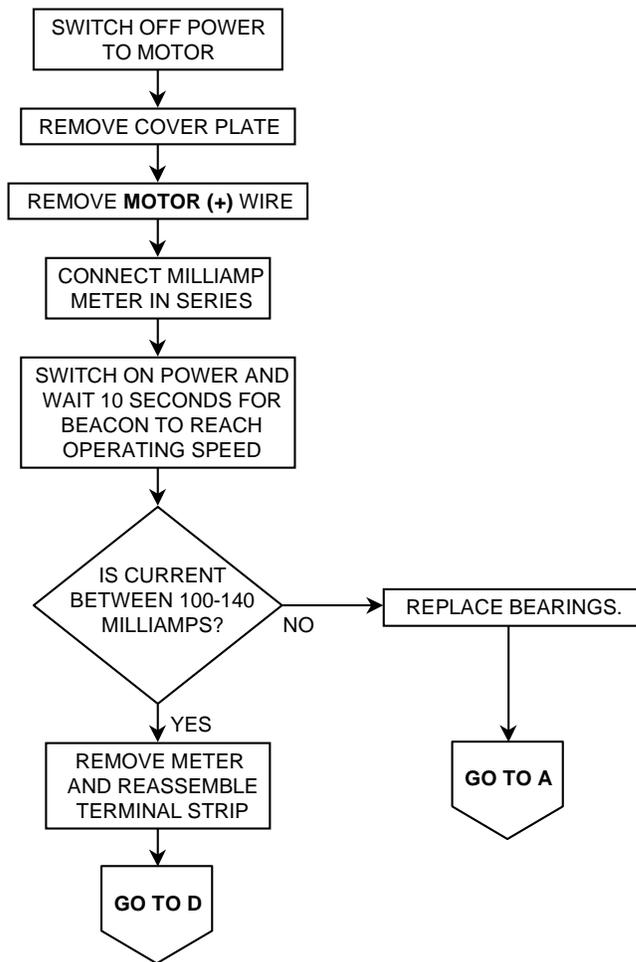
## OVER SPEED PROCEDURE D



### TACHO TRANSDUCER PROCEDURE E



## BEARINGS PROCEDURE F



## ADDITIONAL SERVICE INFO PROCEDURE G

VRB MOTOR IS OPERATING PROPERLY, ONE OR MORE OF THE OF THE FOLLOWING EXTERNAL INTERFERENCES MAY BE CAUSING THE MOTOR TO SHUT DOWN:

1. POWER SUPPLY VOLTAGE SAGS
2. VOLTAGE SPIKES
3. RADIO FREQUENCY NOISE IN VICINITY (EMI). [POWER LEADS SHOULD BE IN GROUNDED CONDUIT.]
4. ELECTRICAL NOISE ON LINE

YOU CANNOT CORRECT THESE PROBLEMS AT THE UNIT LEVEL.

OBTAIN THE FOLLOWING INFORMATION WHILE AT THE AID IN QUESTION:

1. AID NAME AND LIGHT LIST NUMBER
2. TYPE OF POWER:
  - A. SOLAR (TYPE AND NUMBER OF PANELS)
  - B. BATTERIES (TYPE, AMP-HOUR RATING)
  - C. COMMERCIAL (TYPE AND SIZE OF TRANSFORMER, TYPE OF POWER SUPPLY)
3. LAMP SIZE, FLASH CHARACTERISTIC AND RPM OF BEACON
4. CABLE SIZE (TO BEACON), LENGTH AND TYPE
5. ALL CG EQUIPMENT (FOG SIGNALS, FOG DETECTORS, ACMS, RACON, RADIO, ETC.)
6. ALL NON CG EQUIPMENT (NOAA WEATHER GEAR, ETC.)
7. LOCATION AND CONDITION OF LIGHTNING PROTECTION EQUIPMENT.

SEND INFORMATION TO YOUR GROUP ATON OFFICER, CEU OR DISTRICT TRAINING TEAM CHIEF. THEY WILL WORK WITH THE SERVICING UNIT TO ALLEVIATE OR ELIMINATE THE EXTERNAL PROBLEMS AFFECTING THE AID

7. Repair Procedures.

a. **Bearing Replacement.**

- (1) Bearing puller/installer kits and instructions were mailed to Units with spare parts kits. Bearings can be field changed with this kit.

b. **Turntable Removal/Installation.**

- (1) Remove the glazing assembly by releasing the 8 thumb latches securing it to the base.
- (2) Lift the glazing straight up off the beacon.
- (3) Disconnect the wiring to the CG-181 flasher or lampchanger (if no flasher) at the Terminal Plate on the base.
- (4) Remove the 3 capscrews securing the lampchanger plate to the base.
- (5) Pull the flasher/lampchanger and wires out of the beacon.
- (6) Remove the 3 capscrews securing the flasher can to the beacon base.
- (7) Remove the flasher can and the wavy spring (under flasher can) from the beacon. DO NOT LOSE THE 3 SPRINGS USED UNDER THE LAMPCHANGER PLATE.

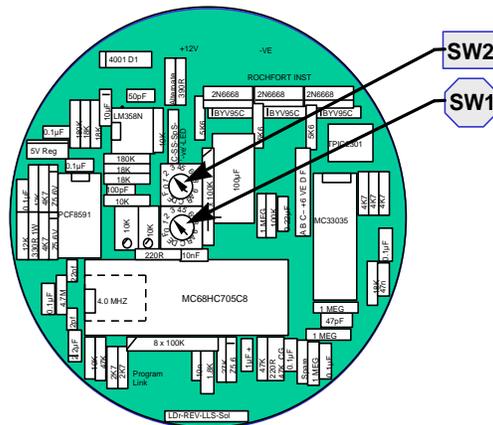
- (8) Grip the turntable assembly by wedging your fingers between it and the base to break the magnetic pull of the stator/magnets. Two personnel, one on each side of the beacon, may be required to pull the turntable straight up.
- (9) Install a new turntable assembly by lining up the central shaft in the base with the bearings.
- (10) Carefully lower the turntable on the base. Be sure your fingers are not under the turntable as the magnetic pull of the stator/magnets may pinch your fingers.
- (11) Spin the turntable slowly and ensure it turns freely with no binding.
- (12) Install the wavy washer and flasher can in the base using the three capscrews. Be sure the 3 springs used under the lampchanger plate are still in flasher can.
- (13) Route the wires from the lampchanger/flasher through the opening in the flasher can and pull them through by reaching into the access hole in the base.
- (14) Attach the lampchanger plate to with 3 capscrews.
- (15) Attach wiring to terminal strip on access plate. If you forgot where the wires went, consult with Section 3.h. or 3.i.
- (16) Turn on power to the Motor terminals and check rotation.
- (17) Secure beacon and focus as described in Section 4.

- (18) Replace bearings on returned turntable assembly in the shop using the appropriate tools and use it as a rotational spare.

c. **CALC-20 Replacement.**

- (1) Remove the 2 clamps securing the CALC-20 housing to the base.
- (2) Pull the housing straight down. It will be tight as an O-ring seals it and a locating pin prevents rotation.
- (3) Remove wiring on CALC-20. Check to see if terminal lugs are labeled, otherwise note from what terminal each wire is removed.
- (4) Remove the Tacho Transducer by removing two screws securing it to the CALC-20.
- (5) Remove the 4 hex screws securing the CALC-20 to the housing using a 5/64" hex wrench.
- (6) Carefully pull the CALC-20 out of the housing.
- (7) Set the speed on the new CALC-20 as shown below:
  - (a) The underside of the controller has two rotary switches that control the rpm. Use a small screwdriver to set each switch in the proper position, as detailed in Figure 3-47.

SW1 Selects Fraction of RPMs  
 SW2 Selects Whole RPMs



SELECTING RPM			
Fractions		Units	
SW1	RPM	SW2	RPM
0	0.00	0	0
1	0.10	1	1
2	0.16	2	2
3	0.20	3	3
4	0.25	4	4
5	0.30	5	5
6	0.33	6	6
7	0.40	7	7
8	0.50	8	8
9	0.60	9	9
A	0.66	A	10
B	0.70	B	11
C	0.75	C	12
D	0.80	D	13
E	0.83	E	14
F	0.90	F	15

Figure 3-47

- (b) Reinstall the CALC-20 in the housing. The “Rot Detector” terminals line up with the notch in the housing.
- (8) Install the Tacho Transducer on a new CALC-20. Be sure it is oriented as shown in Figure 3-48.

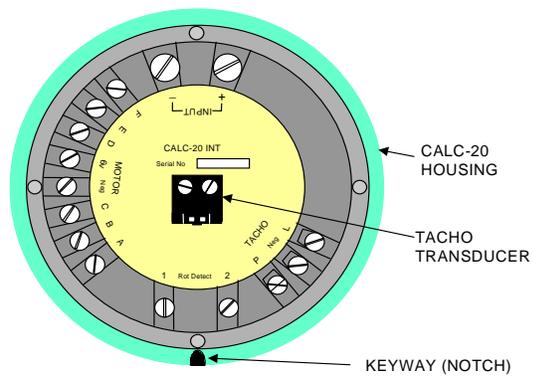


Figure 3-48

- (9) Reattach the wires to the CALC-20. ALL WIRE LUGS FACE IN TOWARDS THE CENTER.
- (10) Install the CALC-20 housing into the beacon by lining up the notch in the can with the stud in the base. Push the housing straight up into the base and resecure with the clamps.
- (11) Apply power to beacon and test for proper operation.

d. **Stator Replacement.**

- (1) Remove the Glazing and Turntable assemblies as described in sections 7.b.
- (2) Remove the CALC-20 as described in Section 7.c. and disconnect the 8 wire leads (A-F, 6V and NEG) on its terminal strip.
- (3) Remove the 4 nuts under the stator using a 7/16" open end wrench.
- (4) Lift the stator off the base, taking care not to damage the wiring harness.
- (5) Install a new stator so that the terminal board is over the CALC-20 housing.
- (6) The nuts are very difficult to start. Place each nut on a folded piece of paper/cardboard/plastic and slide under each stud. Start each nut by hand, remove the cardboard and finish with a wrench. **DO NOT OVERTIGHTEN** as the studs will pull out of the stator causing it to rub on the turntable. If they pull out, or are loose, remove the stator and lock the studs with Super-Glue, Loctite Blue or Loctite Red thread sealer.
- (7) Reattach the wires to the CALC-20. Wire lugs must face in towards the center.
- (8) Reinstall the CALC-20, turntable and flasher/lampchanger as described in Sections 7.c., 7.b., and 3.h. or 3.i.

e. **Checking the Tacho Transducer for proper clearance or obstructions.**

- (1) Remove the Glazing by releasing the 8 thumb latches located on the lower ring of the glazing assembly by rotating them 180 degrees. Carefully lift the glazing **straight** up from the beacon and set aside.
- (2) Look between the Base and Turntable above the CALC-20 housing for the Tacho Transducer. It should be visible against the circuit board on the Stator (a flashlight may be used). Note if any wires appear to be rubbing on the Turntable and if wires are passing above the Tacho Transducer, as shown in Figure 3-49.

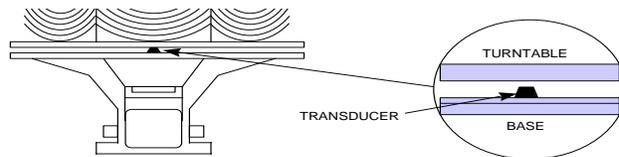


Figure 3-49

- (3) If wires are rubbing or obstructing the Tacho Transducer, remove the CALC-20 by removing the 2 hex screws loosening the clamps that hold the housing, rearrange the wires and reinstall.
- (4) Check the gap between the Tacho Transducer and Turntable by sliding a flat sections of a 5/64" hex wrench above the transducer and the bottom of the Turntable. If the wrench appears very loose or does not slide between the two, replace the Tacho Transducer (see Section 7.c.). **DO NOT TRY TO ADJUST THE GAP.**

f. **Check Optical Track and Tacho Transducer for Damage and Correct Operation.**

- (1) Remove the CALC-20 as described in section 7.c.
- (2) Inspect wiring for abrasions due to the turntable rubbing on the wires. Replace as necessary.
- (3) Look up into the opening in the base where the CALC-20 housing was removed. Rotate the turntable and inspect the optical strip. It should be attached to the turntable (no drooping or bubbles) and not appear scratched (Figure 3-50).



Figure 3-50

- (4) Inspect the Tacho Transducer for dirt. The tip of the transducer has two small holes. One houses an infrared LED (invisible to the eye), the other contains a receiver. Blow out both holes with dry air to ensure they are clear.
- (5) The Tacho Transducer can be tested outside the beacon by turning on the power to the beacon and measuring the voltage across "P" and "NEG" (older versions have  $\frac{+}{-}$  instead of "NEG") terminals on the CALC-20. The voltage should be greater than 4.8 volts.
- (6) Hold a reflective object (chrome wrench, knife blade, signal mirror, etc.) over the Tacho Transducer. Slowly lower the object over the transducer while measuring the voltage across "L" and "NEG" terminals, as shown in Figure 3-51. **Move the object around and up and down until the lowest voltage is observed.** The voltage should fall to 1.2 volts when the wrench is 5/64"

above the top of the transducer. Repeat this step a few times if the proper reading is not obtained, as it is hard to keep the reflective object square with the transducer.

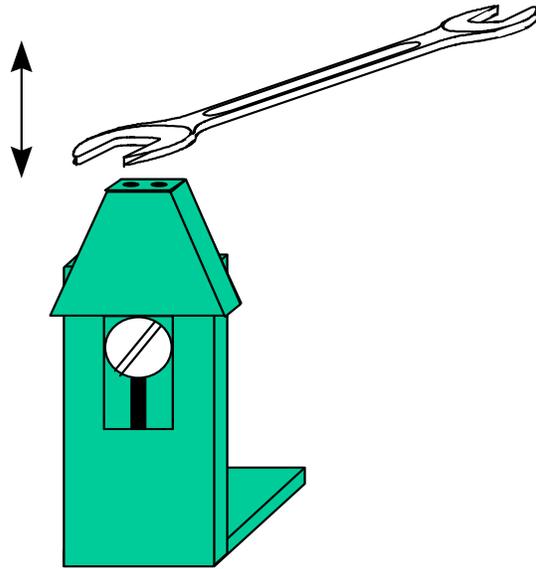


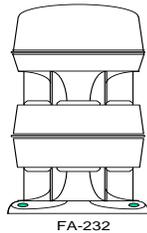
Figure 3-51

- (7) Reinstall the CALC-20 housing into the base ensuring that the wires do not rub the turntable or obstruct the Tacho Transducer.

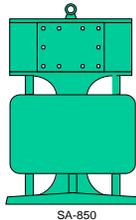


## K. Sound Signals.

### 1. Notes.



- a. The FA-232 and SA-850 ½ mile sound signals are used to warn mariners during foggy conditions. The FA-232 is used on land based stations and the SA-850 is used on buoys. They should not be interchanged as the FA-232 is not robust enough to withstand operation on a buoy and the SA-850 broadcasts a higher frequency which is annoying to residents. Both signals are available as stacked arrays; dual stack (FA-232/02 and SA-850/2A) as 1.0 mile signals and quad stacked (FA-232/04) as a 2.0 mile signal.



- b. Sound signals consist of three electrical components: the oscillator, timer and driver. The oscillator converts the DC input to the appropriate frequency to provide the characteristic tone of the signal, the timer provides the coding and the driver is the speaker assembly. Stacked sound signals have power modules in lieu of the timer/oscillator as the master signal provides the coding. The timer assembly is the only component common between the SA-850 and FA-232.
- c. Sound signals must be secured or adequate ear protection must be worn while servicing and troubleshooting. Permanent hearing damage may result if these guidelines are not followed. Hearing protection must be worn if working closer than the minimum safe distances listed in Figure 3-53. Chapter 7 of the Aids to Navigation Manual-Technical, COMDTINST M16500.3A has additional information on hearing protection devices.
- d. Sound signals are available from Automatic Power, Inc.

2. Installation.

- a. Sound signals must be installed on stable platforms away from walls (reflecting surfaces) and vertical obstructions, as listed in Figure 3-53.

Sound Signal	Minimum Safe Distance	Minimum Distance to Reflecting Surface	Maximum Diameter of Obstruction
FA-232	50 ft	136 in	3.5 in
FA-232/02	90	136	3.5
FA-232/04	280	136	3.5
SA-850	50	64	2.5
SA-850/02	100	64	2.5

Figure 3-53

- b. Stacked sound signals must use the supplied stand (SA-850s bolt together) as vertical spacing of the emitters is critical to sound production.
- c. Install emitters on platform or buoy with 3/4" bolts (5/8" for SA-850).
- d. Plugs may be installed in the emitter of the FA-232 series to control noise pollution on the land side of the horn. If your District specifies that plugs are to be installed, consult the Aids to Navigation Manual – Technical, COMDTINST M16500.3A for instructions.
- e. Remove the top dome on the FA-232(s) by releasing the V-band. Access to the SA-850 is through the bolted plate on the side of the emitter.
- f. Install 12/2 (or larger) SO cable through a stuffing tube and pull enough slack to reach oscillator board.

- g. Install spade lugs on each wire and install on the “+” and “-“ terminals on the oscillator board, as shown in Figure 3-54. The oscillator board is located on the access plate on the SA-850 emitter. Wiring is similar.

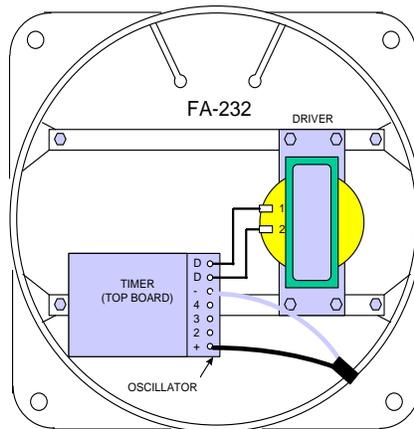


Figure 3-54

- h. Install the dome/cover on the horn and secure.
- i. Apply power to the horn (command fog detector to turn sound on, if equipped), and note if horn sounds on rhythm, as detailed in Figure 3-55.

Rhythm	Timing On/Off in Seconds	Blasts	
		57-63 Sec	PROM
1 blast every 10 seconds	1 on, 9 off	6	1007
1 blast every 15 seconds	2 on, 13 off	4	1024
1 blast every 30 seconds	3 on, 27 off	2	1010
2 blasts every 20 seconds	2 on, 2 off, 2 on, 14 off	6	1145
2 blasts every 30 seconds	2 on, 2 off, 2 on, 24 off	4	1062
2 blasts every 60 seconds	3 on, 3 off, 3 on, 51 off	2	1059

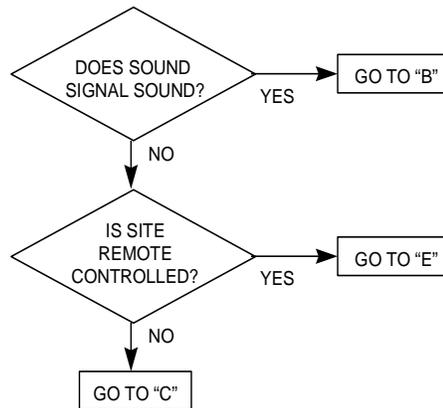
Figure 3-55

3. Maintenance.

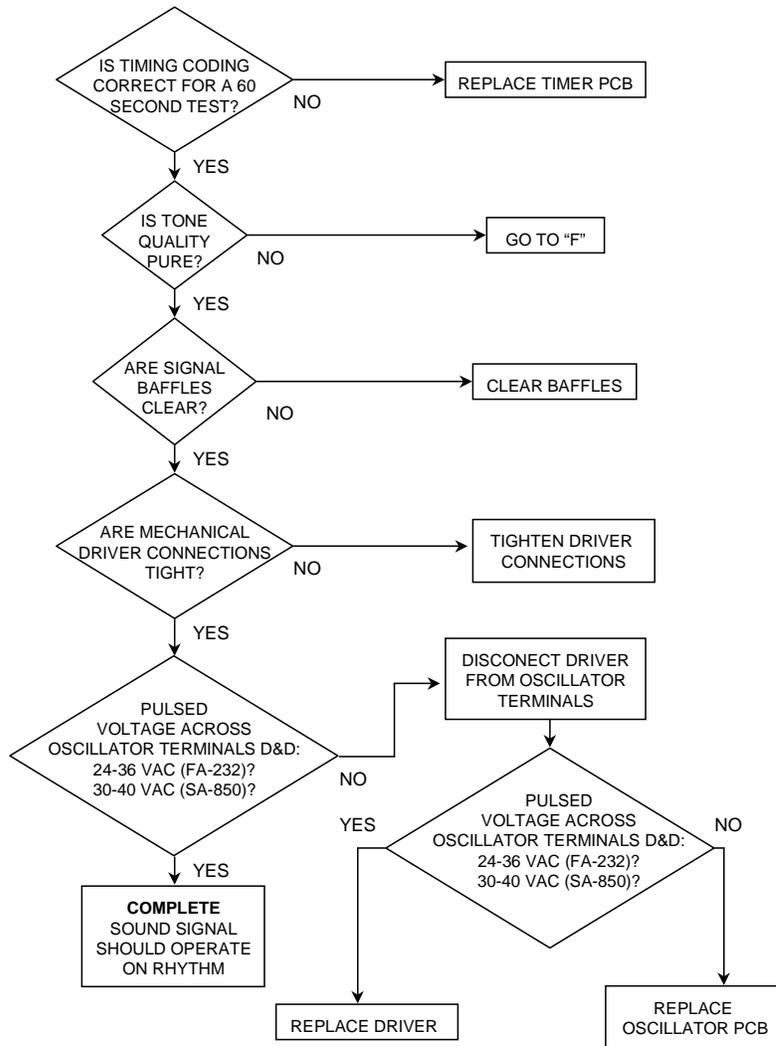
- a. Secure power to the sound signal.
- b. Visually inspect the housing for cracks, crazing, holes, etc. Replace or repair if necessary.
- c. Inspect the emitter openings for debris or dirt and clean if necessary.
- d. Apply power to the sound signal, command the fog detector to turn the horn on (if equipped) and note if all emitters are operating (stacked array), emitting a pure tone and sounding on rhythm.

4. Troubleshooting. Note: Some procedures require monitoring voltages which occur only when the horn sounds. Some rhythms have periods of up to one minute.

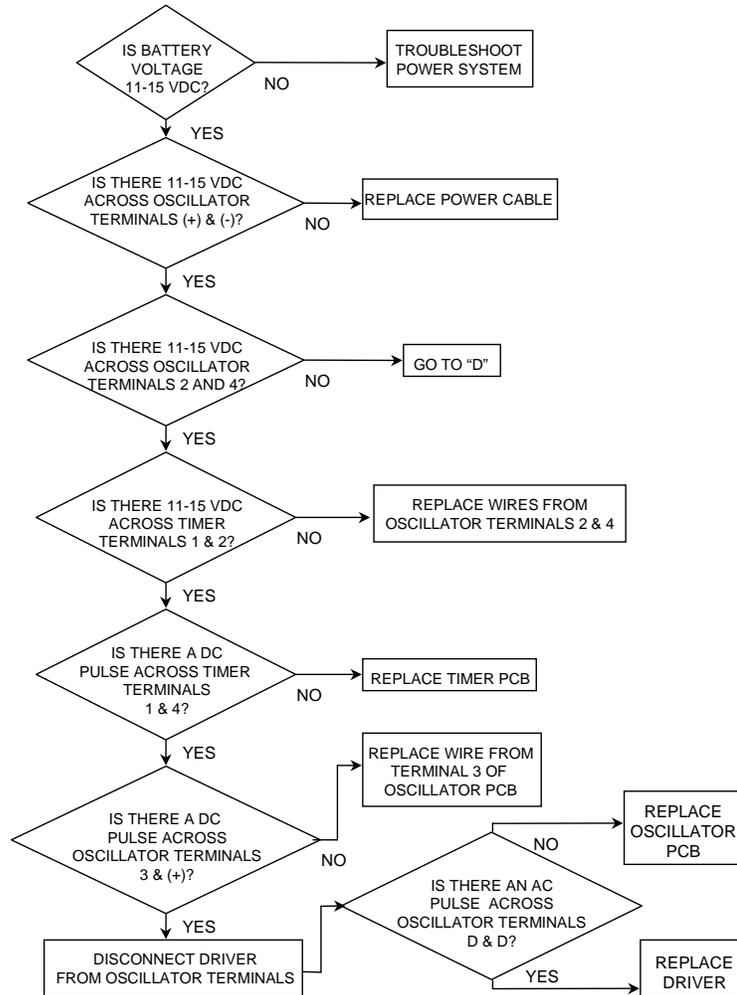
a. Procedure "A":



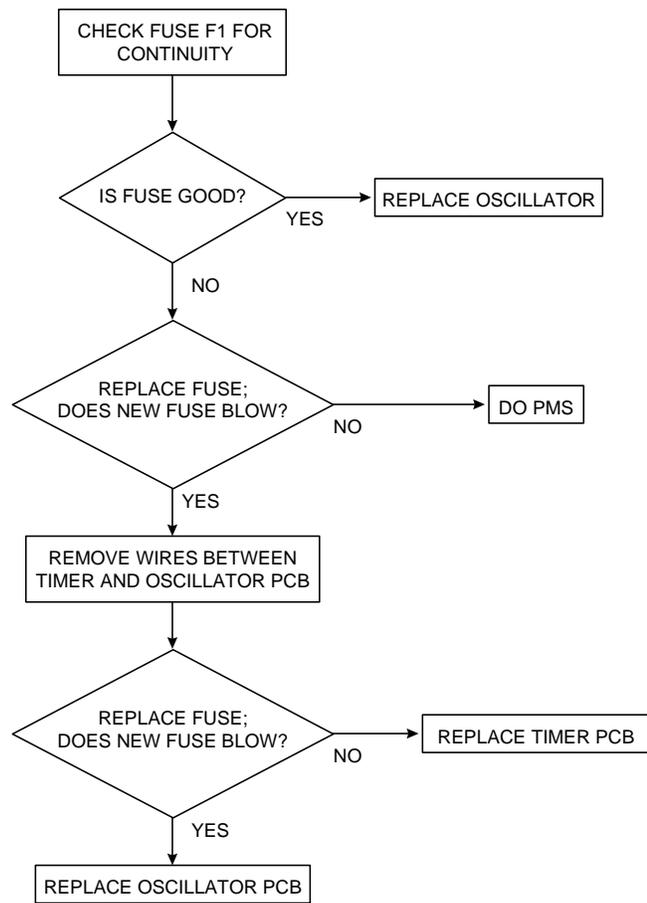
b. Procedure "B":



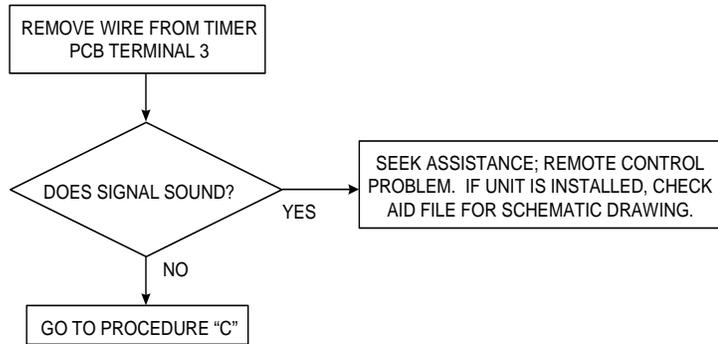
c. Procedure "C":



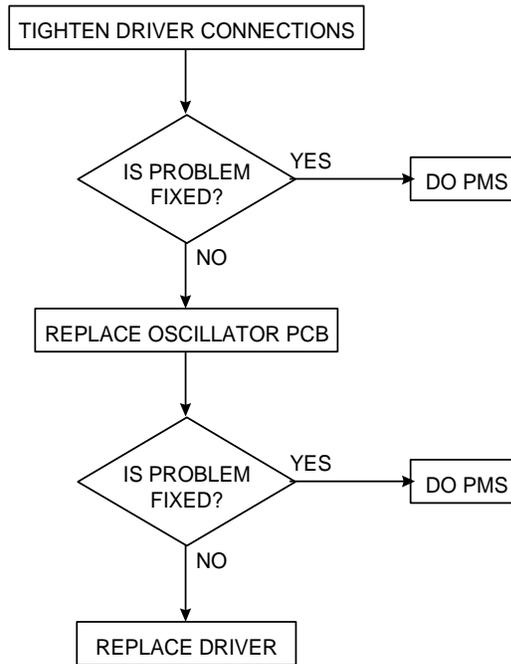
d. Procedure "D":



e. Procedure "E":



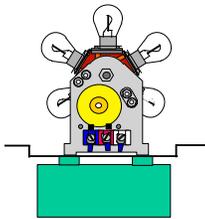
f. Procedure "F":



## CHAPTER 4 - HARDWARE

### A. Minor Aid Lighting Hardware (Used in non-LED Lanterns).

#### 1. Notes.



- a. 12 volt minor aid hardware consists of a flasher, daylight control, wiring kit, the appropriate lantern bracket, lampchanger and lamps.
- b. Flashers (Figure 4-1) are used to regulate battery voltage to the lamp, sense lamp failure, provide a flash rhythm and turn off the light during the daytime. Flashers are available in four versions: the CG-181, CG-493, CG-481 and CG-504. The CG-181 and 493 will operate lamps 3.05 amps or less (35 watt tungsten-halogen lamp included). The CG-481 is used to operate lamps 50 watts and greater. The CG-504 will operate all lamps and can be used as a slave flasher. Flashers are available in standard and non-standard flash rhythms. Standard rhythms are stocked at the Surface Forces Logistics Center (SFLC) Baltimore. Non-standard rhythms must be purchased from the manufacturer. **NOTE:** the proper rhythm must be used. Installing a FL 2.5(1) when a FL 2.5(.3) is required will result in a power system failure.

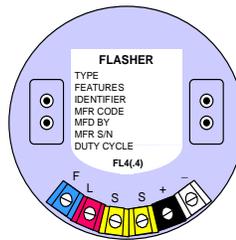


Figure 4-1

**CG-181/493/504 STANDARD RHYTHMS**

<b>Rhythm</b>	<b>Timing in Seconds**</b>	<b>Flashes/57-63 sec</b>
Q	0.3 on, 0.7 off	60
Mo(A)	0.4 on, 0.6 off 2.0 on, 5.0 off	30 (114-126 sec)
FL2.5(.3)	0.3 on, 2.2 off	24
FL2.5(1)*	1.0 on, 1.5 off	24
FL4(.4)	0.4 on, 3.6 off	15
FL4(1)*	1.0 on, 3.0 off	15
FL6(.6)	0.6 on, 5.4 off	10
FL(2)5	0.4 on, 0.6 off 0.4 on, 3.6 off	24
FL(2)6	1.0 on, 1.0 off 1.0 on, 3.0 off	20
FL(2+1)6	0.3 on, 0.4 off 0.3 on, 1.2 off 0.3 on, 3.5 off	30
Iso6*	3.0 on, 3.0 off	10
Iso2*	1.0 on, 1.0 off	30
Oc4*	3.0 on, 1.0 off	15
Fixed*	Steady on	Continuous

\*CG-481 Standard Rhythms

\*\*The ON time is the Contact Closure Time (CCT)

- c. Lampchangers (Figure 4-2) are used to extend the service interval by stocking the lantern with 6 operable lamps. The clockwork mechanism is spring wound and triggered by a solenoid activated by the flasher. Lampchangers are available in two versions: the CG-6P and CG-6PHW. The CG-6P will operate lamps 3.05 amps or less (35 watt tungsten-halogen lamp included). The CG-6PHW is used to operate lamps 50 watts and greater.

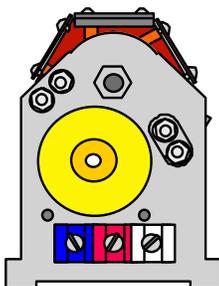


Figure 4-2

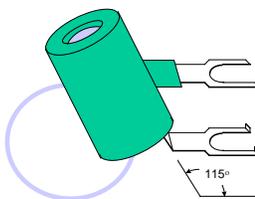


Figure 4-3

- d. Daylight controls (Figure 4-3) are photoresistors that change resistance with respect to light levels. As the light level decreases, the resistance of the daylight control increases. The photoresistor is used on the flasher to turn the light off in the daytime. A flasher **without** a daylight control will operate continuously, 24 hours a day. Daylight controls are available in three types from SFLC Baltimore:

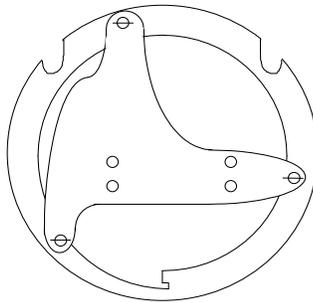
Type	Color	Where Used
Type C	White Case	Yellow and Clear lens
Type R	Red Case	Red or green plastic lenses
Type-L	Gray Plug	Any Fixed-ON rhythm, colored glass, FA-240, RL-14 & VRB-25 Lanterns

- e. The WK-681 wiring kit (Figure 4-4) is used to transmit power between the flasher and lampchanger. Each kit contains three wires, color coded red, white and blue, and spring spade lugs on each end. Kits, packaged 10 per box, are available from SFLC Baltimore.



Figure 4-4

- f. Brackets (Figure 4-5) are used to secure the lampchanger/flasher assembly in the focal position in the lantern. The type of bracket will vary from lantern to lantern. Some brackets have provisions for focusing the lamp. All brackets are sandwiched between the flasher and lampchanger. Replacement brackets are available from the lantern manufacturer.



250MM BRACKET



155MM & 300MM BRACKET

Figure 4-5

- g. Lamps for minor aids to navigation (Figure 4-6) are divided into two categories: tungsten using C-8 and CC-8 filaments, and tungsten-halogen. Tungsten filament lamps are rated by **amperage** and tungsten-halogen lamps are rated by **wattage**. The available lamp sizes are 0.55a, 0.77a, 1.0a, 1.15a, 1.9a, 2.03a, 3.0a, 3.05a, 35w, 50w, 75w, 100w and 110w. The 1.0, 1.9 and 3.0 amp lamps contain coiled-coil (CC-8) filaments and are not suitable for use in drum lenses (155mm, 250mm and 300mm). Lamps are available from SFLC Baltimore.

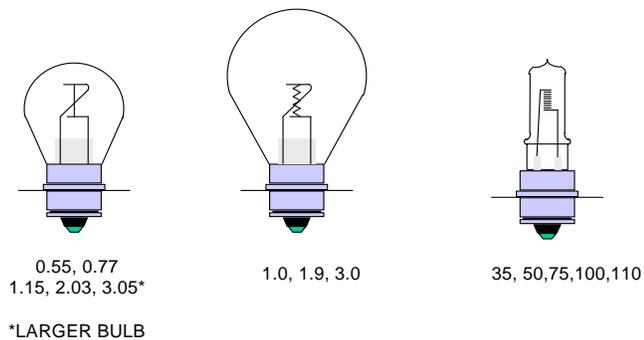


Figure 4-6

## 2. Installation.

- a. Minor aid hardware must be assembled at the ANT or on the Cutter and bench tested for 24 hours prior to installation at the aid site.
- b. Select the appropriate flasher and lampchanger based on the description in section 4.A.b. If using a programmable flasher, select the proper rhythm. NOTE: FL2.5 (1), FL4(1), FL6(1) and ISO2 are RARELY used. Do not confuse them with the other flash rhythms.

- c. Lay a lampchanger behind a flasher with the terminals facing up. Install a WK-681 wiring kit to a lampchanger. The wires are color coded to the terminals and contain spring spade lugs. Push the lugs on the screws until they snap into place, and then tighten screws.
- d. Run the wires across the flasher and install the other end of the WK-681 wiring kit to the flasher's terminals *from the inside*, as shown in Figure 4-7. Then turn the lampchanger 180 degrees as you place it on the flasher so that the terminals are opposite each other with the wires under the bracket (note: the wires must pass through the 250mm's bracket, so wire it with the bracket on the flasher).

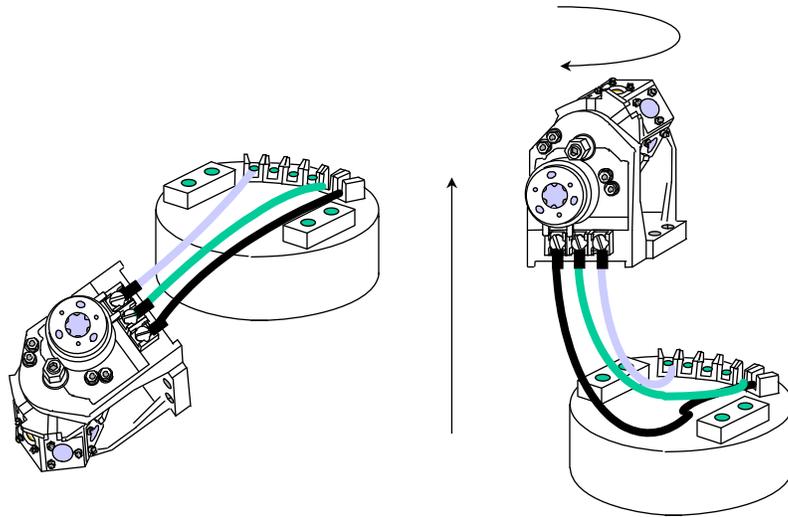


Figure 4-7

- e. Secure the lampchanger to the flasher with four 1" long 10-32 screws. If a spare lantern bracket is available, you may secure it between the flasher/lampchanger and over the WK-

681 wiring kit. Consult with Chapter 3 for the correct bracket and orientation.

- f. Install the proper daylight control (if necessary) to the two yellow "S" terminals on the flasher (Note: the CG-504 flasher has an S/Sy terminal which is the same). The daylight control housing should go next to the "+" terminal, as shown in Figure 4-8.

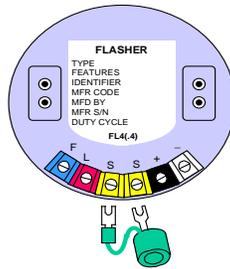


Figure 4-8

- g. Install 6 new lamps of the appropriate size in the lampchanger. Start at the first position (red paint on turret) then manually actuate the lampchanger by turning and releasing the solenoid. The notch in the prefocus collar is installed opposite the centered mounting stud, as shown in Figure 4-9.

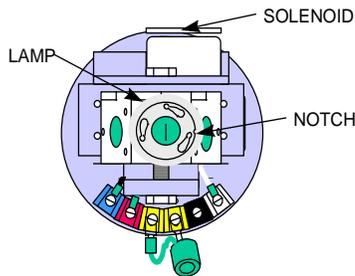


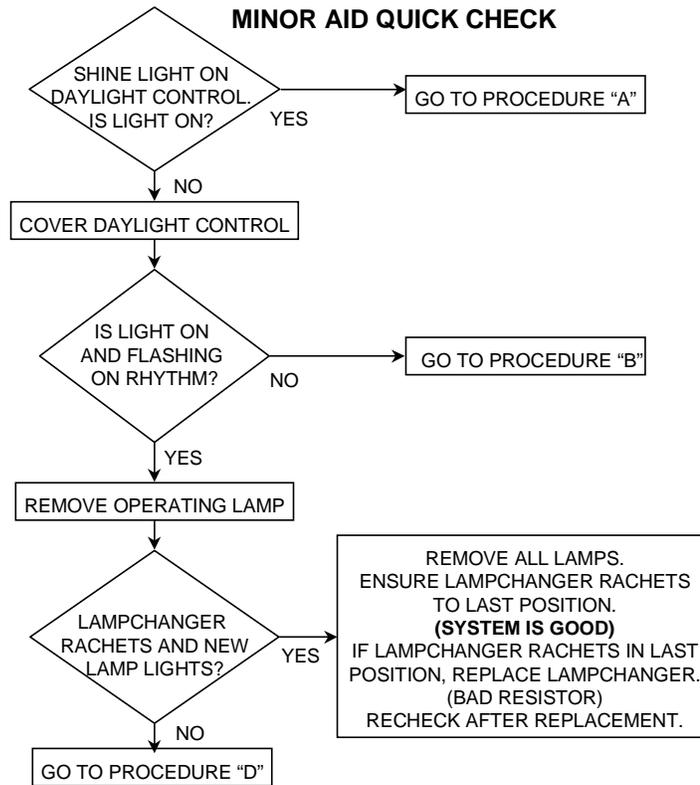
Figure 4-9

- h. Turn each lamp clockwise to lock into place. Bench test all optical assemblies by applying 12 VDC from a power supply or AtoN battery to the “+” and “-“ terminals of the flasher for 24 hours with a daylight control cover installed.
- i. With power applied, while shining a light on the daylight control, the lamp should be off. Cover daylight control with a daylight control cover and the lamp should light and flash on rhythm.
- j. Remove the operating lamp and the lampchanger should ratchet to the next position. **Note: do remove tungsten-halogen lamps while operating as they are very hot.** Instead, turn the lampchanger solenoid. The flasher should continue to hold it in and advance the next lamp into position.
- k. After the 24 hour bench test, install the assembly into the lantern. Consult with the appropriate chapter for detailed instructions.

3. Maintenance.

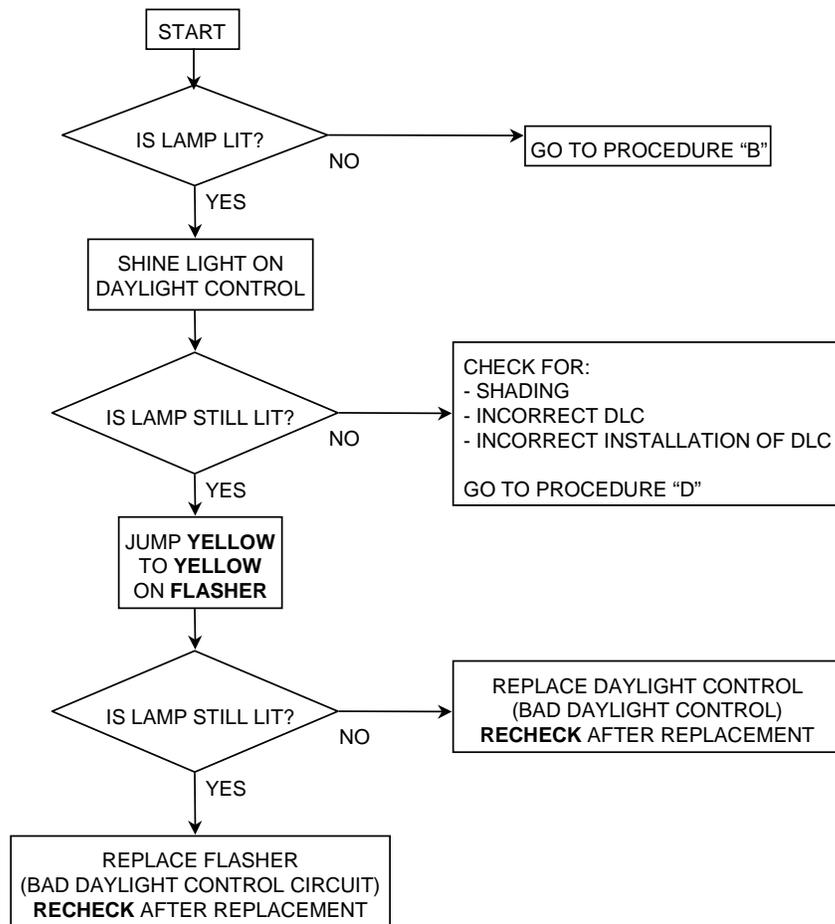
- a. At every scheduled service visit (annual or biennial):
- b. If the light is a **shore aid**, then replace all extinguished lamps and the operating lamp. Rotate remaining good lamps to the forward positions and use new lamps to fill remainder of lampchanger.
- c. If the light is a **floating aid (buoy)**, then replace all extinguished lamps and the operating lamp. Rotate remaining good lamps to the forward positions and use new lamps to fill remainder of lampchanger. If the buoy has 1952 type tappers, then replace all lamps.

- d. Wipe lamps with medicinal swab or a clean rag dampened with denatured alcohol.
- e. Replace daylight control.
- f. To check for proper operation, perform Quick-Check procedure listed below:
- g. Minor aid Quick Check Procedure (Note: Procedures referenced here refer to troubleshooting detailed in section 4.

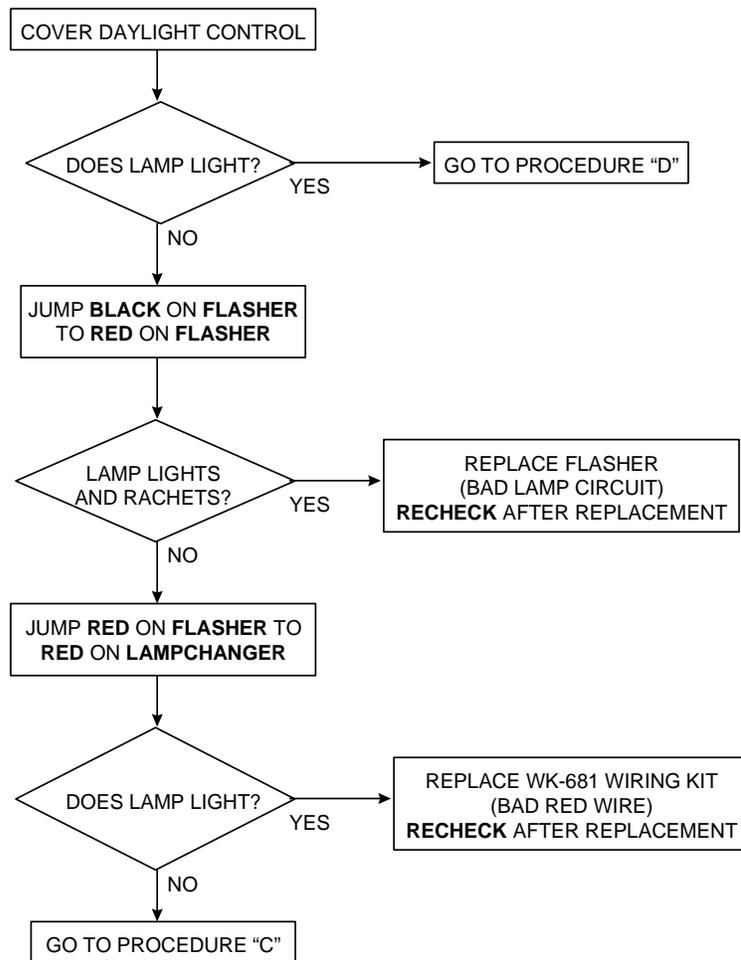


4. Troubleshooting. The following flowcharts will enable you to locate a minor aids lighting hardware failure.

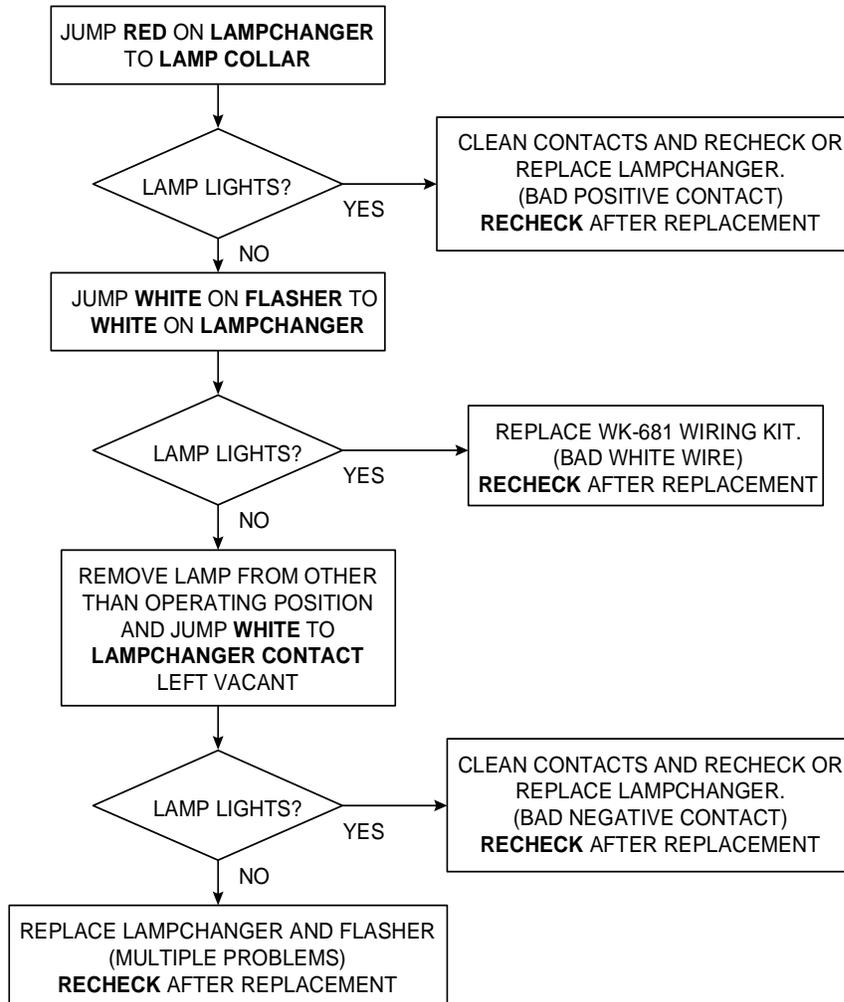
a. Procedure A



b. Procedure "B":



c. Procedure "C":



d. Procedure "D":

