Carmanah M850 & M860 LED Lantern Instructions

The Carmanah M850 and M860 lanterns are self-contained, omni-directional LED marine lanterns for use on lighted buoys and structures with a nominal range of 3 to 7 nautical miles. This document provides the following information:

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Carmanah M850 & M860 Self-Contained LED Lanterns

Overview

The Carmanah M850 and M860 lanterns are manufactured by:

Carmanah Technologies Inc.
250 Bay Street
Victoria, British Columbia
Canada, V9A 3K5
Phone: 1-877-722-8877
Website: http://www.carmanah.com

The lanterns are self-contained: the solar panels, battery, flasher, daylight control, and lantern assembly are all housed as a single unit. The M850 and M860 share the same LED optics but differ in battery and solar panel size (the "solar engine"). The M850 lantern contains the 60X battery (60 watt-hour) while the M860 contains the larger 200BC battery (200 watt-hour) along with larger solar panels resulting in a bigger solar engine. Depending on desired color, flash rhythm, and intensity, in many cases the M860 will be able to operate in locations where the M850 cannot.

Every lantern has an inherent color (red, green, white, or yellow) but the flash rhythm and intensity are programmable. The IR remote control programmers, which are not included with the lanterns, are required for programming. The programmers can be purchased directly from Carmanah for a nominal price (see page 24 and APPENDIX B). The color of the lantern is easily identified by the color of the LED bracket embedded beneath the clear polycarbonate optic head assembly at the top of the lantern.

Lanterns contain a revision number on the circular product label which is visible under the clear polycarbonate optic head assembly. The current version is **Rev A**. If/when future revisions are released, this instruction will be updated to reflect the new revision; and, the M800-series Sizing Program (spreadsheet) will be updated to include the revised lanterns.

Important Notes of Concern:

1. DO NOT store these self-contained LED lanterns in the box after delivery.

These lanterns contain expensive lead-acid batteries that must be kept charged or else sulfation build-up on the lead plates will permanently damage the batteries and reduce their capacity. The easiest way to keep the batteries charged is to program the lantern to the energy-saving **oFF** mode and place them in a cool location exposed to a good dose of daily ambient sunlight/daylight. Alternatively, the lanterns can be recharged using an *optional* battery charger pack connected to either the *optional* external charge port in the lantern base or connected directly to the battery board with the lantern opened up. See the Recharging section on page 16 for more-detailed guidance. If battery charging cannot be carried out immediately upon delivery due to logistical or other unavoidable reasons, store the lanterns in a cool location (the cooler the better) until the lanterns can be adequately recharged. This will help extend the life of the batteries when the lanterns are not being used.

2. After delivery, the lantern should be set to either the on or oFF modes.

When the lantern arrives from the factory it will be in the energy-saving factory storage mode (**Stor**). The lantern should then be turned on and programmed for operation if ready for deployment or turned off if it will not be deployed right away. To establish a connection and get out of storage mode, point the programmer at the lens and press the **Power Key** on the IR programmer repeatedly until the lantern flashes back once in response. Then press and hold the **Power Key** for about 5 seconds. This will permanently take the lantern out of the storage mode. The digital LED display will then change to show "**StAt on**" for on or "**StAt oFF**" for off. Then, holding down the **Power Key** on the IR programmer again will toggle the lantern between **on** and **oFF** modes. When placing the lantern in the **oFF** mode, the digital LED display will show the word "**bYE**" before turning itself off. When not in use, the lantern should always be placed in the **oFF** mode otherwise it will flash when dark, using up battery power unnecessarily.

3. Confirm the ALC Automatic Light Control is turned OFF at all times.

The function of the ALC is to reduce the lantern's intensity upon detection of excessively low battery voltage in an attempt to save the battery. The USCG's priority is to maintain the advertised light intensity for as long as possible, even at the expense of the battery. Thus, the ALC must never be turned on. The M800 lanterns are shipped from the factory with the ALC turned off; but please confirm this to be so before deployment. Once confirmed, this setting should never be changed.

4. Ensure the Day-to-Night and Night-to-Day Transition levels are set to USCG standard Lux levels.

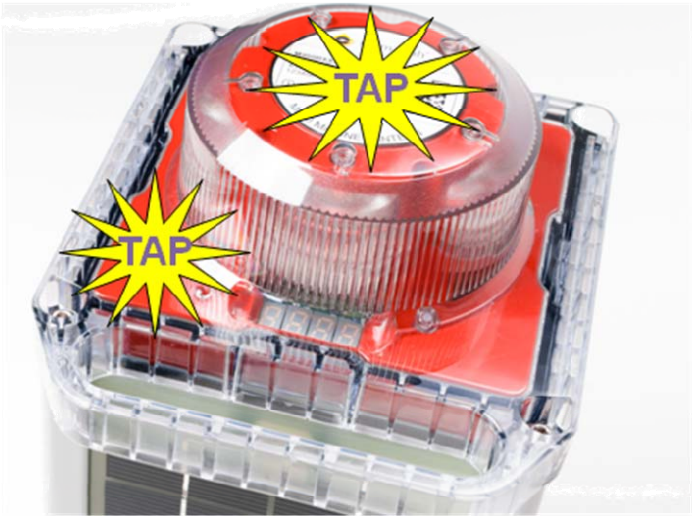
The lux levels for USCG Day-to-Night (d2n) is **250L** and the Night-to-Day (n2d) is **320L**. This is important because the solar sizing programs utilize these critical switching levels; other lux levels could result in unreliable solar sizings. The M800 lanterns are shipped from the factory set to these transition levels; but please confirm this to be so before deployment. Once confirmed, these settings should never be changed.

SECTION 1

General Information

General. The Carmanah M800-series lanterns are 3 to 7 NM self-contained LED lanterns with an extruded metal frame, polycarbonate base, clear polycarbonate optic head, and an LED information display. Five metal bird deterrent wires (included) may be attached to the top lens cover with screws. Please use them if there is any possibility for bird guano fouling. The handle is sufficiently reinforced to act as an attachment point when transporting or hoisting the lantern. There are no top-mounted solar panels. The optic head and battery packs are replaceable. The M850 is approximately 9" tall, 9-¼" wide at the base, and weighs approximately 10 lbs. The M860 is 13" tall, 9-¼" wide at the base, and weighs approximately 22 lbs.

Digital LED Display (Tap-to-Activate). The new top-mounted digital LED display provides essential summary information about your lantern. To activate the LED display, quickly tap the optic head (or the left "shoulder" of the lantern) **three times**. The display will show the primary settings for the lantern in the following sequence: Lantern Status, Battery State-of-Charge & Battery Voltage, Lantern Flash Rhythm, Lantern Effective Intensity, ALC on/off, and Calendar on/off.



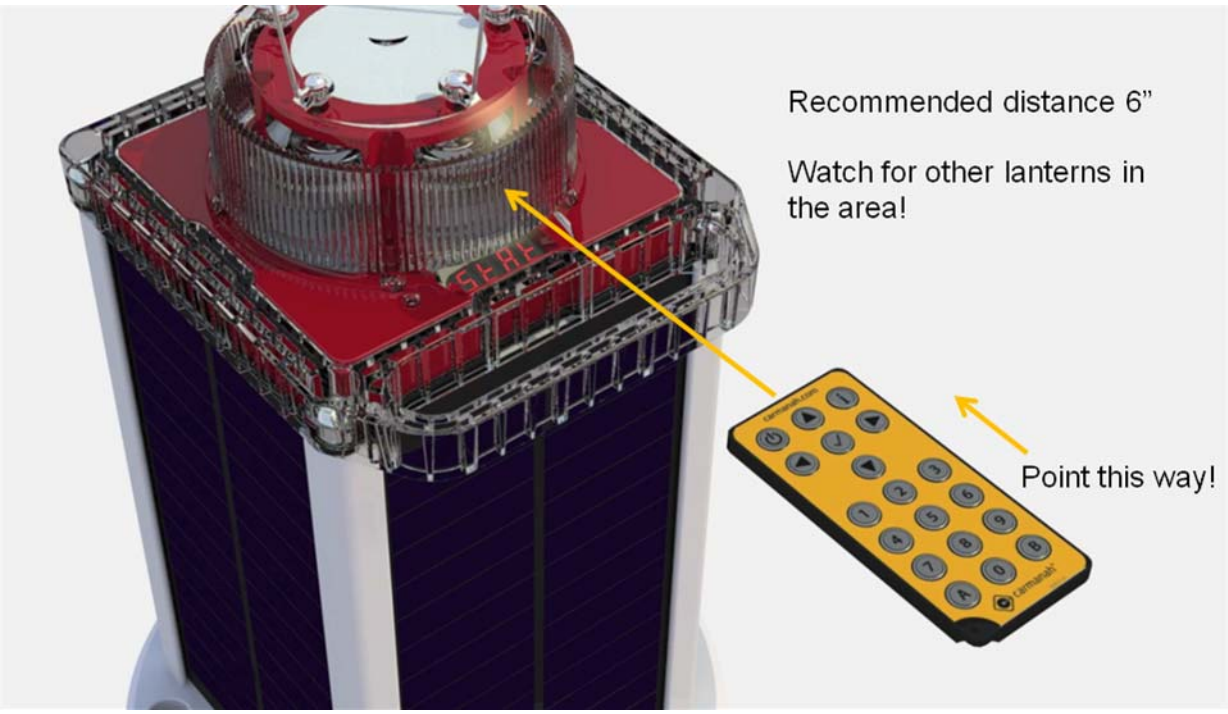
Alternatively, the **Information Key** on the IR remote control programmer can be used instead to access and display this same important summary information without having to tap-to-activate. The tap feature cannot be used to program the lantern - the IR remote programmer is the only way to program the lantern and display *all* of the settings on the digital LED display.

Programming with the IR Remote Control Programmer. All programming and additional menu options are available only while the lantern is in the **on** mode. The M800-series lanterns do not need to be ***transitioned*** between day and night modes in order to program them (as Carmanah's older M700-series lanterns required). Programming works best in a bright room. To conserve battery power, the lantern searches for a signal from the IR programmer on a continual 0.5 second cycle. Press the **Power Key** on the IR remote control programmer

multiple times to establish a connection. Typically, three steady button presses will be sufficient. When a successful connection has been established, the lantern will flash once indicating that it is ready to accept commands from the IR programmer. Each subsequent IR command after that will be confirmed with another flash. After **60 seconds** without input activity, the lantern will revert back to its previously set mode. For best results, do not attempt to program the lantern from a distance **closer than 6"** from the optic head.

When pressing the Power Key, the lantern will display **one flash**. The lantern should respond immediately to button presses with a flash. If there is no flash, the entry was not read. Three (3) quick flashes by the lantern after pressing the **Set Key** to lock in a setting indicates that the entry was accepted. Two (2) slow flashes means the entry was rejected (i.e., the entry was not recognized nor accepted) and the digital LED display will show "**Err**." The digital LED display will respond to and show your actions as you proceed through with programming the lantern.

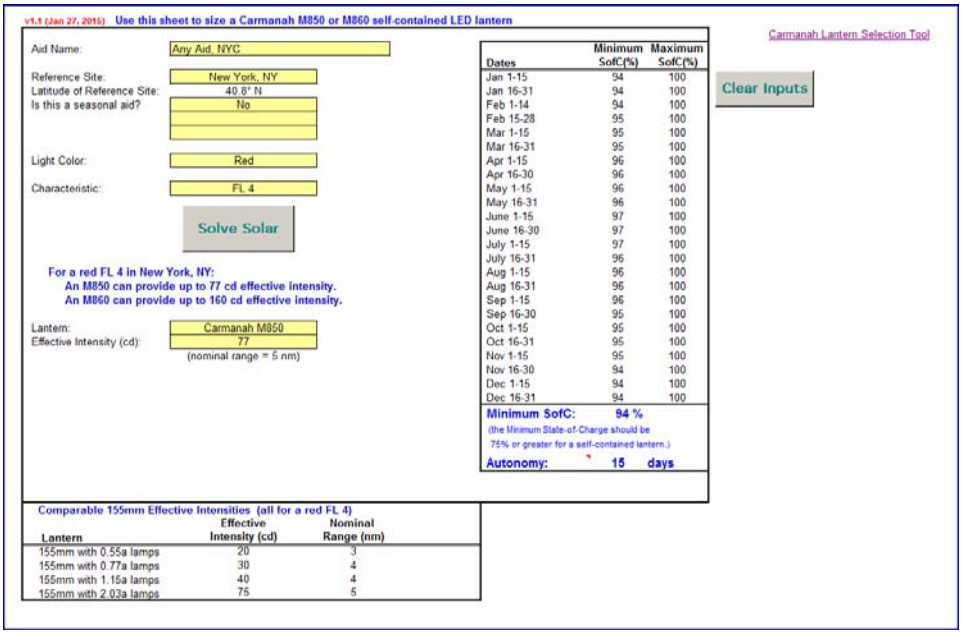
Default Settings. The M850 and M860 lanterns arrive from the factory with three default settings that should never be changed: (1) Automatic Light Control (ALC) must remain off, (2) the Calendar (CAL) must remain off, and (3) the lux transition levels must remain at d2n = 250L and n2d = 320L. The other two factory default settings, which can and must be changed to meet the requirements of the aid, are Effective Intensity (**EInt**) = 015 (which is 15cd) and Flash Code (**FLSh**) = 174 (which is FL 4 (0.4)).



SECTION 2

Solar Sizing / Lantern Selection Program

Solar Sizing. A solar sizing program (or spreadsheet) for the M850 and M860 self-contained LED lanterns is available to you from any web-connected computer. The following weblink will take you directly to the program: http://www.uscg.mil/hq/cg4/cg432/docs/software/Solar/M800SeriesSolarv1.xls. Once launched, please don't forget to enable Macros in the EXCEL spreadsheet. You may download a copy to your computer for future use but please be aware that future updated versions will be available only from the website. The following is an example of a typical readout:



v1.1 (Jan 27, 2015) Use this sheet to size a Carmanah M850 or M860 self-contained LED lantern

Carmanah Lantern Selection Tool

Aid Name: Any Aid, NYC

Reference Site: New York, NY
Latitude of Reference Site: 40.8° N
Is this a seasonal aid? No

Light Color: Red

Characteristic: FL 4

Solve Solar

Clear Inputs

For a red FL 4 in New York, NY:
An M850 can provide up to 77 cd effective intensity.
An M860 can provide up to 160 cd effective intensity.

Lantern: Carmanah M850
Effective Intensity (cd): 77
(nominal range = 5 nm)

Dates	Minimum SofC(%)	Maximum SofC(%)
Jan 1-15	94	100
Jan 16-31	94	100
Feb 1-14	94	100
Feb 15-28	95	100
Mar 1-15	95	100
Mar 16-31	95	100
Apr 1-15	96	100
Apr 16-30	96	100
May 1-15	96	100
May 16-31	96	100
June 1-15	97	100
June 16-30	97	100
July 1-15	97	100
July 16-31	96	100
Aug 1-15	96	100
Aug 16-31	96	100
Sep 1-15	96	100
Sep 16-30	95	100
Oct 1-15	95	100
Oct 16-31	95	100
Nov 1-15	95	100
Nov 16-30	94	100
Dec 1-15	94	100
Dec 16-31	94	100

Minimum SofC: 94 %
(the Minimum State-of-Charge should be 75% or greater for a self-contained lantern.)
Autonomy: 15 days

Comparable 155mm Effective Intensities (all for a red FL 4)

Lantern	Effective Intensity (cd)	Nominal Range (nm)
155mm with 0.55a lamps	20	3
155mm with 0.77a lamps	30	4
155mm with 1.15a lamps	40	4
155mm with 2.03a lamps	75	5

As you see, this new lantern sizing program has a simple user interface and is very easy to navigate, especially for those already familiar with our other solar sizing programs. All guess work has been eliminated at the user level. The inputs are all pull-down menu choices. Once you enter the reference site, lantern color, and the flash characteristic, click on the "Solve Solar" button to see the lanterns' maximum capabilities – the program will display the maximum effective intensities that the two lanterns can provide for the given inputs thereby giving the user a quick indication as to which lantern can be safely used at a particular site; and the table to the right will immediately populate and display the lanterns' yearly predicted performance. You will then be able to select a lantern and effective intensity that will work for your aid. Always select the M850 lantern over the M860 if it provides an acceptable solution as it'll save you about $300 dollars per lantern.

The best way to access this program is from the Solar Sizing Programs Flowchart on the following web address which, incidentally, also provides easy access to all our other solar sizing programs: http://www.uscg.mil/hq/cg4/cg432/docs/software/Solar/SolarSizingProgramsandTablesv2014_11_20.pdf.

SECTION 3

Lantern Quick Start Guide & Programming

IR Remote Programmer

Key	Definition
	Power Key, used to establish a connection with the lantern, change modes, and initiate programming.
	Information Key, will bring up the lantern status display to confirm basic settings.
	"A" Key, to go directly to the **Flash Character** menu.
	"B" Key, to go directly to the **Effective Intensity** (candela) menu.
	Set Key, to select, lock, and unlock settings when making changes (e.g., press this key before and after programming in a flash code).
	Up & Down Arrow Keys, to scroll through main menu options.
	Left & Right Arrow Keys, to scroll through sub menu items or scroll between digits in a setting (not used much).

Basic Digital LED Display Codes

These are the basic codes that will be displayed after tapping the lantern or when using the IR remote programmer's Information Key .

Code	Definition
StAt	Lantern Mode: **on** or **oFF** (displays **bYE** when turning off).
bAtt	Battery Status: **SoC** (charge in percentage), **voLt** (in dc volts; M850 = **6.3 volts** nominal, M860 = **8.4 volts** nominal)
FLSh	Displays the three digit code for the flash characteristic.
EInt	Displays the lantern's Effective Intensity setting in candela (**cd**).
ALC	Displays the Automatic Light Control (ALC) setting (**on** or **oFF**).
CAL	Displays whether the calendar function is on or off (**on** or **oFF**).

Basic Lantern Setup Upon Receipt

The lanterns are shipped from the factory with batteries charged to at least 80% state-of-charge. Since the lanterns must be at 100% state-of-charge at deployment, they will likely have to be recharged after delivery by either placing them outside in direct sunlight for **5 to 10 days** (depending upon light conditions – see the Storage and Recharging Intervals section on page 15) or using an *optional* battery charger pack connected to either the *optional* external charge port in the lantern base or connected directly to the battery board with the lantern opened up. (Both the optional battery charger pack and the optional external charge port are extra-cost options that may be purchased directly from Carmanah after placing a lantern order through SILC Contracting). While charging, a single decimal point on the lower right corner of the lantern's digital LED display will continually flash to indicate that charging is taking place; steady on indicates the battery has fully charged.

The lanterns should never be deployed with the batteries at less than a **100%** state-of-charge. If in the future the state-of-charge ever drops below **60%** during deployment, remove the lantern from service for charging and troubleshooting.

Follow these basic set-up steps and lantern programming using the IR Remote Programmer after receiving your new lantern:

Changing Modes

Step	Action
1	The lantern is shipped in "Storage Mode" **Stor**. By quickly tapping the optic head (or the "shoulder" of the lantern to the left of the display) three times, you will be able to activate the digital LED display, but not change modes or program the lantern.
2	**Press & hold** the **Power Key** until the lantern flashes once and the digital LED display turns on. When turned on, the LED readout will display the flash characteristic it was previously set to (if fresh from the factory, lantern will be set to factory default 174; 174 = FL 4 (0.4)).
3	To change between the **oFF** and **on** modes, press the **Power Key** until the lantern flashes. Then, **Press & Hold** the **Power Key** again for approximately five seconds. The LED display will change to either **StAt on** (for on) or **StAt oFF** (for off); but while transitioning to **oFF**, the display will momentarily show "**bYE**."

Setting the Lantern Flash Characteristic

Note: The lanterns are shipped from the factory set to default flash characteristic FL 4 (0.4) (code 174). The flash rhythm can easily be changed to a different setting using the following procedure:

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Wake the lantern by repeatedly pressing the Power Key until you get a single flash. <u>The lantern must be in the on mode to program</u>. After the flash, you have 60 seconds to make another key entry. If you are entering all programming codes within 60 seconds of each other, you do not need to press the Power Key each time.</td></tr>
<tr><td>2</td><td>Press the A Key (for Flash Character Menu).</td></tr>
<tr><td>3</td><td>Press the Set Key to unlock the flash characteristic setting.</td></tr>
<tr><td>4</td><td>Enter the selected three digit code for the characteristic with the numeric key pad. The codes are same for all Carmanah lanterns.
<table>
<tr><th>Rhythm</th><th>Code</th></tr>
<tr><td>Q (0.3s flash, 0.7s eclipse)</td><td>129</td></tr>
<tr><td>FL 2.5 (0.3) (0.3s fl, 2.2s ec)</td><td>049</td></tr>
<tr><td>FL 4 (0.4) (0.4s fl, 3.6s ec)</td><td>174</td></tr>
<tr><td>FL 5 (0.5) (0.5s fl, 4.5s ec)</td><td>069</td></tr>
<tr><td>FL 6 (0.6) (0.6s fl, 5.4s ec)</td><td>073</td></tr>
<tr><td>FL (2) 5 (0.4s fl, 0.6s ec, 0.4s fl, 3.6s ec)</td><td>175</td></tr>
<tr><td>FL (2+1) 6 (0.3s fl, 0.4s ec, 0.3s fl, 1.2s ec, 0.3s fl, 3.5s ec)</td><td>022</td></tr>
<tr><td>Iso 6 (3.0s fl, 3.0s ec)</td><td>081</td></tr>
<tr><td>Mo (A) (0.4s fl, 0.6s ec, 2.0s fl, 5.0s ec)</td><td>176</td></tr>
<tr><td>Occ 4 (3.0s fl, 1.0s ec)</td><td>118</td></tr>
</table>
The digital LED display will show the codes as you are entering them, and the lantern will provide a single flash for each successful key entry.</td></tr>
<tr><td>5</td><td>Press the Set Key again to lock the characteristic setting. The lantern will provide three quick flashes to confirm that the new setting has been accepted and locked. If incorrect, the display will show “Err.” <u>Important</u>: Anytime the flash code is changed, the lantern will determine if the new flash characteristic can support the preprogrammed effective intensity and will automatically lower it if necessary. Always review the programmed effective intensity setting after changing the flash code to ensure it’s still as desired.</td></tr>
</table>

Setting the Lantern Effective Intensity

Step	Action
1	Wake the lantern by repeatedly pressing the **Power Key** until you get a flash. Then, turn on the lantern by holding down the **Power Key** for a few seconds. You have 60 seconds to make another key entry before the lantern times out.
2	Press the **B Key** (for Flash Character Menu).
3	Press the **Set Key** to unlock the intensity setting.
4	With the numeric keypad, enter the desired *effective intensity* in candelas using three digits (for example, **047 = 47 candelas**, and **125 = 125 candelas**). It will also be shown on the digital LED display. If incorrect or if the lantern is incapable of accepting that particular effective intensity and flash characteristic combination, the display will show "**Err**."
5	Press the **Set Key** again to lock the effective intensity setting. The lantern will provide three quick flashes to confirm that the new setting has been accepted and locked.

Turning off the Automatic Light Control (ALC)

In the unlikely event that the ALC is turned on, follow the steps below to turn it off:

Step	Action
1	Wake the lantern by pressing the **Power Key** until you get a flash. Then, turn on the lantern by holding down the **Power Key** for a few seconds. You have 60 seconds to make another key entry before the lantern times out.
2	Press the **Information Key**.
3	Use the **Down** or **Up Arrow Keys** to scroll through the display until you come to "**ALC**".
4	Press the **Set Key** to unlock the setting.
5	Use the **Down** or **Up Arrow Keys** to toggle between the **On** and **Off** selections. Select **Off** if not there already.
6	Press the **Set Key** again to lock the ALC setting to **Off**. The lantern will provide three quick flashes to confirm that the setting has been accepted and locked.

Checking Day-to-Night and Night-to-Day LUX Transition Levels

It's unlikely ATON units will ever have to change the LUX (Ambient Light Levels) on their M800 Carmanah lanterns. Ambient light levels are used to determine when the lantern will turn on at night or turn off during the day, depending on the amount of ambient light detected by the lantern's internal daylight control sensor. Carmanah's standard factory default settings match the USCG's requirements. But when troubleshooting, you may be asked to report on your lantern's LUX level settings. So, it helps to be able to quickly confirm those settings:

To read the Day-to-Night (d2n) and Night-to-Day (n2d) settings, do the following:

Step	Action
1	Press the **Power Key** until the lantern flashes and the LED display turns on. Ensure the lantern is in the "On" mode or you will not be able to scroll through the menu.
2	Using the **Down Key** , scroll through the menu display until it shows **d2n**. It should then display the number **250L**. Press the **Down Key** again and the display will show **n2d**. It should then display the number **320L**. d2n = 250L and n2d = 320L are the correct USCG LUX transition level settings.

Turning Off the "Tap" Feature

For lanterns deployed in heavy weather conditions where vibrations and shocks may inadvertently activate the Tap-to-Activate feature, it can be turned off by performing the following steps:

Step	Action
1	Press the **Power Key** until the lantern flashes and the digital LED display turns on. Ensure the lantern is in the "On" mode or it will not allow you to scroll through the menu.
2	Using the **Down Key**, scroll down through the menu display until it shows **tAP** for the Tap Activated Feature.
3	Press the **Set Key** to unlock the setting.
4	Use the **Down** or **Up Arrow Keys** to toggle between the **On** and **Off** selections and stop at Off.
5	Press the **Set Key** again to lock the **tAP** setting to Off. The lantern will provide three quick flashes to confirm that the setting has been accepted and locked.

Deploying

After completing all the programming steps, the lanterns should be tested outside for 24 hours. Then just prior to deployment, ensure one last time that the lanterns are fully charged to 100% state-of-charge (recharge if necessary) and programmed to the correct flash rhythm *and* effective intensity. Perform this final check by visually confirming the settings shown in the digital LED display while scrolling through the summary information using either the tap-to-activate method or the Information Key on the IR programmer.

Mounting procedures are the same for all Carmanah lanterns. If using the bird deterrant wires, place a small drop of Lock-Tite thread lock adhesive in each screw hole to ensure the bird deterrents stay in place.

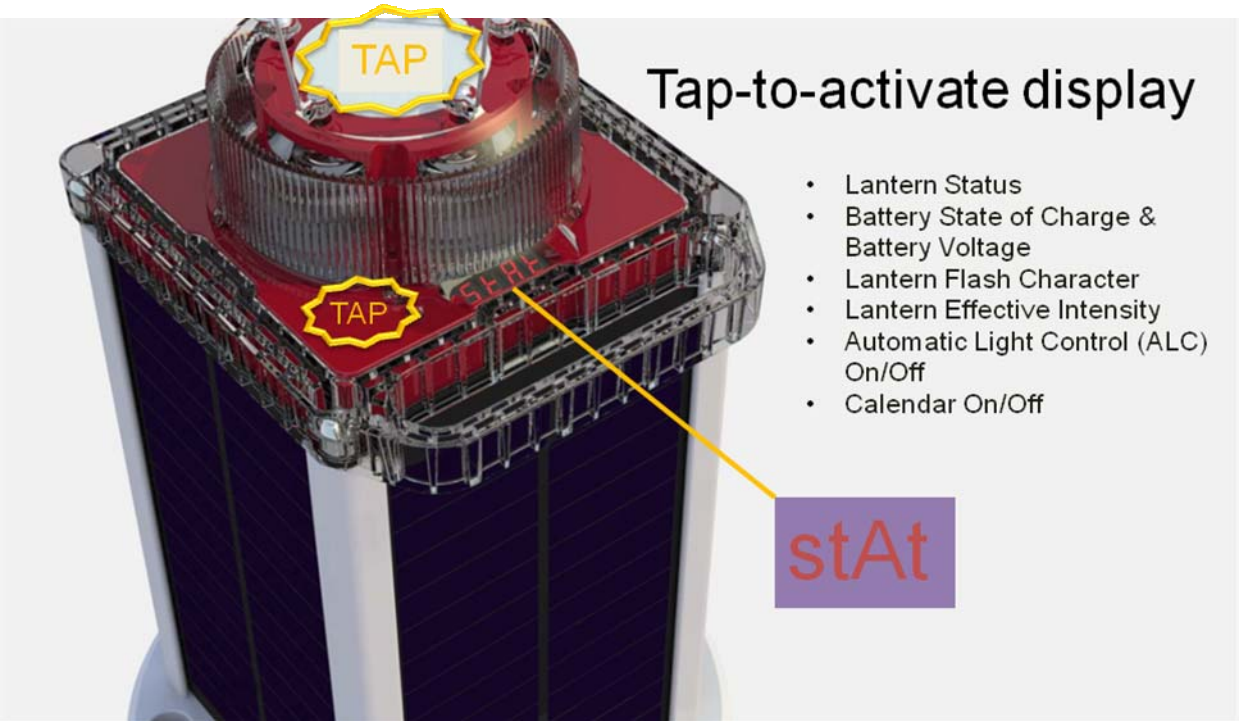
General Servicing and Maintenance

While self-contained LED lanterns do not require the intensive servicing that legacy lanterns require, there are still actions that need to be accomplished. When servicing or troubleshooting the M850 or M860 LED lantern, clean any dirt or guano from the lantern, paying close attention to the solar panels and the optic head/lens cover. Closely inspect the optic head and solar panels checking for any damage, cracks, or discoloring. More detailed information on installation and servicing is presented in SECTION 5. Take the steps below and record the following information:

Step	Action
1	Tap the optic head to activate the digital LED display or press the **Information Key**. The codes listed below will display in sequence.
2	Record the battery state-of-charge and voltage.
3	Confirm that the flash characteristic and effective intensity settings are correct.
4	Confirm that the ALC and CAL are turned off.

Codes	Definitions
StAt	Lantern Status (Mode): **on, oFF**
bAtt	Battery Status: **SoC** (charge in percentage), **VoLt** (in dc volts)
FLSh	Three digit code for the flash characteristic
EInt	Effective Intensity setting for the lantern, in candela (**cd**)
ALC	Automatic Light Control (ALC): **on, oFF**
CAL	Calendar: **on, oFF**

When sending correction messages or reporting lantern problems, ensure that the lantern serial number (not battery tracking number) shown on the optic head is included in the message or email. This information is vital for reporting issues/problems to Carmanah.



SECTION 4

Lantern Selection

Overview

The Carmanah M800 lanterns are authorized replacements for a 155mm, 250mm, and all previous self-contained LED lanterns on either a buoy or a fixed aid if it provides an acceptable effective intensity and if its solar engine is capable of providing the required minimum 15-days of autonomy.

District Considerations -- Intensity

Both the M850 and M860 lanterns provide a wide range of intensities. However, the capabilities of the M860 lantern in the lower intensity settings are duplicated by the M850 lantern. Because of cost considerations, use the M860 only at aid locations where the required effective intensities and/or autonomy cannot be met with an M850 lantern. Use the M800 lantern solar sizing program to determine the capabilities of these two lanterns for your specific application(s) (see SECTION 2).

To determine the intensity requirements for any aid, Districts shall use the standard procedures for selecting an ATON light signal as prescribed in the ATON Technical Manual (Chapter 6, Section 6.B, page 6-1) and the Visual Signal Design Manual (Chapter 3). These references describe how operational range, luminous range, light color, light characteristic, background lighting, and meteorological visibility are used to calculate intensity needs.

After the effective intensity is determined, use the following table to find Nominal Range.

Nominal Range Table

Effective Intensity	Nominal Range
1 – 2	1
3 – 9	2
10 - 23	3
24 - 53	4
54 - 107	5
108 - 203	6
204 - 364	7

Under no circumstances should any lantern replace another lantern based solely on nominal range. Instead, select an effective intensity equal to or slightly greater than that of the lantern being replaced.

SECTION 5

Receipt, Storage, Recharging, Installation, Servicing, and Troubleshooting

Receipt, Handling, and Warranty

As discussed before, the lantern is charged prior to shipping from the factory. It should arrive with a state-of-charge of at least 80% and programmed to be in the storage mode (i.e., it will not flash in a darkened room). If not needed right away, it should be checked for damage, placed in the **oFF** mode, and kept exposed to ambient sunlight/daylight in a safe, cool location if possible (the cooler, the better). Carmanah offers a three (3) year limited warranty: For the first year after purchase, Carmanah will, at their discretion, repair, replace, or provide a credit for a faulty lantern if failure is due to a defect in materials or workmanship. For the second and third year after purchase, Carmanah will, at their discretion, repair, replace, or provide a credit for a faulty lantern if failure is due to a defect in materials or workmanship **with the exception of lantern failure due to battery performance**.

If a lantern is found to be defective even after troubleshooting and it's still within the three-year warranty period, contact Carmanah at the customer service address/phone number provided after the troubleshooting section below to launch a warranty claim. You will need to provide Carmanah with as much information about the defective lantern as possible, the most important of which is the lantern's serial number.

Storage and Recharging Intervals

Storage of self-contained lanterns is not encouraged but is sometimes unavoidable for logistical or other compelling reasons. The batteries inside these self-contained lanterns are very susceptible to self-discharge, especially if the lantern is left unused in a hot, dark location for a long period of time. To avoid this unnecessary loss of charge and resulting battery damage, first charge the lantern to 100% SoC and then store the lantern at temperatures no higher than 68° F if at all possible (and, as mentioned before, the cooler the better but refrigeration temperatures are best: 35° to 40°). Depending on the storage temperature, the lanterns must be taken out of storage and charged as follows:

Storage Temperature (°F)	**Recharging Interval** (months)
68° or lower	6
69° – 77°	3
78° – 86°	2
87° – 103°	1
104° or higher	Do not store at these temps

For example, an M860 lantern stored at 80° F will have to be taken out of storage and charged outside exposed to natural sunlight for 5 to 10 days **every 2** months in order to preserve the battery.

The lantern should always be brought up to 100% state-of-charge before storing it to reduce the chance of battery damage. Upon checking the battery's state-of-charge, if the displayed value is not 100%, then recharge the lantern per instructions in the Recharging section below prior to storage. **Important**: Don't forget to place the lantern in the **oFF** mode prior to storage by pressing and holding down the Power Key for approximately five seconds until "**byE"** is displayed.

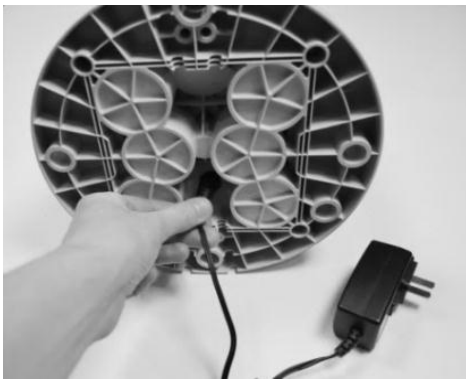
Recharging

There are several ways to recharge the lantern and bring the battery back to 100% state-of-charge. The best and easiest way is to leave the lantern outside exposed to natural sunlight for 5 to 10 days. If this is not possible, you may use the optional power pack style battery charger connected to either the optional charge port in the base or directly to the battery board after opening up the lantern. However, opening up the lantern to access the battery board is not encouraged because the environmental factory seal will be compromised. A flashing decimal point in the digital LED display indicates that battery charging is taking place; steady on indicates that the battery is fully charged.

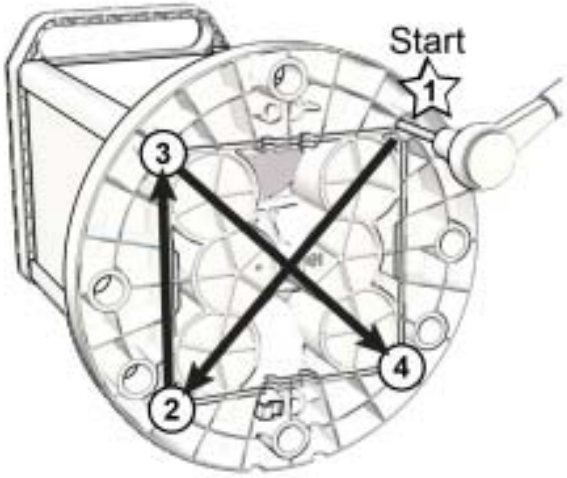
Battery charging options are presented in the following order of precedence:

1. **Using Sunlight.** The easiest way to recharge the lantern to 100% state-of-charge is to leave it outside exposed to natural sunlight for 5 to 10 days. Ensure that the lantern is turned **oFF** so that it does not activate at night extending the recharging time.

2. **Using Optional Charge Port.** The battery charge port is a $95 option that, if desired, must be purchased immediately after placing an order against the current requirements contract through SILC Contracting by calling Carmanah and providing the order number and the additional payment. If you purchase this option, a battery charge port will be added to the bottom of the lantern's base flange for charging the battery using an external 120VAC power-pack style battery charger ($56 option, p/n: 69885). If lanterns are charged using this method, the battery will fully charge within 24-hours and an intelligent charge controller built into the lanterns' circuitry will prevent overcharge if/when left connected for long periods of time. Upon charge completion (confirmed when decimal point in digital LED display is steady on), let the lantern rest for at least one (1) hour in the oFF mode (but preferably 24-hours) before confirming settings and deploying the lantern.



3. **Opening the Lantern.** Use this method only as a last resort since it involves disturbing the factory seal. Any Carmanah self-contained lantern, with or without a charge port, can always be opened up and charged using the external 120VAC power-pack style battery charger ($56 option, p/n: 69885) connected directly to the battery board. If lanterns are charged using this method, the lantern head must remain electrically connected to the battery board. The battery will fully charge after 24-hours and an intelligent charge controller built into the lanterns' circuitry in the lantern head will prevent overcharge if/ when left connected for longer periods of time. Upon charge completion (as indicated by the decimal point in digital LED display being steady on), let the lantern rest for at least one (1) hour in the oFF mode (but preferably 24-hours) before confirming settings and deploying the lantern. However, this method requires the additional step of properly reassembling the lantern after battery charging is completed. To retain a proper environmental seal when reassembling the lantern, reconnect the four base plate screws and tighten each screw down to 50 inch-lbs in a cross pattern using a calibrated torque wrench as shown below (right).

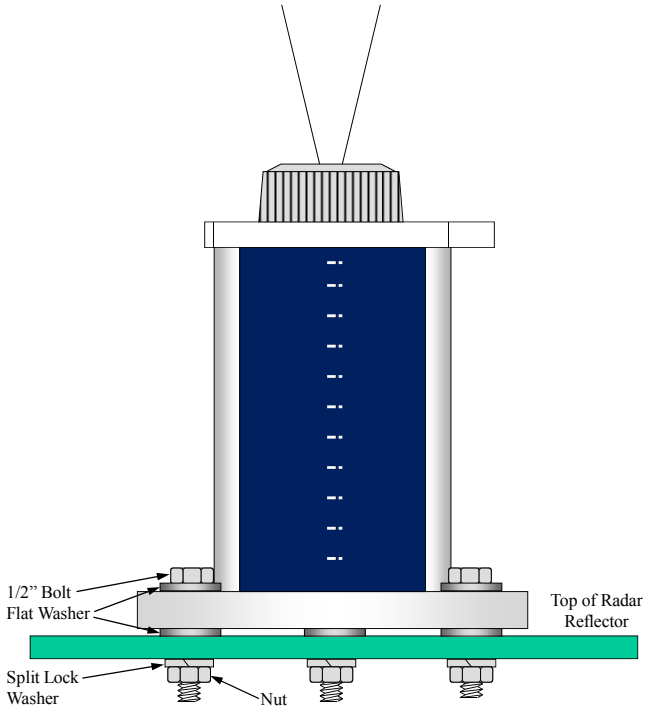


Installation

If District has determined that the Carmanah M850 or M860 satisfies effective intensity and autonomy requirements, then the lantern may be installed on either a steel buoy, a 5 X 9 foam buoy, or on a structure.

Program the lantern prior to installation on the buoy or structure according to the instructions provided in SECTION 3. After programming, cover the lantern or move to a dark room to simulate nighttime. Confirm that the lantern flashes under the correct flash characteristic. "Time" the light with a stopwatch. Confirm that all five LEDs are operating (check the LEDs by looking around the lantern just above the lantern's focal plane but DO NOT look directly into the lantern with your eye at the focal plane). Another method is to wrap a piece of white printer paper around the lens and view the projected image of the LEDs on the paper. Then, verify one last time that the correct effective intensity has been programmed in by tapping the lantern's optic head and checking the digital LED display readout. The effective intensity setting (EInt) sequences immediately after the flash characteristic setting (FLSh). Test the lantern outside for 24 hours to ensure proper operation; and, finally, recharge the lantern back to 100% state-of-charge before deployment.

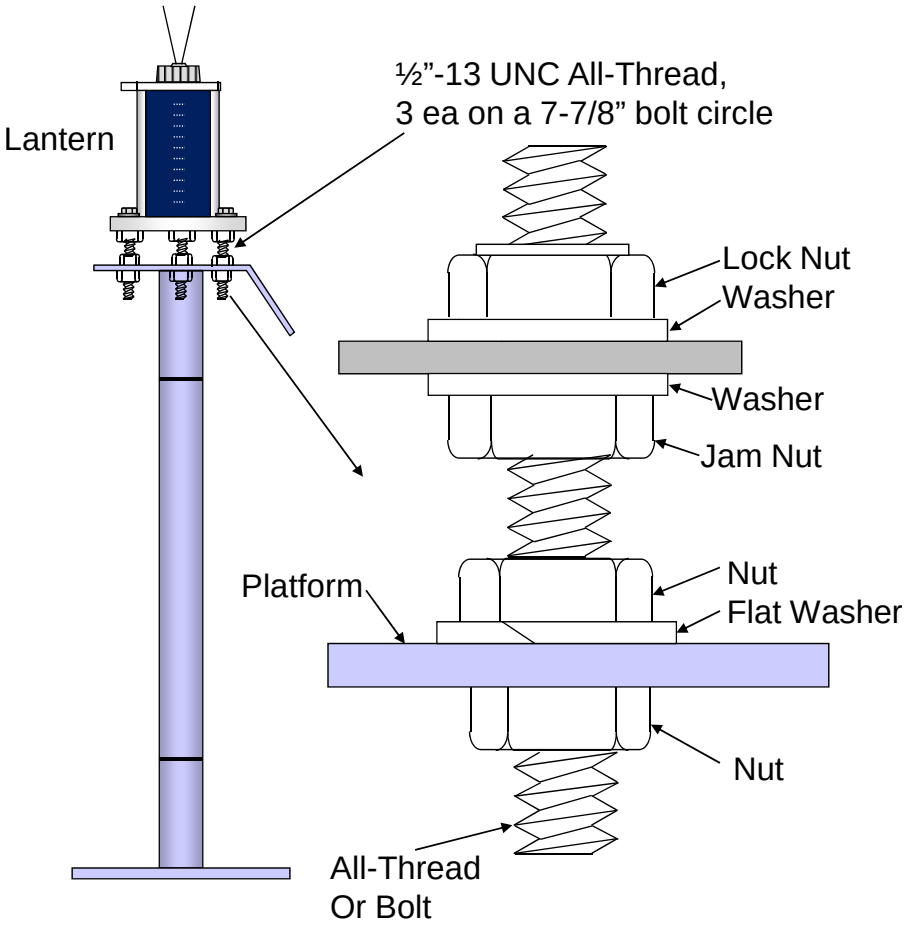
Buoy Mount



Mount the lantern **on a buoy** as shown in the figure above. The lantern must always be mounted with 3 bolts, never 4. Note that stainless steel or nylon flat washers **MUST BE** installed between the lantern and buoy's mounting plate to prevent distortion of the lantern's base. Stainless steel washers should also be installed between the heads of the mounting

bolts and the top of the lantern's base, as shown in the above figure. The mounting bolts should be torqued to 40 to 44 ft-lbs (4.5 to 5 N m).

Fixed-Aid Mount



Mount the lantern **on a fixed aid** as shown in the figure above. The lantern should ALWAYS be mounted with 3 bolts (or lengths of all-thread), never 4. The bolts will shadow the solar panels if they extend too far above the lantern's base. Therefore, after securing the bolts (or all-thread) to the structure's mounting plate as shown in the figure, install three jam nuts and washers on the bolts so that only about 1" of thread is exposed on top. Place the lantern on top of the jam nuts, then drop on the washers and position the uppermost locknuts at the very upper end of the thread. Do not tighten these uppermost nuts yet – they are positioned at this time to ensure that the lantern doesn't fall off. Level the lantern by adjusting the jam nuts (use a torpedo level on the base plate of the lantern - use the "T" method described in the Short Range Aids to Navigation Servicing Guide COMDTINST M16500.19A). When the lantern is level, tighten the upper-most nuts to 40 to 44 ft-lbs (4.5 to 5 N m).

Servicing

Servicing should be performed in accordance with the standard cycle established for the aid.

Ensure that the lens and solar panels are clean. Wipe with a cloth dampened with mild soap and water, if necessary.

Using either the tap-to-activate digital LED display feature or the information key on the IR remote programmer, check the battery state-of-charge: Look for battery state-of-charge reading XXX (bAtt – SoC – XXX) in the digital LED display that will sequence immediately after lantern status information. Battery state-of-charge must be at least 60%; if less than 60%, the lantern must be removed from service for charging and troubleshooting. Since the two M800 lanterns use different battery configurations and voltages (M850/60X = 6.3 volts, M860/200BC = 8.4 volts), we rely primarily on battery state-of-charge to determine the health and status of the battery. However, battery voltage information can be useful when troubleshooting a discrepant lantern and reporting back to customer service technicians at Carmanah for assistance.

Cover the lantern with a shroud, jacket, box, blanket, etc., to simulate darkness. The lantern should flash on rhythm after a few seconds. While covered, confirm that all five LEDs are operating (check the LEDs by looking around the lantern just above the lantern's focal plane; DO NOT look directly into the lantern with your eye at the focal plane).

Uncover the lantern. It should stop flashing.

Battery Service Life

The expected battery life is highly dependent on temperature: The higher the temperature, the shorter the expected battery life. Battery recharge intervals (i.e., replacement intervals) range from four years in hot climates to ten years in cold climates. Field units should recharge (replace) batteries at intervals shown in the table on the next page.

A battery replacement kit can be ordered directly from Carmanah (see SECTION 6 below). The battery kits contain a Cyclon battery pack, harness, battery hold-down plate, head/base gasket and washers (lantern base not included). Detailed battery replacement instructions are included with each kit. If the lantern fails due to a battery problem within the first year after purchase, contact Carmanah's customer service department at 1-877-722-8877 for an RMA number before shipping the lantern back to them for repair or replacement.

60X Battery Pack (6.3V)

200BC Battery Pack (8.4V)

District	Recharge Interval (Years)
D1	8
D5 (VA north)	7
D5 (NC)	6
D7 (SC & GA)	5
D7 (FL & PR)	4
D8 (FL, MS, AL & LA)	5
D8 (TX)	4
D8 (rivers - Cairo south)	6
D8 (rivers - Cairo north)	7
D9	8
D11 (southern CA)	6
D11 (northern CA)	7
D13	9
D14	4
D17	10

Lantern Service Life

The lantern can be kept in service as long as it provides an acceptable signal.

Battery Tracking

Batteries shall be tracked and Battery Tracking Labels shall be affixed to the base of the lantern. Remove any dirt, oil, and/or grease from the lantern's base before applying the tracking label to ensure maximum adhesion since it will be exposed to the environment. When the battery is replaced, remove the label (if possible) and attach it to the battery to track it through disposal. If the label is destroyed, write down the battery tracking number on the battery after it is removed from the lantern. Attach a new label to the lantern when a new battery is installed.

Troubleshooting

Symptom: ***Lantern will not respond to the remote (or no connection to remote)***.

- Have you removed the battery protector tab from your remote programmer?
- It's possible that the batteries in the remote are dead or the remote is not functioning. Change the batteries in the remote. If that doesn't work, try another remote.
- The lantern searches for an IR signal on a 0.5 second cycle. The lantern's search signal may not coincide with the push of the power button. Try pressing the power button quickly and repeatedly.
- Is lantern still in factory mode? Use tap-to-activate and look for factory storage mode (**Stor)**. If so, wait two hours and the lantern should respond to the IR programmer as normal.

Symptom: ***Settings cannot be changed.***

- Is the lantern in the off mode (**StAt oFF**)? Press and hold the power button for approximately 5 seconds until **Stat on** is displayed.
- Is the remote connecting properly to the lantern? See previous trouble Symptom.

Symptom: ***Lantern does not flash the programmed flash characteristic.***

- The battery state-of-charge is unacceptably low. The lantern may be in LVD mode. If the lantern was sized and programmed properly (to the correct flash characteristic AND light intensity setting) then it should maintain a high state-of-charge. Confirm proper solar sizing using the M800-series Sizing Program. Recharge the lantern and confirm proper programming.
- Look for other reasons the system did not maintain a satisfactory state-of-charge. Are the solar panels covered with dirt or guano? Is the lantern shaded? Is the DLC properly turning off the lantern during daylight?
- How old is the battery? Is it past the recharge interval shown in the "Battery Service Life" section? If the battery is past its recharge interval, replace the battery.
- If all items above check out, contact the ATON/MER Asset Line.

Symptom: ***Lantern reported discrepant.***

- Check the battery's state-of-charge. If state-of-charge is less than 60% then proceed through the steps in the troubleshooting section immediately above.
- If battery state-of-charge is 60% or greater, then reprogram the lantern and charge it back to 100% SoC. Ensure that the lantern responds properly to programming instructions.
- When lantern flashes, confirm that all five LEDs are operating (check the LEDs by looking around the lantern just above the lantern's focal plane; do not look directly into the lantern with your eye in the focal plane).
- If the lantern does not perform as it should, and the problem is not attributable to physical damage, Carmanah will replace the lantern under warranty – free of charge – within the first three years of purchase if problem is not related to the battery. If battery-related, Carmanah will replace the battery within the first year of purchase only. Contact Carmanah's Customer Service department before returning a lantern or seeking a warranty claim.

Symptom: ***Tap-to-activate not working.***

- Tap quickly and firmly on left shoulder or directly on the optic head.
- Confirm that the tap-to-activate feature is turned on (**tAP** is **on**).

Symptom: **Err** ***message on display.***

- Invalid IR programmer entry attempt.
- Use the M800-series solar sizing/selection program to ensure you are using an acceptable flash characteristic and/or effective intensity setting.

Symptom: ***Lantern LEDs do not turn on.***

- Environment is too bright. Test in a dark area.
- Lantern is in Low Voltage Disconnect (LVD) mode. Charge the lantern.
- If a flashing decimal point does not appear in the display while charging, battery replacement may be required.
- Calendar shutdown may be activated.

Symptom: ***LEDs are dim.***

- Check the M800-series solar sizing/selection program for sustainable settings.
- Adjust effective intensity settings.
- ALC is activated (unlikely) due to low battery state-of-charge. Turn **oFF** ALC if found to be **on**.

Carmanah Customer Service

Mail: Carmanah Technologies Inc.
250 Bay Street
Victoria, British Columbia
Canada, V9A 3K5
Phone: 1-877-722-8877
POC Mike Battagello
Fax: 1-250-380-0062
Email: customerservice@carmanah.com
Website: www.carmanah.com

Before contacting Carmanah's Customer Service Department, please have the serial number of the M800 lantern available, a detailed description of the problem, as well as all details of initial installation and recharging efforts.

SECTION 6

Ordering Instructions

The USCG SILC Contracting established a 5-year requirements contract with Carmanah Technologies for M850 and M860 self-contained LED lanterns. Detailed ordering instructions and pricing are available from the ATON Asset Line's webpage here: http://www.uscg.mil/hq/cg4/cg432/products.asp (click the "LED Lantern Prices" weblink under "Products & Services"). The buyer specifies the model number (M850 or M860) and color (red, green, white, or yellow).

The Carmanah M850 and M860 LED lanterns are manufactured and sold by:

Mail:	Carmanah Technologies Inc. 250 Bay Street Victoria, British Columbia Canada, V9A 3K5
Phone:	1-877-722-8877
POC	Mimi Drabit (ext: 8354) or Steve Oh (ext: 8330)
Fax:	1-250-380-0062
Email:	mdrabit@carmanah.com, soh@carmanah.com
Website:	www.carmanah.com

The following items are **NOT** included in the 5-year requirements contract but are available for purchase separately (outside the contract), directly from Carmanah:

(All prices are in U.S. dollars)

P/N	Description	Price
69899	IR Remote Programmer, slim	$24.00
69885	M850/M860 Battery Charger, external, 120VAC-powered	$56.00
69954	M850 Battery Kit – 60X	$189.00
69956	M860 Battery Kit – 200BC	$379.00
N/A	Head Kits (for M850/M860), specify color	$350.00
71757	M850/M860 Bolt Kit (1/2-13 UNC x 2" long x 4)	$18.00
71884	M850/M860 Security Bolt Kit, not including driver or socket (1/2-13 UNC x 2" long x 2 security + x 2 hex head)	$75.00
30768	Security screw bit (5/32" hex w/center pin)	$9.00
53288	Security bolt kit driver	$75.00
53289	Security bolt kit socket	$123.00
N/A	Battery Charge Port	$95.00

(If you purchase this option, a battery charge port will be added to the bottom of the lantern's base flange for charging the battery using the 69885 battery charger mentioned above. Please contact Carmanah as soon as your lantern purchase order (PO) has been issued and provide the order number and additional payment so that this optional charge port can be added to your lantern(s)).

APPENDIX A

SAFETY DATA SHEET

Form #: SDS 853027
Revised: 05/14/15
Supersedes: NEW
ECO #: 1001584

I. PRODUCT IDENTIFICATION

Chemical Trade Name (as used on label):
Cyclon®, Genesis®, SBS, SBS J, Hawker XE™, Odyssey®, Trolling Thunder™, NexSys™, OptiGrid™ or XFC

Chemical Family/Classification:
Sealed Lead Battery

Synonyms:
Sealed Lead Acid Battery, VRLA Battery

Telephone:
For information and emergencies, contact EnerSys Energy Products Environmental, Health & Safety Dept. at 660-429-2165

Manufacturer's Name/Address:
EnerSys Energy Products Inc.
617 N. Ridgeview Drive
Warrensburg, MO 64093-9301

24-Hour Emergency Response Contact:
CHEMTREC DOMESTIC: 800-424-9300 CHEMTREC INT'L: 703-527-3877

II GHS HAZRDS IDENTFICATION

HEALTH		ENVIRONMENTAL	PHYSICAL
Acute Toxicity (Oral/Dermal/Inhalation)	Category 4	Aquatic Chronic 1	Explosive Chemical, Division 1.3
Skin Corrosion/Irritation	Category 1A	Aquatic Acute 1	
Eye Damage	Category 1		
Reproductive	Category 1A		
Carcinogenicity (lead compounds)	Category 1B		
Carcinogenicity (acid mist)	Category 1A		
Specific Target Organ Toxicity (repeated exposure)	Category 2		

GHS LABEL:

HEALTH	ENVIRONMENTAL	PHYSICAL

Hazard Statements

DANGER!
Causes severe skin burns and eye damage.
Causes serious eye damage.
May damage fertility or the unborn child if ingested or inhaled.
May cause cancer if ingested or inhaled.
Causes damage to central nervous system, blood and kidneys through prolonged or repeated exposure.
May form explosive air/gas mixture during charging.
Extremely flammable gas (hydrogen).
Explosive, fire, blast, or projection hazard.

Precautionary Statements

Wash thoroughly after handling.
Do not eat, drink or smoke when using this product.
Wear protective gloves/protective clothing, eye protection/face protection.
Avoid breathing dust/fume/gas/mist/vapors/spray.
Use only outdoors or in a well-ventilated area.
Causes skin irritation, serious eye damage.
Contact with internal components may cause irritation or severe burns. Avoid contact with internal acid.
Irritating to eyes, respiratory system, and skin.

III. HAZARDOUS INGREDIENTS/IDENTIFY INFORMATION

Components	CAS Number	Approximate % by Weight
Inorganic Lead Compound:		
Lead	7439-92-1	45 - 60
Lead Dioxide	1309-60-0	15 - 25
Tin	7440-31-5	0.1 - 0.2
Sulfuric Acid Electrolyte (Sulfuric Acid/Water)	7664-93-9	15 - 20
Case Material:		5 - 10
Polypropylene	9003-07-0	
Polystyrene	9003-53-6	
Styrene Acrylonitrile	9003-54-7	
Acrylonitrile Butadiene Styrene	9003-56-9	
Styrene Butadiene	9003-55-8	
Polyvinylchloride	9002-86-2	
Polycarbonate, Hard Rubber, Polyethylene	9002-88-4	
Polyphenylene Oxide	25134-01-4	
Polycarbonate/Polyester Alloy	--	
Other:		
Absorbent Glass Mat	--	1 - 2

Inorganic lead and sulfuric acid electrolyte are the primary components of every battery manufactured by EnerSys Energy Products.
There are no mercury or cadmium containing products present in batteries manufactured by EnerSys Energy Products.

IV. FIRST AID MEASURES

Inhalation:

Sulfuric Acid: Remove to fresh air immediately. If breathing is difficult, give oxygen. Consult a physician
Lead: Remove from exposure, gargle, wash nose and lips; consult physician.

Ingestion:

Sulfuric Acid: Give large quantities of water; do not induce vomiting or aspiration into the lungs may occur and can cause permanent injury or death; consult a physician
Lead: Consult physician immediately.

Skin:

Sulfuric Acid: Flush with large amounts of water for at least 15 minutes; remove contaminated clothing completely, including shoes. If symptoms persist, seek medical attention. Wash contaminated clothing before reuse. Discard contaminated shoes.
Lead: Wash immediately with soap and water.

Eyes:

Sulfuric Acid and Lead: Flush immediately with large amounts of water for at least 15 minutes while lifting lids
Seek immediate medical attention if eyes have been exposed directly to acid.

V. FIRE FIGHTING MEASURES

Flash Point: N/A

Flammable Limits: LEL = 4.1% (Hydrogen Gas) UEL = 74.2% (Hydrogen Gas)

Extinguishing Media: Carbon dioxide; foam; dry chemical. Avoid breathing vapors. Use appropriate media for surrounding fire.

Special Fire Fighting Procedures:

If batteries are on charge, shut off power. Use positive pressure, self-contained breathing apparatus. Water applied to electrolyte generates heat and causes it to spatter. Wear acid-resistant clothing, gloves, face and eye protection.
Note that strings of series connected batteries may still pose risk of electric shock even when charging equipment is shut down.

Unusual Fire and Explosion Hazards:

Highly flammable hydrogen gas is generated during charging and operation of batteries. To avoid risk of fire or explosion, keep sparks or other sources of ignition away from batteries. Do not allow metallic materials to simultaneously contact negative and positive terminals of cells and batteries. Follow manufacturer's instructions for installation and service.

VI. PRECAUTIONS FOR SAFE HANDLING AND USE

Spill or Leak Procedures:

Stop flow of material, contain/absorb small spills with dry sand, earth, and vermiculite. Do not use combustible materials. If possible, carefully neutralize spilled electrolyte with soda ash, sodium bicarbonate, lime, etc. Wear acid-resistant clothing, boots, gloves, and face shield. Do not allow discharge of unneutralized acid to sewer. Acid must be managed in accordance with local, state, and federal requirements.
Consult state environmental agency and/or federal EPA.

VII. HANDLING AND STORAGE

Handling:

Unless involved in recycling operations, do not breach the casing or empty the contents of the battery.
There may be increasing risk of electric shock from strings of connected batteries.
Keep containers tightly closed when not in use. If battery case is broken, avoid contact with internal components.
Keep vent caps on and cover terminals to prevent short circuits. Place cardboard between layers of stacked automotive batteries to avoid damage and short circuits.
Keep away from combustible materials, organic chemicals, reducing substances, metals, strong oxidizers and water. Use banding or stretch wrap to secure items for shipping.

Storage:

Store batteries in cool, dry, well-ventilated areas with impervious surfaces and adequate containment in the event of spills. Batteries should also be stored under roof for protection against adverse weather conditions. Separate from incompatible materials. Store and handle only in areas with adequate water supply and spill control. Avoid damage to containers. Keep away from fire, sparks and heat. Keep away from metallic objects which could bridge the terminals on a battery and create a dangerous short-circuit.

Charging:

There is a possible risk of electric shock from charging equipment and from strings of series connected batteries, whether or not being charged. Shut-off power to chargers whenever not in use and before detachment of any circuit connections. Batteries being charged will generate and release flammable hydrogen gas.
Charging space should be ventilated. Keep battery vent caps in position. Prohibit smoking and avoid creation of flames and sparks nearby.
Wear face and eye protection when near batteries being charged.

VIII. EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure Limits (mg/m3) Note: N.E.= Not Established

INGREDIENTS (Chemical/Common Names)	OSHA PEL	ACGIH	US NIOSH	Quebec PEV	Ontario OEL	EU OEL
Lead and Lead Compounds (inorganic)	0.05	0.05	0.05	0.05	0.05	0.15 (b)
Tin	2	2	2	2	2	N.E
Sulfuric Acid Electrolyte	1	0.2	1	1	0.2	0.05 (c)
Polypropylene	N.E	N.E	N.E	N.E	N.E	N.E
Polystyrene	N.E	N.E	N.E	N.E	N.E	N.E
Styrene Acrylonitrile	N.E	N.E	N.E	N.E	N.E	N.E
Acrylonitrile Butadiene Styrene	N.E	N.E	N.E	N.E	N.E	N.E
Styrene Butadiene	N.E	N.E	N.E	N.E	N.E	N.E
Polyvinylchloride	N.E	N.E	N.E	N.E	1	N.E
Polycarbonate, Hard Rubber, Polyethylene	N.E	N.E	N.E	N.E	N.E	N.E
Polyphenylene Oxide	N.E	N.E	N.E	N.E	N.E	N.E
Polycarbonate/Polyester Alloy Rubber, Polyethylene	N.E	N.E	N.E	N.E	N.E	N.E
Absorbent Glass Mat	N.E	N.E	N.E	N.E	N.E	N.E

NOTES:

(b) As inhalable aerosol
(c) Thoracic fraction

Engineering Controls (Ventilation):

Store and handle in well-ventilated area. If mechanical ventilation is used, components must be acid-resistant.
Handle batteries cautiously to avoid spills. Make certain vent caps are on securely. Avoid contact with internal components. Wear protective clothing, eye and face protection when filling, charging or handling batteries. Do not allow metallic materials to simultaneously contact both the positive and negative terminals of the batteries. Charge the batteries in areas with adequate ventilation. General dilution ventilation is acceptable.

Respiratory Protection (NIOSH/MSHA approved):

None required under normal conditions. When concentrations of sulfuric acid mist are known to exceed the PEL, use NIOSH or MSHA-approved respiratory protection.

Skin Protection:

If battery case is damaged, use rubber or plastic acid-resistant gloves with elbow-length gauntlet, acid-resistant apron, clothing and boots.

Eye Protection:

If battery case is damaged, use chemical goggles or face shield.

Other Protection:

Under severe exposure emergency conditions, wear acid-resistant clothing and boots.

IX. PHYSICAL AND CHEMICAL PROPERTIES

Properties Listed Below are for Electrolyte:

Boiling Point:	203 - 240° F	**Specific Gravity (H2O = 1):**	1.215 to 1.350
Melting Point:	N/A	**Vapor Pressure (mm Hg):**	10
Solubility in Water:	100%	**Vapor Density (AIR = 1):**	Greater than 1
Evaporation Rate: (Butyl Acetate = 1)	Less than 1	**% Volatile by Weight:**	N/A
pH:	~1 to 2	**Flash Point:**	Below room temperature (as hydrogen gas)
LEL (Lower Explosive Limit)	4.1% (Hydrogen)	**UEL (Upper Explosive Limit)**	74.2% (Hydrogen)
Appearance and Odor:	Manufactured article; no apparent odor. Electrolyte is a clear liquid with a sharp, penetrating, pungent odor.		

X. REACTIVITY DATA

Stability: Stable X Unstable ___

This product is stable under normal conditions at ambient temperature.

Conditions To Avoid: Prolonged overcharge; sources of ignition

Incompatibility: (Materials to avoid)

Sulfuric Acid: Contact with combustibles and organic materials may cause fire and explosion. Also reacts violently with strong reducing agents, metals, sulfur trioxide gas, strong oxidizers and water. Contact with metals may produce toxic sulfur dioxide fumes and may release flammable hydrogen gas.

Lead Compounds: Avoid contact with strong acids, bases, halides, halogenates, potassium nitrate, permanganate, peroxides, nascent hydrogen and reducing agents.

Hazardous Decomposition Products:

Sulfuric Acid: Sulfur trioxide, carbon monoxide, sulfuric acid mist, sulfur dioxide, and hydrogen sulfide.

Lead Compounds: High temperatures likely to produce toxic metal fume, vapor, or dust; contact with strong acid or base or presence of nascent hydrogen may generate highly toxic arsine gas.

Hazardous Polymerization:

Will not occur

XI. TOXICOLOGICAL INFORMATION

Routes of Entry:

Sulfuric Acid: Harmful by all routes of entry.

Lead Compounds: Hazardous exposure can occur only when product is heated, oxidized or otherwise processed or damaged to create dust, vapor or fume. The presence of nascent hydrogen may generate highly toxic arsine gas.

Inhalation:

Sulfuric Acid: Breathing of sulfuric acid vapors or mists may cause severe respiratory irritation.

Lead Compounds: Inhalation of lead dust or fumes may cause irritation of upper respiratory tract and lungs.

Ingestion:

Sulfuric Acid: May cause severe irritation of mouth, throat, esophagus and stomach.

Lead Compounds: Acute ingestion may cause abdominal pain, nausea, vomiting, diarrhea and severe cramping. This may lead rapidly to systemic toxicity and must be treated by a physician.

Skin Contact:

Sulfuric Acid: Severe irritation, burns and ulceration.

Lead Compounds: Not absorbed through the skin.

Eye Contact:

Sulfuric Acid: Severe irritation , burns, cornea damage, and blindness.

Lead Components: May cause eye irritation.

Effects of Overexposure - Acute:

Sulfuric Acid: Severe skin irritation, damage to cornea, upper respiratory irritation.

Lead Compounds: Symptoms of toxicity include headache, fatigue, abdominal pain, loss of appetite, muscle aches and weakness, sleep disturbances and irritability.

Effects of Overexposure - Chronic:

Sulfuric Acid: Possible erosion of tooth enamel, inflammation of nose, throat and bronchial tubes.

Lead Compounds: Anemia; neuropathy, particularly of the motor nerves, with wrist drop; kidney damage; reproductive changes in males and females. Repeated exposure to lead and lead compounds in the workplace may result in nervous system toxicity. Some toxicologists report abnormal conduction velocities in persons with blood lead levels of 50mcg/100 ml or higher. Heavy lead exposure may result in central nervous system damage, encephalopathy and damage to the blood-forming (hematopoietic) tissues.

Carcinogenicity:

Sulfuric Acid: The International Agency for Research on Cancer (IARC) has classified "strong inorganic acid mist containing sulfuric acid" as a Group 1 carcinogen, a substance that is carcinogenic to humans. This classification does not apply to liquid forms of sulfuric acid or sulfuric acid solutions contained within a battery. Inorganic acid mist (sulfuric acid mist) is not generated under normal use of this product. Misuse of the product, such as overcharging, may result in the generation of sulfuric acid mist.

Lead Compounds: Lead is listed as a Group 2A carcinogen, likely in animals at extreme doses. Per the guidance found in OSHA 29 CFR 1910.1200 Appendix F, this is approximately equivalent to GHS Category 1B. Proof of carcinogenicity in humans is lacking at present.

Medical Conditions Generally Aggravated by Exposure:

Overexposure to sulfuric acid mist may cause lung damage and aggravate pulmonary conditions. Contact of sulfuric acid with skin may aggravate diseases such as eczema and contact dermatitis. Lead and its compounds can aggravate some forms of kidney, liver and neurologic diseases.

Acute Toxicity:
Inhalation LD50:
Electrolyte: LC50 rat: 375 mg/m3; LC50: guinea pig: 510 mg/m3
Elemental Lead: Acute Toxicity Point Estimate = 4500 ppmV (based on lead bullion)

Oral LD50:
Electrolyte: rat: 2140 mg/kg
Elemental lead: Acute Toxicity Estimate (ATE) = 500 mg/kg body weight (based on lead bullion)

Additional Health Data:

All heavy metals, including the hazardous ingredients in this product, are taken into the body primarily by inhalation and ingestion.
Most inhalation problems can be avoided by adequate precautions such as ventilation and respiratory protection covered in Section 8.
Follow good personal hygiene to avoid inhalation and ingestion: wash hands, face, neck and arms thoroughly before eating, smoking or leaving the worksite. Keep contaminated clothing out of non-contaminated areas, or wear cover clothing when in such areas. Restrict the use and presence of food, tobacco and cosmetics to non-contaminated areas. Work clothes and work equipment used in contaminated areas must remain in designated areas and never taken home or laundered with personal non-contaminated clothing. This product is intended for industrial use only and should be isolated from children and their environment.

The 19th Amendment to EC Directive 67/548/EEC classified lead compounds, but not lead in metal form, as possibly toxic to reproduction.
Risk phrase 61: May cause harm to the unborn child, applies to lead compounds, especially soluble forms.

XII. ECOLOGICAL INFORMATION

Environmental Fate:

Lead is very persistent in soil and sediments. No data on environmental degradation. Mobility of metallic lead between ecological compartments is slow.
Bioaccumulation of lead occurs in aquatic and terrestrial animals and plants but little bioaccumulation occurs through the food chain.
Most studies include lead compounds and not elemental lead.

Environmental Toxicity: Aquatic Toxicity:

Sulfuric acid:	24-hr LC50, freshwater fish (Brachydanio rerio): 82 mg/L
	96 hr- LOEC, freshwater fish (Cyprinus carpio): 22 mg/L
Lead:	48 hr LC50 (modeled for aquatic invertebrates): <1 mg/L, based on lead bullion

Additional Information:

· No known effects on stratospheric ozone depletion.
· Volatile organic compounds: 0% (by Volume)
· Water Endangering Class (WGK): NA

XIII. DISPOSAL CONSIDERATIONS (UNITED STATES)

Spent batteries: Send to secondary lead smelter for recycling. Spent lead-acid batteries are not regulated as hazardous waste when the requirements of 40 CFR Section 266.80 are met. This should be managed in accordance with approved local, state and federal requirements. Consult state environmental agency and/or federal EPA.

Electrolyte:
Place neutralized slurry into sealed containers and handle as applicable with state and federal regulations. Large water-diluted spills, after neutralization and testing, should be managed in accordance with approved local, state and federal requirements. Consult state environmental agency and/or federal EPA.

Following local, State/Provincial, and Federal/National regulations applicable to end-of-life characteristics will be the responsibility of the end-user.

XIV. TRANSPORT INFORMATION

U.S. DOT:

Excepted from the hazardous materials regulations (HMR) because the batteries meet the requirements of 49 CFR 173.159(f) and 49 CFR 173.159a of the U.S. Department of Transportation's HMR. Battery and outer package must be marked " NONSPILLABLE" or "NONSPILLABLE BATTERY" Battery terminals must be protected against short circuits.

IATA Dangerous Goods Regulations DGR:

Excepted from the dangerous goods regulations because the batteries meet the requirements of Packing Instruction 872 and Special Provisions A67 of the International Air Transportation Association (IATA) Dangerous goods Regulations and International Civil Aviation Organization (ICAO) Technical Instructions. Battery Terminals must be protected against short circuits.

The words " NOT RESTRICTED" , SPECIAL PROVISION A67" must be provided when the air waybill is issued.

IMDG:

Excepted from the dangerous goods regulations for transport by sea because the batteries meet the requirements of Special Provision 238 of the International Maritime Dangerous Goods(IMDG CODE). Battery terminals must be protected against short circuits.

Requirements for Safe Shipping and Handling of Cyclon Cells:

Warning – Electrical Fire Hazard – Protect against shorting. Terminals can short and cause a fire if not insulated during shipping. Cyclon product must be labeled “NONSPILLABLE” during shipping. Follow all federal shipping regulations. See section IX of this sheet and CFR 49 Parts 171 through 180, available online at wwww.gpoaccess.gov.

Requirements for Shipping Cyclon Product as Single Cells:

Protective caps or other durable inert material must be used to insulate each terminal of each cell unless cells are shipping in the original packaging from EnerSys, in full box quantities. Protective caps are available for all cell sizes by contacting EnerSys Customer Service at 1-800-964-2837.

Requirements for Shipping Cyclon Product Assembled Into Multicell Batteries:

Assembled batteries must have short circuit protection during shipping. Exposed terminals, connectors, or lead wires must be insulated with a durable inert material to prevent exposure during shipping.

XV. REGULATORY INFORMATION

UNITED STATES:

EPA SARA Title III:

Section 302 EPCRA Extremely Hazardous Substances (EHS):

Sulfuric acid is a listed "Extremely Hazardous Substance" under EPCRA, with a Threshold Planning Quantity (TPQ) of 1,000 lbs.
EPCRA Section 302 notification is required if 1000 lbs or more of sulfuric acid is present at one site (40 CFR 370.10). For more information consult 40 CFR Part 355. The quantity of sulfuric acid will vary by battery type. Contact your EnerSys representative for additional information.

Section 304 CERCLA Hazardous Substances:

Reportable Quantity (RQ) for spilled 100% sulfuric acid under CERCLA (Superfund) and
EPCRA (Emergency Planning and Community Right to Know Act) is 1,000 lbs. State and local reportable quantities for spilled sulfuric acid may vary.

Section 311/312 Hazard Categorization:

EPCRA Section 312 Tier Two reporting is required for non-automotive batteries if sulfuric acid is present in quantities of 500 lbs or more and/or if lead is present in quantities of 10,000 lbs or more. For more information consult 40 CFR 370.10 and 40 CFR 370.40.

Section 313 EPCRA Toxic Substances:

40 CFR section 372.38 (b) states: If a toxic chemical is present in an article at a covered facility, a person is not required to consider the quantity of the toxic chemical present in such article when determining whether an applicable threshold has been met under § 372.25, § 372.27, or § 372.28 or determining the amount of release to be reported under § 372.30. This exemption applies whether the person received the article from another person or the person produced the article. However, this exemption applies only to the quantity of the toxic chemical present in the article.

Supplier Notification:

This product contains toxic chemicals, which may be reportable under EPCRA Section 313 Toxic Chemical Release Inventory (Form R) requirements.
If you are a manufacturing facility under SIC codes 20 through 39, the following information is provided to enable you to complete the required reports:

Toxic Chemical	CAS Number	Approximate % by Wt.
Lead	7439-92-1	45 - 60
Sulfuric Acid Electrolyte (Sulfuric Acid/Water)	7664-93-9	15 - 20
Tin	7440-31-5	0.1 - 0.2

See 40 CFR Part 370 for more details.

If you distribute this product to other manufacturers in SIC Codes 20 through 39, this information must be provided with the first shipment of each calendar year.

The Section 313 supplier notification requirement does not apply to batteries, which are "consumer products".

TSCA:

TSCA Section 8b – Inventory Status: All chemicals comprising this product are either exempt or listed on the TSCA Inventory.

TSCA Section 12b (40 CFR Part 707.60(b)) No notice of export will be required for articles, except PCB articles, unless the Agency so requires in the context of individual section 5, 6, or 7 actions.

TSCA Section 13 (40 CFR Part 707.20): No import certification required (EPA 305-B-99-001, June 1999, Introduction to the Chemical Import Requirements of the Toxic Substances Control Act, Section IV.A).

RCRA:

Spent Lead Acid Batteries are subject to streamlined handling requirements when managed in compliance with 40 CFR section 266.80 or 40 CFR part 273. Waste sulfuric acid is a characteristic hazardous waste; EPA hazardous waste number D002 (corrosivity) and D008 (lead).

CAA:

EnerSys supports preventative actions concerning ozone depletion in the atmosphere due to emissions of CFC's and other ozone depleting chemicals (ODC's), defined by the USEPA as Class I substances. Pursuant to Section 611of the Clean Air Act Amendments (CAAA) of 1990, finalized on January 19, 1993, EnerSys established a policy to eliminate the use of Class I ODC's prior to the May 15, 1993 deadline.

STATE REGULATIONS (US):

Proposition 65:

Warning: Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. Batteries also contain other chemicals known to the State of California to cause cancer. Wash hands after handling.

INTERNATIONAL REGULATIONS:

Distribution into Quebec to follow Canadian Controlled Product Regulations (CPR) 24(1) and 24(2).

Distribution into the EU to follow applicable Directives to the Use, Import/Export of the product as-sold.

XVI. OTHER INFORMATION

Revised: 05/14/2015

NFPA Hazard Rating for Sulfuric Acid:

Flammability (Red) = 0
Health (Blue) = 3
Reactivity (Yellow) = 2
Sulfuric acid is water-reactive if concentrated.

carmanah® | Marine

UNITED STATES COAST GUARD CONTRACT DETAILS

Carmanah Technologies Corporation (TSX: CMH), has been awarded a multi-year contract to supply marine aids-to-navigation to the US Coast Guard. Per USCG contract # HSCG84-14-R-BHQ044, Carmanah's M850 marine lantern with a 60X battery is the product of choice for small self-contained LED lanterns. The M860 marine lantern with a 200BC battery is the product for large self-contained LED lanterns.

For customer service or technical support:

1.866.247.6527
customerservice@carmanah.com

USCG 2014 Q4 Item List

carmanah®
we put solar to work

NOTES:

1. Flash code 000 is no longer available for M850/M860 lights; it has been replaced with "off"; see manual for details

M850 Marine Lantern - Includes 60X Battery Pack

Line Item	Features				
	Output	Optic	Battery	Options	Settings
M850	White Red Green Yellow	Standard	60X		15 cd Flash Code 174, ALC Off

M860 Marine Lantern - Includes 200BC Battery Pack

Line Item	Features				
	Output	Optic	Battery	Options	Settings
M860	White Red Green Yellow	Standard	200BC		15 cd Flash Code 174, ALC Off

MPV LED - Heavy Duty Ice Buoy LED Light (made by Sabik)

Line Item	Features		
	Output	Optic	Options
MPVLED (Heavy Duty)	White Red Green Yellow	Narrow (6°)	None
Additional >	Wide (10°)		
	Lower Flange for MPVLED **(Order Line item MPVLEDUF)**		
	OPT1 Optical feedback unit OFBS to SMC flasher (cost per tier)		
	OPT4 GPS sync unit for SMC flashers incl. GPS antenna		
	OPT7 External GPS antenna Trimble Bullet with cable and mounting kit		
	OPT8 Integrated 3-axis G sensor for tilt and shock sensing		
	OPT9 LightGuard SMC GSM+GPS plug-in for SMC flashers incl. GSM/GPS ant.		
	OPT10 LightGuard SMC GSM plug-in for SMC flashers incl. GSM antenna		

Head Kits

M850 M860	White Red Green Yellow	Standard	None	15 cd Flash Code 174, ALC On
Additional >	GPS Sync			

USCG 2014 Q4 Item List

Recommended Spare Parts	
61872	M701 Replacement 15 amp Battery Kit - Single Pack
61873	M702 Replacement 24 amp Battery Kit - Single Pack
61087	M704/M708 Battery Replacement 10 lbs
61874	M701/M702 Replacement Gasket Kit
30787	M701/M702 Battery Pack Charger
69885	M850/M860 Battery Charger
69954	M850 Battery kit - 60X
69955	M860 Battery kit - 96E
69956	M860 Battery kit - 200BC
53097	M701/M702 Bird Deterrent Kit
69934	M850/M860 Bird Deterrent
38339	700 series Bolt Kit (1/2-13 UNC x 1.25" long x 4)
53291	700 series Security bolt kit, not including driver or socket
71757	M850/M860 Bolt kit (1/2-13 UNC x 2" long x 4)
71884	M850/M860 Security bolt kit, not including driver or socket
30768	Security screw bit (5/32" hex with center pin)
53288	Security bolt kit driver
53289	Security bolt kit socket
69899	IR Programmer, slim

Spare parts for USCG MPV-LED ice buoy lanterns (made by Sabik)	
65253	810305 - LED Flasher threaded rod M5 x 50MM MPV-LED USCG
64502	980340 - LED Flashers
64492	820460 - MPV Lens (narrow)
64493	911530 - LED Circuit Card, Red
64494	911540 - LED Circuit Card, Green
64705	911542 - LED Card Assembly, Yellow
64706	911550 - LED Card Assembly, White
64495	892678 - LED Circuit Card Gasket (GAPPAD)
64496	910255 - Steel Bird Spike Sets (7 pins)
64497	970602 - Can (no ring) with wired data port & stuffing tube & gasket
64498	810271 - Ring for Can
64499	821187 - Data Port, wired with cover
64500	713322 - Power Cable 2m to fit stuffing tube
65246	820570 - Can Gaskets - GASKET FOR SS COVER
65247	892674 - Lens Gaskets - LENS RUBBER GASKET
65248	651376 - Lantern O-Rings - O-RING 279,3/5,7 EPDM
65249	591130 - CABLE GLANDS/STUFFING TUBES M20+O-RING
65250	892677 - Captive Bolts - HEX BOLT 12X50 A4
65251	634827 - Nylon Washers - PLASTIC SPACER 13X24X2,5
65230	980320 - Sabik Programmer Mk 2