SeaArc®2 400w HMI
Operation Manual

Rev. 01/15/2010

DEEPSEA POWER & LIGHT
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Limited Warranty:

DeepSea Power & Light warrants that the goods (except internal electronic components) sold under this contract will be free from defect in material and workmanship for a period of one year from the date of shipment from the factory, if they have been properly used. Internal electronic components are warranted for 90 days from the date of shipment from the factory, if they have been properly used.
This warranty will be limited to the repair or replacement of parts and the necessary labor and services required to repair the goods. IT IS EXPRESSLY AGREED THAT THIS WARRANTY WILL BE IN LIEU OF ALL WARRANTIES OF FITNESS AND IN LIEU OF THE WARRANTY OF MERCHANTABILITY. This warranty is the exclusive and only warranty to pass with the goods under this contract. No agent, employee, or representative of the Seller has any authority to bind Seller to any information, representation, or warranty concerning the goods sold under this contract, and unless an affirmation, representation, or warranty made by an agent, employee, or representative is specifically included within this contract, it will not be enforceable by Buyer.
If notice of defect is given to DeepSea Power & Light, Inc. within such 90 day or one year warranty period, the sole obligation of DeepSea Power & Light, Inc. shall be to furnish new or repaired parts free of charge in exchange for parts which have been proved defective and does not include any other costs such as the cost of removal of the defective part, installation, labor, or consequential damages of any kind, the exclusive remedy being to require DeepSea Power & Light, Inc. to furnish such new parts. Under no circumstances shall the Buyer be entitled to recover any incidental damages as that term is defined in Commercial Code §2715

This Warranty does not apply to the MSR400HR lamp - On average these lamps will function properly for 650 hours but may not and as actual hours of operation are impossible to verify our policy is that we will not replace lamps under warranty.

Specifications:

Ballasts:

MECHANICAL: See drawings on pages 17 and 18

	Single ballast	**Dual ballast**
Case material	Titanium 6AL-4V	Titanium 6AL-4V
Length	12.7 in (32.3 cm)	21.8 in (55.4 cm)
Diameter	5.8 in (14.7 cm)	5.8 in (14.7 cm)
Air weight	21.06 lb (9.56 Kg)	34.25 lb (15.54 kg)
Water weight	11.76 lb (5.34 Kg)	20.45 lb (9.28 kg)

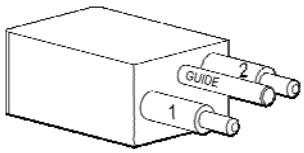
ENVIRONMENTAL:

Depth rating: 19,680 ft (6000 m)
Design safety factor: 1.5 X depth rating
Temperature: -5 to +40 deg C

ELECTRICAL:

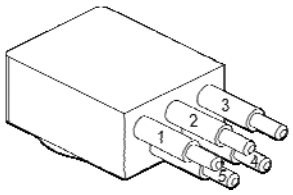
Connector:

Ballast input, no dimmer



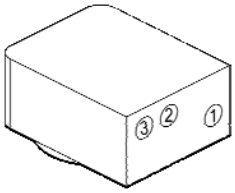
LPBH2MP
Pin 1: Power
Pin 2: Power Return

Ballast input, with dimmer



LPBH5MP
Pin 1: Power
Pin 2: Power Return
Pin 3: Ground to Shell
Pin 4: Dimmer (+)
Pin 5: Dimmer (-)

Ballast output



LPBH3FS
Socket 1: Power
Socket 2: Power Return
Socket 3: Ground to Shell

Input voltage: 105v to 265v AC or DC
Input current/steady state current: 5 amps max at 105v DC
6 amps max at 120v AC
Inrush current: 30 amps DC, 35 amps AC
Output power: 400 watts
Output wave shape: Square Wave
Output frequency: 300 HZ +\- 10%

Lighthead:

MECHANICAL: See drawing on page 22

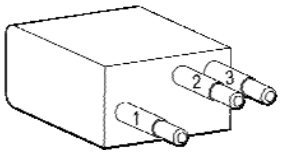
Lighthead body:	Titanium 6AL-4V
Dome retaining cowl:	Delrin
Dome:	Borosilicate glass
Length:	10.8 in (31.5 cm)
Diameter:	5.3 in (16.5 cm)
Air weight:	8.5 lb (3.86 kg)
Water weight:	3.15 lb (1.43 kg)

ENVIRONMENTAL:

Depth rating:	19,680 ft (6000 m)
Design safety factor:	1.5 X depth rating
Temperature:	-5 to +40 deg C

ELECTRICAL:

Connector:



LPBH3MP
Pin 1: Power
Pin 2: Power Return
Pin 3: Ground to Shell

Input voltage:	From Ballast (400 W, 300 Hz Sq.Wave)
Input power:	400 watts
Average lamp life:	650 Hours
Recommend lamp replacement interval:	650 Hours

Note: Average lamp life is related to a burning cycle of 3.5 hours on and 0.5 hours off duty cycle. Because the risk of arc tube rupture increases as the lamps age, it is advised not to use the lamp longer than the recommended replacement time. Lamps tend to exhibit difficulty during hot re-strike as they approach the end of their service life.

Installation and Operation

Assembly:

1. Remove the protective connector cover on the ballast end-cap.
2. Plug the lighthead to ballast interconnect cable into the lighthead.
3. Plug the other end of the interconnect cable into the ballast output connector.
4. Plug the ballast power cable into the ballast input connector.
5. Reinstall the protective connector cover on the ballast end-cap.
6. Connect the ballast power cable to the power source through a proper on/off switch and circuit protector (fuse/circuit breaker).
7. The light is now ready to test.

NOTE - DC INPUT: The input is not polarity sensitive (either pin can be plus and the other minus). The input is less than 5 amps when running but the surge current at turn on can be as high as 30 amps.

NOTE - AC INPUT: The input is less than 6 amps when running but the surge current at turn on can be as high as 35 amps.

Warning: Whenever AC power is used in the vicinity of water, we strongly recommend that a Ground Fault Interrupt (GFI) or other protective device is utilized to minimize the chance of electric shock due to a short circuit.

Operation:

Apply power to the ballast to turn on the light. At turn on there is a delay of approximately 3 seconds before the lamp will strike. After the lamp strikes it goes through a warm up stage that takes 60 to 90 seconds to complete.

Warning: The lighthead must be submerged in water when running or it will overheat and cause damage to the seals and dome. The ballast can be run dry (in air) for up to 15 minutes without causing damage.

Warning: HMI lights emit a significant amount of UV radiation that can cause sunburn and damage to the eyes. The borosilicate glass dome filters out some of the harmful UV when the lamp is installed in the lighthead. Do not run the lamp with the dome removed.

To turn off the light, remove power to the ballast.

To restart the light wait 10 seconds and then re-apply power to the ballast. There will be a delay of approximately 3-5 seconds before the lamp will restrike. The lamp does not require the full warm up cycle as it is still warm but it could be as much as 30 seconds until the lamp is at full color temperature and light output.

HMI lamps start best when cold. If a lamp fails to restrike, allow several minutes for the lamp to cool and then attempt to strike the lamp again. Though immediate restriking of the lamp is supported, the recommended practice is to allow at least two minutes between restrikes and longer periods when possible.

Lamp Replacement

General Information

It is important when opening the lighthead for servicing to take all reasonable steps to ensure that the work is carried out in a clean dry stable environment. It is useful to have a selection of clean plastic bags readily at hand for storage of parts.

Tools required to service the lighthead:

3/16" spanner wrench	Latex gloves
1/4" spanner wrench	Eye protection
3/8" spanner wrench	Reagent grade alcohol
1/4" Medium slotted screw driver	Paper towels

Lamp Life and Indications for Replacement

The manufacturer's rated lamp life is 650 hours. This is based on manufacturer tests using a work cycle of 3.5 hours on and 0.5 hours off. The manufacturer also states that replacement is recommended after 650 hours due to an increased risk of the bulb shattering.

As the HMI lamp ages, starting will become more difficult and "dropping out" may occur. Lamp "drop out" is when the lamp only gets part way through its warm up cycle and unexpectedly goes out. Light output will slowly decrease over the lamps lifetime and a shift in color temperature may occur. Older lamps will also become more difficult to restrike.

NOTE: It is normal for the inside of the arc tube (the smaller inner glass bulb) to appear stained. Different lamps may appear quite different in color and degree of staining.

<u>The lamp should be replaced if:</u>

1. Physical damage is apparent such as:
   - Cracking, blistering or whitening of the outer bulb.
   - Cracks in the inner bulb.
   - Damage to the lamp base pins.
   - Damage to the ceramic compound at the lamp's base.
2. Air has leaked into the outer quartz envelope. This will cause a yellow film on the inside of the outer envelop, a result of oxidation of Molybdenum at high temperature in the presence of oxygen.
3. The lamp fails to ignite and the ballast is known to function properly. Test the ballast with another lighthead to verify that the ballast is working. Replace the lamp and test the lighthead with the ballast. If the lamp ignites properly then lamp was bad. If lamp does not ignite contact DeepSea for instructions.
4. The lamp ignites but drops out before achieving full output.
5. The lamp is difficult to ignite or restrike.

RELAMPING PROCEDURE

Opening the Lighthead

1. Disconnect the ballast power and ballast to lighthead interconnect cables.
2. Remove the lighthead from the vehicle and take to a clean, dry work area.
3. Place a protective dummy plug on the connector.
4. Using a 1/4" pin diameter spanner wrench, place the spanner pin in one of the 1/4" holes in the lighthead body (where the lighthead head and lighthead body join). Place a 3/16" pin diameter spanner wrench in one of the 3/16" holes in the lighthead head. See figure 1.

Figure 1

5. Leveraging the spanner handles, unscrew, counter clockwise, the lighthead head from the body. The threads are standard right-hand threads. **DO NOT DISTURB THE DOME RETAINING COWL**. Take care to ensue that the spanner wenches are well seated in their respective holes. Wrench slippage will result in damage to the Tiodized finish. If necessary, use a soft mallet to tap the spanner wrenches in order to free the parts.
6. After loosening the lighthead body and head, the pieces may be easily unscrewed by hand. It takes approximately 3 1/2 rotations to fully separate the pieces.
7. Carefully remove the lighthead body and attached lamp from the lighthead head. The lamp fits very close to the reflector and care must be taken to not damage the lamp or reflector during disassembly. We recommend that the lighthead head be placed dome down on the work table and that the lighthead body be pulled straight up from the head. See figure 2.

Figure 2

8. Place the lighthead head in a clean zip lock bag and set aside.

Remove the lamp

Warning: When handling the HMI lamp, wrap the lamp in several layers of clean dry paper towel to protect against injury in the event that the lamp shatters or breaks.

The lamp fits tightly in the socket and there is some risk of breakage during removal. The lamp is a bi-pin type base and does NOT unscrew or rotate, it pulls straight out from the socket. Wrap the lamp in a clean, dry paper towel and then grasp the lamp as close to the base as possible. Gently pull straight up from the socket. See figure 3. If necessary, use a very slight side to side rocking motion to facilitate removal. The rocking motion should be in the plane of the base. The base pins, lamp pinch and arc tube pinch seal will lie in this same plane. Dispose of the lamp properly. The lamp contains a small amount of mercury and Krypton-85.

Figure 3

Lamp handling Notes

HMI lamps must be absolutely clean prior to use. Fingerprints or other contaminants on the quartz envelop will damage the lamp when it becomes hot. Substances such as sodium and potassium diffuse into the hot quartz and cause divitrification of the glass. In turn, the glass may become opaque and brittle and may blister or crack.

Hydrocarbon contaminants will leave black carbon deposits causing a hot spot resulting in loss of light output and overheating. Once the lamp is operated with contaminants on the glass, the lamp is permanently damaged. **DO NOT** touch the lamp envelope during handling. Prior to use, thoroughly clean the glass envelope with reagent grade alcohol, another high purity organic solvent, or the cleaning device supplied with the replacement lamp. See figure 4.

Figure 4

Installing the lamp

1. Install new O-rings before installing the new lamp, this reduces the likelihood of contaminating the lamp's outer glass envelope (bulb) with O-ring grease.
2. Remove the lamp from its box. See figure 5.

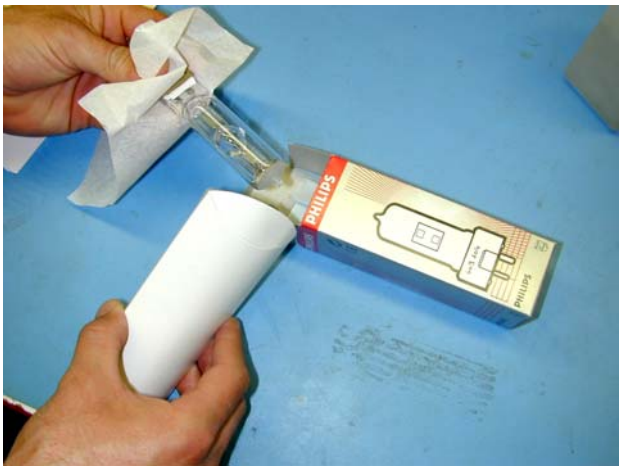


Figure 5

3. Visually inspect the lamp inside the sealed plastic bag before opening. Do not break the seal on the plastic bag if the lamp is broken or damaged.
4. Wrap the bulb with a clean, dry paper towel. Holding the lamp by the paper towel carefully seat the lamp so that it bottoms out in the socket. See figure 6.

Figure 6

5. Clean the lamp with the special towel provided by the lamp manufacturer inside the lamp box or with a clean paper towel well moistened with reagent grade alcohol.

Closing the Lighthead

1. Verify that the O-rings have been installed. See figure 7.

Figure 7

2. Place the head assembly, dome side down, on the work surface, this orientation helps prevent the 2-039 O-ring from falling out of its groove during reassembly and reduces the risk of lamp breakage. See figure 8.

Figure 8

2. Carefully align the lighthead body such that the lamp passes cleanly through the hole in the parabolic reflector in the head assembly. See figure 9.

Figure 9

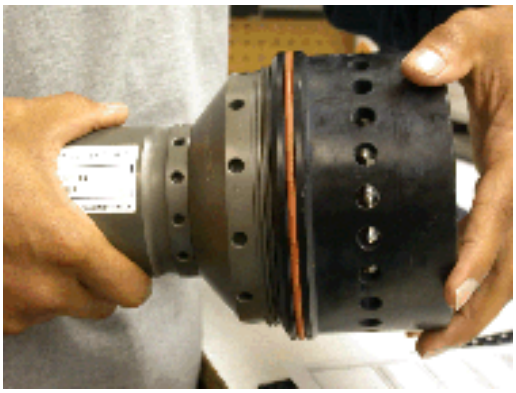
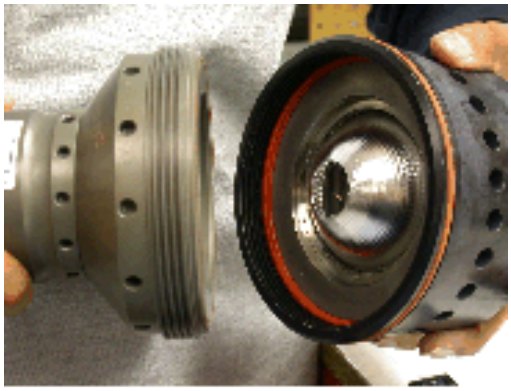
4. If possible, dry nitrogen purge the inside of the lighthead for one minute before engaging the threads of the two assemblies. Ensure that the nitrogen nozzle does not introduce any contamination onto the O-rings and sealing surfaces or cause the 2-039 face seal O-ring to pop out of its groove in the head section. A low nozzle pressure is recommended. See figure 10.

Figure 10

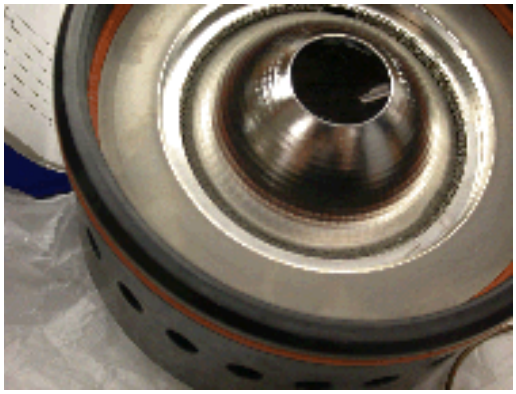
5. Screw the pieces together. Verify that the bore seal Teflon back up ring is on the low pressure side (towards threads) of the 2-142 O-ring and that it stays in its groove and does not catch as it enters the bore during assembly.
6. Ensure that the 2-039 O-ring is in place and does not get pinched as the head section bottoms against the body section.
7. It is VERY important that the body and head sections bottom metal-to-metal against each other. The rotation of one part against the other will end abruptly when these parts meet. Torque to approximately 20 ft lbs. If the body and head sections are not fully seated, the threads may jam at high pressure resulting in damage to the lighthead. Lightheads damaged in this way may become difficult or impossible to open.
8. Reinstall lighthead on vehicle.
9. Reconnect ballast power and interconnect cables.

Dome, Cowl and Reflector removal and installation:

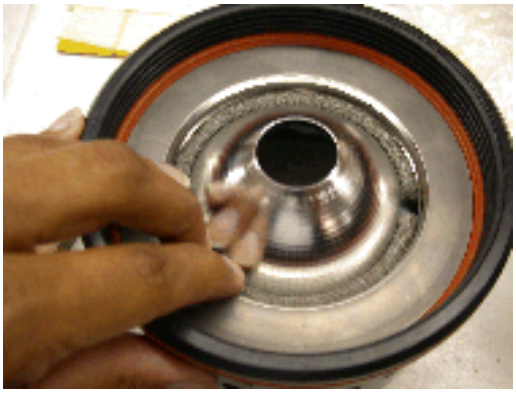
1. Remove cowl from lighthead body.

2. Remove snap ring from cowl.



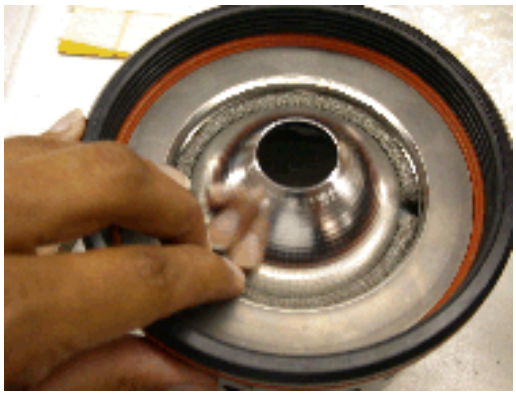

3. Remove Monel mesh from around reflector.



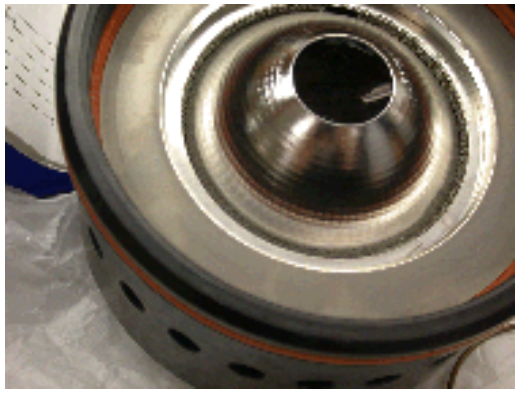

4. Remove old reflector then install new reflector.


5. Ensure everything is absolutely clean and dry inside the cowl, dome and reflector. Reagent grade alcohol may be use for cleaning. **Any residue left inside the lighthead will result in smoke which will coat the internal components and cause the lighthead to overheat.**

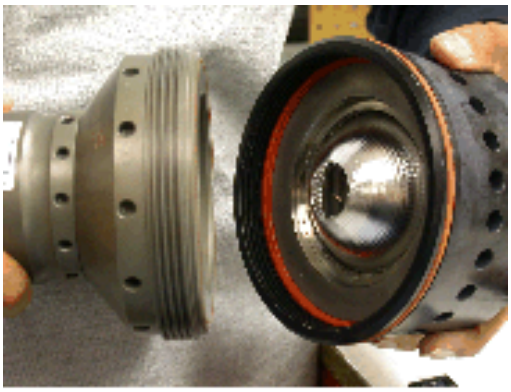
6. Insert Monel Mesh around reflector -- make sure reflector sits evenly in dome.

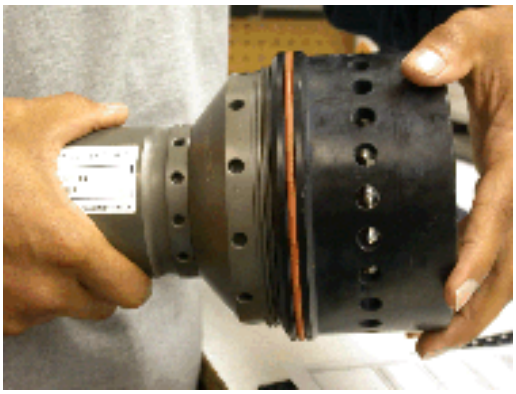



7. Install snap ring.

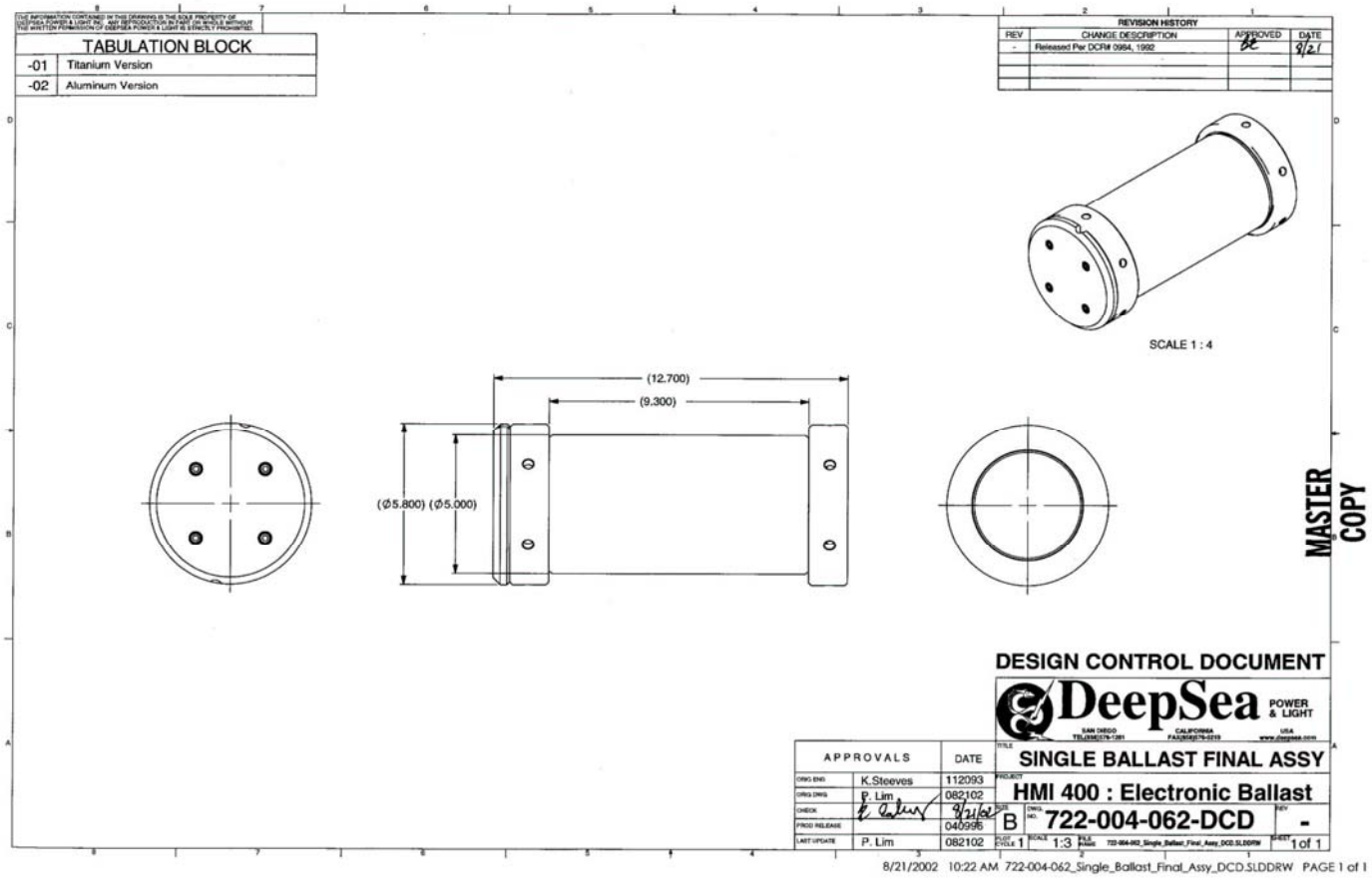
8. Tighten cowl onto lighthead body.

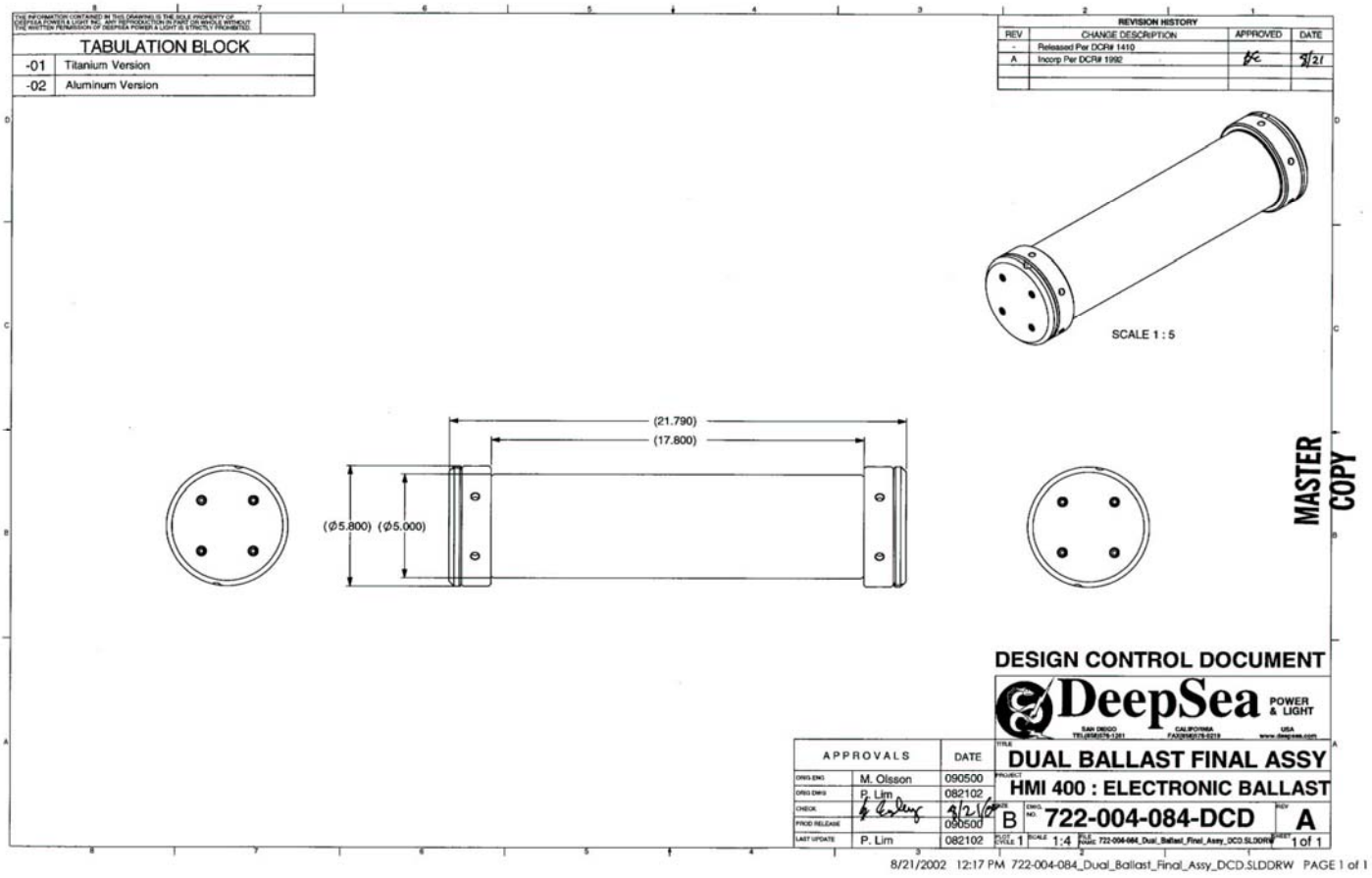




Ballast Drawings:

Please Note: These drawings are for standard products and connectors.

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-02 Aluminum Version
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MASTER COPY
DESIGN CONTROL DOCUMENT
DeepSea POWER & LIGHT
SAN DIEGO TEL(858)576-1261 CALIFORNIA FAX(858)576-0219 USA www.deepsea.com
APPROVALS | DATE
DWG ENG | M. Olsson | 090500
DRG DWG | P. Lim | 082102
CHECK | | 090500
PROD RELEASE
LAST UPDATE | P. Lim | 082102
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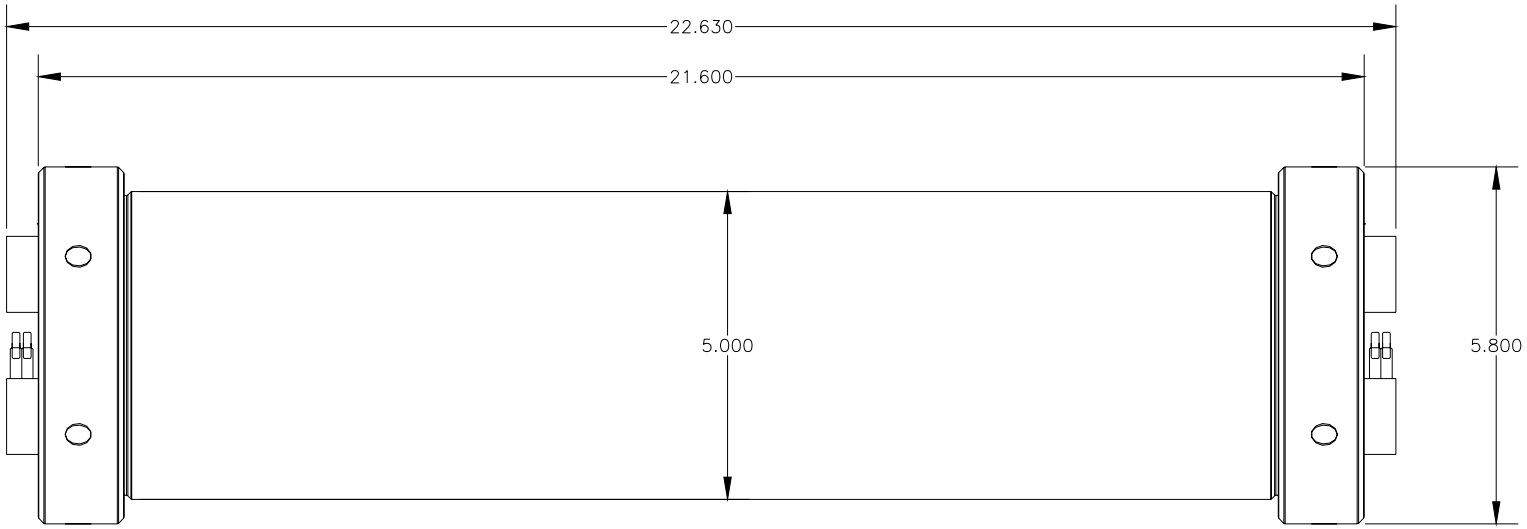
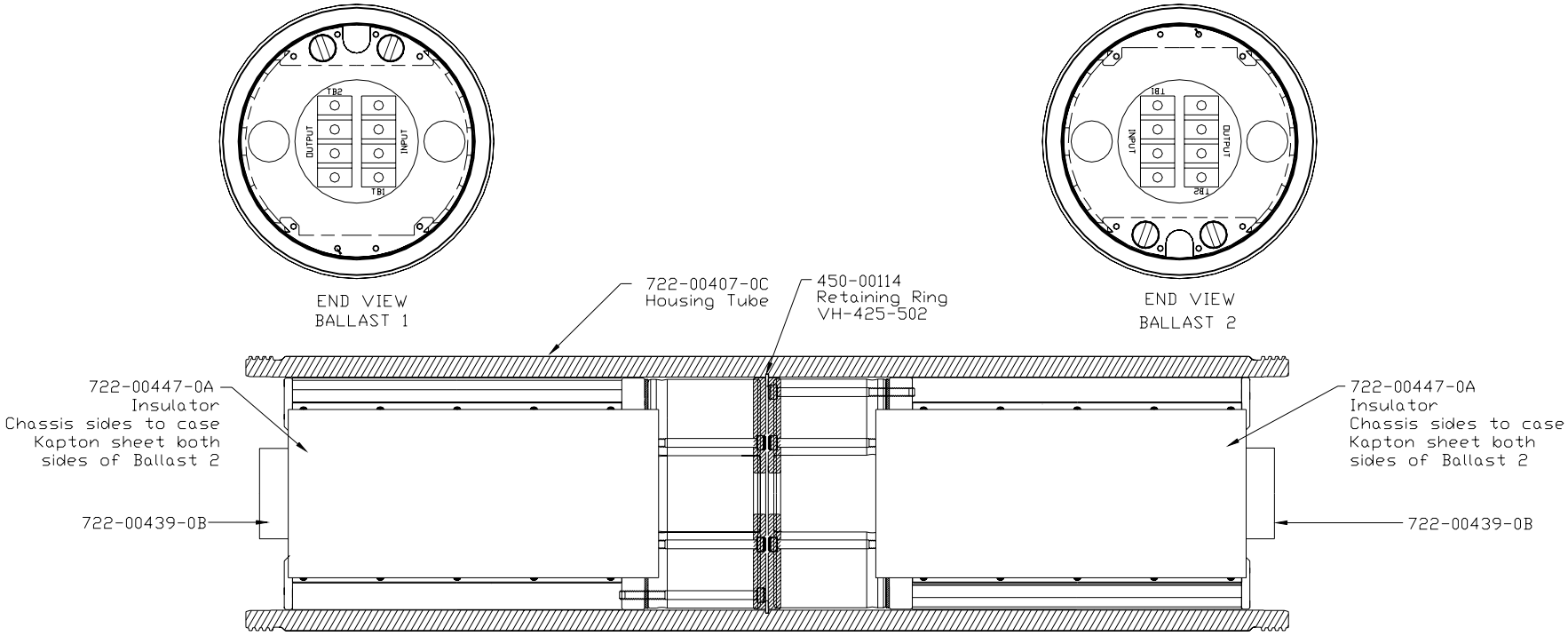


DUAL BALLAST ASSEMBLY
PLEASE NOTE:
THESE DRAWINGS ARE FOR STANDARD CONNECTORS AND PINOUTS



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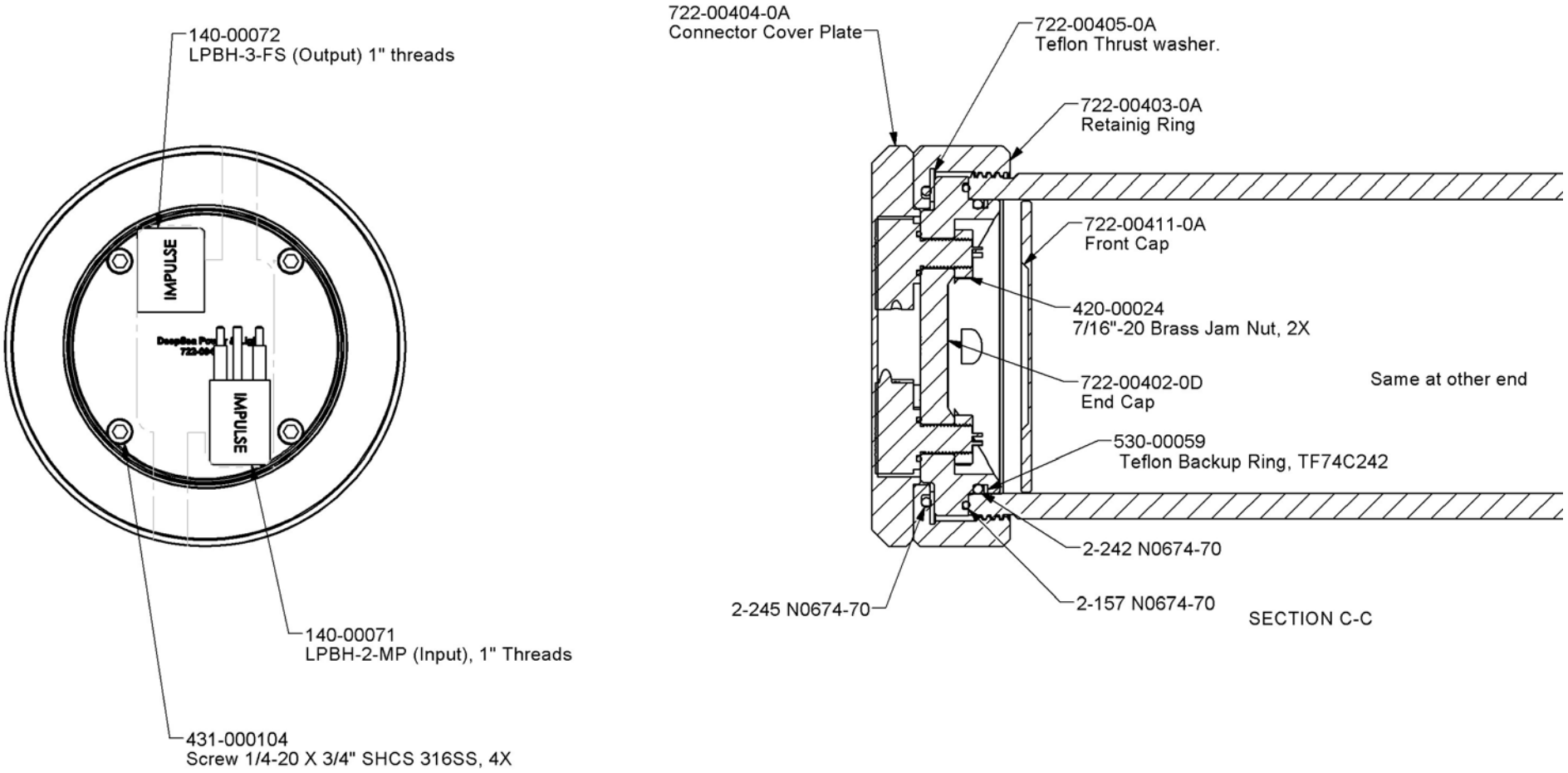

BALLAST ENDCAP DETAIL
PLEASE NOTE:
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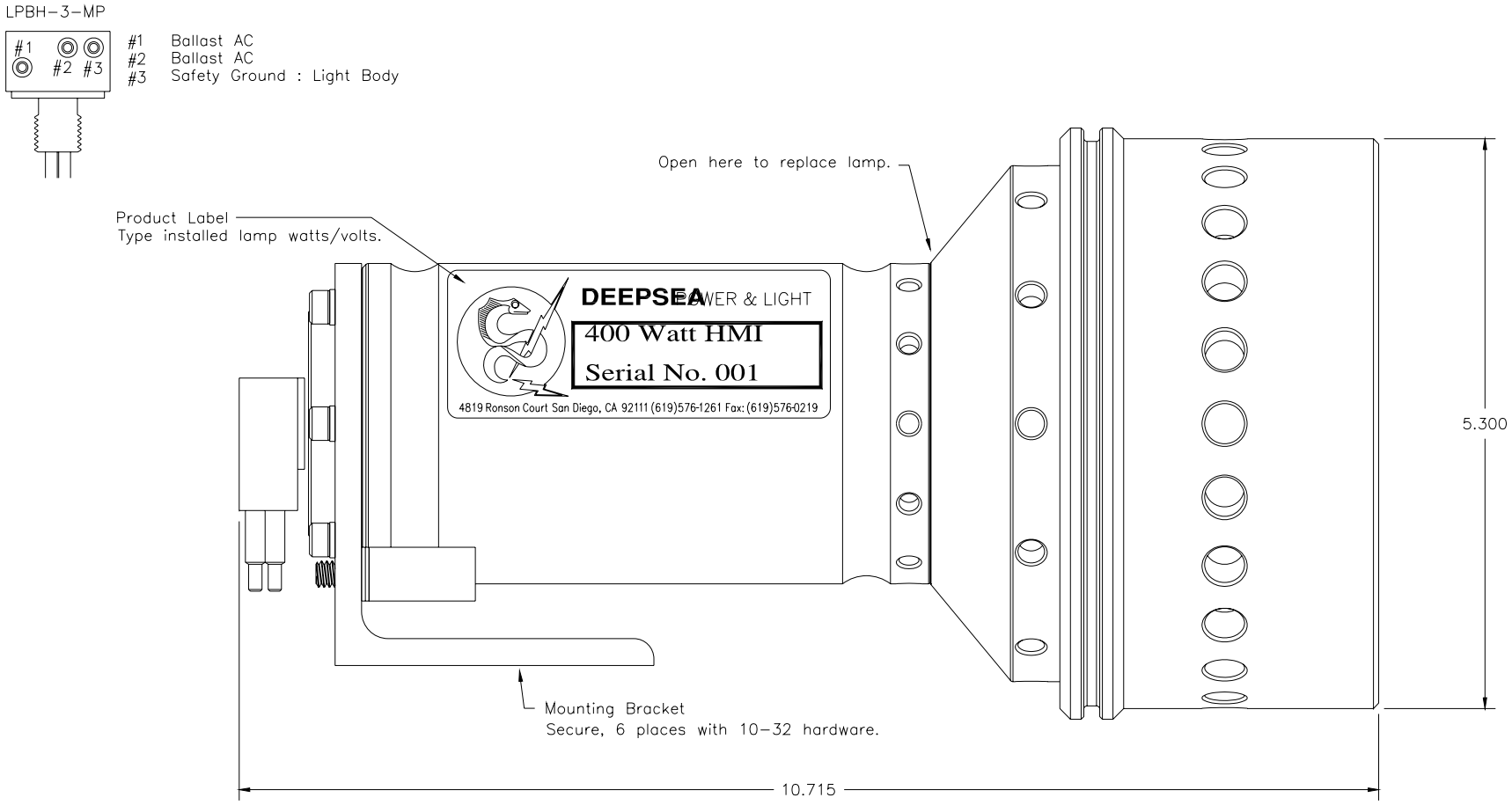
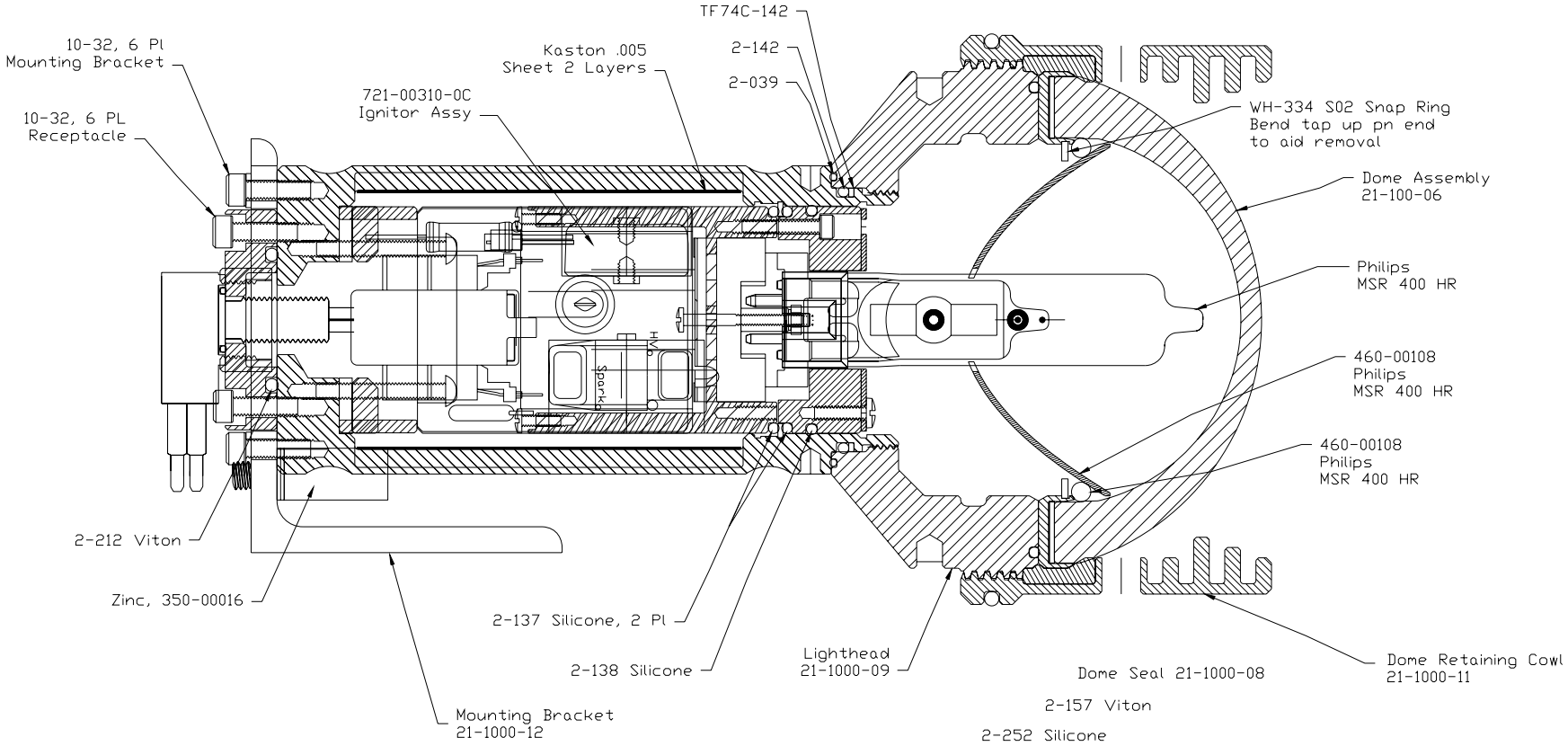


4. Avoid thermal shock on glass window.
3. Maximum water temperature 60 C.
2. Submerged IN−WATER operation only.
1. Rated Depth, 6000 meters.

Notes:

PLEASE NOTE: THESE DRAWINGS ARE FOR STANDARD CONNECTORS AND PINOUTS



400W-6000M ASSEMBLY
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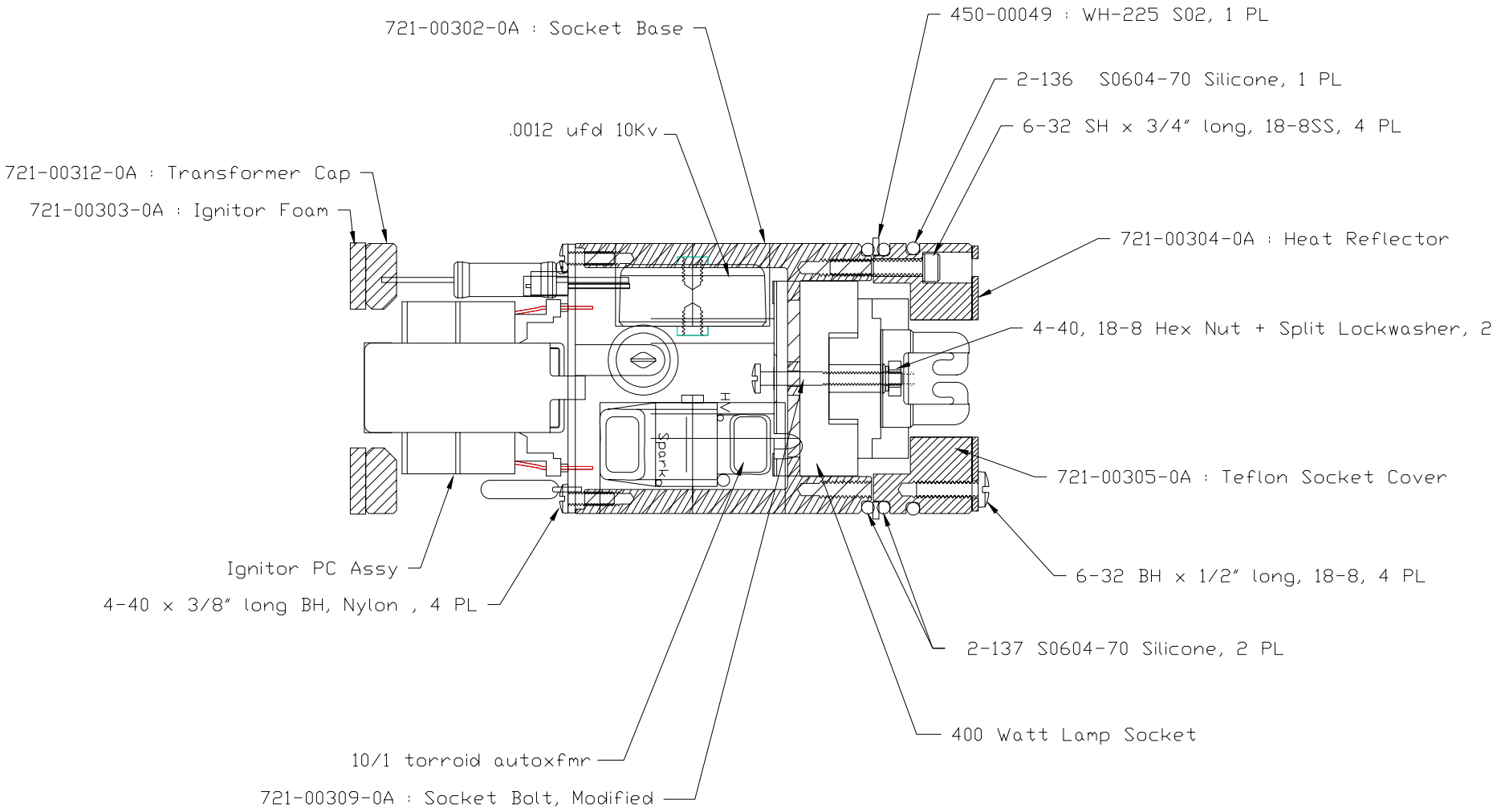


400W IGNITOR ASSEMBLY
PLEASE NOTE: THESE DRAWINGS ARE FOR STANDARD CONNECTORS AND PINOUTS

Appendix:

Ballast Dimmer / Enable Option

HMI 400W Ballast Dimmer/Enable Option

The Dimmer/Enable option provides a 2-wire, isolated, low voltage interface to control the ballast. The Dimmer option allows the user to reduce the light output to adjust for changing filming conditions, or to reduce power consumption when full light output is not critical. This is especially useful in battery powered applications. The Enable option is useful in applications where you want to turn the ballast on and off using a logic signal, without using a relay to interrupt power to the ballast. This feature will prove useful when designing remotely controlled/microprocessor controlled lighting platforms, as well as applications where one wishes to use a handheld controller to control a number of lights.

Ballasts equipped with the dimmer/enable option can be shipped in 4 different configurations, as specified by the customer. A DIP switch, which is located on the connector end of the ballast module, allows the configuration to be changed in the field. The dimmer and enable circuits are controlled by an opto-isolated input current, which is applied to the pins +dimmer/enable and -dimmer/enable. The configurations are:

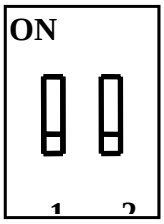
DIMMER ONLY (SW1 ON, SW2 ON):

If power is applied to the ballast, it will have a 400w output, even if there is no current in the control pins (+ and - dimmer/enable). Varying the control current between 16-32mA will vary the ballast output between 400W and 200W, respectively. Note that in the range 0-16mA, the ballast will have a 400W output.

ENABLE ONLY (SW1 OFF, SW2 OFF):
The ballast will not have an output or draw more than 5mA input current, until it is enabled by applying 16mA to the control pins (+/- 3mA). The ENABLE option is useful for applications where you want to turn the ballast on and off using a logic signal (greater than 5V provides the current to enable), without using a relay to interrupt power to the ballast.

DIMMER/ENABLE (SW1 ON, SW2 OFF):
Both the DIMMER and ENABLE options are active. To enable the ballast, apply 16mA. Increasing the current from 16-32mA decreases the ballast output from 400W and 200W, respectively. If no control signal is present, the ballast will have no output, and will draw less than 5mA input current with power applied.

STANDARD (NO OPTIONS) (SW1 OFF, SW2 ON):
Returns the ballast to its standard pre-option configuration (400W output whenever it has an input, no control current needed). This configuration allows the ballast to be used without control circuitry, when only a 400W ballast is required. In addition, this configuration allows the ballast module to be used in a housing which only has a standard 2 or 3 pin power input connector.



<u>HMI 400W Dimmer/Enable Notes:</u>

WARM UP PERIOD:
There will be a 1.5 minute warm up period during which the ballast will apply 400W to the lamp, regardless of the setting of the Dimmer control. This allows the lamp to warm up properly. For Dimmer only ballasts, this will occur every time input power to the ballast is cycled. For Dimmer/Enable ballasts, this will occur in either of these two cases: power to the ballast is interrupted or the Enable control current is interrupted.

DUAL BALLAST CONTROL:
If two ballasts with the Dimmer/Enable option are located in the same dual ballast housing, they may be configured at the factory for dual control. Both ballasts then share the same pair of control leads (+/- dimmer/enable). The required control current is unchanged from the single ballast case (i.e. 16mA will enable both ballasts for 400W output, 32mA will cause both ballasts to output 200W). Note the voltage required to cause a given current in the control leads will increase by about 1V. So to enable the units with 16mA will require about 6V.

CONTROLLER PCB

The following description is a specification of an optional controller PCB which frees the user from the need to generate the control currents for the ballast. The PCB can control a single or dual ballast. The PCB converts a logic level enable input (5V = ENABLE), and a 0-10V dimmer input (0V = 400W, 10V =200W) into the appropriate current in the Dimmer/Enable control lines. NOTE: LOCATE THE CONTROLLER PCB SO THAT CONTROL SIGNALS WHICH ARE TRANSMITTED OVER LONG CABLES ARE TRANSMITTED AS CURRENTS (IE KEEP THE INPUTS SHORT AND THE OUTPUTS LONG, IF NEED BE). The PCB has an LED which is in series with the output current, and a potentiometer to generate the 0-10V dimmer input in hand-held applications. Shunts are provided to short out the LED for low voltage (13-15V supply) operation, and to select either the potentiometer or the dimmer input. The maximum voltage at any input is 25V. The PCB also has a shunt which can select internal (always enabled) or external enable. The PCB will be 1.5"x1.5"x1.5" in size. With the potentiometer removed, the height is reduced to .52" (please specify no potentiometer when placing your order). There are 6 wires brought out for the user to connect:

WIRE COLOR	CONNECTION
Red	+15V input
Black	Ground
Yellow	+Dimmer/Enable Output
Brown	-Dimmer/Enable Output
Orange	Enable Input
Blue	Dimmer Input

CONTROLLER INTERFACING:

DeepSea can supply a small controller PCB with each ballast equipped with the Dimmer/Enable option. The following information is provided for users who wish to design their own control circuitry. The Dimmer/Enable interface inside the ballast consists of two 16mA current regulators in parallel. The dimmer regulator has 2.4V of diode drops added in series to ensure that the first 16mA of control current applied will always go to enable the ballast. The enable regulator will not draw additional current above 16mA, so current between 16-32mA will be routed to the dimmer current regulator. Even if the voltage across the control leads rises, the ballast will not draw more than about 34mA on its control leads. The control current must be applied such that there is a positive voltage on the +Dimmer/Enable lead relative to the -Dimmer/Enable lead. The control inputs are protected against reverse voltage and overvoltage. Typical voltages and currents are listed below (add the copper loss for your cable):

Minimum Enable Current (400W)	1mA	(3.2VDC)
Maximum Enable Current (400W)	16mA	(4.9VDC)
Maximum Dimmer Current (200W)	34mA	(8.2VDC)

LIGHT OUTPUT:

When the lamp is dimmed to 200W output power, its light output will be about 40% of the output at 400W, and its color will shift slightly toward the blue part of the spectrum.