

**ASPEN**

**C100 OWNERS MANUAL**



# CAPACITY SPECIFICATIONS

Unit	Capacity		Material
Holding Tank	30	Gallons	Polypropylene
Starboard Water Tank	21	Gallons	Polypropylene
Port Water Tank	23	Gallons	Polypropylene
Fuel Tank #1	33	Gallons	Aluminum
Fuel Tank #2	47	Gallons	Aluminum
Engine Oil	6.8	Quarts	
Transmission Fluid	2.6	Quarts	
Hot Water Tank	6	Gallons	
Batteries House Bank	200	Amp Hours	

# SERVICE POINTS & PARTS

<b>1</b>	<b>OIL CHANGE</b>		
	Crank Case Breather Filter (D3)	21368879	1 ea
	Volvo Oil Filter Kit (D3)	30788490	1 ea
	Delo 15W-40 Motor Oil	400-1-QT-LE	6.8 quarts

<b>2</b>	<b>TRANSMISSION FLUID CHANGE</b>		
	Transmission Oil MD-3 ATF	ATF-4	2.6 quarts

<b>3</b>	<b>ZINCS</b>		
	Transom Zinc	MFG# CMZHC2AZ	2
	Trim Tab Zinc	MFG# CMR02	1 pair
	Sand Bar Zinc	MFG# CMM24	1
	Swim Step Zinc 1-1/4"	MFG# SL-1250	3
	Bow Thruster Zinc	MFG # SM31180A	1
	Stern Thruster Zinc	MFG # SM31180A	1 pair

# ENGINE SPECIFICATIONS

ENGINE MANUFACTURER: <i>Volvo Penta</i>	
MODEL NUMBER: <i>D3-220</i>	SERIAL NUMBER:
FUEL TYPE: <i>Diesel</i>	ZINC SIZE: <i>N/A</i>
ALTERNATOR AMPERAGE: <i>180</i>	
ALTNERATOR BELT SIZE: <i>30731809</i>	
PROPELLOR SHAFT DIAMETER: <i>1.25"</i>	
PROPELLOR SHAFT ROTATION: <i>Right</i>	
PROPELLOR DIAMETER: <i>17"</i>	PROPELLOR PITCH: <i>18"</i>
NUMBER OF BLADES: <i>3</i>	PROPELLOR MATERIAL: <i>Bronze</i>
PRIMARY FUEL FILTER: <i>Racor 30 Micron</i>	
SECONDARY FUEL FILTER: <i>Part #21139810</i>	
AIR FILTER: <i>Part #21379288</i>	OIL FILTER: <i>#30788490</i>
ENGINE OIL TYPE: <i>15W-40</i>	ENGINE OIL QUANTITY: <i>6.8 qt.</i>
IMPELLER PUMP MAKE & MODEL: <i>Jabsco #21951352</i>	
TRANSMISSION MANUFACTURER: <i>ZF</i>	
TRANSMISSION REDUCTION RATIO: <i>2.03</i>	
TRANSMISSION FLUID TYPE: <i>ATF</i>	
TRANSMISSION FLUID QUANTITY: <i>2.6 US Quarts</i>	



# ENGINE MAINTENANCE SCHEDULE

Your Volvo Penta engine and its equipment are designed for high reliability and long life. The engines are built to withstand the marine environment, but also to have the smallest possible environmental impact. If the engine and transmission are serviced regularly according to the schedule, these qualities will be retained and unnecessary malfunctions will be avoided.

- C = Clean

R = Replace

A = Adjust

L = Lubricate
- I = Inspect *(clean, adjust, lubricate or replace if necessary)*

FSI = First Service Inspection

A – F = Type of service *(regular service)*

FSI: FIRST SERVICE INSPECTION, after 50–100 running hours	
<i>Or within 180 days of the date of delivery, or the end of the first season, whichever comes first</i>	
Coolant level and antifreeze mixture	I
Drive belt and belt tensioner	I
Fuel pre-filter, draining water / contamination	I C
Outboard drive, corrosion protection	I
Outboard drive, oil level in Power Trim	I
Outboard drive, oil level in Power steering	I
Start and warm up engine	
Engine and transmission, oil / fuel / water leakage	I
Engine and transmission, abnormal noises	I
Power steering and Power Trim, function and leakage	I
Stop engine	
Reverse gear, oil level	I



<b>EVERY 100–200 HOURS / AT LEAST EVERY 12 MONTHS</b>	
<i>Oil change intervals vary, depending on engine type, oil grade, and sulfur content of the fuel</i>	
Engine oil and oil filters / by-pass filter	R
Crankcase ventilation filter	R
Coolant level and antifreeze mixture	I
Air filter	R
Fuel pre-filter and fuel fine filter	R
Seawater filter	I
Drive belt (tension)	I
Impeller, raw water pump	I
Reverse gear, oil and filter	R
Reverse gear, propeller shaft seal	I
Outboard drive, oil	R
Outboard drive, corrosion protection	R
Outboard drive, propeller shaft. Visual inspection of propeller seal	I L
Outboard drive, U-joint and primary bearing	L
Outboard drive, bellows, rubber hoses, and clamps	I
Checking exhaust line	I
Outboard drive, universal joint bellow	I
Hydraulic hoses and fittings. Thoroughly inspect for signs of leaks, wear, cracks, aging	I
Engine and transmission, oil / fuel / water leakage	I
Engine and transmission, touch up paint as required	L
Batteries, electrolyte level	I

<b>EVERY SECOND YEAR</b>	
Impeller, seawater pump	R
Outboard drive, universal joint bellow	R

<b>EVERY FOUR YEARS</b>	
Coolant	R

<b>EVERY 400 HOURS / AT LEAST EVERY 4 YEARS</b>	
Outboard drive, hydraulic valve oil and oil filter (steering control unit)	R



**A**

Recommended once a year		Every 200 hours ✓	
Check software status	Inspect	•	<input type="checkbox"/>
Engine oil and oil filters	Replace	•	<input type="checkbox"/>
Coolant level and antifreeze mixture	Inspect	•	<input type="checkbox"/>
Drive Belts	Inspect	• / o	<input type="checkbox"/>
Air Filter	Replace	•	<input type="checkbox"/>
Fuel pre-filter and Fuel fine filter	Replace	•	<input type="checkbox"/>
Seawater filter	Clean	• / o	<input type="checkbox"/>
Anode, protection system	Inspect	• / o	<input type="checkbox"/>
Impeller in seawater pump <sup>(1)(2)</sup>	Inspect	• / o	<input type="checkbox"/>
Rudder Actuator, oil <sup>(3)</sup>	Inspect	•	<input type="checkbox"/>
Crankcase ventilation filter	Replace	•	<input type="checkbox"/>
Exhaust hose	Inspect	•	<input type="checkbox"/>
Seawater Inlet	Clean	•	<input type="checkbox"/>
Transmission, oil	Replace	•	<input type="checkbox"/>

1) Engine version A-D: Replace every 200 hours / at least every 24 month.

2) Engine version E-F (engines without engine mounted seawater filter): Replace every 200 hours / at least every 24 month.

3) For inboard joystick installations only.

**B**

Recommended every second year		Every 400 hours ✓	
Impeller in seawater pump <sup>(1)(2)</sup>	Replace	•	<input type="checkbox"/>

1) Applies not for engine version A-D.

2) Applies not for engine version E-F, without engine mounted seawater filter.

**C**

Recommended every fourth year		Every 800 hours ✓	
Exhaust hose	Replace	•	<input type="checkbox"/>
Drive Belts	Replace	•	<input type="checkbox"/>
Compressor, oil	Replace	•	<input type="checkbox"/>
Rudder Actuator, oil <sup>(1)</sup>	Replace	•	<input type="checkbox"/>

1) For inboard joystick installations only.

**D**

Recommended every fourth year		Every 2000 hours ✓	
Coolant	Replace	•	<input type="checkbox"/>

Service Type A-D (in accordance with Service and Maintenance manual).

Operation "Inspect" includes if necessary: cleaning, adjustment, lubrication and replace.

• = Service operation is recommended to be performed by an authorized Volvo Penta dealer.

o = Service operation could be performed by owner/operator.



# D3-170,200,220

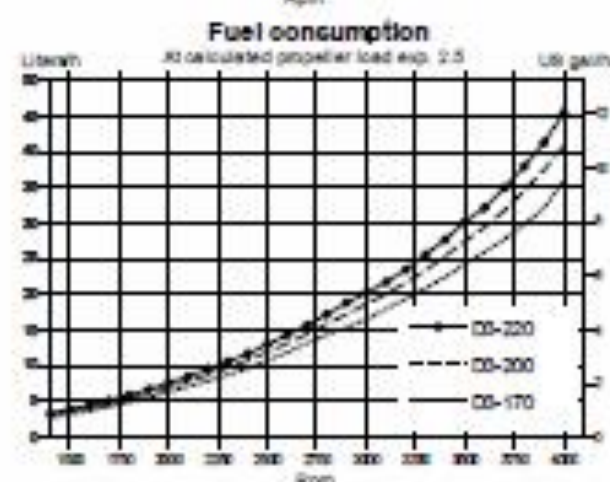
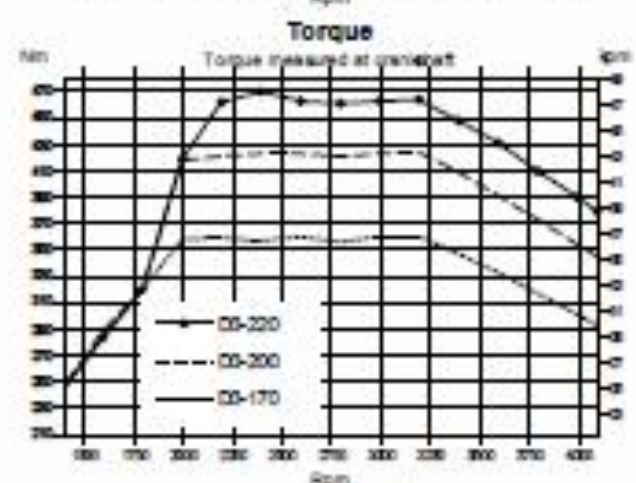
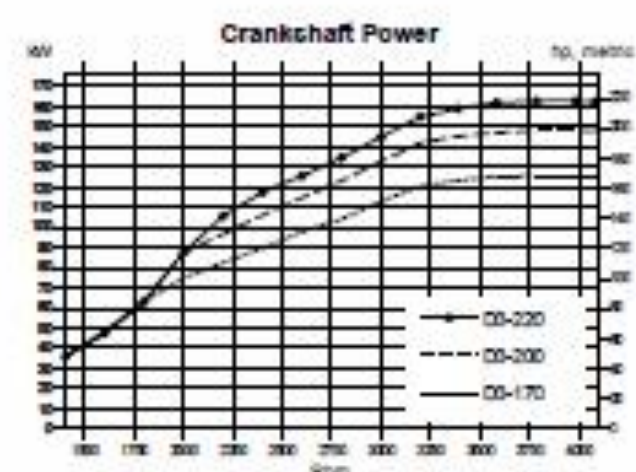


## Technical Data

Engine designation	D3-170 I	D3-200 I	D3-220 I
Crankshaft power, kW (hp)	125 (170)	147 (200)	162 (220)
Propeller shaft power, kW (hp)	121 (165)	143 (194)	157 (213)
Engine speed, rpm	4000	4000	4000
Displacement, l (in <sup>3</sup> )	2.4 (146)	2.4 (146)	2.4 (146)
Number of cylinders	5	5	5
Bore/stroke, mm (in.)	81/93.2 (3.19/3.67)	81/93.2 (3.19/3.67)	81/93.2 (3.19/3.67)
Compression ratio	16.5:1	16.5:1	16.5:1
Dry weight with HS45AE, kg (lb)	301 (664)	301 (664)	301 (664)
Dry weight with HS63VE, kg (lb)	335 (739)	335 (739)	335 (739)
Rating	R5*	R5*	R5*
Emission compliance	IMO NOx (D3-200 & D3-220), EU RCD, US EPA Tier 3		

Technical data according to ISO 8665. With fuel having an LHV of 42700 kJ/kg and density of 840 g/liter at 15°C (60°F). Merchant fuel may differ from this specification which will influence engine power output and fuel consumption.

\*RATING 5. For pleasure craft applications, and can be used for high speed planing crafts in commercial applications



**VOLVO  
PENTA**



# D3-170,200,220

## Technical description:

### Engine block and head

- Cylinder block and head made of aluminum
- Cylinder block with integrated bed plate
- 4-valve technology with hydraulic lash adjusters
- Double overhead camshafts
- Oil-cooled pistons with two compression rings and one oil scraper ring
- Cast-in grey iron cylinder liners
- Replaceable valve seats
- Six-bearing crankshaft
- Front-end transmission

### Engine mounting

- Flexible engine mounting

### Lubrication system

- Easily replaceable (insert) full-flow oil filter
- Plate oil cooler

### Fuel system

- Common rail fuel injection system
- Piezo-electric injectors
- Constant power output regardless of fuel quality or temperature (5–55°C/ 41–131°F)

- Fine filter with water separator and water in fuel sensor with alarm

### Air inlet and exhaust system

- Replaceable air filter
- Closed crankcase ventilation with oil separator and filter
- Stainless steel exhaust elbow
- Turbocharger with variable geometry

### Cooling system

- Thermostatically regulated freshwater cooling
- Tubular heat exchanger with separate large volume expansion tank
- Coolant system prepared for hot water outlet
- Easily accessible impeller pump

### Electrical system

- 12V one-pole electrical system
- 180A alternator, and integrated temperature compensated charging regulator
- Auxiliary stop button

### Instruments/control

- Electronic shift and throttle

- Full range of instrumentation available

### Reverse gear

**HS45AE** Hydraulic – drop center with 8° down angled output shaft.

- Ratio 2.43:1 or 2.03:1 (RH/LH)

**HS63IVE** Hydraulic V-drive.

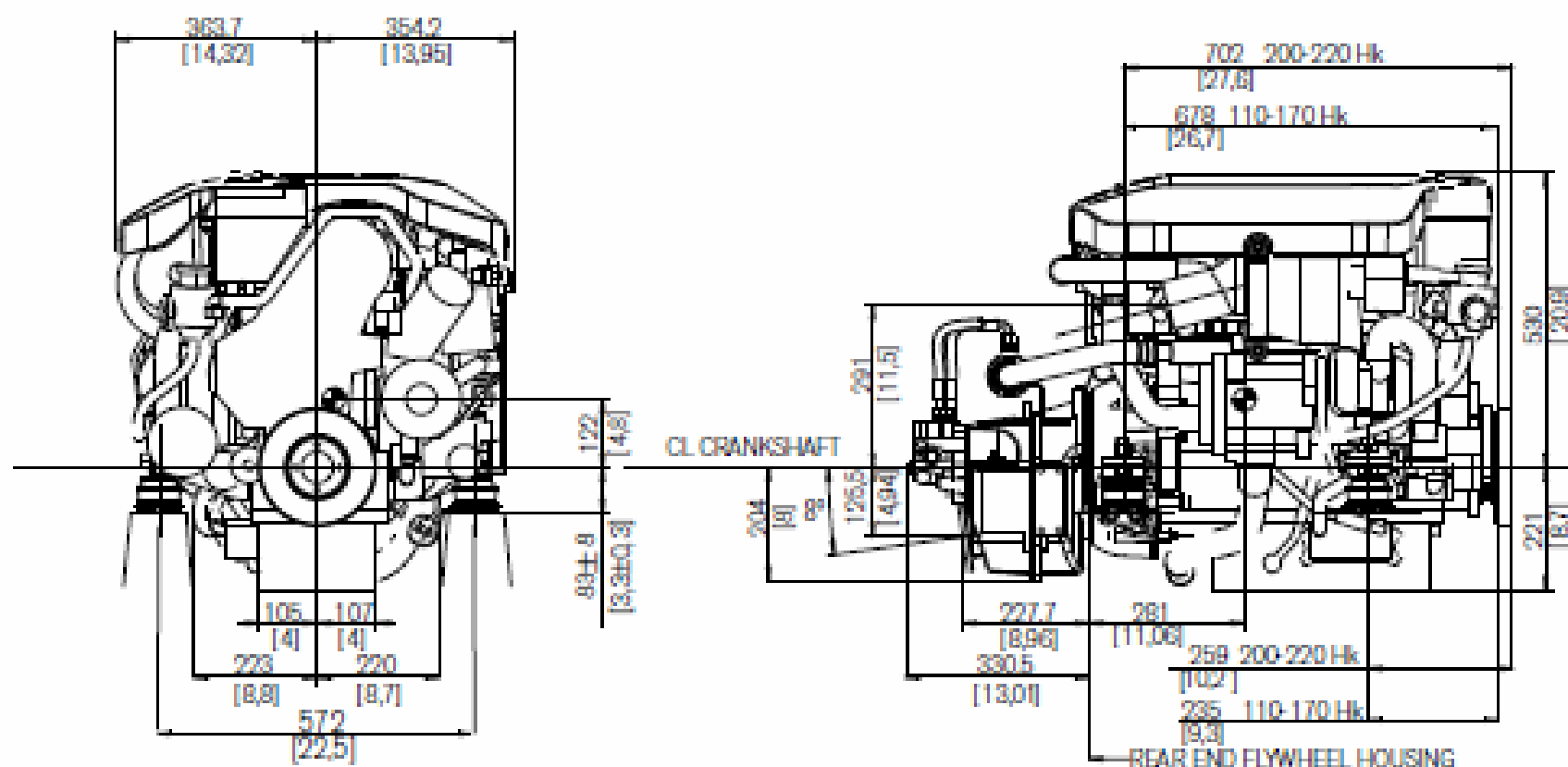
- Ratio 2.48:1 or 1.99:1 (RH/LH).

### Option

U.S.C.G./MED (SOLAS) kit available.

## Dimensions D3-170,200, 220/HS45AE

Not for installation

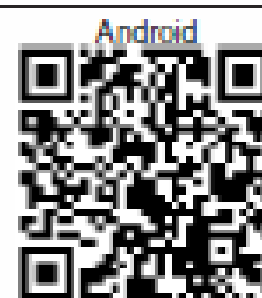


## More information

Contact your nearest Volvo Penta dealer for more information about Volvo Penta engines and optional equipment/accessories or go to [www.volvopenta.com](http://www.volvopenta.com)



IOS



Android

Download the Volvo Penta dealer locator App for your iPhone or Android

# VOLVO PENTA

**AB Volvo Penta**  
SE-405 08 Göteborg, Sweden  
[www.volvopenta.com](http://www.volvopenta.com)

Not all models, standard equipment and accessories are available in all countries. All specifications are subject to change without notice. The engine illustrated may not be entirely identical to production standard engine.



## **Aspen Power Catamarans Consumer Warranty**

At Aspen our goal is to build your new boat with the best materials available from the world's premier vendors. These are installed by very well trained experienced builders. Each system is fully function tested in our plant and then water tested during factory sea trials prior to delivery. So our expectation is that new owners will have a very very short list of items that need addressing after delivery.

### **Basic Agreement:**

On the issues where we errored we will take full responsibility and exceed your expectations in every way during its service. In short, we will be 110% responsible for our work, materials and equipment; we will also manage the suppliers warranty's when possible.

Aspen or our agent will provide dockside service at your marina for the first 3 months at our expense. There after Aspen will cover all parts and labor but dockside transit expenses are not covered. If the boat is located outside Puget Sound we will mutually agree to a local service provider and with your call Aspen will contact and manage the service at our expense. Aspen will provide parts and freight to the boat/service company. For complex projects, Aspen may send a team to the boat for service. In the rare instance the boat needs to return to the factory the cost of its return will be the responsibility of the owner.

### **What is Covered:**

**Hull, Deck** small fiberglass parts, structural **10 Years**

**Tanks, Steering,** shaft, prop, rudder, **5 Years**

**Electrical Harness** switches, breakers, fuse holders, **5 Years**

**Gel Coat** blistering, crazing, **5 Years**

**Engine Transmission,** (by vendor) Cummins/Volvo Twin Disc, **2 years**

**Electrical components,** water pump, bilge pumps, **2 Years**

**Hardware,** components **3 years**

**Electronics** (by vendor) typically **2 years**

### **What is Not Covered:**

**Damage** from abuse, impacts or groundings or commercial use

**Damage** from acid washing gel coat by boat cleaning companies

**Normal wear** and exposure in normal use under normal conditions

**Transport** or any expense associated with it being out of service I.E. living expenses, personal transportation

**Transferability:** Yes, first 3 years with a \$695 service fee

**Extended Warranty Available:** Yes Bow to Stern w/engine and gear, 5 years (Brunswick)  
(Contact Aspen for Price)



# OWNER NOTES

## ANCHORING

The anchor is on the bow roller. Note: if the winch runs but the line/chain is not coming in, the clutch is most likely not snugged up. Using the wrench (Lewmar) from the blue owner's info bag, insert it in the top of the winch and tighten clockwise. Test again, be careful not to tighten too far as the bow roller can be bent with the motor's force.

## BATTERIES

The house batteries are located in the starboard aft cockpit storage compartment. The start battery is located in the port aft cockpit compartment next to the propane tank.

## BERTHS

There is a king berth forward. The dinette folds down for a queen-size berth. There is also a ¼ berth in the starboard hull which can also be used for storage.

## BILGE PUMPS

There are 3 bilge pumps per hull – each in water tight compartments and an emergency large capacity pump located under the engine. All bilge pumps are on automatic float switches and powered by full time power, even if the switches are off.

## DINGHY

Always wear your life jacket when using the dinghy. The 8' 9" dinghy has a 450lb capacity and allows 3 people on board safely.

## ENGINE

The engine is located in the starboard hull. It can be accessed under the front cockpit lazarette.

## FUEL TANKS

There are 2 fuel tanks. Only diesel fuel. The tanks have a total capacity of 80 gallons.

## HOLDING TANK

The holding tank holds 28 gallons. To empty, be away from shore and hold macerator switch on to dump. It's best to do when the engine is off so you can hear the change in motor speed when the tank is dry. There is also a pump outfitting on the step through at the transom gate.

## HEATER

Wallace 30D runs off port fuel tank when it's more than 1/3 full.

## HOT WATER

There is a 6 gallon hot water tank – 110V and tied to engine water jacket.

## SAFETY EQUIPMENT

Aspen boats are equipped with 8 life jackets: two under the helm seat (suspender inflating type), 4 in the starboard aft cockpit storage compartment, and two under the master bed. The flare kit and first aid kit are also stored under the helm seat. Fire extinguishers are located to port side of helm and on the aft wall of the ¼ berth.

# OWNER NOTES *CONTINUED*

## SHORE POWER

Boat comes equipped with a 30 amp service cord.

## STOVE:

The stove is propane and has a 15lb propane tank. Remember to turn the tank on at the bottle, and then push the toggle switch next to the sniffer control to feed it power. Then turn on the sniffer control unit to the right of the stove. Turn switch at stove off after use and close bottle if leaving the boat for an extended period.

## WATER

The boat has 2 water tanks, one in each hull. To activate the port tank, switch the water pump switch at the dash to port side. To activate the starboard tank, move switch to starboard. If switch is centered, both pumps are off. Capacity is 50 gallons. Remember to not run water continuously to conserve your water supply.

## QUICK START

The main battery switches are typically left on, as are the AC and DC breakers at the helm.

- A. ENGINE CHECKS:** engine oil level and transmission level should be checked prior to each trip. Before starting, push the engine's primer pump at the top of the white hull side filter until it firms up. This greatly reduces cranking time after the engine has set unused for more than 2 days.
- B. COVERS & CUSHIONS:** aft deck cooler should be pulled out of the ¼ berth and placed on the non-skid mat.
- C. READY INSTRUMENTS:** no action needed.
- D. POWER PANELS:** DC switches are normally off when leaving the boat for an extended period of time. This kills power to 95% of the DC equipment. Note: if you want the refrigerator left on, the lower sub-panel switch must be on. AC panel breakers are also typically all on except the hot water 110V heater breaker – use this only when needed as it, with other loader, can exceed 30 amps.
- E. START ENGINE:** assure throttles are in neutral position. The hold key fob flat with square edge toward key box and pass down over box. A green light will come on solid, then push button after fuel pressure pump has stopped humming.
- F. CASTING OFF:** remove lines in appropriate manner and stow safely. Then remove fenders/lines and stow safely.
- G. UNDERWAY:** attentive helmsman at all times.
- H. ARRIVING AT MARINA:** place fenders on proper side. Remember that neutral is your friend. Use thrusters to get to dock.
- I. ANCHORING:** remove snubber line (safety line/bungee on anchor). Check to see line in locker is clear and not bound by stored gear. Either at the helm or on the deck, lower the anchor using switch pad. While retrieving, be sure to clean anchor (bounce while in water) to clear mud and debris before it gets on the deck and in the anchor locker.



# OWNER NOTES *CONTINUED*

## BOTTOM PAINT

We use Pettit Hydrocoat Eco paint (PN 1804-1), typically black. This paint is good for boats stored in and out of the water. We also protect the transducer with water based antifouling paint (PN: MDR-720).

## PAINTING PROCEDURE

The typical yard will make a major mess of bottom painting an Aspen, as they do not care about how smooth the final finish is. Their goal is gobs of paint fast, no finesse, paint spurs are OK.

Our goal is a smooth finish that keeps the boat speed at 100% fo new. We mix the paint really well, then strain it so it flows well when you apply it with a marine FOAM roller (you'll need 9" roller on large surfaces and 4" to move fast in detail areas). We quickly roll the paint in an area about 3 feet long by 3 feet high, and then put the roller down and go over this area with a quality 4" finish paint brush or fam paint brush lightly TIPPING the surface. When you do it right, the paint lays down very flat – no lines are present and no paint spurs are sticking up – smooth as Formica. Key to this is while the paint is still wet, roll the next section forward 3 feet and tip it while the first is still WET so you don't get scuff lines in the paint at the transition points. Try to end your painted sections on a chine or other hull feature for a smooth finish everywhere. You might be asking, why do it this way? Aspens are a displacement hull so when it's running all – 100% of the hull stays in the water. If you turn this surface into 36 grit sand paper, it drastically slows down the boat. We had one owner whose yard did a very lumpy paint job and he lost 5mph of his cruise and top speed. The whole paint job had to be sanded off.

We do two coats on all surfaces, a third on the sides and sun exposed areas, and a fourth on the bow. On re-coat jobs, it typically takes a day to prep the surface and a day to do the coating.

## PRODUCTS NEVER TO USE ON YOUR BOAT

Swimming pool cleaner

Soft Scrub with bleach

Comet

Scotch Bright Sponges

Toluene

Acetone

Anything really strong will take the expensive UV stabilizers out of the gel coat surface. And with no UV protection, the boat will chalk and age.

# BATTERY SWITCHES

The C100 has five main battery switches:

1	HOUSE ON/OFF
2	ENGINE ON/OFF
3	EMERGENCY PARALLEL
4	BOW THRUSTER
5	STERN THRUSTER

Normal operation position is to leave both House, Electronics, and Engine switches in the ON position. Emergency Parallel should be in the OFF position and is rarely used and then only for 3 to 5 minutes max.

**Thruster battery switches** are located below the main battery switches and are normally ON. ***These must be switched OFF when swimmers are in the water, or for service.*** The thrusters are very powerful and will suck objects in the water toward them. Do not operate the thruster for more than 30 seconds at a time or the motor's thermal breaker may shut the motor off until it cools down.

The batteries have three charging sources:

1. 2 ProMariner chargers (8A for the Start Battery & 20A for the House Battery). Shore power is connected and AC breakers at dash are switched on.
2. 2 130watt solar chargers (12A) while anchored – automatic.
3. 1 125A engine-driven alternator.

The boat has a **Blue Sea Voltage Sensitive Relay** (black box located near the switches) that disconnects the House Batteries from the Start Battery when the voltage on the Start Battery drops below 12.3 volts. Once the charging system has brought the Start Battery back to 12.3 volts, it reconnects to the House Battery Bank.

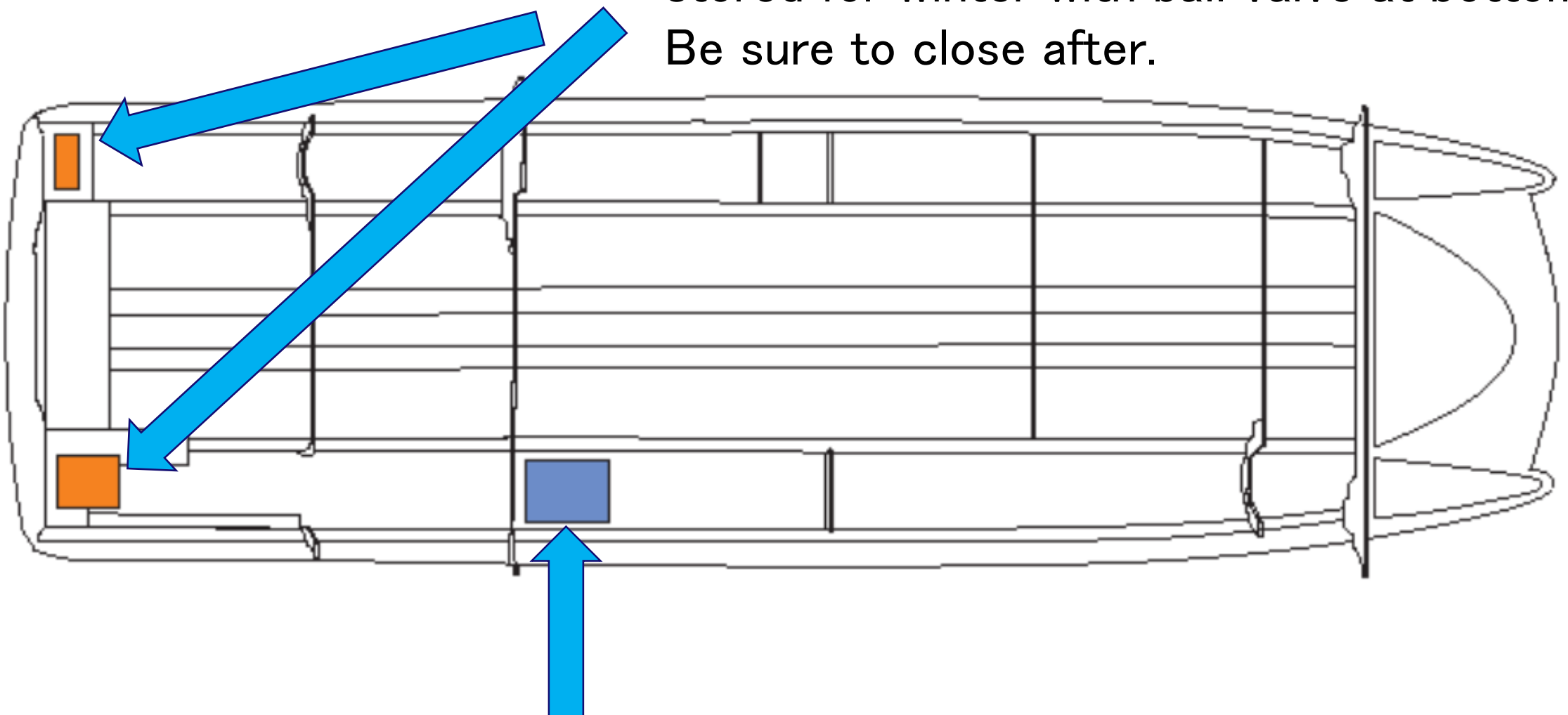




# BATTERY LOCATIONS

## HOUSE BATTERIES

2ea Golf Cart 6Volt Deep cycle, wet lead acid, in series for 12V house supply. 4" water lift muffler to left, drain muffler when stored for winter with ball valve at bottom. Be sure to close after.



## ENGINE START BATTERY

G27 (Typically next to propane locker) with the Teliflex SeaStar hydraulic steering ram.

**Note:** on Generator boats we double up the start batteries and locate in aft starboard hull for weight and balance issues.

**Note:** Rudder packing should be re-tightened/checked with each oil change every spring.

# PROMARINER CHARGERS & FULL-TIME POWER BREAKER

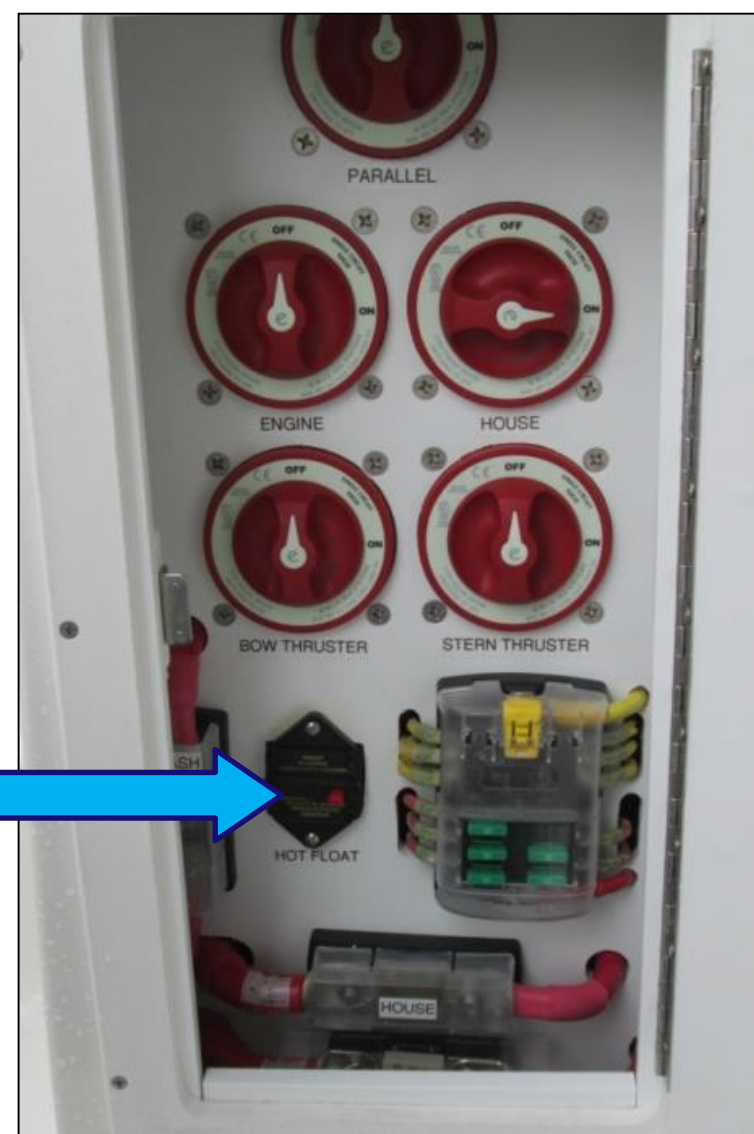


The 20amp House ProMariner automatic chargers are wired to come on when the boat's shore power is connected and the A/C breakers at the dash are in the ON position. The chargers are four-stage, smart units that charge aggressively when the battery is low and then ramp down as it charges. They stop completely when the battery is fully charged and do a small topping charge weekly. The design greatly extends battery life and prevents overcharging and subsequent battery damage.

Check battery water levels monthly. Lower water levels and/or exposed plates will damage the batteries' lead plates. Note: chargers will only charge if they see voltage. If batteries are dead, you will need to use the Emergency Parallel Switch and charge for a maximum of 4-6 minutes.

The **Full-Time Power Breaker** is **always on**. The 12V power fuse is just inside the battery switch compartment. **It is important to leave this on** as it supplies power to the boat's six automatic bilge pumps and other devices that need power to save memory settings. It is not affected by the battery switch position.

**NOTE:** *If the breaker has popped or fuse is burned out, there is no bilge pump protection from leaks.*





# AC / DC PANELS

The AC and DC panels are both Blue Sea Systems premium panels.

**DC Panel:** The DC panel is fed from the House batteries. It includes both voltage (pressure) and amp (volume) gauges to manage your power during the day. Reducing amps used is important to extend battery life. While boating, turn all of the breakers ON. The small silver toggle switch will show Engine battery voltage (#1 left), House battery voltage (#2 center). (The third is not connected as there are only two battery banks.) These breakers then feed the dash DC switch panels (see next page) and the fuse blocks for electronics and pumps. A DC shunt is standard for the amp meter.

**NOTE:** *On DC panel with bilge pump switches, the top three switches correspond with pumps on the starboard hull and the bottom three switches correspond to the pumps on the port hull. First pump is forward, second is mid-ship, and third is aft in the port lazarette. On starboard side, the shower pump is mid-ship.*



**AC Panel:** This panel is fed from the 30-amp shore power connection.

Typically all of the breakers, with the exception of the hot water heater, are left **ON** to energize the boats outlets.

If the red reverse polarity light is lit (second bulb down), see your dock master before continuing. It is possible some boat systems could be damaged.

**NOTE:** *Turn on hot water only when needed.*

**NOTE:** *This panel is fed through the whole boat GFI, mounted just behind the deck side shore panel connection. The whole boat GFI does have a reset button on it.*

**BOAT GFI:** Located on far port side behind the dash above the Master Stateroom bed.





# DC PANEL LAYOUT



**PUMPS PANEL:** The pumps panel controls the bilge pumps and shower sump pump. Most of these are automatic, but these switches allow you to manually turn on each of the six pumps for each water-tight compartment. With the exception of the fresh water switch, these switches are normally in the off position. This panel is fed from the pumps breaker on the main DC panel. **The automatic portion of the bilge pumps is not affected by this panel.**

**NOTE:** *The engine room has a seventh pump (1100GPH) which serves as an emergency pump. It is wired to a very loud horn behind the dash. Should you lose an engine hose and the engine room begins to fill, this pump will automatically start and the horn will sound.*



**SHIP SYSTEMS PANEL:** This panel includes controls for navigation lights, blower, and many other ship systems. Like the Pumps Panel, it is fed from the main DC panel breaker.

**These panels have separate automotive blade fuses under the plastic snap cover ranging from 5- to -20 amps.** If a fuse has blown, determine and fix the cause and replace the fuse. (Possible causes could be debris in pump, shorted wire.)

To access fuses, carefully pop the grey cover off with a flat-blade screwdriver or tape-wrapped dinner knife. Pull rubber gasket over fuses and replace fuse.



# SHORE POWER DISCONNECT



**1) SWITCH OFF BREAKER**



**2) UNPLUG CORD**



***\* NOTE: NEVER LEAVE A HOT OR LOOSE CORD ON DOCK, IT COULD SHOCK SWIMMERS IF IT FELL IN THE WATER. IF A CORD DOES FALL IN THE SALT WATER, REPLACE THE ENTIRE CORD; A FIRE COULD OCCUR AS IT CORRODES INSIDE.***

# TANK GAUGES & SOLAR PANEL CONTROLS



## TO READ TANK LEVEL:

Left Gauge = Left Water Tank  
Right Gauge = Right Water Tank  
Center Gauge = Waste Tank

## SOLAR PANEL CHARGE CONTROLLER

The Solar Boost 2000 is a premium charge controller that helps capture all of the sun's peak mid-day energy. **The unit is automatic and requires no operator input.** As the batteries become fully charged, the system automatically ramps down its charge so batteries are not overcharged. It also automatically shuts down if it senses another charge source (engine or battery chargers). The slide switch is useful to see the current voltage and input of the battery bank. If the batteries are low and the sun is bright, the unit will put out up to 11-amps.



**NOTE:** *If it seems not to be charging, the batteries may be full, or the Kayaks could be blocking the sun. 1 sq ft. of shade on the solar panel will disable 2 sq ft. of panel.*



# FUSE PANELS BEHIND DASH



## BLUE SEAS PANELS: AUTO BLADE FUSE-TYPE

Each of these four fuse blocks is dedicated to a specific system and is powered by a dedicated breaker.

- 1) Hot Float – 8 gang, right
- 2) Electronics – 6 gang, top
- 3) House equipment – 6 gang, middle
- 4) House lights – 6 gang, bottom.

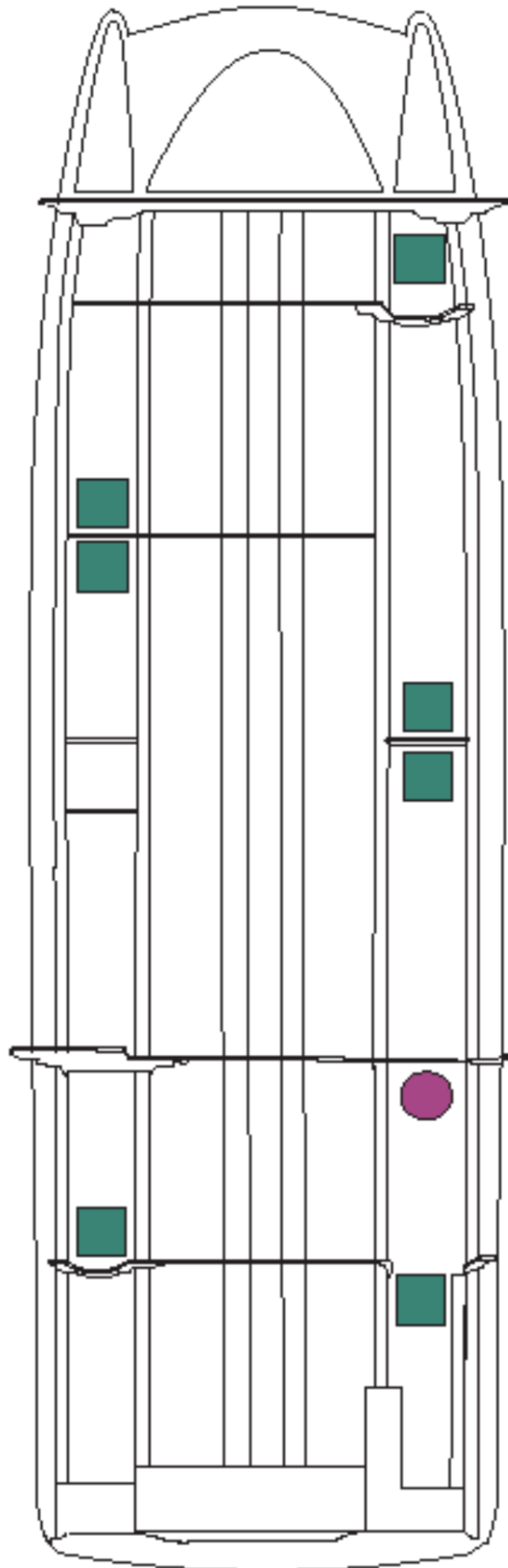
The black box to the right of the helm is a Blue Seas dimmer for dash lights. Fuses are from 3- to -20 amp, most are 5- to -10 amp.

400 watt 12V to 120V inverter for laptops and for charging phones.



**Note:** There is a Carbon Monoxide detector under the edge of the bed.

# BILGE PUMP DIAGRAM





# LENCO TRIM TABS

The C100 is equipped with large trim tabs. The tabs are primarily used to trim the boat for maximum efficiency and comfort while cruising. Due to their size and positioning, they can lift a great deal while creating very limited drag.

Typically, after setting for a given throttle RPM, you will level and trim down to find the maximum speed for that RPM. If the seas are choppy you may find that less trim is a softer and drier ride. Use your discretion. I find that in 0 – 12” seas full tabs are most efficient and a good ride. In 12 – 24” seas, you will need to reduce tabs to 2 / 3 or less and let the bow float through the seas. In larger seas you may find no tab is best. Please note your best ride in heavy seas will often be at 14 – 17Kts. If the boat is bouncing or thumping, try something different.

## Full Tabs:

Used for 0-1' seas: 14-17Kts



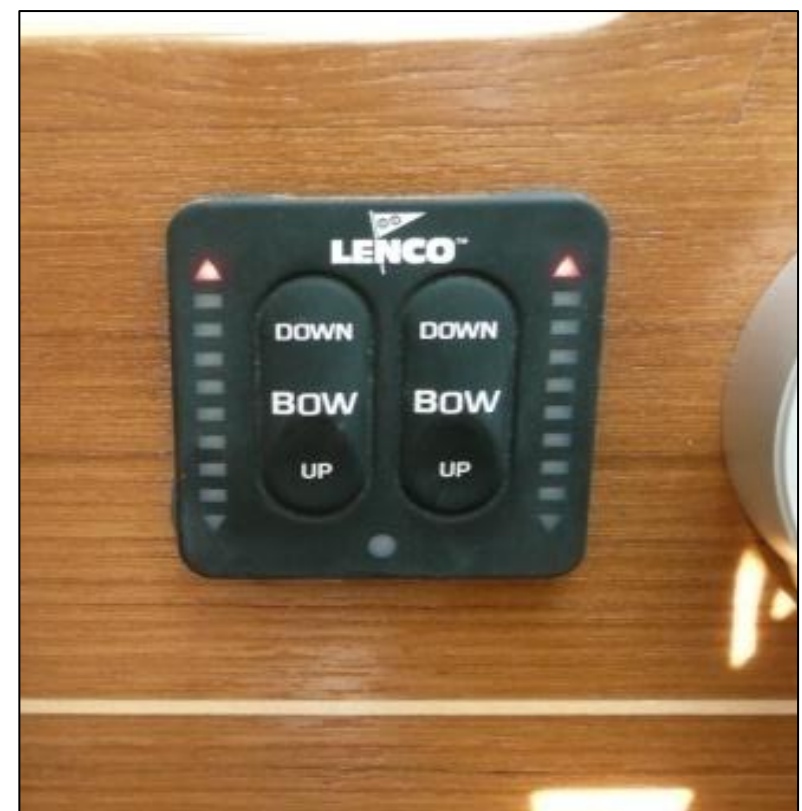
## Half Tabs:

Used for large seas: 14-20Kts



## Zero Tabs:

Used for large seas: 14-20Kts



**Full Tabs** is also used when there is excessive weight in Stern for best efficiency

**\*Note:** Retract tabs when not in use to protect actuator shaft from marine growth.

# GETTING READY TO GO

Before getting under-way, there are key things to do and check:

1. Check all safety equipment, bilges, machinery spaces, and service points.
2. Turn on remote battery switches at the helm. Check voltage on the House & Engine Start batteries & make sure you have adequate voltage on all systems.
3. Check all seacocks & make sure they are in the open position. If handle is parallel to the valve, it is open. If the handle is 90 degrees to the valve, it is closed.
4. Check tank capacity levels. Fill water tanks (port, starboard, cockpit fwd walls) & fuel tanks as needed. Be sure water is good – taste it! During long inactive periods, add a little chlorine to keep the water fresh. **Note:** Fuel & water are your heaviest loads. Take what you need plus a good safety margin.
5. Check engine & generator fluid levels and top off as needed.
6. Start Engine. Allow to idle while checking all of your gauges and make sure you have proper readings according to the Engine Manufacturer Specifications.
7. Always remember to follow safe navigation practices.



*Switch on engine blower*

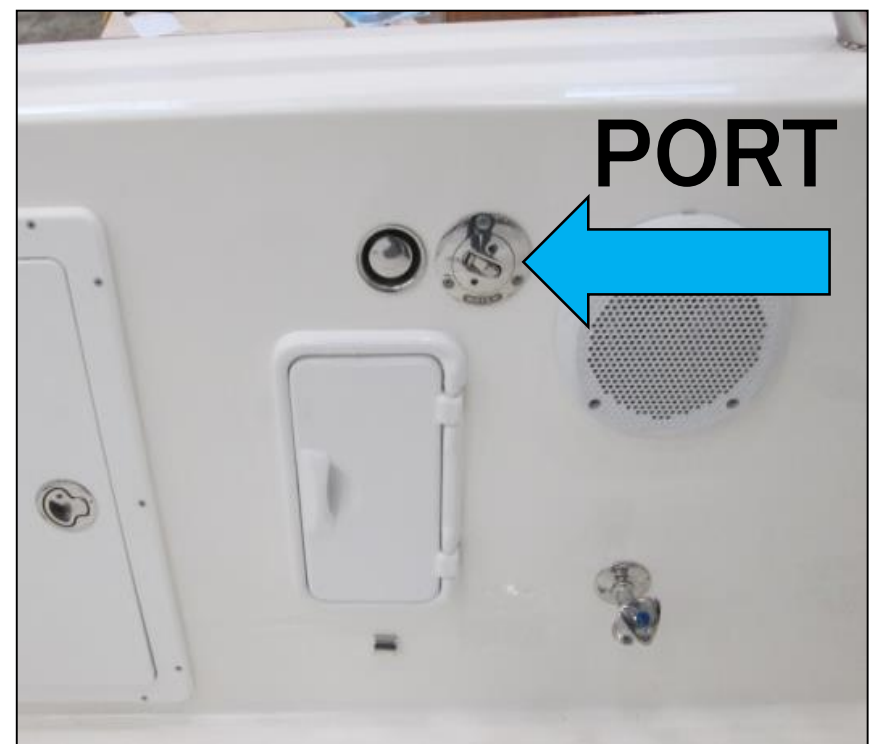


*Switch on refrigerator,  
Lower left DC panel*

**NOTE:** switch fuses are behind cover plate



*Stow fenders, dock  
lines & kicker motor  
in aft compartment*





# GETTING READY TO GO: THRUSTERS, RADIO & WIPERS



**Thrusters:** These side power units are very handy while docking.

**Caution:** *Be certain no one is in the water near the boat when the thrusters are on. The thrusters work like a vacuum, sucking from a large area.*

To use, ensure battery switches are on, then press both ON buttons simultaneously. A green light will illuminate signaling the joy sticks are ready. Press bow stick left and boat will go left.

Use in 5 – 10 second bursts and never for more than one minute of continuous use to make sure motor keeps cool. Unit shuts off automatically after three minutes of inactivity.

A wireless remote is available for solo docking.

**NOTE:** *When using thrusters make sure inverters are off. Otherwise, the low voltage alarm will ring on the inverter. Thrusters use a lot of voltage and may even cause low voltage on the chart plotter.*



## GARMIN VHF Radio

Turn on by rotating top right knob. Most conversations with other boaters will be on low power. Channel 16 is used only for hailing. Switch to Channels 72 or 68 for other communication. Weather information is available by pushing the WX button. Use the lower knob to squelch background static.



## Wiper Motor

The controls are on the left side of the dash. The wipers have two speeds. Push the control to wash. Wash tank is located in the back corner of the storage bin, behind the refrigerator, under the helm seat. You will have to remove safety gear to gain access.

Rain-X works great on front and side windows to aid in visibility.



# GETTING READY TO GO: ENGINE & SAFETY GEAR



**Starting Engine:** Once batteries and blower are on you can start. Hold Key Fob flat with square edge toward key box and pass down over box. A green light will come on solid, then push start button after fuel pressure pump has stopped humming. ***Important:*** you must warm the engine up slowly at RPM's under 2000 over a 10–15 minute period. DO NOT go above 2000 RPM until motor has reached **176 degrees**. 80% of engine wear is while motor is cold.



**Engine Computer:** The engine computer is very useful as it allows you to view engine data. Toggling the propeller button allows you to scan various details. It is fine to push the boat and horizon buttons for additional information. Oil pressure while running will be about 90 PSI and water temperature will be about 176 – 180 degrees.

**NOTE:** If you hear a horn or beeping sound while underway you must stop and determine the cause. Engine manuals can be found under the helm seat in a black brief case.



**Safety Gear  
Storage/Owner  
Manuals**



# GETTING READY TO GO: GARMIN CHART PLOTTER

To start the chart plotter, locate the power button at the top right of the unit. Press and hold the power button for three seconds. The unit will start in approximately ten seconds.

1) Press “Charts”

2) Press “Navigation Charts”

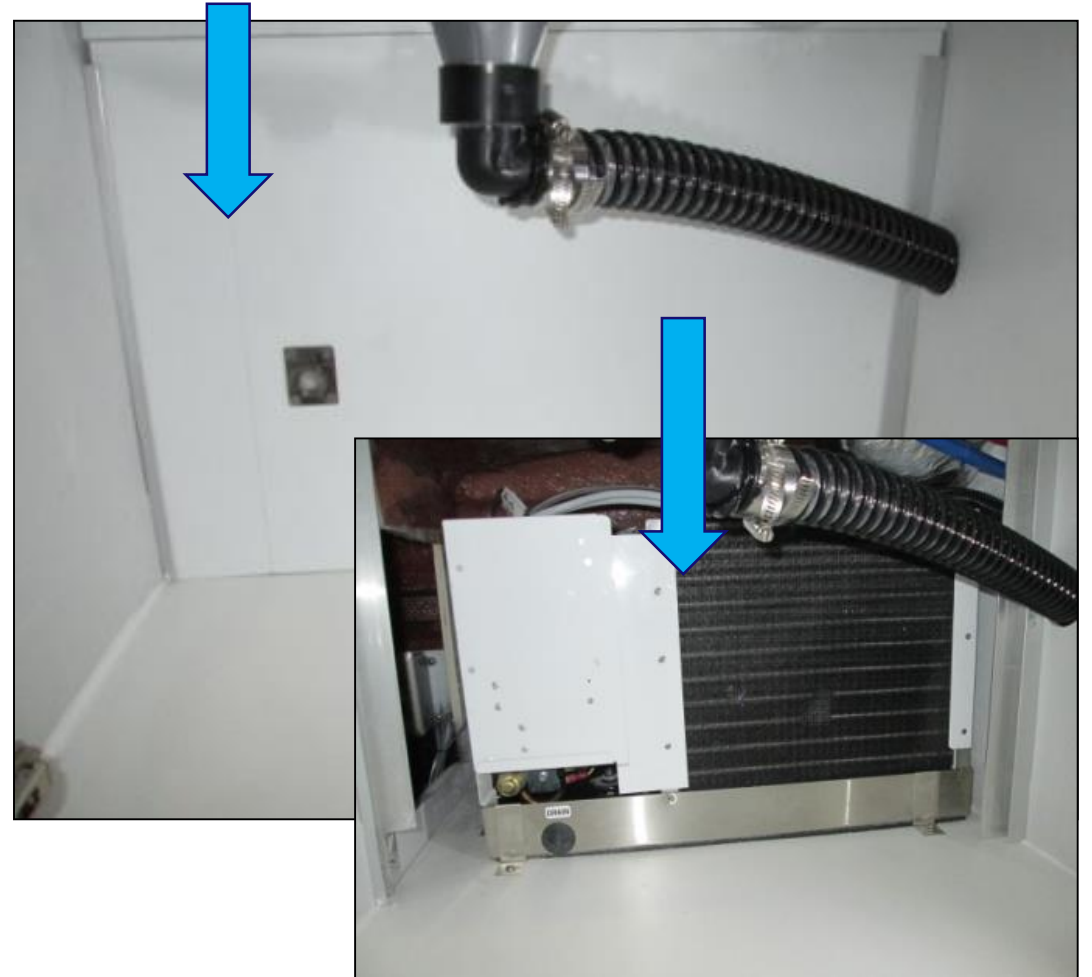
The screen will display chart and data fields. To zoom in, press the + key; to zoom out, press the – key. To change the page to sounder, press the home button and toggle to the desired page.

**NOTE:** *To dim the unit at night, tap the power button and use the active button to adjust light level. You must turn the light level back up when done or the screen will be black the next day, making it difficult to see the buttons.*

**GARMIN HELP LINE #1-800-800-1020**

# AIR CONDITIONING UNIT

The unit is located under the sink.



## Quick-start Operations Checklist:

- 1) Ensure seawater-intake ball valve is open.
- 2) Make sure the control is powered off.
- 3) Turn on the air conditioner circuit breaker. If the seawater pump has it's own circuit breaker, turn that on also.
- 4) Turn the control ON.
- 5) Press the Fan button. Verify that the fan is running and that there is steady airflow out of the supply-air grille.
- 6) Select a temperature set point lower than the current cabin temperature. This starts the compressor and seawater pump.
- 7) Check for a steady solid stream of water from the overboard discharge.
- 8) Verify that there is a steady airflow out of the supply-air grille.

For more specific operation instructions, see your AC Unit owners manual for further detail.

The vents are located in the salon, at the dash and in the master stateroom.

Do not block the flow as this will overheat the unit and cause it to shut down. There is a boost fan for defrosters. It can be switched on at the DC panel to the left of the helm. We have found that at times it may shut off after 4 – 6 hours on the lowest flow setting. To reset, trip the constant hot power breaker in the engine room and then turn breaker back on.

**Note:** *If a vent is not flowing, remove the grill and twist the inside valve open.*



# LEWMAR WINDLASS



The Lewmar Windlass is mounted on the front deck. For ease of use, it has power controls located at both the helm and front deck. The unit uses  $\frac{1}{4}$ " chain, typically 40', and 250' of  $\frac{1}{2}$ " line, typically triple-braid, that's been woven to the chain. The capstan can handle both the chain and line, transitioning automatically as the line moves through. When the line is new, it is a good idea to remove the anchor at its swivel and run the line up and down two-to-three times to clear any kinks in the line.



The windlass has a friction clutch built in to the capstan. Its tension is adjusted by turning the SS knob and tightening clockwise for more friction, counterclockwise for less friction. This is a delicate procedure, as too little tension causes the clutch to slip when lifting under-load. Too much tension while the anchor is lifted can cause damage. When the anchor rode has been purchased from Aspen, it includes depth markers every 30' to aid in anchoring.



The windlass breaker is located in the master staterooms hanging locker, just forward of the bow thrusters service hatch. **Note:** *The anchor line end must be secured to the bitter end cleat in the anchor locker. Be sure to secure the anchor with a bungee or line while underway.*



# ANCHOR DETAILS

ANCHOR WITH SNUBBER BUNGEE



LINE AFTER STACKING – DETANGLE



ANCHOR DEPTH MARKERS



WINDLASS WRENCH



Use wrench to tighten/loosen clutch, capstan.

***Note:** The wrench is key to adjusting how much force the windlass pulls in with. Too tight and you will damage the roller assembly.*

***\*Used on 28' and early 32' Aspens\****



# TILT HELM & CURTAINS



The Tilt Helm lever is located under the steering wheel.



The hydraulic fluid (Teliflex) fills at the top under rubber cover.



Running attitude, 16 Kts, tabs down.



Master Curtains snap in. Each is Labeled Port/Starboard with arrow showing forward. Fold and store in headboard bookshelf.



# SHOWER CURTAIN & SPRAYER

First, set water to preferred temperature. The sink wand lifts to hanger near the door. The curtain from shelf behind door is snapped into the ceiling buttons. Dry door and shower floor when done. Door can be left open or closed while showering. The automatic sump pump under the head evacuates the water.

***Note:** To conserve water, “boat” showers are recommended. Get wet, turn off water, soap up, rinse off!*

Before leaving the boat for an extended period of time, sponge out the sump under the toilet to eliminate odors.



**Sprayer has three positions:**

**OFF**



**ON**



**ON FULL TIME**





# ENGINE & TRANSMISSION OIL

The Volvo D3 220 engine uses premium **15W-40** oil. It's best to check oil levels prior to use. Be careful not to spill or overfill. Change your oil and filter at 50 hrs, then every 100 hrs after.

Note: The engine dip-stick is located on the port side, under the emergency off button. You must snap down to lock in place or oil will blow out.



The ZF Transmission uses ATF (automatic trans fluid) oil for its gear lubrication and to engage its clutch. When you go to check the oil level, make sure the engine is warm (just after its been idling in neutral) but off. Check the oil with the dip stick pushed against the threads but not screwed into the housing. If the oil is low, the clutch will drop out and the boat will stop. Find the leak, repair it and refill the transmission oil. To top it off, it's easiest to fill through the dip stick opening with supplied funnel. Check frequently while filling, as overfilling can damage the transmission. Change after 50 Hrs and then every 200 hrs there after, and clean wire mesh filter with each oil change.



# VOLVO D3 ENGINE BELT

## Drive Belt, Check and Change

### WARNING!

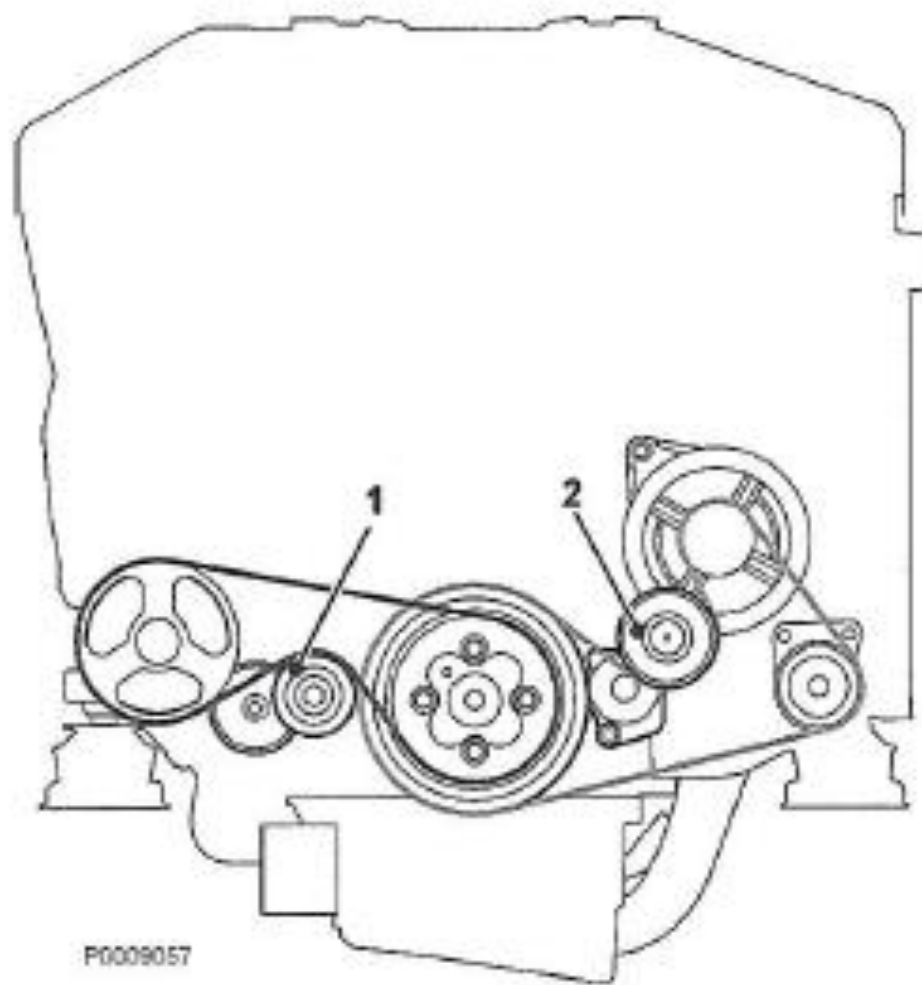
Stop the engine before doing any maintenance work.

Check belt tensions and condition regularly.

The drive belts have automatic belt tensioners and do not need to be adjusted. Check that the belt tensioner does not bottom.

### IMPORTANT!

Always replace a belt that appears worn or is cracked. Belts working in tandem must be replaced simultaneously.



P0009057

## Replacing drive belts

- 1 Remove the protective cover (accessory) over the drive belts, where fitted.
- 2 Turn the belt tensioner (1) out of the way and remove the drive belt.  
The belt tensioner can be locked in its bottom position with the aid of a screwdriver to facilitate belt replacement.  
Repeat the procedure with the other belt (2).
- 3 Install the new drive belts.
- 4 Check that the drive belts are positioned correctly in the grooves.
- 5 Replace the protective cover (accessory) over the drive belts.



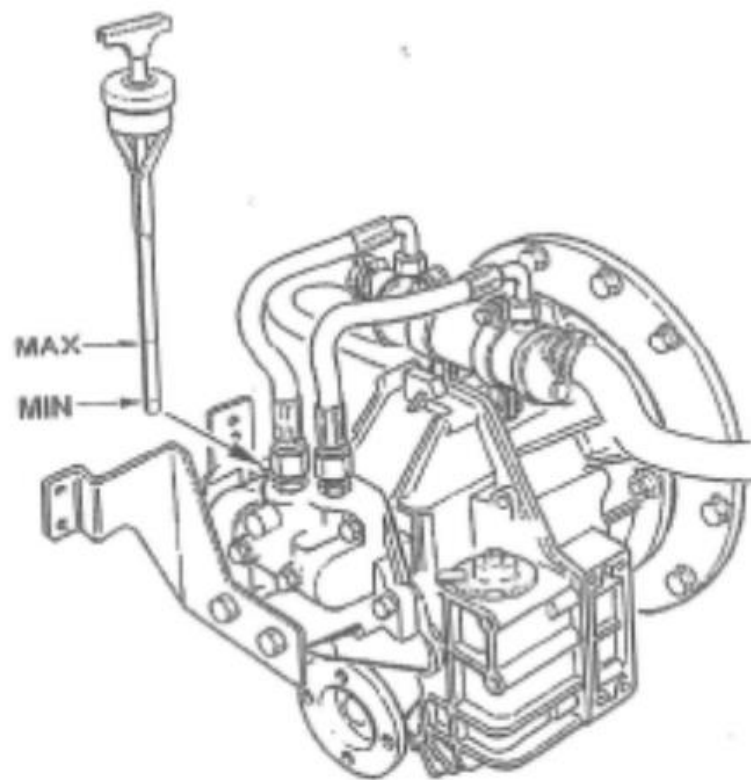
# VOLVO D3 GEAR OIL

Maintenance. Reverse gear

## Reverse gear

The HS25A/HS45A/HS63IV reverse gear is hydraulic, which means that ahead/astern engagement and disengagement is hydraulically activated. The reverse gear lubrication system has an oil filter and oil cooler. The reverse gears is equipped with solenoid valves for electronically controlled shifting.

⚠ **IMPORTANT!** Volvo Penta recommends the installation of a seawater filter to guarantee the proper coolant water flow to the engine and reverse gear. Contaminants in the seawater will otherwise foul the reverse gear radiator and other cooling system components.

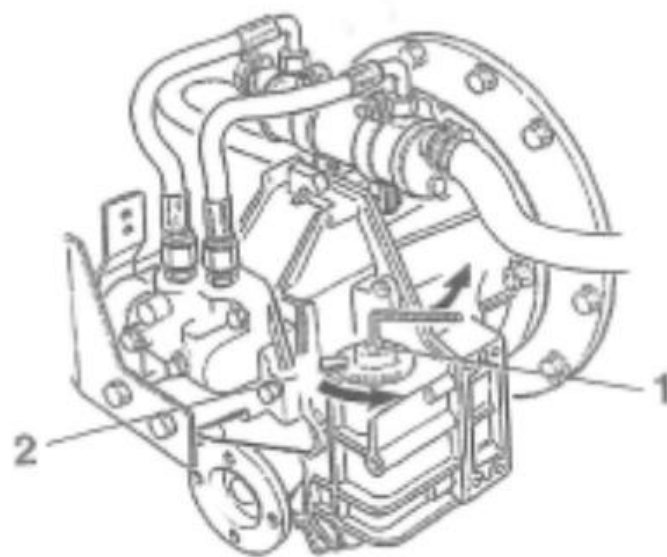


### Oil level

Start the engine and let it run a couple of minutes. Stop the engine and remove the dipstick by turning it anti clockwise. Dry off the dipstick and reinstall it in the reverse gear, **without screwing it into place**. Remove the oil dipstick again and check the oil level. The correct oil level is inside the marked area.

If necessary, top the oil up through the dipstick hole. Please refer to the "Technical Data" chapter for oil grades and volume.

⚠ **IMPORTANT!** Never over-fill the reverse gear. The oil level must always be inside or at the recommended levels.

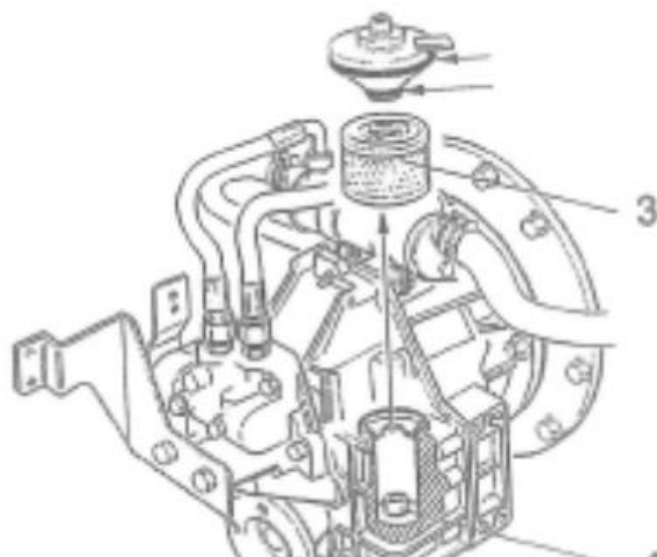


### Oil change and filter change

1. Clean around the lid, so that there is no risk that dirt could fall down into the filter housing.
2. Undo screw (1) with a 6 mm Allen key. Remove lid (2). Replace and oil in the new O-rings in the lid.
3. Lift up the filter (3).
4. Suck up the oil with an oil drain pump, via the oil filter housing. Connect hose to the suction pipe (4) at the bottom of the housing.
5. Measure up the correct quantity of oil and fill the reverse gear with the oil via the oil filter housing. Please refer to the "Technical Data" chapter for oil grades and volume.

⚠ **IMPORTANT!** Never over-fill the reverse gear.

6. Install the new filter (3) in the filter housing.
7. Install the lid. Tightening torque 5-8 Nm.
8. Put the control lever in neutral. Start and run the engine at 1500 rpm for a few minutes to ensure that the reverse gear oil cooler is filled with oil.
9. Stop the engine and check the oil level. Top up as necessary.



# FUEL SYSTEM: FILTERS & PRIMING



The **C100 fuel system** includes two filters and an electric switching valve at the dash that controls a spool valve **under the dinette**. In normal operation, there is no owner/operator activity needed other than to inspect the Racor Filters clear glass bowl for water (clear liquid). If water is present, you will need to remove the brass plug under the petcock (typically in finger tight) then drain it into a cup through the petcock at the bottom. The engine has its own fuel filter assembly but this is not typically changed as it is protected by the Racor unit. The engine has a manual fuel pump activation button on its port side fwd near the top. The Racor uses a 30 Micron 500 series diesel filter.



The **Fuel Tank Switch** is located on the left side of the dash. It is labeled Main and Aux. Main is the engine side of the tank, Aux is the port tank. Select the desired tank by pressing the switch of the desired tank. Typically you will run on one tank for 2 hours and then switch so the tanks drop equally while underway. Each tank holds 40 gallons, with approximately 36 being usable. With full fuel and running at 14Kts, you should have approximately 14 hours of running time. This switch also swaps the engines fuel return lines at the same time.



# RUDDER BEARING, PACKING GLAND & SHAFT SEAL



## **PYI Shaft Seal**

It is maintenance free and water cooled from the raw water off the engine. This should be inspected with each oil change for leaks. If it is ever removed, it's critical to use new, sharp, cup point set screws with lock-tight and to preload spring to correct tension.

# RAW WATER BALL VALVES

There are two raw water valves on the boat. Both are located in the Starboard Lazarette. The smaller valve (1/2") is for the head & the aft deck wash down. The larger one (1.5") is for the engine.

Both valves should be left on while running the boat, as closing the valves while running the boat will damage the engine and impellers. Be sure to close valve when cleaning the raw water strainer.

Raw Water  
Valve OFF



Raw Water  
Valve On



Engine Cooling  
Water Ball  
Valve OFF

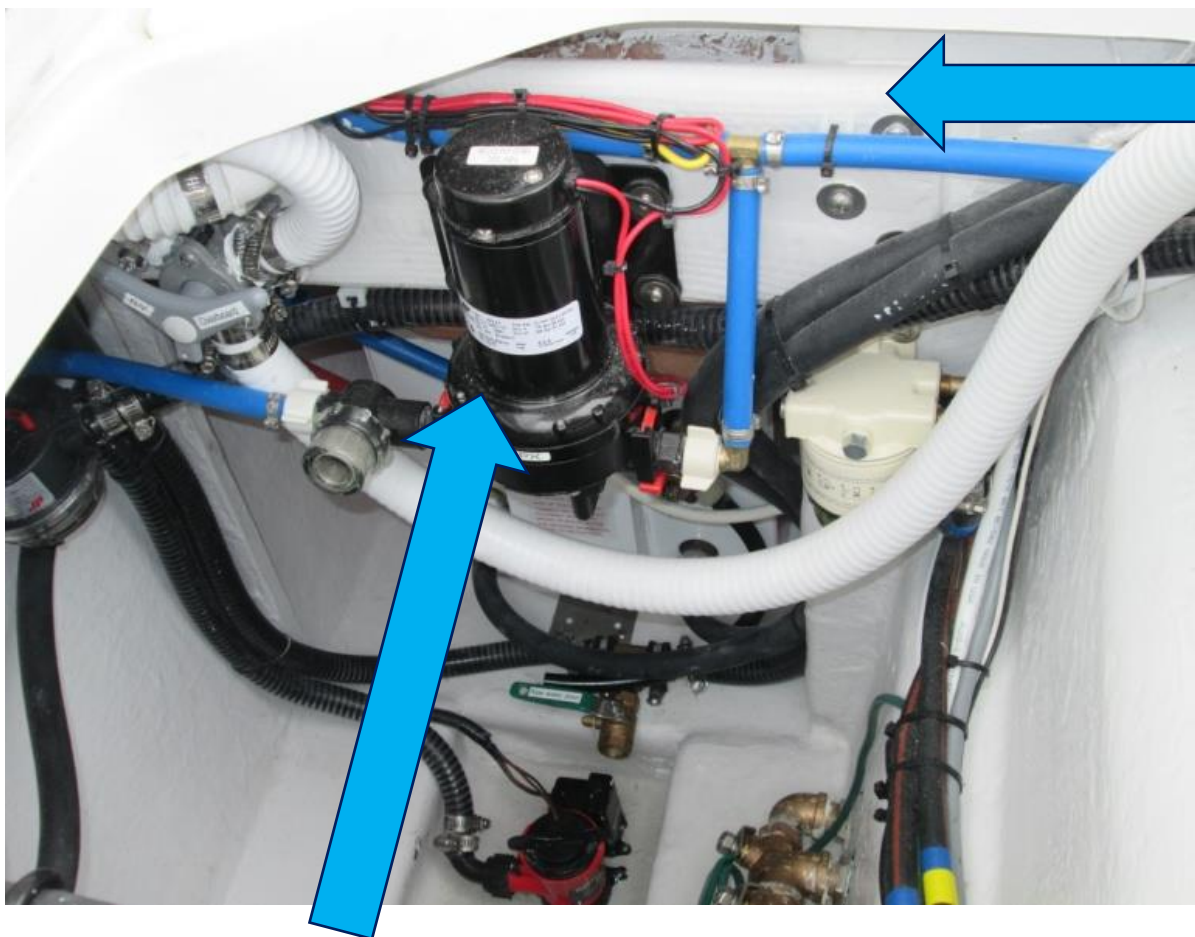


Engine  
Cooling  
Water ON





# PORT LAZARETTE EQUIPMENT



**6 Gallon Seaward Hot Water heater** SS is located in the hull under the port fish well. It runs on 120 V while at dock. Note it draws 1800 watts so you will not be able to run large additional loads while water heater is on. Switch its breaker on only when hot water is needed. While cruising the engines hot water is plumbed through the heater to heat water.

## **Pressure Water Pump & Strainer**

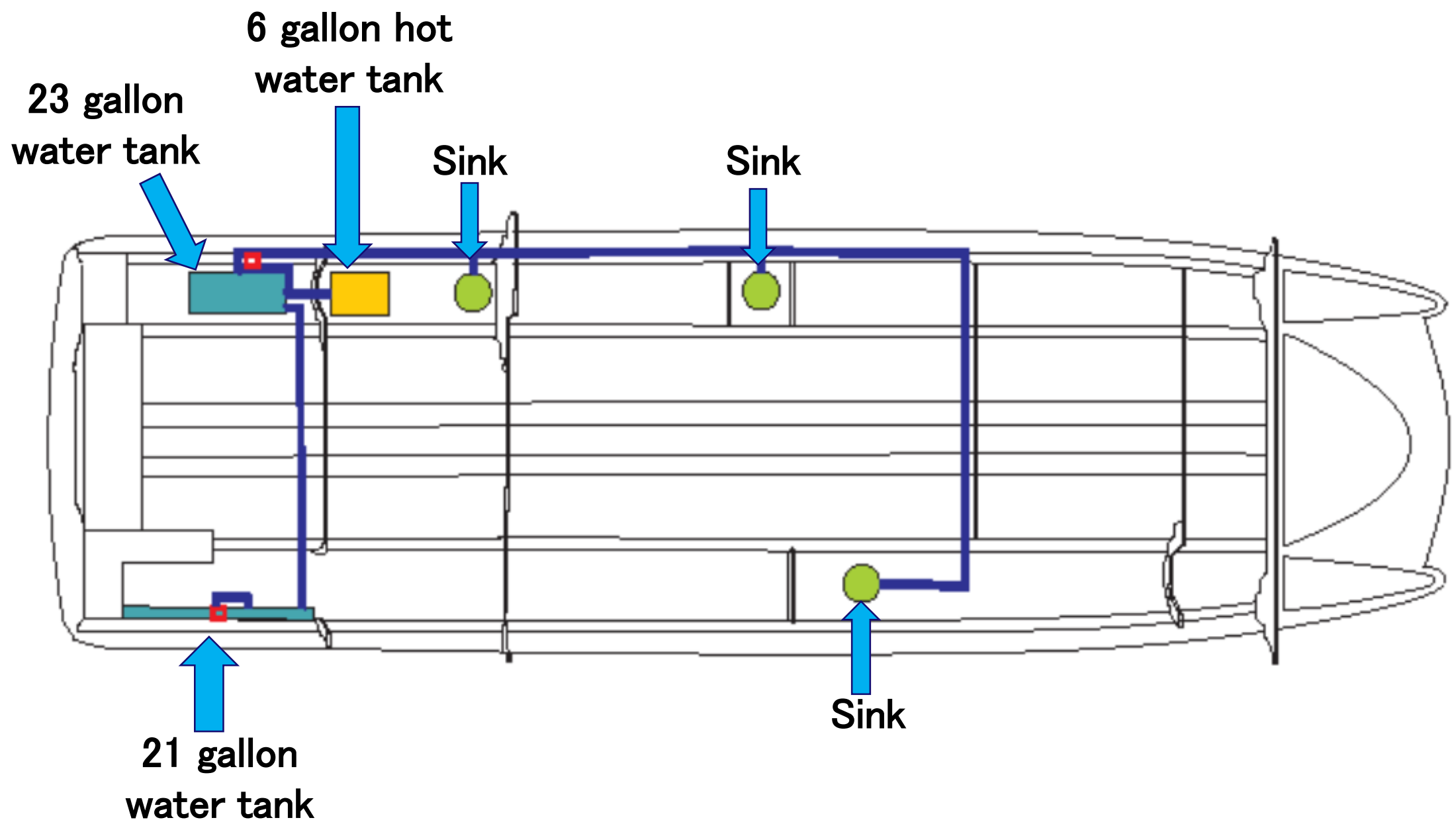
The C100 has two water tanks (24 gallons port side and 26 gallons Starboard side) each has a dedicated pump. The fresh water pump switch is located on the dashes lower DC switch panel. Two tanks are provide so owners can use water to trim the boat port to starboard if needed. Water like fuel is a heavy cargo, top off only if you need it. Water Tanks must be drained and system primed with RV antifreeze during winter storage.



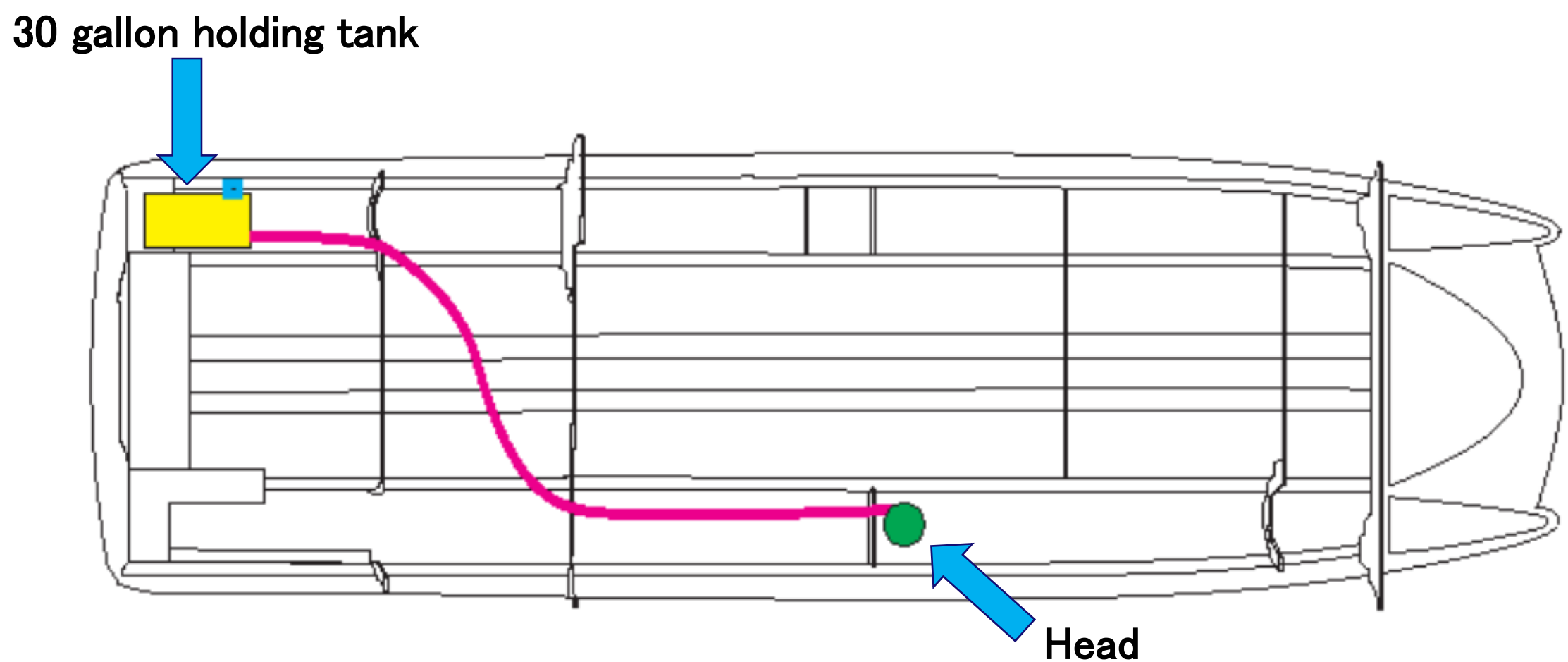
**The black water holding tank is a 28-gallon tank.** It is equipped with a Wema sensor gauge system located to the right side of the dash. If the tank is full the head will not flush. You must be three miles offshore and in an area with current that will flush to use the macerator switch at the dash. The tank can also be emptied at a pump-out station using the fitting near the transom door. The tank includes two dip tubes so there is no Y-valve to switch.

**NOTE:** *Shut the boat off to hear the change in tone when the tank is empty. Running the pump dry will damage its rubber impellers.*

# WATER SYSTEM DIAGRAM



# HOLDING TANK DIAGRAM





# LPG TANK STORAGE & OPERATION



**Propane tank** is in the Port Cockpit storage locker. Note: Locker is plumbed with a hose to a through hull overboard so a gas leak would not enter the boat. If you ever smell gas stop—turn off valve and open boat to clear fumes. Find leak.

To use, make sure hose connection is tight, **open valve**, gauge will show approx. 90 Psi. If you hear a hissing or smell gas turn valve off ,check connections w/ soap 50/50 water solution.. 15 pound tank will typically last 2–4 weeks.



**Electric shut off valve** only comes on if gas controller by sink is on and sniffer smells no gas.



The tank must be centered in compartment to latch lid in place.

# LPG CONTROL DETECTION SYSTEM



The propane sniffer control unit is just fwd of the sink. This units power may be switched with the black switch just below it. The sniffer is very sensitive and false alarms can be disconcerting. When its off, the solenoid valve in the tank is closed. When stove is not in use, tap the control button and turn the gas off . It will take about 30 seconds before the sensor can be turned to ON position.



Green light when Power is ON, but unit is OFF.



Gas is ON when the green Light is ON.



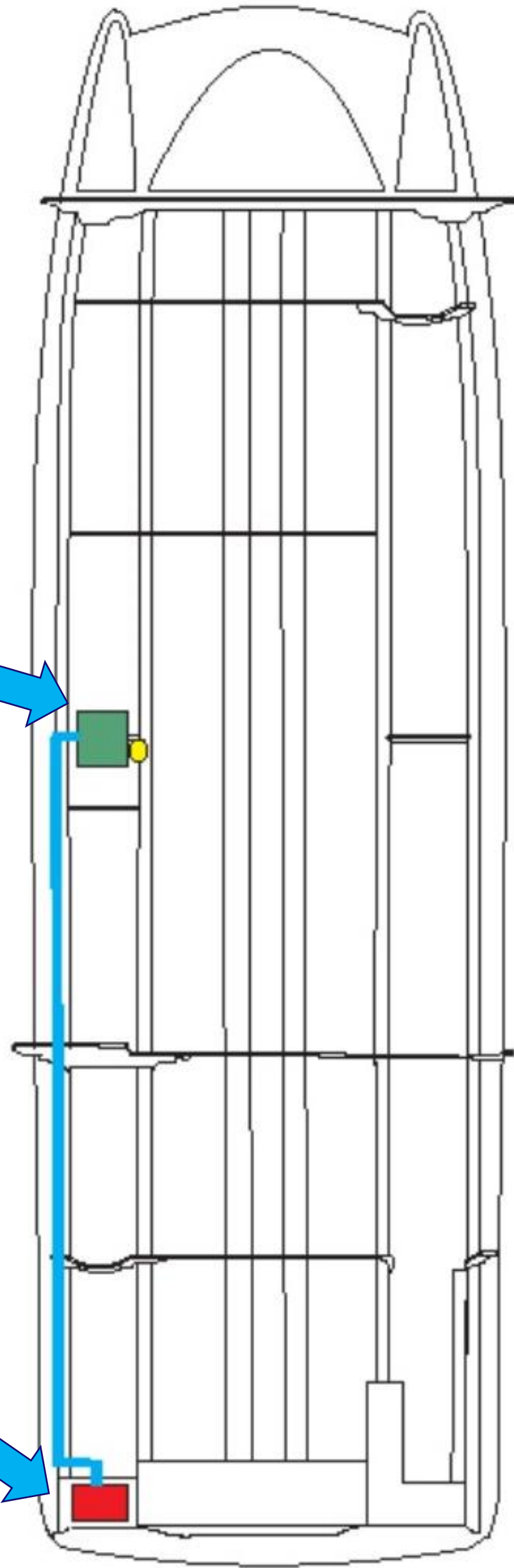
# LPG SYSTEM

## STOVE & IGNITOR

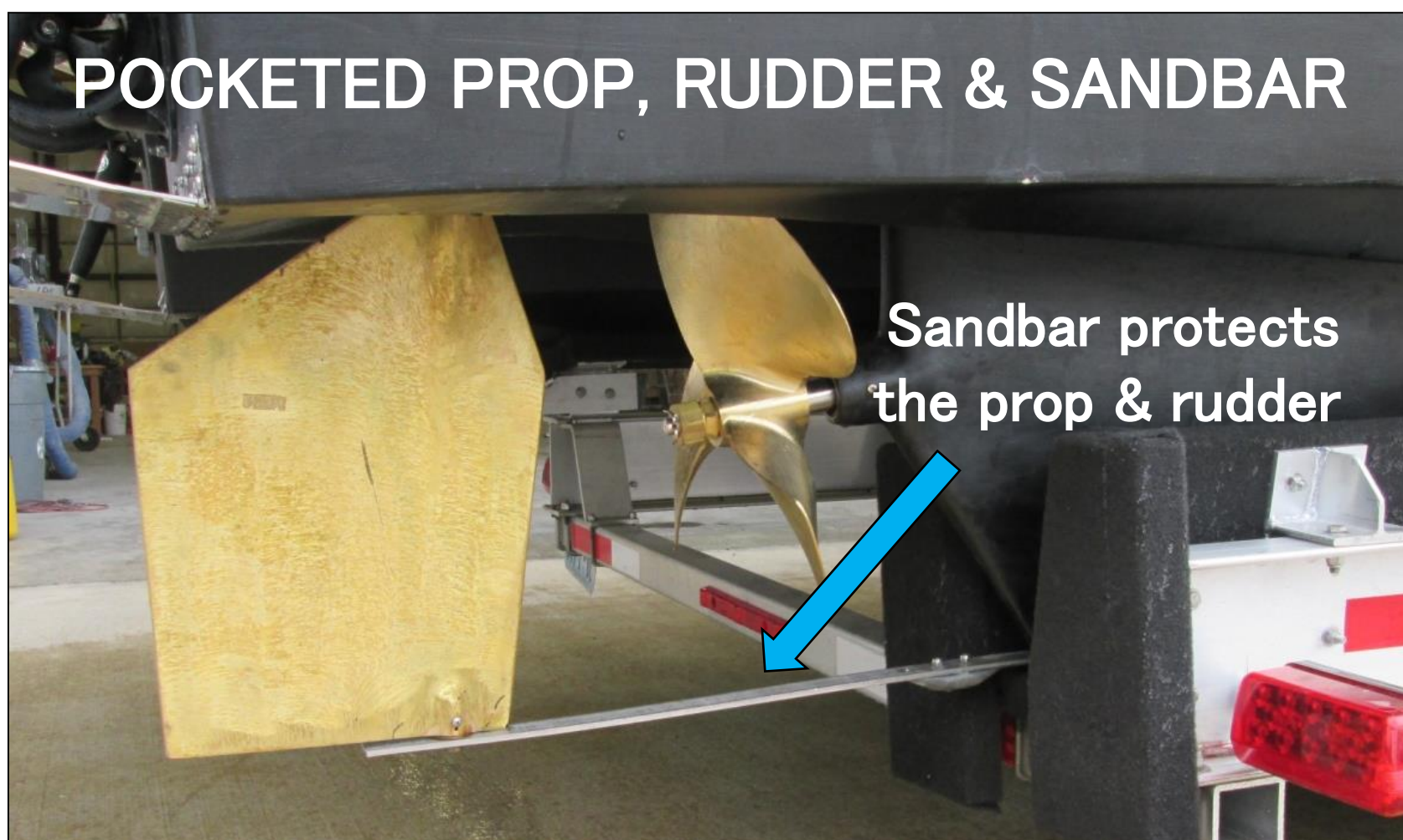
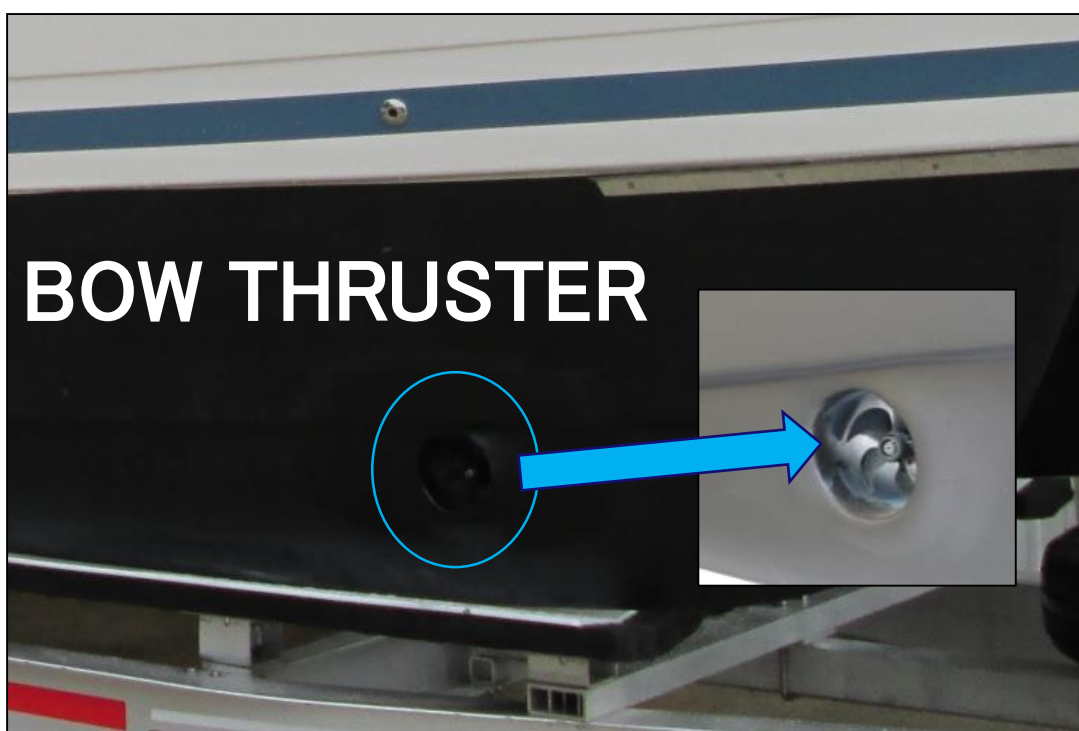
Ignitor is located in the drawer underneath the galley sink

## LPG TANK

Located in port cockpit storage locker



# UNDERWATER GEAR

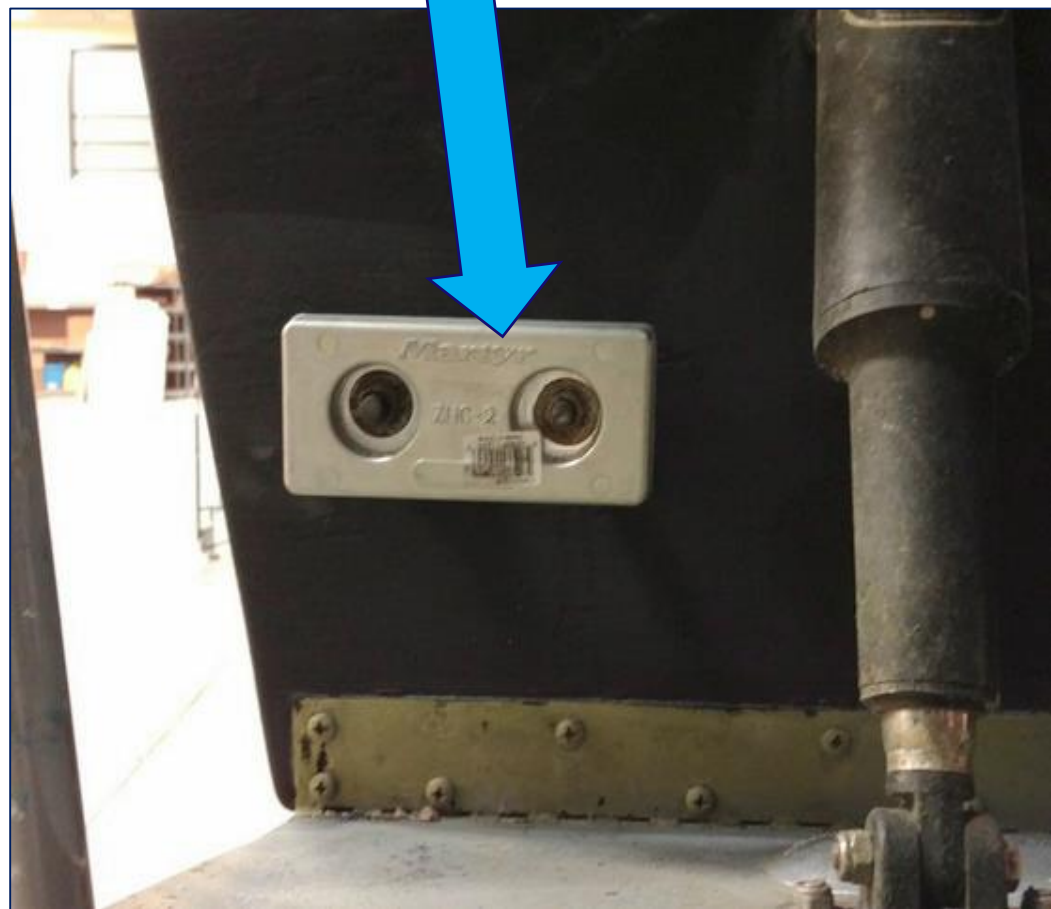




# ZINC REPLACEMENT: TRANSOM

## *MFG PART #: CMZHC2AZ*

### PORT



### STARBOARD





# ZINC REPLACEMENT: SWIMSTEP

## *MFG PART #: SL-1250*

PORT



STARBOARD





# ZINC REPLACEMENT: TRIM TAB

## *MFG PART #: CMR02*

PORT



STARBOARD

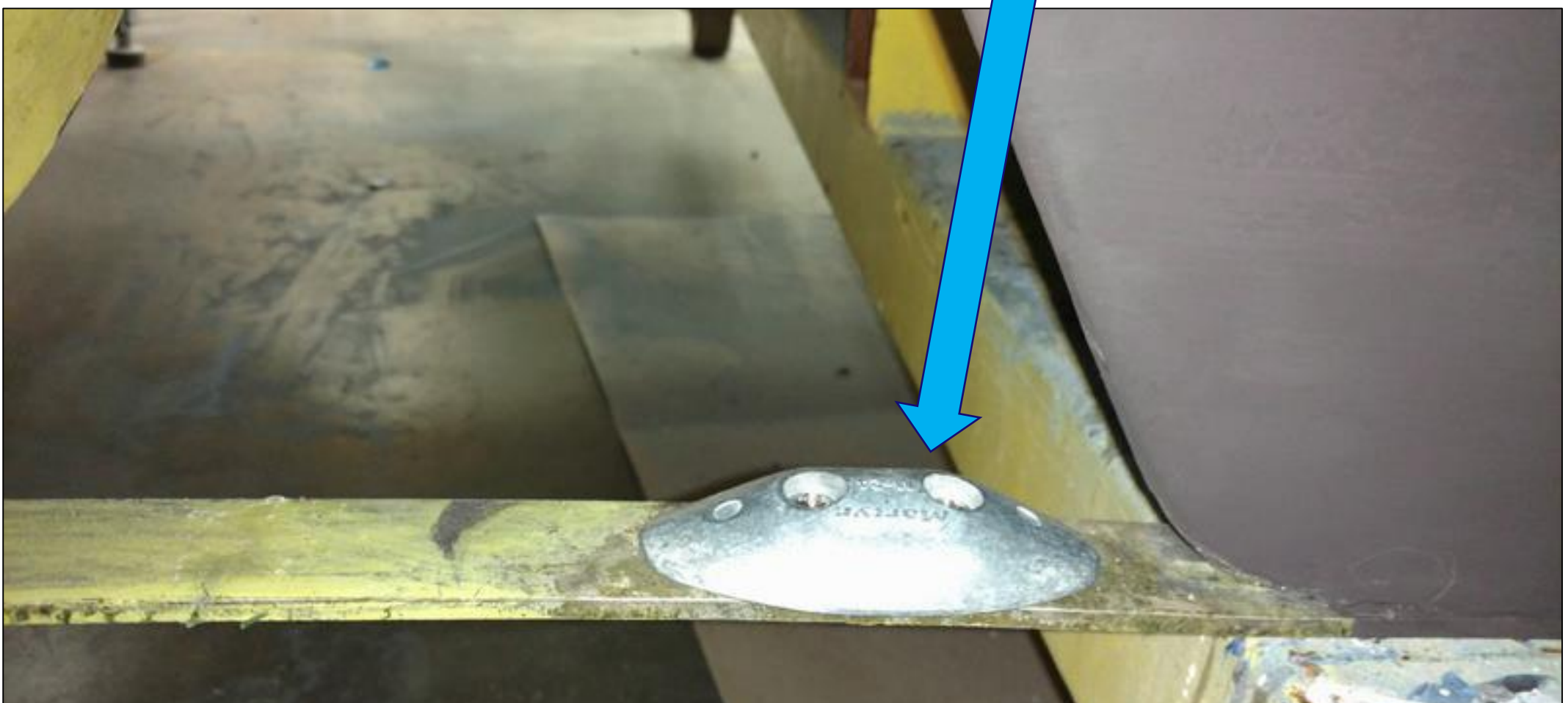




# ZINC REPLACEMENT: SAND BAR

## *MFG PART #: CMM24*

*STARBOARD SIDE ONLY*

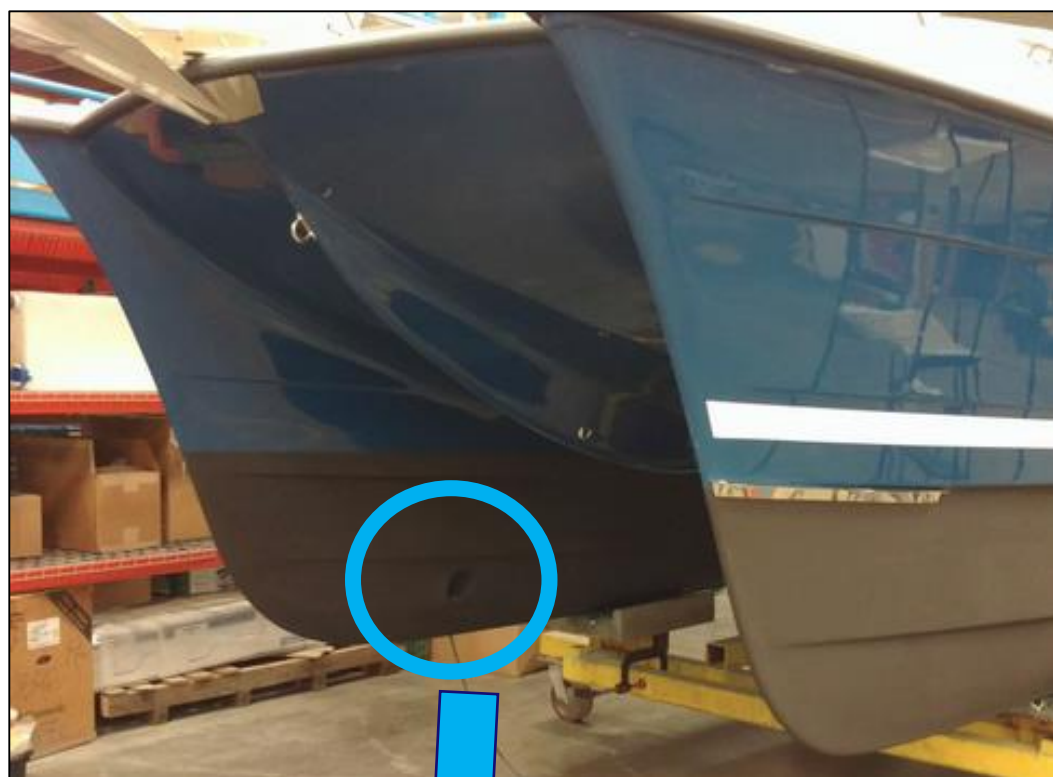




# ZINC REPLACEMENT: THRUSTER

## *MFG PART #: SM31180A*

### STARBOARD – BOW



### STARBOARD – STERN





# TRAILER INFO



Aspens Trailer is built by Float On Trailers in Vero Beach Florida. It is a 10,000–12,000 pound capacity aluminum trailer. The minimum tow truck size is  $\frac{3}{4}$  Ton. When the ball weight is set to 6–7% of the towed weight (600–800 pounds) she tows like a dream. Includes a solid winch stand assembly with stair for access while loading. Shown are the optional mag wheels and electric hydraulic breaks (nice for hilly terrain and backing up steep driveways). The design is self centering and loads under power to the winch stand.



Shown is the keel capture and guide pads to center hull as it pulls out of the water. Be sure tires are inflated to within 5 PSI of the recommended capacity. Check bearing and tire temperature with a touch at each fill up. Increased temperature is a sign of bearing problems, low air pressure will heat up the tires.

Shown are the guide bunks. On west coast ramps the tow truck tires will typically be at the waters edge. On east coast ramps which are steeper you will back in less to get the correct depth.



# FOLDING THE MAST FOR TRAILERING

While folding, be careful not to lean on the solar panel glass. Rest the support tube carefully on the SS mast, tip in to cockpit, then lift forward to corner for towing.

**NOTE:** *It is best to close the door before placing support.*

1. Climb onto Hardtop



2. Remove Pin from Mast



3. Get Support Tube Lined Up



4. Insert Pin Back into Mast



5. Carefully Fold Mast Back



6) Done





# LIFTING STRAP LOCATION

Note: If the spreader bars are less than 11ft., you will need 24" carpeted 2x6's just under the gunwales to spread the compression load from the straps and reduce damage to the gunwale rubber.



Arrows show location of the lifting straps. On the stern the goal is to lift on the keel (Fiber Glass) about 6" forward of the Stainless Sand Bar.

**Note:** Be sure to pre-load the starboard side as tension is brought up by pulling the cross bar down closer to the deck/engine load (approximately 10"). This will keep the boat level as it lifts.



The forward Sling goes just forward of the port light well clear of the thruster. The cross bar is typically level for the bow. **Note:** If you lift one end at a time to put blocks in to place the straps be sure to block the trailer frame to support it or you will bend the frame. Add pinch pads if necessary.



# BOAT HAULING PROCEDURE

## *SLINGING THE BOAT*

Pre-loading  
this strap  
down 12-18"  
will lift the  
boat level.





# ZODIAC LAUNCH

## 1. Un-clip SS support rods



## 2. Store Rods on transom clip



## 3. Tip Tender in, leave clipped to boat while mounting motor.



## 4. Un-buckle engine from aft compartment



## 5. Support Engine on swim step, step into tender and swing engine to tender and secure.



## 6. When done, rinse engine with hose before storing.



# REMOVABLE KICKER BRACKET



Be sure to put the locking pin in the kicker bracket and clamp the motor tight! Find the balance point rudder angle. Once you get it up to speed, lock the tiller clamp and steer the boat from the helm forward.

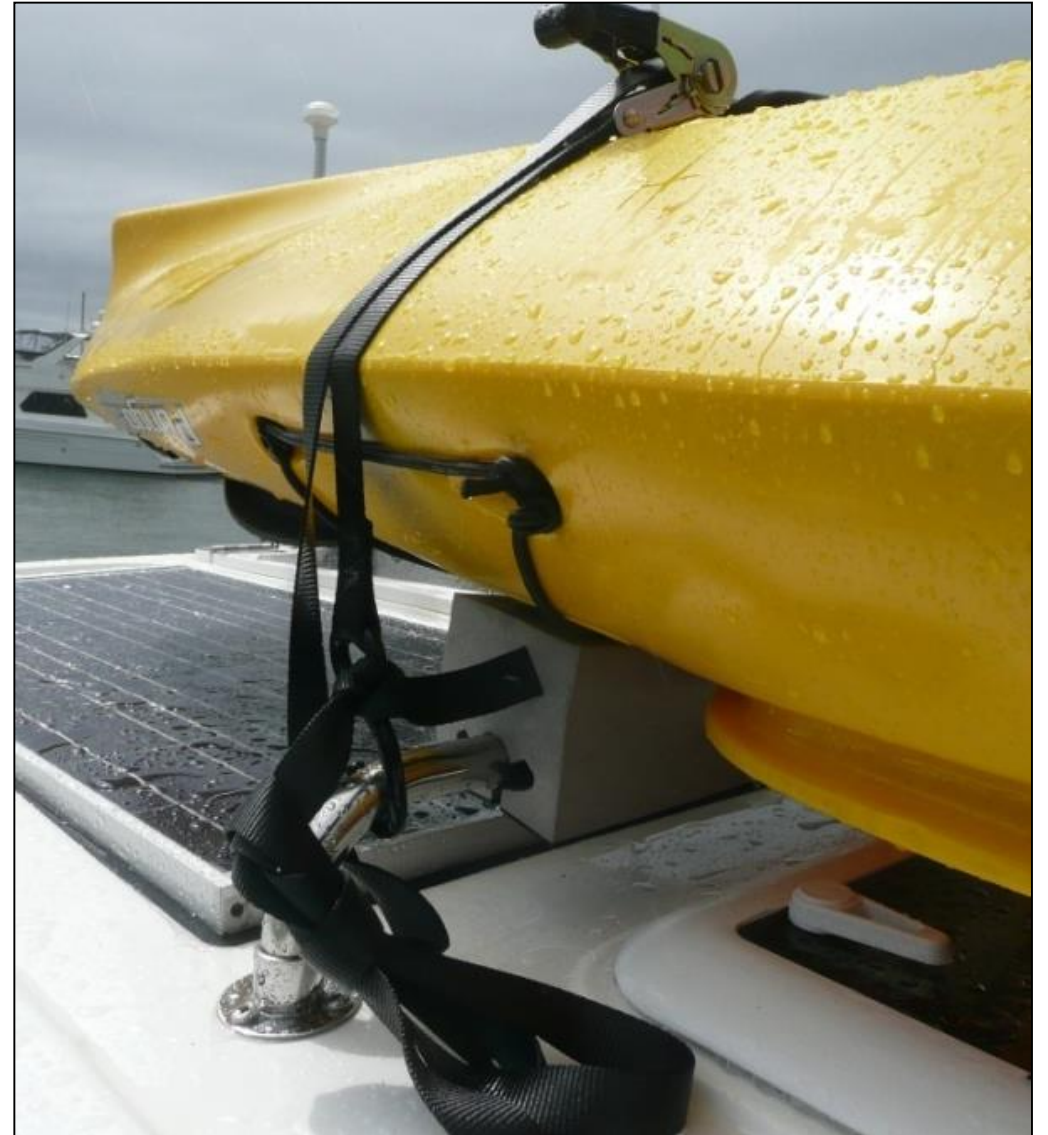




# EXTRA DETAILS



Electrical junction box is behind enclosure.



Kayak with ratchet straps and foam pad. Be sure to remove Kayak while towing.



**Tender Snubber Ling:** used for medium range towing to take wind buffeting out. For long hauls it is best to deflate the tender. The line is also used to help with lower/raise tender.

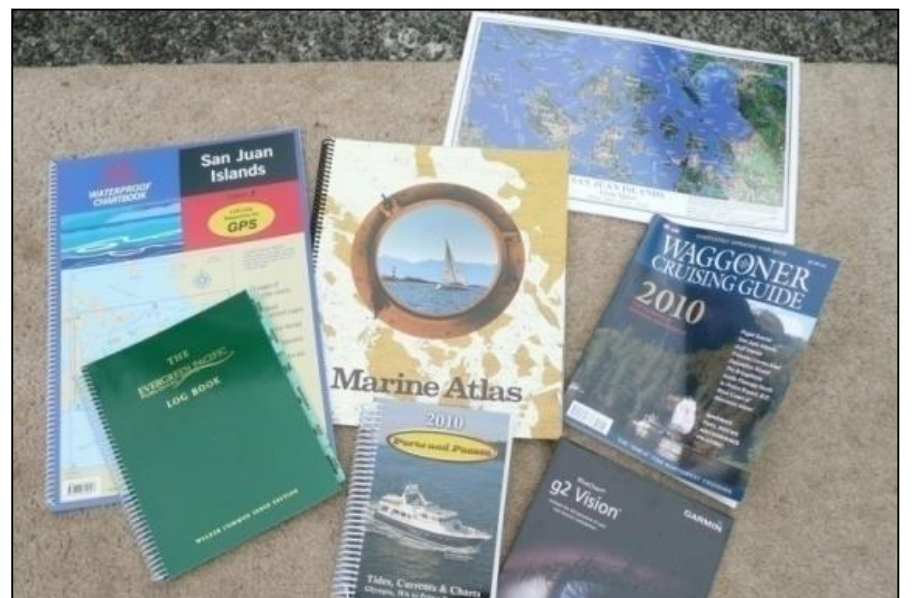


# OUTFITTING YOUR BOAT





# OUTFITTING YOUR BOAT





# OUTFITTING YOUR BOAT





# OUTFITTING YOUR BOAT



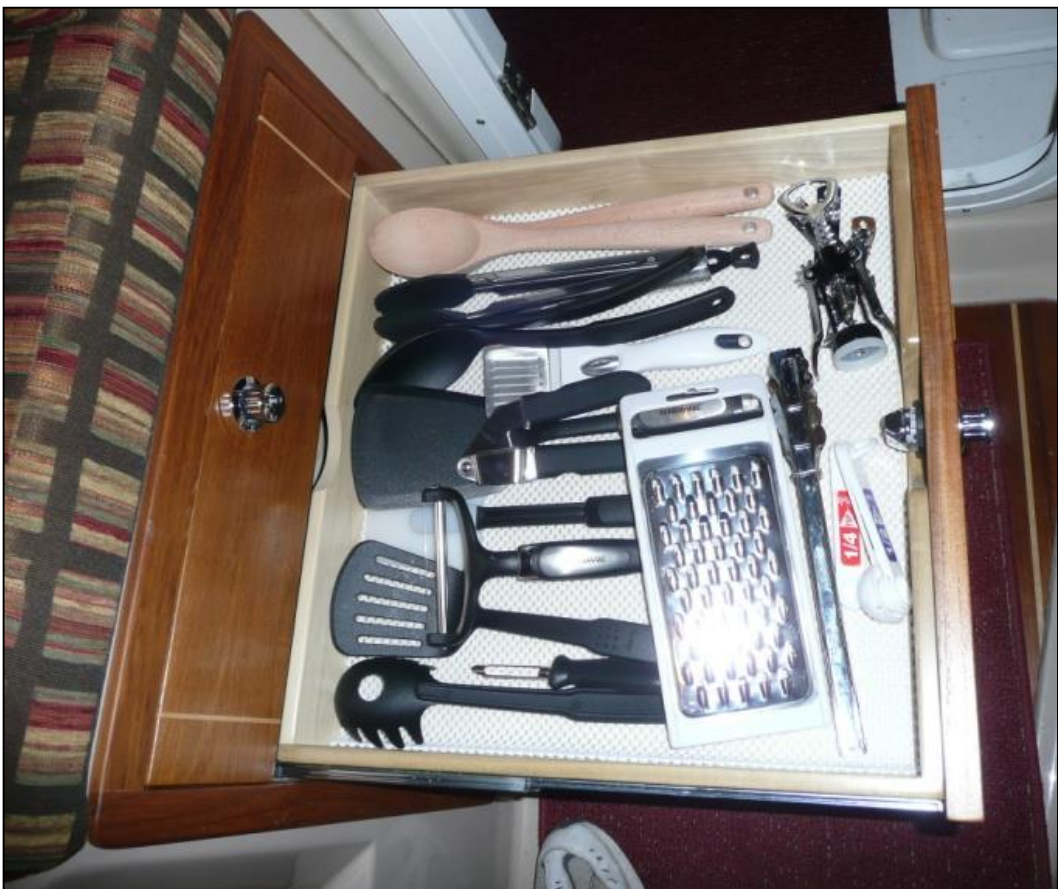
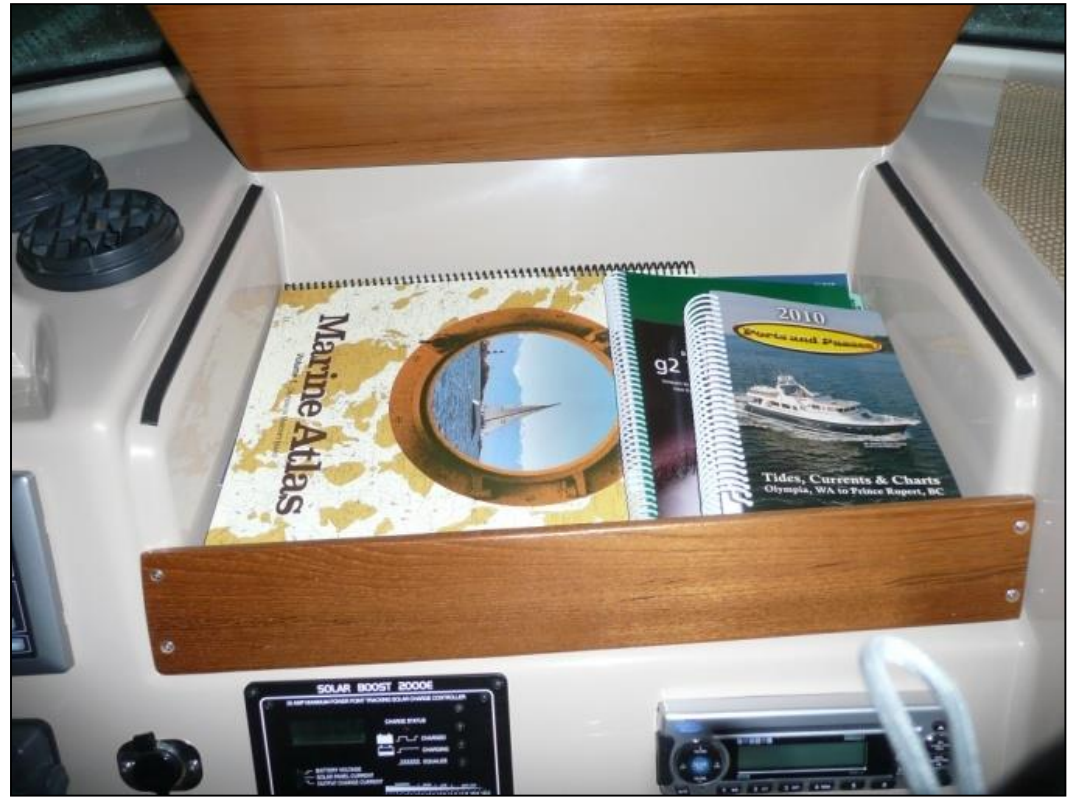


# OUTFITTING YOUR BOAT



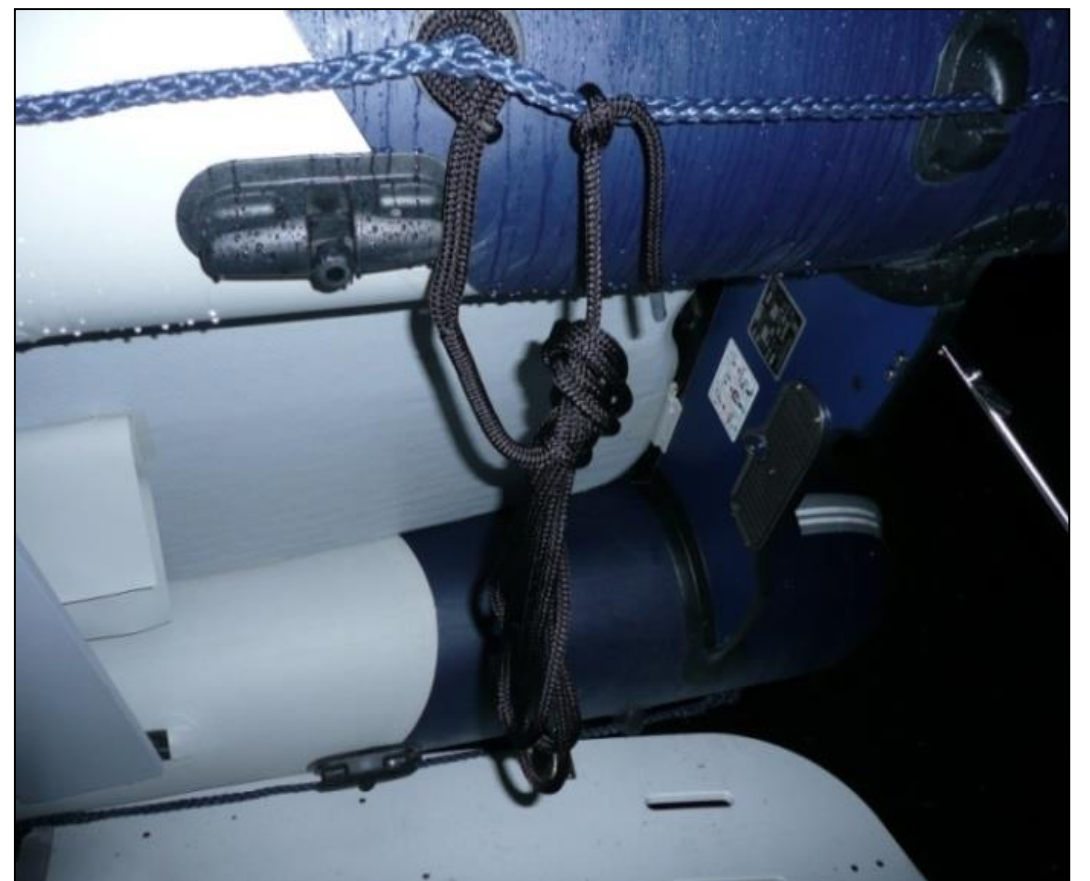


# OUTFITTING YOUR BOAT





# OUTFITTING YOUR BOAT





# BOAT CLEANING PRODUCTS



**MAGUIRE' S MARINE BOAT SOAP WITH  
WAX KEEPS THE BOAT WAX INTACT.  
GREAT FOR GEL-COAT.**





# BOAT CLEANING PRODUCTS



## **T-9 BOESHIELD:**

This is wonderful for your engine rooms metal parts, all of them, bronze, SS clamps, motor metal parts, battery connections, bonding system connections and kicker motor. Keep away from plastic, and belts. Light re-coat every 6 months. Wipe up any excess while wet.



## **303 AEROSPACE PROTECTANT:**

This material is for plastic that's out in the sun, I.E. Vinyl seats, Zodiac boats, recoat every 3 months.



## **MEGUIAR'S FLAGSHIP WAX:**

This is a premium wax that provides UV protection. Hand wax once per year in Northern climates, twice in southern. Wax both deck and hull. In the south, even the non skid maybe waxed with a brush.

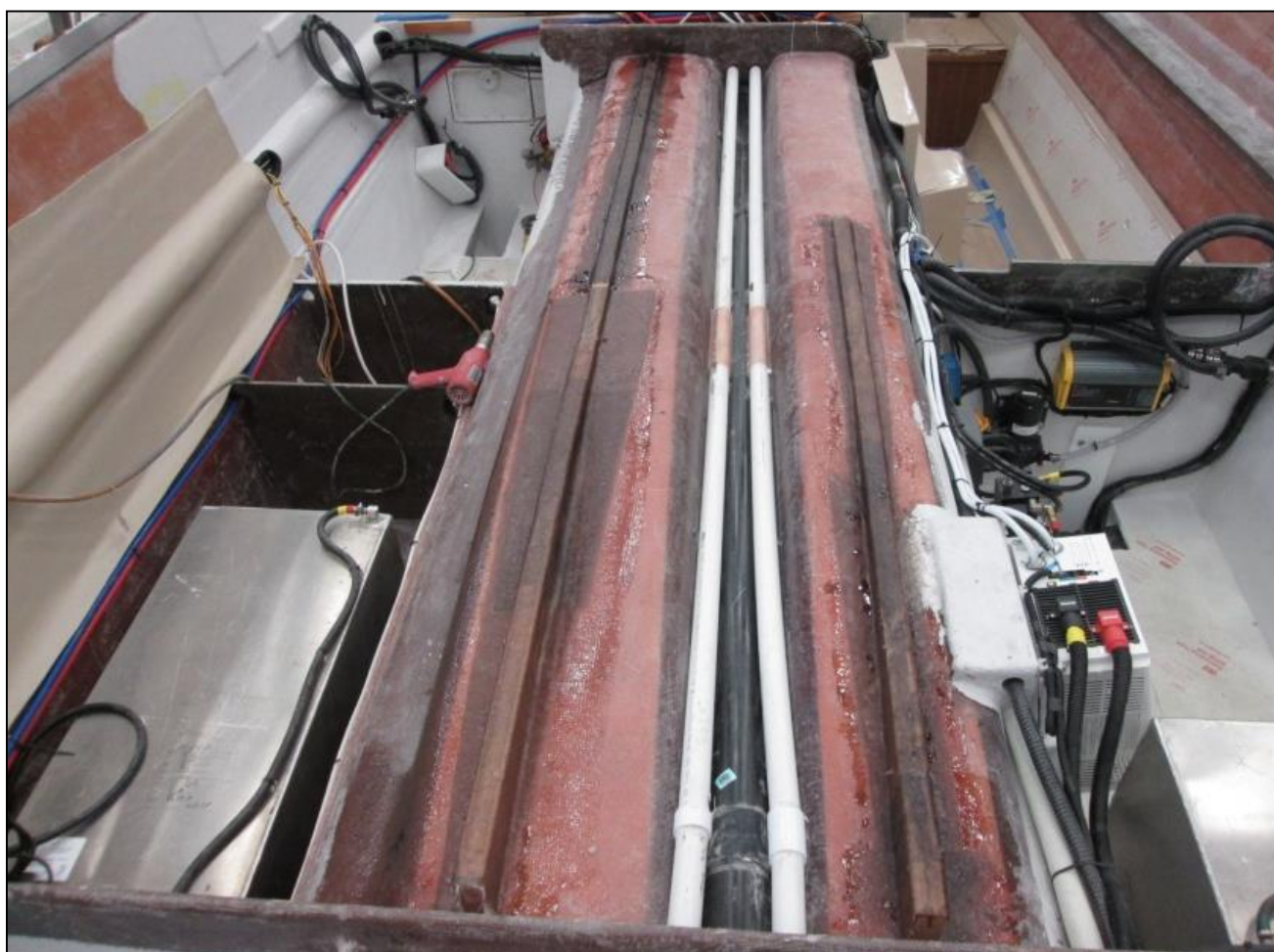


# OPEN HULL

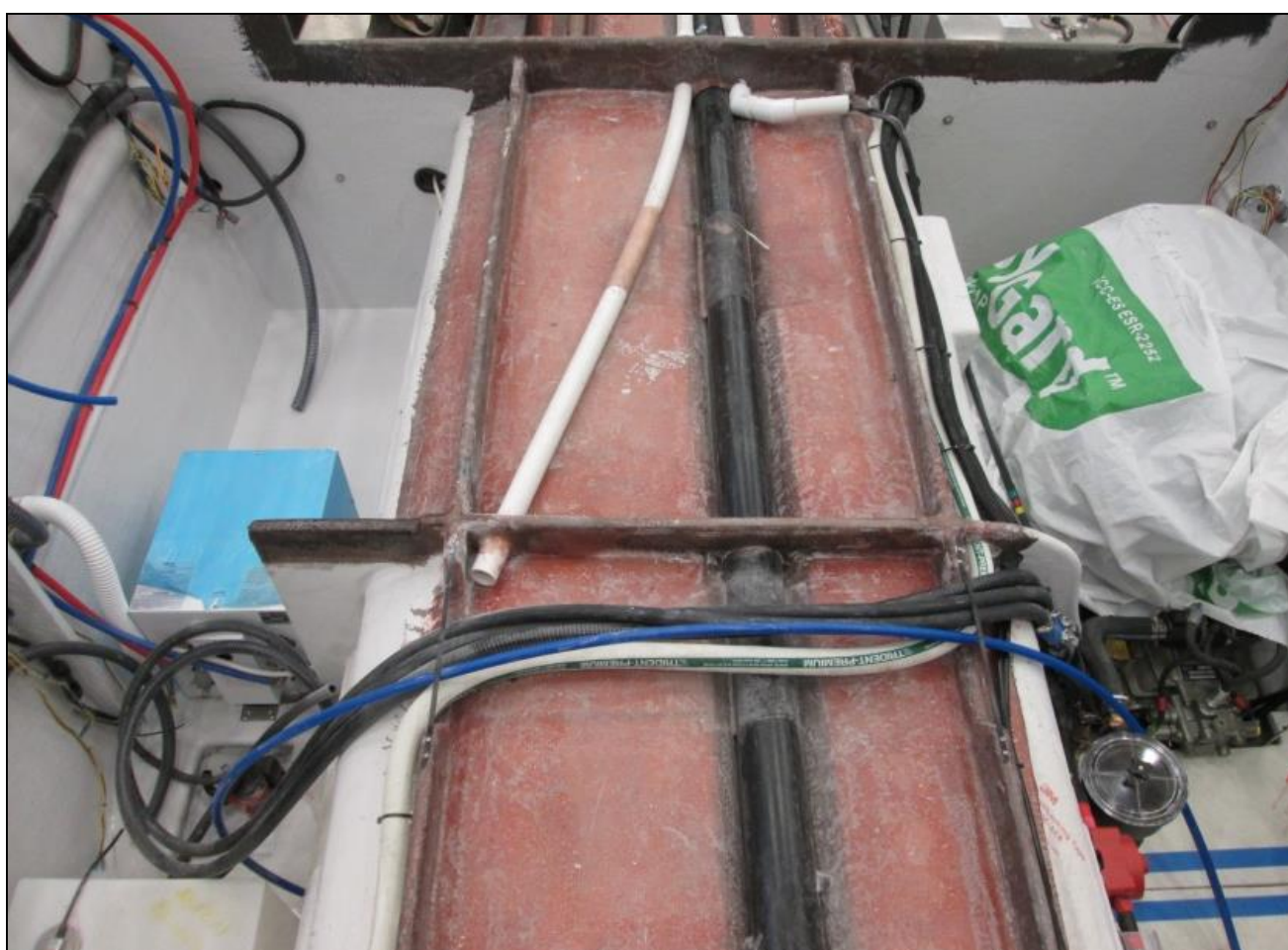
**BOW**



**MIDSHIP**



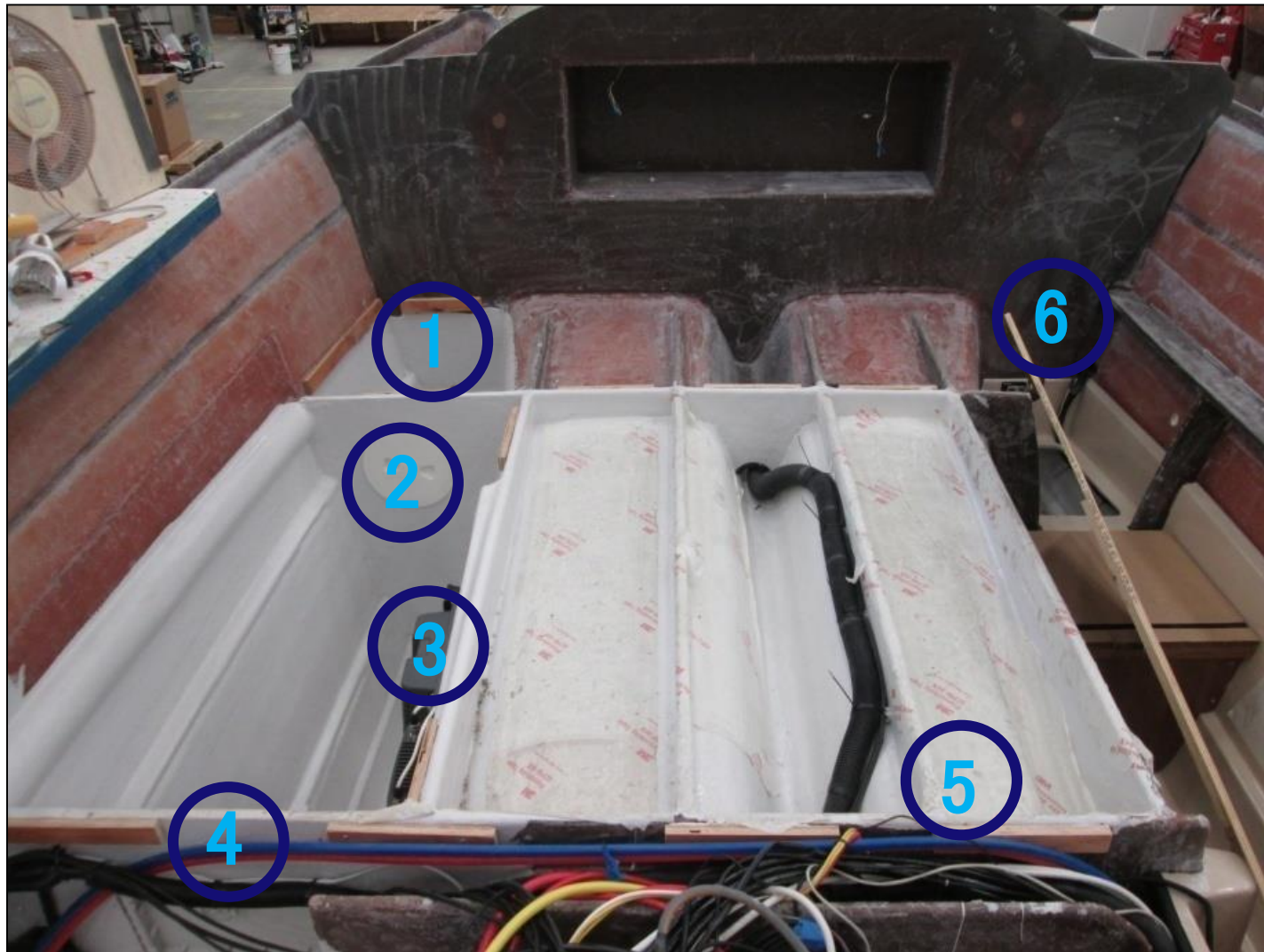
**STERN**





# OPEN HULL

## *PORT BOW*



**1** Drain Plug



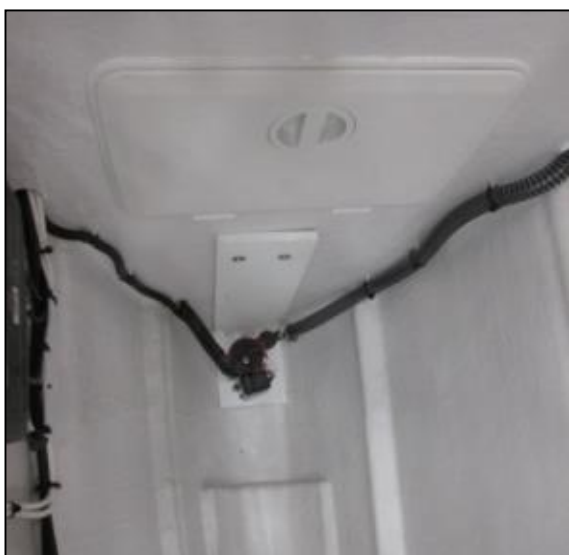
**2** Access Hatch



Optional Garmin  
Electronics/ Port  
**3** Compartment  
Under Bed



**4** Access Hatch  
/ Bilge Pump



**5**  
Optional  
Garmin Auto  
Pilot Compass

**6**  
Windless Anchor  
Breaker  
(Located in Bottom  
of Hanging Locker)



# OPEN HULL

## *PORT MIDSHIP*



- ① 45 gal. Diesel Fuel Tank
- ② Empty Compartment  
*(Sometimes houses the optional auto pilot pump)*
- ③ Compartment contains a Bilge Pump & Transducer



# OPEN HULL

## *STARBOARD MIDSHIP*

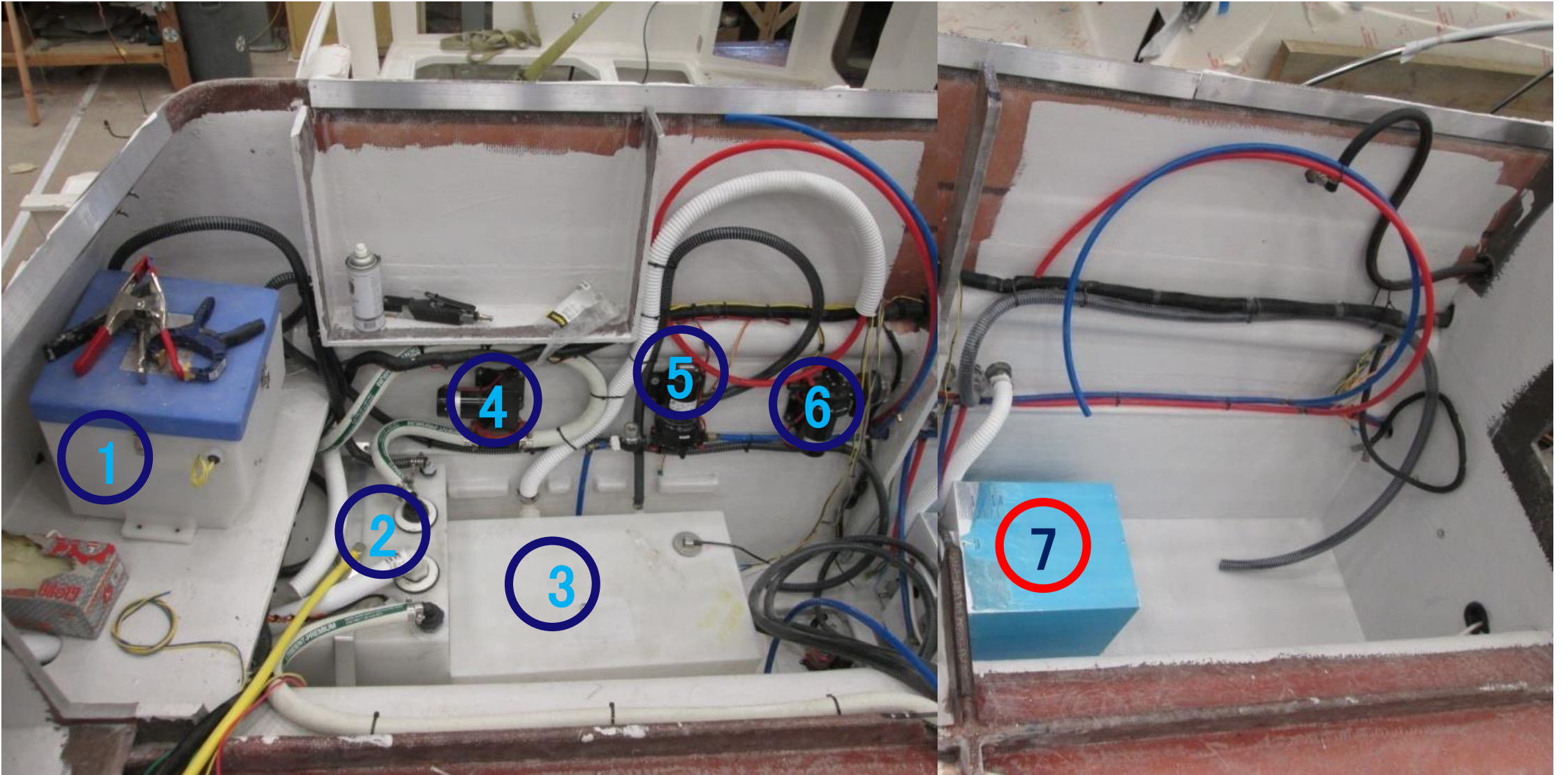


- 1** PRIMARY FUEL FILTER
- 2** FUEL TANK SELECTOR VALVE
- 3** 38 GAL DIESEL FUEL TANK
- 4** OPTIONAL 2000 WATT INVERTER
- 5** OPTIONAL AUTO PILOT PUMP
- 6** RAW WATER PUMP FOR TOILET
- 7** BATTERY CHARGER



# OPEN HULL

## *PORT LAZARETTES*



**1** Propane Tank Locker

**7** 6 gallon Hot Water Tank

**2** 28 gallon Waste Tank

**3** 23 gallon Water Tank

**4** Macerator Pump

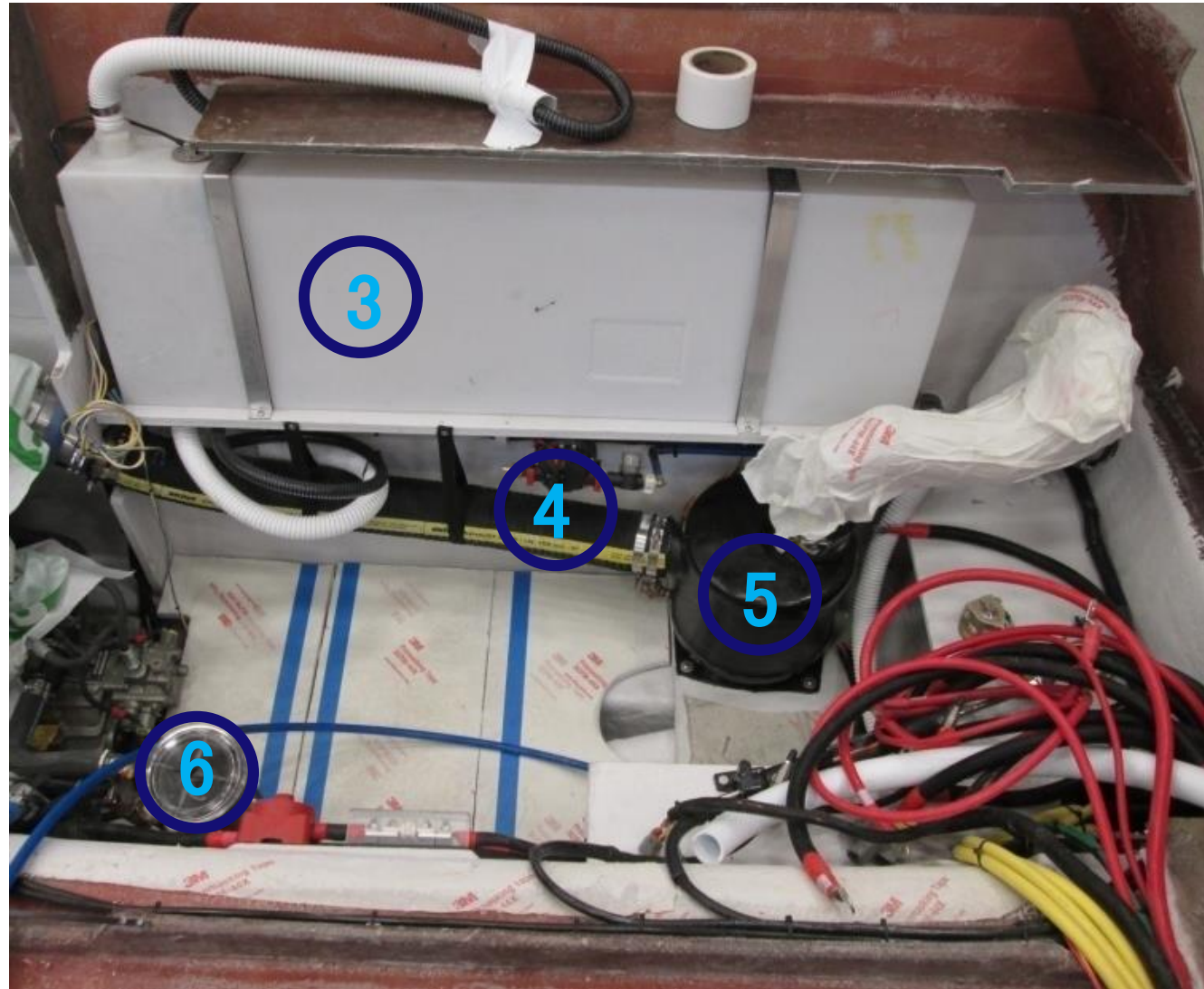
**5** Fresh Water Pump & Strainer

**6** Raw Water Pump & Strainer



# OPEN HULL

## *STARBOARD LAZARETTES*



**1** Volvo Penta Engine

**2** Crash Pump

**3** 26 gallon Water Tank

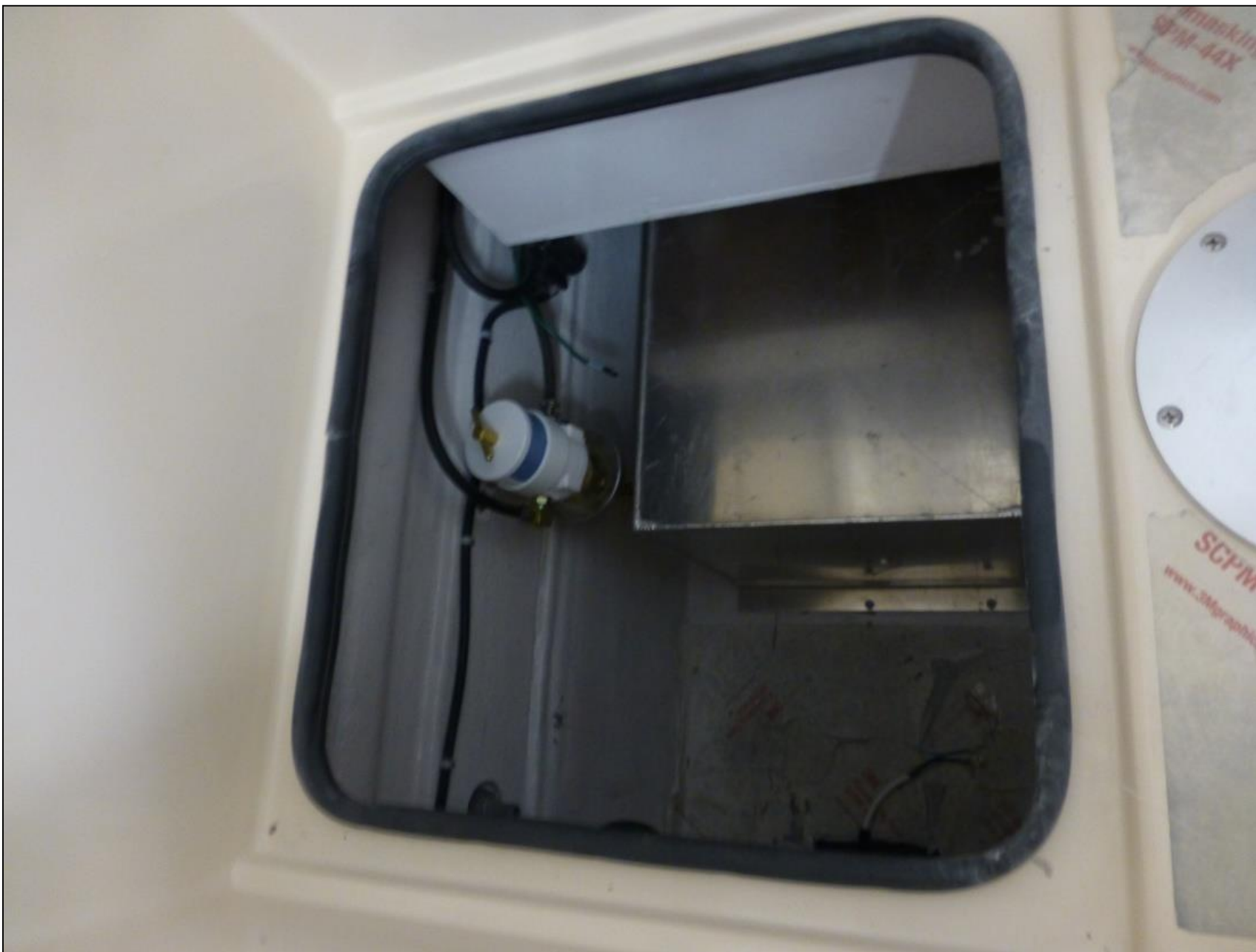
**4** Water Pump

**5** Muffler

**6** Engine Sea Water Strainer



# ENGINE & STARBOARD FUEL TANK





# WATERPROOF PLUGS





# TROUBLE SHOOTING

This list is developed from common customer questions.

## ELECTRICAL

- **I here beeping but can't figure out from where?** There are about 10 devices on the boat that can beep a warning. Here is a list of the most common and what to do.
  - **Co2 Sensor** under bed overhang– comforter covers it, it's tan colored about 3"x3". Its hard wired to the boats hot float power supply (stays on even when battery switches are off). It will beep if it gets low voltage and keep beeping until power is back up to 12v. To reset it, you have to interrupt its power, either by pulling its fuse behind the dash – wait 10 seconds then reinstall, or pop off the hot float breaker near the battery switches and wait 10 seconds then reset it on. Hot float power is always left on. If you leave it off, the automatic bilge pumps are disabled. This sensor is easily damaged and very sensitive. Acetone fumes – hair spray – some aerosol cleaners will damage the sensitive/rare earth metals inside. If this happens it will need to be replaced. Its sensitivity is amazing. It can go off from a dingy motor or generator 50 ft. away if the port lights are open. If you happen to be having a bad night intestinally, it can also go off. But its job is to keep you safe from invisible carbon monoxide fumes in situations like, if your neighbor runs his generator or furnace all night.
  - **400 watt Inverter** in master is standard, under the dinette as an option. These should normally be turned off when not in use. They beep both with high or low voltage ( 14.8V+ or 11.0 V low), they also beep if overloaded. It's only 400 watts which is fine for a computer or phone charger, but you will overload and pop its internal fuse if you try a 1800 watt hair dryer.
  - **Electronics** in general and auto pilot, especially, have the same beep horn as the above items. The auto pilot will beep incessantly if you're running a set course and it drops its inbound satellite signal. It wants you to note the loss of signal on the screen. It also beeps if it's lost the heading sensor/gyro compass signal. The gyro compass is mounted under the bed on centerline aft. It's important you do not store electrical things there. Things like vacuum cleaners with DC magnet motors really pull on the heading sensor, destroying its effectiveness.
  - **Stove propane Sensor/Auto shut off Computer.** This device is mounted just under the sink, smells for gas and is also very, very sensitive, easily damaged by cleaners. The black unit is in the corner near the floor, under is its sensing unit. To disable, flip the black power switch next to the unit off/down. This will also turn off the computer but also closes the solenoid valve in the propane tank stopping gas flow. It's the most annoying beep.



# TROUBLE SHOOTING

- **Engine warnings.** These flash on the engine monitor and also beep on the chart plotter. You will see things like “low coolant level” or “over temp” on the engine in both units. These two are tied together through the NMMA backbone that shares information. Normally, resetting the error/acknowledging it on the Volvo/engine display will reset the chart plotter. If the chart plotter continues with its warning, stop and shut the engine and the chart plotter off. Then restart and turn plotter back on. If the engine is warning you they are not normally false, it’s doing what it says and you need to address the issue. If you are getting warnings, for instance, “water in the fuel” erroneously, this sensor may need to be changed. Once they see water they often do not work well in the future. To reset the whole engine to factory, you can pull the main ECU fuse at the motor near the emergency off button (port side mid motor) But you will have to re-teach the throttles to the engine (single station) and so on, so not my favorite solution. You’ll need the owner’s manual to do this.
- **High water Alarm/Pump.** This alarm is behind the dash, it’s tied to a second high capacity bilge pump (2200Gph most models). This pump is mounted 2” above the first pump in the engine room. If you hear a very loud alarm from behind the dash this is probably it. Do not ignore, go look in the engine room, you have big problems. It’s designed so, should you melt a large pressurized hose or blow one off the engine, it will pump big volumes of water. But you need to fix the problem – shut the engine off, this stops the raw water pump.
- **Battery Chargers.** Your Aspen has two chargers, one 12amp dedicated to the engine start battery and a second 20 amp dedicated to the house battery. On boats with 1,000 or 2,000 watt inverters, they have built-in 80–100 amp chargers for the house battery charging. The most common issue with the battery chargers is the owners plugging in to shore power but forgetting to turn on the boats house breaker, dock breaker or charger outlet breaker. Then they leave the boats systems on, like refrigerator and depart for 1–2 weeks. When they come back they have flattened the house batteries dead. Once they do turn on the chargers nothing happens, it’s still dead. The issue is new computerized chargers need even to sense voltage so the computer can calibrate the charge. No voltage no go, even the engine alternator. So if this happens, you will need to switch on the emergency parallel battery switch for 5–10 minutes. Don’t leave on too long, as it’s very hard on the batteries. One is up at, for example, 10,000 ft. (12.7 volts) and the other is flat at sea level. This big difference puts big stress on the batteries, they try to equalize at warp speed. After 5 minutes the house will typically have enough voltage to be seen by the chargers and they will fill smartly. Note: if you leave the emergency parallel on all the time, you run the risk of having both battery banks dead and no way to start the engine.



# TROUBLE SHOOTING

- **Inverters 1000 – 2000 watt.** These devices take 12 volt power and step it up to 120Volts and also turn it into a sign wave (AC power). What most people don't understand is how much energy is in a typical 120 volt outlet and how that compares to 12V power. The formula is: Volts x Amps = Watts. A typical 120V outlet can pull 15 amps or 1,800 watts. 12V outlet at the same 15 amps (max typical) only produces 180 watts. So it would take TEN 12V outlets to run one 1800 watt hair dryer. The second factor in inverters is the size/capacity of the house battery bank where they pull the power. Ours typically run from 2ea 70 amp hour (140amp hr. C90) to 2ea 6V 120amp hour (240 amp Hr C100). So if you're running a 800 watt micro wave at 120 volts, your burning 66 amps at 12Volts (a lot). In a C100 you could do this for about 2 hrs. before your house bank got down to ½ charge. However, if you start the engine, warm it up and then run it at fast idle while you're running the inverter, the engines 125 amp alternator will put out approximately 70–80 amps working very much like a generator. Then after you're done with appliances, the house batteries are at, or still near full charge. These inverters are a “pass through type”, so when you're hooked to shore power and are switched ON, they feed the shore power automatically through and to the outlets without using 12V battery power.
- **12Volt central breaker panel.** This panel is the central distribution point for 12 volt ships power. It comes from the house batteries, forward in a finger thick cable through the breakers and then out to the ships switch panels, thrusters and also behind the dash to the four fuse panels, ships systems, electronics, lighting and options. The panel includes an LED display that shows both volts and amps being burned. This panel also lets you toggle from house battery to start battery, to read each voltage. Typically, these will be almost the same voltage as the Blue Seas voltage sensitive relay will be engaged and tying the house and start batteries together. But it's important to understand these breakers must be on to get any of the downstream equipment to work.
- **Voltage Sensitive Relay.** This device is mounted in the transom (3"x4" black box) opposite the battery switches. Its job is to automatically pair both your house and start batteries together so they can share the work load. It does this up to the point that the engine start battery drops below 12.3 volts (the point where you're sure to have power to start) after this voltage, the (VSR) voltage sensitive relay says nope, house you can't have any more power from us, we're protecting the start battery. This protection only works if the parallel switch is off.
- **Dash DC, left of helm switch panels.** The upper one controls the ships pumps manually, the lower one controls ship equipment like Nav lights, horn, macerator pump, refrigerator and fresh water pump. The fresh water pump toggles left for port pump, center for off, and right for starboard water tank. It's important to know that the panel's plastic cover pops off the panels and reveals a rubber boot that covers individual 12V GM type blade fuses for each device. If the fuse has blown it typically is “not the problem”, it's the symptom of a problem at the device. Inspect and identify the device before you put in a new fuse. Going larger is almost always the wrong solution.



# TROUBLE SHOOTING

## MECHANICAL SYSTEMS

- **Ships Hydraulic Steering.** Aspen uses a Teleflex Sea Star steering system made in Richmond, BC. The unit's hydraulic reservoir is filled by removing the rubber cover on top, then the black screw cap on top of helm. The boat ships with a clear hose with the fitting to attach to the bottle and the helm (in owner's manual bag). Once hoses are attached, you tip the bottle up and slowly turn the wheel port, then starboard while burping air out. Be careful not to over fill and have lots of rags nearby; this is a messy process. Also, it typically is low only if there is a leak in the system. It is a clear oil that's hard to see and better to touch. Look for loose fittings. Don't fill to the top it, should be down from the threads about 3/8<sup>th</sup> inch. The oil expands on warm days and will burp out the breather hole in the cap and make a mess.
- **Macerator Pump.** The macerator is a diaphragm type pump located in the port aft lazarette (black pump with red ring around bellows section). To activate, hold on the spring loaded switch at the dash. The design does not use a lock out key switch as the driver must hold the button to engage and there is no Y valve in the system. We use two dip tubes in the holding tank, one plumbed directly to the suck out fitting and one directly to the macerator. The rules about lockout don't apply as there is no Y valve in the system to position incorrectly. The pump is very robust and can pump amazing things but it does have valves inside that do not like string, diaper wipes, nuts and non RV/Marine toilet paper. Nine out of ten times when they stop, it's due to these things. The pump will have to be disassembled, cleaned out and reassembled.
- **Windless.** The windless is a Lewmar unit. Use is pretty obvious but few owners give it the respect it deserves. These are very strong geared down motors. Never try to have two people work the anchor at the same time. Keep your fingers and toes well clear of the chain and line, go slow, think. Tap on the control is good, especially when the anchor is nearing the bow roller. Many owners do not realize the motors design includes a cone clutch under the tension cap (wheel that moves) this cap (or knob on some models) can be tightened or loosened, allowing the gear motor to slip a bit, rather than pull with full force. This is especially important as the anchor jams into the bow roller in the up position. It can, when locked tight, pull with 700 to 1,000 pounds of force. This can damage the roller and fiberglass. Spray the motor and anchor chain off with fresh water after long trips. Be sure to hook a bungee cord or safety line to the anchor when not in use. We had one owner who had his anchor deploy at cruising speed (loose clutch).



# TROUBLE SHOOTING

- **Hatches.** Easy to use but many owners miss the “open just a crack” option. If you look at the area where the handle latches, there are two tabs that protrude. If you open the hatch  $\frac{1}{4}$  Inch and twist the latch, it locks in that position. This is handy, allowing some ventilation while keeping 90% of the water out except in big down pours. If you’re latched tight and still getting slight leaking at the gasket, often you can tighten the Philips screw in the handle for extra tension. In some cases, we have also fixed leaks by thinning the handles plastic slightly. If the hatch seems tight yet you’re still getting a drip, check the seal around the outside next to the fiberglass. We have, at times, seen the hatch plastic move just a bit with temperature, heating and breaking the seal.
- **Windows and Screens.** Issues here normally have to do with the screens being stiff to move/slide. The core issue is they ride in a vinyl track that has a center open section in the top so they can slide to this area and be lifted out for window cleaning. Owners will get off track a bit while sliding through this area and if they push really hard they bend the plastic and derail the screen. The trick is to go easy and push out a bit while sliding. This plastic can be removed but at times the screen will vibrate annoyingly. The second window issue has to do with overloading the gutter tracks weep holes with heavy seas or boat wash hose. This will cause some dripping inside, typically aft. There is no great fix for this. If we increase the height of the inside track, then the screens can’t be removed for cleaning.
- **Engine Raw water Strainer.** This device protects the engine from sea weed and such getting into the engines cooling system. It’s accessed from the Starboard aft engine hatch. Common problems are; A. Owners pull the top off before they turn off the ball valve = wet bilge and lots of excitement. They reinstall the strainer upside down (cone Up) letting debris flow past the mesh without cleaning. The Strainer goes cone down, fitting over the cone at the bottom of the strainer, snug with no slip from side to side. The last area to be careful is with the square O-ring gasket at the top. It is greased with silicone to make assembly easy but it must be pressed in to the gutter all the way around before you push the clear cap back in place and snug the wing nut back on. Note: the wing nut does not have a gasket or O-ring, it fits tight against a machine surface. The VERY IMPORTANT to RE – Open the Ball Valve. Running the engine for even 2 minutes with the valve closed damages the raw water pump (I did this one day).
- **Garmin Electronics.** For set-up instructions, see your Garmin Manual. If you electronics aren’t working, it could be a loose plug, the fuse or breaker is off, it’s a faulty unit, or it may need an update. You can find updates on the Garmin website, or call their service # for further assistance:  
**1-800-800-1020**



# WINTERIZING YOUR BOAT

1. Drain water tanks, Port & Starboard: Flip on DC breakers, located left side center under glove box. Then push toggle switch for water pump switch (**Left** = port tank, **Right** = starboard tank) and open faucets.
2. Hot Water Heater Drain: Flip open the hot water tank drain (Note: on older boats, open Port Lazarette to access hot water heater) and drain to bilge, then turn on bilge pump to empty over.
3. Put 2–3 gallons of RV antifreeze in each water tank. You will need a funnel with hose attached to get this into the water tank fill as they are horizontal. Then run each pump till red comes out at all faucets.
4. Drain Muffler (it will hold about 2 gallons of salt water): Drain plug is a ¼" black hex bolt on bottom of muffler or ball valve. Once empty, re-silicone plug and reinstall.
5. Engine; Remove raw water feed hose from the strainer, drop it into the bilge and drain. Re-attach/re-seal for the spring. (**Only done on boats being stored out of water**)
6. Pump bilges dry and then vacuum the remaining.
7. Pump head out then pour in 1 gallon RV antifreeze until it touch's pump motor. The Head salt water in-feed line will drain when the boat comes out of the water. Run most of it into the waist tank leaving 2" in the bowl and hose. Open the ball valve on the raw water washdown pump so it can also drain out; freezing water in any of the pumps will damage them. Check/drain macerator pump. (**If boat is kept in the water, you need to drain the raw water pick-up manually**)
8. Crank up winch stand so the bow is up. The center hull wave breaker also has a drain plug. With the bow up, this is a good time to check and drain this area, then re-silicone and reinstall the plug now so you don't forget in spring. (**Only done on boats being stored out of water**)
9. Turn off batteries. Coat the battery terminals with boeshield. (**Only done on boats being stored out of water**)
10. Wash Motor with fresh water to spray off any salt. Once dry, coat any metal parts with boeshield, NOT the belts or rubber/plastic parts.
11. Add Fleetguard Microbiocide to both Fuel Tanks; an anti-fungal stabilizer per Volvo recommendation.
12. On Cummins motors, pull heat exchanger Zinc (brass hex plug on back side) and check/replace if it's melted. Reinstall snug.
13. Put in some type of heat or dehumidifier. We like a 1500 water boat heater (West Marine \$69), set to 400 watts or 600 watts on a thermostat so it keeps the boat about 50 degrees. This will keep the boat dry and not smelling old. Open all doors and compartments for air flow, even under the bed – both compartments.





## Trouble-shooting Guide for DC Thrusters

Post 2005 thrusters  
with IPC control system





Please read over the owners manuals and familiarize yourself with the product. There is a trouble-shooting section in each manual. This guide is meant to be a supplement to these providing illustrated instructions for more detailed trouble-shooting.

**Note: This guide is intended for Thrusters utilizing SIDE-POWER "Plug and Play" wiring only, and not intended for thrusters utilizing SIDE-POWER's Auto-Main Switch or SIDE-POWER's voltage conversion box.**

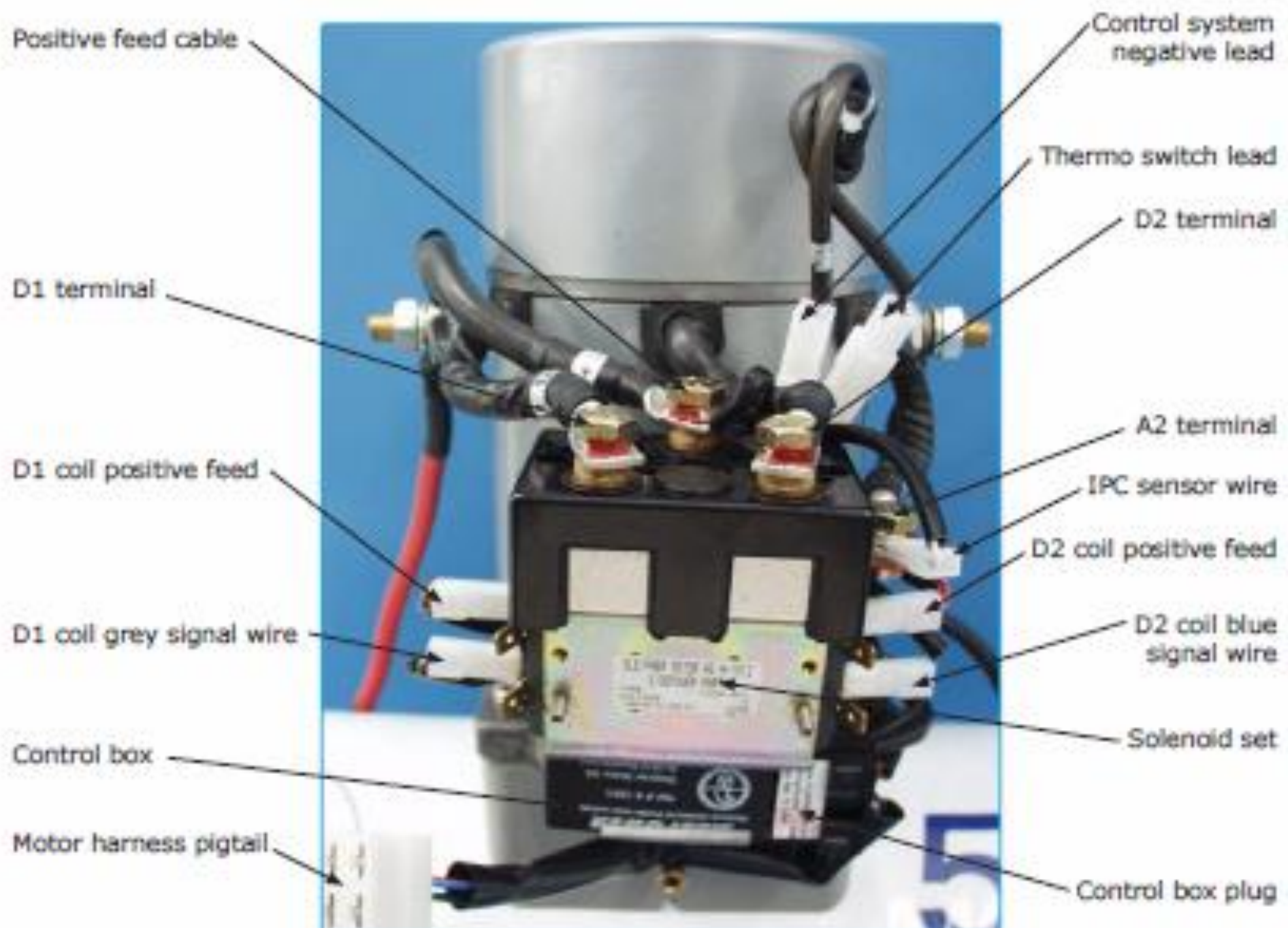
### Recommended Tools for Trouble-shooting:

- Metric Allen Wrenches, 4mm to 12 mm
- Metric wrenches or sockets
- Needle Nose Vise-Grips  
(for holding jam nuts when removing battery cables from motor)
- Phillips head screwdriver
- Small jumper wire  
(with male quick disconnect terminals if available, Fig. A)
- 12" jumper wire with alligator clips
- Multi-meter (with alligator clips if available)





## Identifying thruster parts





## If Control Panel does not turn on.

(Light between two On buttons does not light)

### 1. Check battery power.

- The control panel is powered through the bow thruster. The thruster is usually on its own circuit, meaning the positive and negative battery cables run directly between the thruster and the battery. A fuse should be installed on the positive cable within 72" of the battery, check that it is not blown. A battery switch is usually installed in close proximity to the fuse and battery, check that the battery switch is turned on.



Control panel on

### 2. Check voltage at the thruster.

- You should read battery voltage at the thruster. If there is no voltage at the thruster there is a problem with the power supply, check the battery, fuse, switch, or cabling.



Checking voltage at thruster

### 3. Check for voltage on the control harness pigtail on motor and at control panel.

- With multi-meter set to DC volts, check from red wire (positive) to black wire (negative) on motor wiring harness pigtail. If there is battery voltage at the thruster battery cables, but no voltage at the motor harness pigtail, then proceed to step 4.

If there is battery voltage on the motor control harness repeat step 3 on control harness at the control panel to ensure there is no fault with the control harness run. If there is battery voltage at control panel then there is a problem with the control panel. Please contact your local Side-Power distributor for service support.



Checking voltage on motor harness





#### 4. Check control system positive and negative.

- Check for voltage between the battery negative stud and red wire on motor harness pigtail.
- **If no voltage is present**, then check that all motor harness and control box plug connections are tight and in place. If the motor harness checks out, then there may be a problem with the control box. Please contact your local Side-Power distributor for service support.



Checking voltage on motor harness to battery negative stud

- **If voltage is present**, locate the control system negative lead and unplug it from the motor harness. With multi-meter set on ohm ( $\Omega$ ), check for continuity between the control system negative lead and the A1 battery negative stud. There should be continuity; ohms will go close to 0 (usually about 0.2 $\Omega$ -0.5 $\Omega$ ).



Checking continuity between negative lead and battery negative post

- **If there is no continuity** between the control system negative lead and battery negative stud, then please contact your local Side-Power distributor for service support.
- **If there is continuity** between negative lead and battery negative stud, reconnect control system ground lead to motor harness, then check for continuity between the black wire on the motor harness pigtail and battery negative stud. Set the multi-meter on diode-test position, showing about 0.5V-0.7V. (A diode is fitted on the black wire).

**Note:** Be sure to have Positive lead connected to motor pigtail and negative lead to control box plug!

If there is no continuity between these two points then the motor harness has been damaged



Checking continuity between black in motor pigtail and control box plug



**If control panel does turn on but thruster does not run, or thruster runs in one direction only.**

***NOTE:** The preceding tests are to be performed while the boat is in the water. Please contact your local Side-Power distributor for service support if you have any questions.*

**1. Bypass control panel and check thruster control box and solenoid operation.**

- Remove control panel and unplug wiring harness or unplug control harness from motor harness pigtail, whichever is more convenient. On the four wire Amp connector (wiring harness if disconnected at control panel or motor pigtail if disconnected at motor), with short jumper wire, jump from red to blue for starboard run, and red to grey for port run.

***NOTE:** Be careful not to jump red to black as this will permanently damage the control box*

- **If thruster runs** in both directions when jumping red to blue and red to grey on the motor harness pigtail, repeat this test on the control panels harness at the control panel. If the thruster runs then the control panel is likely damaged.
- **If thruster does not run**, or runs in only one direction, at the control panel, but runs in both directions at the motor harness pigtail, then the harness or terminals are damaged.

***NOTE:** Be sure that all control panels in the system are unplugged when doing this test!*

- **If thruster does not run**, proceed to step 2.

**2. Bypass thruster control box and check thruster solenoid operation.**

- Disconnect the white IPC sensor wire on the A2 terminal.



*Jumping red to blue on motor pigtail*



*Jumping red to grey on motor pigtail*



*Disconnecting white IPC sensor wire*





With long jumper wire, jump from negative battery stud to D1 coil grey signal wire for port run, and to D2 coil blue signal wire for starboard run.

- **If thruster runs properly,** proceed to step 3.
- **If thruster does not run,** proceed to step 4

### 3. Checking the thermo switch.

- Locate the thermo switch lead and unplug it from the motor harness. With multi-meter set on ohm ( $\Omega$ ), check for continuity between the thermo switch lead and the battery negative stud. There should be continuity; ohms will go close to 0 (usually about  $0.2\Omega$  -  $0.5\Omega$ ).
  - **If there is no continuity** between thermo switch lead and A1 battery negative stud, then either the thermo switch needs to be replaced or the A1 battery negative stud has been damaged internally. Verify that the A1 Battery negative stud is OK by checking for continuity between A1 and A2. If there is continuity then the A1 battery negative stud is OK.
  - **If there is continuity** between thermo switch lead and battery negative stud then there is a problem with the control box or the motor wiring harness. Please contact your local Side-Power distributor for service support.



Jumping ground to grey on D1 coil



Jumping ground to blue on D2 coil

### 4. Check for solenoid output.

- With jumper wire still attached and IPC wire detached from step 2, check for voltage on the A2 terminal.
  - **If no voltage is present** on A2 terminal then the solenoid pack may need to be replaced. Please contact your local Side-Power distributor for service support.
  - **If voltage is present** on A2 terminal then the motor may be damaged. Please contact Your local Side-Power distributor for service support.



Checking voltage on A2 with ground to blue jumper attached and IPC wire disconnected.





## 5. Check the operating voltage

- Once the thruster is operating properly, check the voltage between the battery positive post and the battery negative post while the thruster is running. The voltage will drop initially and then should level off after approximately 5-10 seconds.

The voltage should be no lower than 9.5 for a 12 volt thruster and 19 volts for a 24 volt thruster after the voltage has stabilized.

If the voltage does not stabilize and continues to drop below 9.5 or stabilizes below 9.5 for 12 volt thrusters (19 volts for 24 volt thrusters), then the battery source needs to be checked to ensure the amp capacity is sufficient to run the thruster or the cable run needs to be checked for voltage drop. Please contact your local Side-Power distributor for service support if you have low operating voltage.

## Distributors

### Argentina

Titner S.A.  
Buenos Aires  
Tel: +54 11 4580 0444  
Fax: +54 11 4580 0440  
www.titner.com.ar  
titner@titner.com.ar

### Australia

AMI Sales  
Parramatta, NSW  
Tel: +61 89 331 0000  
Fax: +61 89 314 3029  
ami@amisales.com.au

### Austria

G. Aachert GmbH  
Hard, Ingeratz  
Tel: +43 5574 59000  
Fax: +43 5574 59001-10  
www.aachert.at  
office@aachert.at

### Belarus

ASA Boat Electro  
Vitebsk  
Tel: +375 20 436 9100  
Fax: +375 20 436 9108  
www.asaboatelectro.by  
info@asaboatelectro.by

### Brazil

Electra Service Ltda.  
Guarujá  
Tel: +55 12 3354 3599  
Fax: +55 12 3354 3471  
www.electraservice.br.com  
aberton@electraservice.com.br

### Bulgaria

Yachting BG  
Burgas  
Tel: +359 56 919030  
Fax: +359 56 919031  
www.yachting.bg  
info@yachting.bg

### Canada

Imbra Corporation  
New Bedford, MA  
Tel: +1 508 895 3000  
Fax: +1 508 895 5059  
www.imbra.com  
side-power@imbra.com

### China/Hong Kong

Storm Force Marine Ltd.  
Wanchai, Hong Kong  
Tel: +852 2868 0114  
Fax: +852 2868 9050  
www.stormforcemarine.com  
sales@stormforcemarine.com

### Croatia

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SIDE-POWER THRUSTER SYSTEMS



# VOLVO D3 & D6 DETAILS

## *Notes from Larry Graf*

*As many of you know, we typically share details about our experience with the various engines and what our owners are seeing when they get serviced. The Volvo 220, in general, has been very reliable with few issues at all. But now that we have some owners with 500 to 1100 hrs., the experience base is getting large enough to show potential problem areas. Here is what we've seen so far in the last 3 years with approximately 24 boats in use.*

### Fuel Injectors

Each engine has 5 Boch injectors. So far we've had two boats, out of 24, where they were changed. One boat had them changed twice; first time at 200 Hrs. and second time this spring at 1,000 hrs. The other boat had them changed early in its life at approximately 150 Hrs. The symptoms were poor idle at start up, some heavy smoke and a little oil in the water while cold. Also, the fuel economy is reduced when an injector is no longer working properly. The injectors are not re-buildable and cost \$850 each plus several hrs. to change.

Why injectors fail is a little bit of a mystery. Dirt/sludge seems to be the most often sighted cause, followed by water drops passing through and even small air bubbles. The other common problem has to do with the EPA changing the fuel mix to a low sulfur mix which has less lubricating quality's than earlier fuels. The injectors and the high-pressure fuel pumps with many small, very high precision parts that move very fast to adjust the fuel mixture during the engines explosion cycle, must run just right and do so hundreds of times per minute.

Things to review and do to help your injectors life:

Check your Raycore filters clear bowl for dirt, sediment and water monthly. Drain bowl and replace filter if you have debris.

Add a Fuel Additive to each tank of fuel. Volvo recommends and approves Stanadyne lubricating cleaner (available at Fisheries Supply – Item ID# STY 38560P). Personally, on my diesel truck, I've used 1 Qtr. of automotive ATF type F (automatic transmission fluid per 25–35 gallons) for the last 3 years and 230,000 miles. It's a good cleaner (full of detergents) and lubricant and not too expensive (I buy the base \$4–5 per Qtr. **ATF type F fluid**). My friends with the same truck, not using a fuel treatment, have had to replace their injectors at 100K to 120K. But its officially not "approved" and may not meet EPA requirements. I found out about using ATF fluid from a trucker friend and recently asked the owner of a brand new Peterbuilt who was hauling a C120 to Florida what he used, "ATF-type F every 50 gallons". A third option is Shell Rotella DFT (Diesel Fuel Treatment) available at many truck stops.

While the engine is at cruise speed, check the fuel filters clear bowl for air bubbles. A few very fine bubbles is normal but if you're seeing lots of air, some mechanics feel this can cause premature injector wear. The air may be from a loose hose connection in the fuel system or possibly obstructions in the fuel system.

### Water Pumps

The Volvo water pump itself seems to be a very robust design, the bearings are larger than others we've used and the pump impellers we've changed at 150–200 hrs. have been in fairly good shape. Like any impeller, running them dry makes them fail in a minute or less at cruise speed. The pump housings we have replaced at 500 hrs. still look OK but there is no way to tell if they would have kept running and our owners did not want to take the risk. The pumps pulley is metal and have been 100% reliable so far. On another company's engine, they use a plastic pulley that failed at times.



# VOLVO D3 & D6 DETAILS

## *Continued notes from Larry Graf*

### **Raw Water Intake Hose Collapsing**

On two boats, so far, the 1 ½" factory installed hose that crosses over the aft right side of the engine, in route to the raw water pump, collapses at full throttle due to the raw water pumps vacuum. This limits the raw water flow, causing the engine temperature to climb unexpectedly. Temps typically run 178–185 degrees. At WOT (wide open throttle) with the hose collapsed, the temperature climbs to 190–200 degrees and the intercooler over heat warning typically comes on – it's raw water cooled and an early indicator of trouble. Slowing down to idle drops the vacuum and allows the hose to reshape and the engine, if not run at full throttle, works just fine again. If you've had this, Coastal in Seattle has the updated hoses in stock. Replacing it takes about 1 hr. The soft hoses that cause this were in production for only about 4 months, 2 years ago, so not many boats got them.

### **Loose Hose Clamps**

This is typically on a newer engine but there are quite a few hose connections on the 220 Volvo, and during our 50 Hr. service, we often find 1–2 that are not snug after the engines been warm. A loose clamp can cause a bad day and even spray your engine with salt water (corrosive). Depending on the clamp, you could end up with the engines very capable raw water pump (think mini fire hose) spraying and flooding the engine room. If you hear a very loud buzzing alarm from behind the dash, your high water 1700 GPH bilge pump has come on. It's time to stop, shut down the engine, and identify the problem. If this happens, it's very important to call us to get our detailed procedure on washing the engine clean of the salt, as well as the wire harness and plugs and turbo/turbo blanket. Not cleaning very thoroughly will cause you frustration down the road. One note on hose clamp tightness: Snug is good but trying to tighten them every week is a problem – cuts the hose.

### **Loose Ground Cables**

This has happened on 2 boats, so far, where the large ground cable that connects low on the engine, near the starter, has come loose. The symptom is typically intermittent starting or the engine stops mid-stream, you restart and all seems fine, then 2 hrs. later it stops again. Any loose battery cable connection can do this and this is why we locktight or use locking washers on all big cable connections.

### **Throttles Left in Weather Failing**

For those fishermen who opted for the outside throttles, we've had one owner who had to replace his electronic throttle unit (6 months out of warranty) due to corrosion. When this throttles not in use, it's a good idea to have a Sunbrella bag over it to protect it from the elements. The replacement part cost \$2,200 plus 2 hrs. labor.

### **Cables & Communications Bus**

On two boats we've had intermittent problems with the computers communicating with each other. The engine has three computers and each throttle is also smart. They communicate and check each other continuously over many, very precise, multi-wire cables and water proof plugs. The system is designed with many fail safe modes. If the communications don't check each time requested (happens many times per minute) the system shuts down and goes too idle, or shuts the engine down completely. Re-setting the computers by turning off the engine, turning off the engine battery switch, and then turning everything back on, the system almost always runs fine again, often for days or weeks. It's very frustrating and because what it seems to be is in the wire harness itself, the computer's ability to self-diagnose is often wrong or gives erroneous error messages. This leads to a wild goose chase. Volvos Tech team has gotten a good handle on this problem over the last 6 months, but initially it was very difficult to figure out. The fix may involve replacing the engines harness and computers which means the engine is pulled for easy access (seems like a big deal but actually only about 2 hrs. or less each way on an Aspen 32).



# **VOLVO D3 & D6 DETAILS**

## *Continued notes from Larry Graf*

### **Muffler Crack**

On 2 boats, we've seen the Cyntec Muffler develop a hair line crack after use, just under where the exhaust hose connects. The symptom is a little puddle of water under the hose connection caused by a fine mist from the crack area when at cruise speed. We suspect it's one of two things; 1) A manufacturing flaw when the muffler was made or 2) Overtightening of the hose clamps just above the crack. Again, there is snug and tight with hose clamps. If you tighten a clamp into a rubber hose and then heat it, after heating the rubber will flow just slightly away from the clamp. If you retighten again, the same will occur again. We've seen some boats where tech's have tightened clamps over and over and the clamp has cut ½ way through the hose. So, snug is good but be thoughtful and keep an eye on your tech's in the field.

### **Fuel Water Sensor**

We've seen this on about 5 boats. The Volvo engine has a water sensor in the bottom of its engine mounted 2-micron fuel filter/ water separator. This sensor is connected to the engines warning computer system. It's a very specialized component that's very sensitive, and should its wire harness be interrupted in any way, it can fail on. Water in the fuel of a diesel engine is BAD. It can damage fuel pumps, injectors and even internal engine components. But with this sensor, in our experience, 7 out of 10 warnings seem to be false or at least the Raycor pre-filter (30 Micron) we install with its vortex water separator bowl, shows no water or debris. Most often slowing down and re-setting the error code, the fault disappears, often for months. If it's a regular occurrence with the Raycor bowl showing no clear fluid in the bottom (IE water), the Volvo sensor has probably gone bad (we suspect that once its seen water once it's likely to be intermittent after).

### **Dip Stick Oil Leak**

4 boats. Here what's happening. When checking the engine oil, the owner puts the dip stick back in, but forgets to push it down until it clicks-positive. The engine is a positive crank case pressure design, designed to meet EPA rules. If this dip stick is not seated, it will blow fume's and oil back up the dip stick. In heavy seas, we had one owner who pushed so much oil out the dip stick he had the low oil pressure warning alarm come on. Makes a BIG mess in the engine room. So, push down to the Click.

### **Melted Transmission Dip Stick**

Twice now, owners who try travelling with their dock lines attached / tied to rail mid ship, have the line fall into the water while underway. It is sucked into the prop (Very large Vacuum) and wraps around the prop stopping the motor abruptly. In both cases, it pulled the engine out of alignment and damaged (melted) the end of the shaft log. For one owner, they were not sure what happened and in a windy situation next to a piling breakwater, attempted to continue pushing hard with the shaft locked. This caused a great deal of friction and heat build-up in the transmission, IE melted the dip stick. It may need a new transmission.

Attached is a spread sheet with details and costs. It is important to remember all these problems did not happen to one owner this is everything we have EVER seen or had happen. But I think it's good to know what to keep an eye open for while your inspecting or operating your boat.

Best Regards and good times on the Water!

Larry Graf



# VOLVO 150–220 D3 SERVICE HISTORY

## *Notes from Larry Graf*

*Information is based upon experience with 24 boats over 4 years (updated as of November 18, 2016)*

ITEM	DESCRIPTION	DETAILS	NUMBER OF BOATS	ESTIMATED COST	FIX
A	CABLES & COMMUNICATION BUSS	On 3 boats, the engine computer has tripped into a safe mode (idle) or shut the boat down unexpectedly. Once re-set by turning off the engine battery switch, waiting 20 seconds, then switching on & re-starting the engine, it runs fine for 2 hours to 2 weeks & then does it again. In all cases, it eventually restarts. The error codes that come up vary: “communication error,” “emergency stop activated” (the button on side of engine), “ECM error.” We think the core issue was with the harness which allows the other components to communicate or not.	3	Warranty \$15,000	In these 3 boats’ early stages of understanding the problem, Volvo has replaced the engine wire harness and computers. It takes about 4 days. Once the parts have been changed, the boats have run perfectly.
B	WATER IN FUEL WARNING	The Volvo D3 on board fuel filter has a water sensor at the bottom. It’s a very fine coil of wire that senses water molecules that can gather at the bottom of the filter. Though out of the five activations, I’m aware of 4 that have been false. No debris or water was in the Raycore filter assembly; the first area it should collect and be visible. This water sensor is very sensitive.	5	Warranty \$90 + \$80 Sensor #3808616  \$55 + \$45 #21139810	Owners go through reset and clear error, often gone for months. If it’s repeated, we can replace the filter and the sensor. If you do get dirt/water in the filter, it will let you know.  2 Micron Volvo Fuel Filter
C	WATER PUMP IMPELLER / PUMP	These wear out, normally about 200–250 hours. We have seen them go in 100 hours or less if the intake gets plugged, even for 1 minute. Never use Sierra aftermarket impeller = poor synthetic rubber, alternator belts heat and fail.	14	\$815 + \$160 #21379102  #21951352	Replace, full pump at 500 hours with pulley. Replace impeller every 100–150 hours
D	CRANKCASE FILTER PLUGS	The filter is part of the breather system and can get plugged with soot/dirt if it does the engine will spit oil – typically out the intercooler drain.	4	\$140 + \$40 #21368879	Replace annually or 150–200 hours or at each oil change.
E	ELECTRONICS THROTTLES EXTERIOR	Electronics throttle units left uncovered out in salty environments failed after 2 years; gave all kinds of error messages.	1	\$2,400 + \$180	Replaced part, made canvas cover to protect when not in use.
F	ENGINE MOUNTS CAME LOOSE	The adjustment threaded bolts/nuts can rattle loose. The motor settles and alignment goes out and big vibration happens.	2	\$300 – \$2,200	Re-align, replace bolts, and lock nuts.
G	ENGINE AIR CLEANER DIRTY	Low power.	1	\$90 + \$40 #21379288	Typically replace bi-annually.



# VOLVO 150–220 D3 SERVICE HISTORY

## *Notes from Larry Graf*

*Information is based upon experience with 24 boats over 4 years (updated as of November 18, 2016)*

ITEM	DESCRIPTION	DETAILS	NUMBER OF BOATS	ESTIMATED COST	FIX
H	FUEL INJECTORS PLUG	Motor runs poor, lumpy, worst at idle. Add <b>Stanadyne fuel</b> treatment to each tank of fuel, lubricates, and cleans. I use ATF fluid on my diesel truck; 1 quart per 25 gallons – lubes and cleans. Add just before each fill up. My last truck had 250,000 miles.	2	\$22	Use Fuel Treatment Stanadyne Diesel fuel additive Lubricity formula
I	FUEL INJECTORS FAIL	Typically from lack of lubrication due to new EPA diesel fuel requirements and soot build up. Boats with dirty or bad injectors can have unburned fuel in water at startup; extra smoke at start up and be slow to start. If they don’t seal well, the fuel pressure leaks down while at rest. Take time to re-pressurize.	2	\$895 + \$200	Per Injector (expensive vs. ATF fluid or Stanadyne Fuel Treatment)
J	RAN OUT OF FUEL – PRIMING	One owner got mixed up in his fuel switches and ran one tank empty, then needed to switch to the tank with fuel with the selector switch at the dash. Open the engine hatch. On the left side, mid engine, is a round red primer button about 1 inch in diameter. When pushed, it activates an electric primer to pump fuel in and build pressure. Crank the engine; it will sputter. Then pump hard again. Repeat until she starts.	1	Time feelings	Typically takes 5 – 10 minutes to get going again. May need to put anchor down.
K	LONG-TERM SERVICE ITEMS TO WATCH	1. Water Pump Impellers 2. Overhead Cam Belt 3. Fan Belts 4. Trans Oil Cooler replacement (or inspection) from corrosion 5. Fuel treatment for injector cleaning 6. Raw Water Pump replacement – complete unit (bearings can go out)	HOURS  1. 150 2. 1000 3. 500 4. 4–5 years 5. Fill Up 6. 300	EST COST  1. \$200 2. \$1,500 3. \$150  5. \$700	2. We stock parts, important to do  4. Typically grows white crystals on ends



# PETTIT HYDROCOAT PROCEDURES

## *Notes from Larry Graf*

Notes as of November 18, 2016:

Washington State law will eliminate copper bottom paint next year (2017). We began testing copper free paint last year (2015).

*These are notes from a discussion with Rachael Cartwright of Pettit paints after our one-year test of Rich Pettit's C100 (no relation) using the new Hydrocoat ECO water based copper free bottom paint. The active ingredients are 6% Ecomea (a Biocide by Jansen Pharmaceuticals) and 2% Zinc, similar to the zinc in shampoos. The balance is binders and adhesives that slowly degrade, allowing the paint to sluff and resurface.*

**Results:** After 12 months: The boat came out of the water extremely clean, almost no slime, NO barnacles on the hull anywhere, even where the paint had sluffed off one section 6"x18". The hull was clean, the biocide around the area missing the paint seems to have kept the paint free area clean. The trim tabs, actuators and rudder coated with Prop Gold did have growth. They face the sun and had more growth than most boats with Prop Gold have, so his marinas got the critters, yet his bottom was VERY CLEAN. The Zinc's were in unusually good condition, 80% still there except for the keel sand bar Zinc.

**Problems:** On the port side, the paint had mini bubbles in about 25% of the surface in a sweeping, almost rag stroke, pattern. We suspect that we wiped the old Interlux Ultra with 216 solvent before coating with Hydrocoat (standard procedure for Interlux paints) and that may not have fully evaporated prior to recoating or that it affected the Interlux surface. It's also possible that the surface was not scuffed as aggressively in the areas that bubbled. The bubbles were about 1/8<sup>th</sup> inch to 3/16<sup>th</sup> inch in diameter, approximately 200 on the port side only. They did have water inside.

**Plan Forward:** Pettit will supply 2 more gallons of Hydrocoat ECO. We will remove the bottom paint, then re-prepare the port side area where the bubbles occurred, being careful to follow application procedure. We need to get this system figured out. Washington State, starting in January 2017, is implementing "no copper based paints" allowed on new builds. Starting in January 2018, no re-coats are allowed with copper based paints.

**Details:** The process of repainting an ablative paint has some risks. As the paint ages, the adhesive has to dissolve just slightly slowly so the outside layer can ablate and self-clean over time. The actual glue holding things together degrades and goes away and the paint flakes off, taking anything on top away with it; IE, possibly the new paint. It happens when the paint dries after pulling it out of the water. We've had this on two boats this year, both 4-5 years old. It's frustrating and an exceptionally labor intensive process to get the hull back to gel coat to restart the process. One boat took over 80 man hrs. to clean, sand and recoat. The old paint is a bit like sanding tar; uses lots of pads and goes slow. Soda blasting is faster but you must be careful to not damage the gel coat. Rachael w/ Pettit also recommended we try coating the metal parts and Tab cylinders' w ECO Hydro Coat after priming with 1792 Barnacle Barrier primer. I was concerned about how well the paint would hold on the prop considering the volume of water passing by and positive and negative pressures working on it. While swimming on each boat on this year's trip up north in Princess Louisa, I checked this application after approximately 20 hrs. and the paint on the prop was 95% intact and the other metal parts were 100% as it had left the shop. The boat had no barnacle starts anywhere. Conversely on Gateway 5, which had been pressure washed 9 days prior but not repainted this year, there were 8-10 1/2" tall barnacles already – they do grow fast.



# PETTIT HYDROCOAT PROCEDURES

## *Continued notes from Larry Graf*

### **ECO Application Procedure:** Hull over Interlux Paint

- Clean/wash all growth off
- Light Sand/scuff w 60 grit – remove any loose paint and feather in chipped edges.
- Wash with WATER – Do Not use solvent too clean
- Re-coat with ECO Hydrocoat using 3/16<sup>th</sup> nap roller, Tip as you go with foam brush for smooth surface. It's OK to thin with water if needed. You do not want the paint thick, it causes problems.
- Let Dry 3 Hrs.; fans are OK to speed up drying
- Do 2<sup>nd</sup> coat every where
- Let Dry 3 hrs.
- Bow leading edge and Water line outside down 8", do 3<sup>rd</sup> coat tipping as you go
- Let dry 24 hrs., min 12 hrs., before splashing. Maybe sooner if fan dried.
- It's OK to put only Hydrocoat over transducer (none Copper)

### **Application Procedure:** Recoating Over Hydrocoat:

- Same as above but only Scuff with Scotch bright pad after cleaning
- Then Wash with water and re-coat.

**Metal parts Coating:** Using Eco Hydro Coat to replace Prop Gold (It's copper free so it can be used with Bronze and stainless metal parts with no electrolysis damage).

- Clean Metal well. Scotch bright pad is OK to use, you want it very clean.
- Wash/wipe with Acetone.
- Coat with 1792 Barnacle Barrier (rattle can). It's a Primer for the ECO to be painted over.
- Coat Metal with Hydro Coat Eco (No Copper). It's OK to put in a Prevail sprayer. It works if you remove the screen at the bottom for trim tabs and detail parts.
- Let Dry 3 Hrs. – using fans to help dry is OK
- Re-coat, then Let Dry 12 Hrs. +



# THRUSTER LOGIC & STRATEGY

## *Notes from Larry Graf*

Notes as of November 18, 2016:

Bow and Stern Thrusters are wonderful assets while docking. They take 95% of the worry out of docking for most owners, allowing precise positioning. There are, however, some details to understand about the underlying engineering and physics of electric thrusters.

The units range in horse power from 2.5 Hp. on a 32' er to 7 Hp on a 40' er. Most owners don't realize that electric motors of this size draw from **280 amps to 580 amps at 12volts** (a huge load). They work just great if used for a minute or less during each docking – typically 5–10 second bursts six to 10 times to reposition the angle of the boat.

**Thrusters should be 10–15% of your docking strategy**, basically used to fine tune your main positioning done with the rudder and engine in gear (fwd. or reverse) at idle. Many owners make a game of seeing how often they can dock with no thrusters at all.

Other owners attempt to use their thrusters as 90% of their docking strategy. Getting within 50 feet of the dock and then beginning to thruster all the way to the dock against wind and current. Even at times using both bow and stern thrusters at the same time (= 870 amps on a 40' er). This type of docking is problematic; first it puts a huge instant drain on the battery bank basically ripping large chunks of battery power from the battery's which can heat and damage the battery bank. Next, the motors are basically marineized heavy duty truck starter motors designed for high output but short period of use. If you run them too much, they heat up and eventually shut down from a thermal protective breaker. If you do this regularly the windings in the motor or controller melt and you have a \$2–3K motor to replace. The other problem with getting to the thermal breaker is you then have no thrusters what-so ever for 20–30 minutes until it cools down.

To give you a comparative feel for battery loads, the refrigerator on a 32 Aspen on average uses 4 amps, the house lights use 5 amps if all are on, so 530 amps is a lot of power.

Several owners have asked about **installing more battery's** so they can thruster longer, one even did this. There are several issues with this; first is you still get to the thruster over heat thermal switch, then it's a question of where you put them. The one owner who did put two more Golf Cart batteries did it in front of the current house battery bank. It was an easy install but he then had no access under the floor boards to service or inspect his pumps, shaft seal or shaft grounding brush. Pulling the battery's each time he needed to inspect was not friendly. The next issue is weight and balance; each of these battery's weighs 75 pounds so 150 pounds' and does make the boat list a bit. In the end, this owner pulled the extra battery's back out.

One owner asked about having a **dedicated battery bank** just for thrusters so his house loads could be separate from his thruster loads. He was having issues with the Garmin low voltage alarm going on while thrusting. The first thing to check is the low voltage alarm set point on the Garmin unit. Some were set to 12.5 volts which means if you thruster at all it comes on. I recommend resting it to 10.7 volts, this is above the 10 volts needed for the Garmin units but low enough that during typical docking, the alarm will not go off. My strategy while designing the house battery bank was to size it first for typical thruster docking while still having sufficient capacity to overnight easily without being plugged in. I did assume we'd get 5 amps of Solar Charging while anchored for six hrs. each day. Most owners find they have more than enough power to anchor for 2–3 days during the summer.

One last area that owners have noticed is that their initial thrusting (first minute) is very powerful then they notice a **distinct drop in thruster power**. This stems from the **VSR (voltage sensitive relay)** that typically ties the house and start battery banks together. At the beginning of thrusting, both battery banks are full but after about a minute, the thrusters have pulled enough power out of the combined battery bank to hit the separation voltage on the start battery. From this point on the thrusters are only drawing from the house bank. Once thrusting has stopped, the VSR will typically re-latch the house and start battery's together within 5 minutes. This is the source to recharge the house bank while underway. The other two house bank charge sources are the battery charger or inverter or the solar panels. The reason we install a VSR is so that no matter what loads are being pulled from the house bank the engine always has a dedicated battery for starting. Note: you can disable this protection if you switch the EMERGENCY parallel switch on (not a good idea).

Owners also wonder about the capacity of their house battery banks. When full the C100 32' er has

- C100 Two Golf Cart battery's GC2 group size combined capacity 115 amp hrs. (60 Minutes)
- C120 Four Golf Cart battery's GC2 AGM DC224–6 + 1 ea. G27 Combined 336 Amp Hrs.



# TOILET LOGIC: DETAILS & MAGIC

## *Notes from Larry Graf*

### Notes as of November 18, 2016:

Marine toilets are mission critical components in cruising but also one of the most problem prone areas for new owners. The goal is reliability and little or no smell while in use or storage. Our toilets are premium Dometic units with a very powerful macerator pump to blend debris into liquid making it easy to move into and out of the holding tank. The hose we use is Trident Marine triple wall premium hose that feeds into a double thick polyethylene holding tank. The triple wall hose and double thick holding tank (1/4") are to eliminate smells, wicking into to living spaces. The holding tank is vented overboard with a 5/8" fuel hose on our 32s and 3/4" on 40s. This vent being open and able to breath is critical to limit smells.

In use starting with an empty tank you add typically 1 Cup of Thetford biodegradable liquid holding tank treatment. We find this effective as both a detergent to keep the tank clean over the years and as a very good odor suppressant. Once the treated and before use its important to run 2-3 gallons of water into the head so the bottom of the tank starts with a wet surface. Not doing this can lead to a solids layer developing in the bottom of the tank especially in warm weather.

**Now it's ready to use**, do what every comes to mind, but do use RV or Marine toilet paper in a limited way no huge balls. This type of paper dissolves very fast when wet and never coagulates on the bottom of the tank. When flushing you will need to run the pump in the dual position "water in waste out at the same time" for about 5 seconds after bowl clears debris. This gets to the waste down the hose and clear of the pumps valves and such. **Prior to big jobs** It's a good idea to push the switch that add just water to the bowl to fill 2" of water or so in the bowl so you don't get stickies on the bowl. After you flush be sure to leave the opening in the bottom covered with water to seal out any fumes. Watch the gauges as you go, I typically pump every 2 days while out at the 1/2 to 3/4 full point, I like to get rid of this stuff often while it's very liquid and before it ferments. Pumping regularly and especially when you get back from a trip and before the boat sits idle for more than a day or two allows you to empty the tank before the solids can settle to the bottom of the tank. If they settle this sludge can over time and in warm weather start a biochemical reaction that has a horrific phosphorus odor that's very bad, especially when the toilet is flushed pushing new liquid in and pushing old air out of the tank. Your neighbors will notice this smell! Another reason to pump often is if you unexpectedly get full and then continue to pump debris in, it overflows out the tanks vent line (Bad Smell) and often plugs this line. If you have plugged the vent typically as you try to flush things away never to return. They do return the over time- you flush again and darn they return again. The tank is working like a spring. If this happens be sure the tanks empty (look at it if possible) then with a fresh water garden hose 40-80 psi back flush through the vent fitting back into the tank.



# TOILET LOGIC: DETAILS & MAGIC

## *Continued notes from Larry Graf*

**Note:** be positive your back flushing the waste tank vent and not a fuel tank vent, run the macerator pump and listing to the vent often helps identify which vent is waste or follow the vent hose up to the hull side fitting. You do not want water in your fuel.

**To empty the holding tank**, you have two options; first is to drive over to the marine pump-out station at your marina pull the waste cap (deck trail 40s or cockpit entry 32s) and suck it out. The second option is while offshore away from harbors to activate the macerator pump out switch at the dash. On 40s Both port and starboard can be activated at the same time. The gauges will drop but typically when the gauges hit empty the tanks will continue to pump for an additional 2-3 minutes as the tank sensor doesn't reach the bottom of the tank. Its best on the 40s to do this while at trolling speed, on the 32 and 28s this pumping can be done at speed.

Here's a list of things never too put in your Toilet.

- Diaper Wipes – instant Plug – locks macerator motor – pops fuse
- Feminine Products – will try to eat first 2 but by third and more they plug up hose to tank
- Nuts not chewed – plugs valves – can allow back flow of black water to bowl – bad smell
- Chlorine Bleach – damages rubber parts
- Comet – has Chlorine (limited occasional use OK)
- Seeds– Bones – Jamb macerator
- Home type toilet paper premium brands are worst (thicker)

### **Leaving The boat more than 2 Days**

On our 32s the heads always run on raw water (IE Salt Water). To conserve the fresh water on 40s the boat is pre plumbed so an owner can switch too fresh if he feels he has enough for both domestic and head use. Saltwater is just fine for heads if you understand a few things and follow the shutdown procedure noted bellow, I feel it's sort of a waste of fresh water to wash it down the toilet. Because Salt water is full of microbes (little critters) when you leave the boat and leave saltwater in the toilet bowl the critters first love it and multiply in the warm water. Then they die and then ferment and smell BIG BAD. When you come back to the boat it smells and takes 2-3 hrs. to clear out.

However just a little pre-boat departure procedure can eliminate this. Take the fresh water sink wand stretch it over to the bowel and put in 3-4" of water and flush it out using the flush down only button (no saltwater) then refill 2" more and let it sit. You're done, no smells no salt build up in the waste hoses. In the winter I put RV anti-freeze in the bowl and Thetford treatment in the empty tank with a little RV antifreeze. A second very common fix for the critters is to put a ¼ cup of White vinegar in the bowl before you leave kills the critters – no smell.

### **Coast Guard Inspections**

The Coast guard inspectors are required to see your Y valve is locked in the (waste in Tank Position). Aspen's don't have a Y valve as most boat owners don't position it correctly and things get plugged in the valve. In our design all the waste always goes into the holding tank, you have no way to pump directly from the head to the ocean. Once the waste is in the holding tank you have two options to clear it out. First is the deck waste fitting and a pump out station. Second is the boats macerator diaphragm pump which is controlled by the hold on switch at the dash. Since it only works when you physically hold it on, it meets the requirement. This will take a little bit for the guys to understand. The concept that the tank has two dip tubes down into the waste is unusual.

### **Transom Deck Vent**

This vent fitting being clear is critical to no or limited holding tank fumes. We install it on the transom to keep spray flowing past the hull side from entering the vent. However, because this surface is sloped fwd. if you do overflow your holding tank by accident clearing the debree and vent requires you to unclamp the hose from the fitting wash out the debree and clear the water from the low spot just under the hose connection. The shape of the vent component creates a catch for water and waste once its capped with liquid, the tanks wont vent like new and the aggressive fermentation process begins. One other very important detail is to make sure the screens have been pulled on the waist tank vent. This part is used on all types of tanks many need the screens but for waist vents they are typically pulled out at our factory. The screens plug with this type of fluid and they also can plug from buffing compound/fuzz during annual detailing = bad.



**DOES YOUR BOAT HAVE A HEAD?** Yeah? More than one? Yeah? That many? How much fun is that? Really? That doesn't sound like much fun at all. You know, you could have potentially avoided that scenario, if you'd spent some time on the, shall we say, pre-digestive end of things, taking care of the common problems and planning for a better-ventilated, better-smelling head compartment. Learn from our primer how to get your head checked — and take care of your boat's toilet and its attendant odors, too.

## ● Common Issues

Any number of things can go wrong in a marine head, but if you know the most common issues and how to deal with them, you improve your chances of being in the pink (instead of some other color).

### 1 | CLOGS.

Compared to their terrestrial brethren, marine toilets use very little water during flushing, which is one reason clogs are such a common problem. Another clog-inducing dilemma can be the toilet's multiple valves, pumps and impellers, which can have difficulty passing solid waste (much less paper towels, baby wipes and other products). Marine toilet paper will almost dissolve on contact with water, but so will the cheap, one-ply stuff available most anywhere. For everything else, that old saw about not putting anything in the toilet that hasn't passed through your body first is actually sage advice when it comes to clog-avoidance.

### 2 | BILGE FUNK.

One of the more unsanitary practices aboard boats is showers that drain directly into the bilge. It's a setup that not only generates odors but also introduces pump-clogging hair and soap scum into the bilge. A common

aftermarket solution is mounting a gravity-fed sump beneath the shower pan, which collects the water and automatically pumps it overboard or to a gray-water tank (using a small submersible pump and float switch mounted inside). A second option is connecting the shower-pan drain hose directly to a diaphragm pump, eliminating the need for a sump, as well as the odors and mechanical float failures often associated with them. Instead of an automatic float, users turn on the pump manually when showering, then off again when finished.

**3 | HOSE BUILDUP.** Calcium deposits can form inside your sanitation hoses, valves, seacocks, etc., to the point that the system becomes difficult to flush, experiences leaking back into the bowl or simply clogs up. An ounce of prevention is worth a pound of cure or, in this case, pumping two cups of white vinegar through the toilet monthly will help prevent buildup.

## Tricks for a Better-Smelling Head

Since there's a fine line between an odor and a scent, we wanted to provide a few tips for elevating the former to the latter.

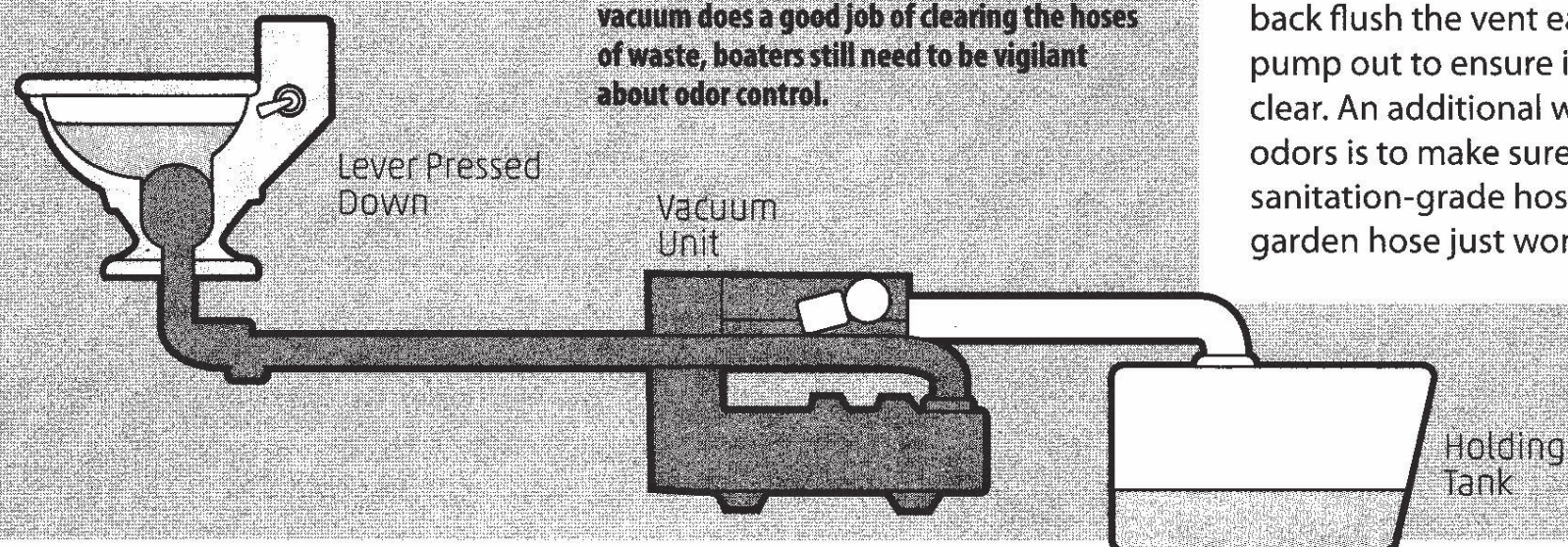
Leaks are one of the most common sources of head odors. Start at one end of your sanitation system and check each hose joint for leaks, ensuring all hose clamps are tight and corrosion free. Install double hose clamps where possible, but only if you have sufficient hose barb to allow it, otherwise you'll simply damage the hose and cause even more leaks.

Always use proper sanitation hose when installing or replacing old hoses, including vent hoses. Sanitation-grade hose is expensive but imperative from a head odor-control standpoint. That red heater hose may have been a bargain, but your nose will soon tell you why it wasn't such a good choice to plumb your toilet and holding tank. Premium rubber sanitation hose has a thicker wall and features two-ply reinforcement and a wire helix. It may sound like overkill, but just remember it has to handle human waste that's roughly 30 times more concentrated than typical residential sewage.

Check your system and hose runs for places raw sewage can collect. Hose runs should be kept as short and straight as possible. Holding tank discharge hoses should also be self-draining — deck pumpout fitting hoses should drain back into the holding tank, while overboard discharge hoses should drain to the discharge seacock without loops or low spots.

Check your vent hose for clogging. Clogs are typically caused by overfilling your holding tank, which pushes solids into the hose and vent. When possible, back flush the vent each time you pump out to ensure it stays open and clear. An additional way to prevent odors is to make sure your vent hose is sanitation-grade hose (that length of garden hose just won't cut it).

HOW A VACUFLUSH HEAD WORKS







### 3 Good Upgrades

If you're looking for ways to improve the head in general, and you don't mind spending a little money, check out a few products that can help.

1 | Add a solar-powered vent to improve ventilation. Good air flow is crucial for head comfort. No great mind wants to contemplate the problems of the world astride a "thought enhancer" located in a stuffy head. Running on solar power during the day while charging a small battery to run at night, solar-powered vents freshen your head 24/7 with a constant flow of air and without the need for external power.

2 | Install a Gulley IC (Intelligent Control) shower

drain from Whale Pumps (whalepumps.com). The Gulley IC is a prewired system that consists of two components: a Gulley IC, essentially a "smart" shower drain, and a Gulper IC self-priming diaphragm pump. The shower gulley has a built-in electronic, water-sensing switch that automatically turns the pump on when water is present and off once the shower is dry. While a bit more expensive than a conventional pre-engineered sump, the Gulley IC system promises

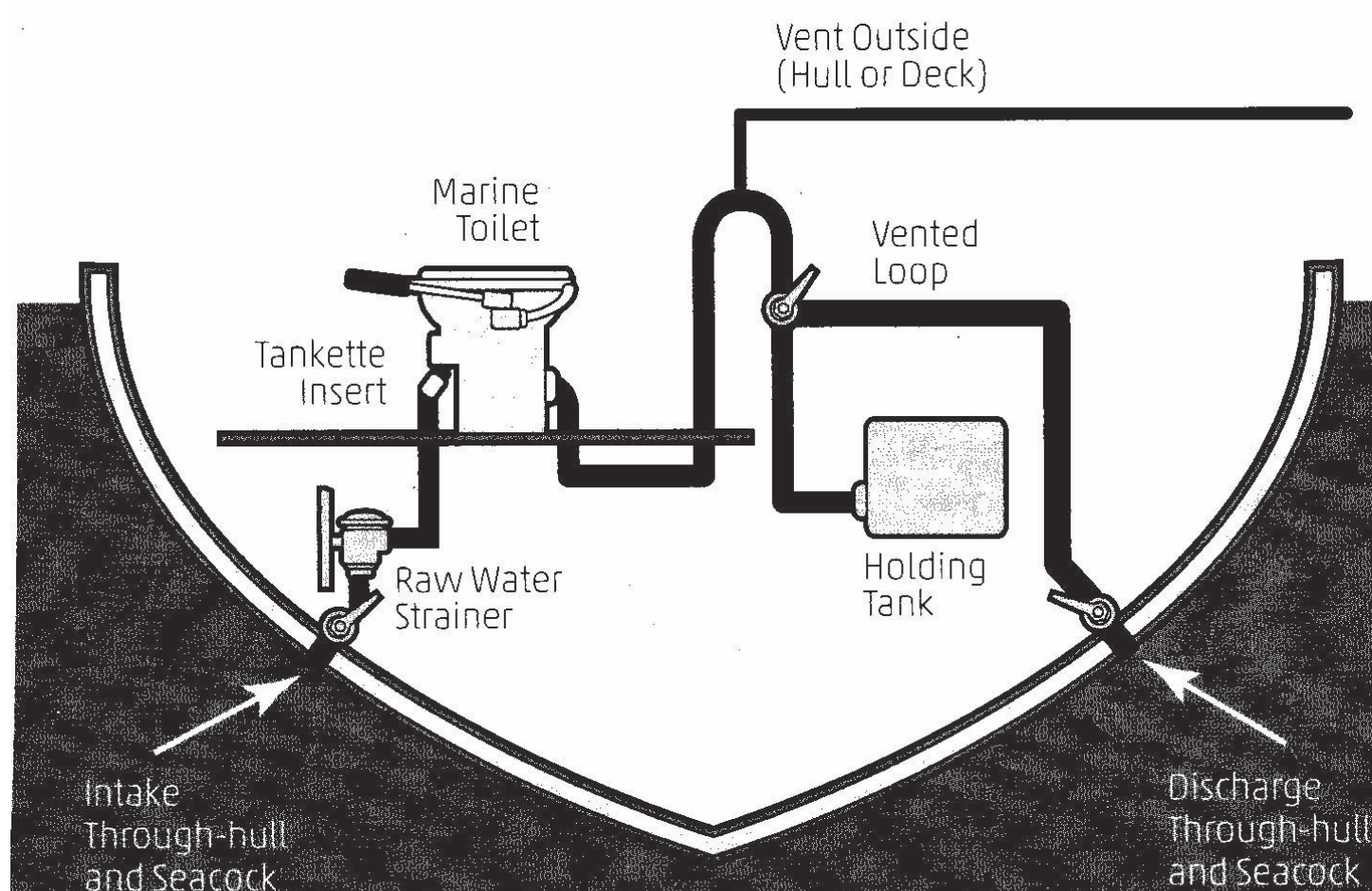
much greater reliability while presenting a good compromise between cost, ease of installation and convenience.

3 | Upgrade your antiquated "seat of ease" with a modern unit. Units such as the Vacuflush system use fresh water for flushing, which eliminates a lot of the smell associated with saltwater flush systems. As it uses a vacuum to pull water to the holding tank, it also does a better job of clearing the hoses of waste (another source of odor).

### Head Care

While cleaning to-do lists aren't particularly popular with most boaters, the Head item on the list is even less well-liked. No matter, it has to be done, and if you take care of the frequent tasks, the less frequent ones will be less ... memorable.

A TYPICAL HEAD SYSTEM



#### EVERY TIME YOU USE YOUR BOAT...

► Flush the head sufficiently to push sewage from the hoses, and rinse behind it. At the end of each trip, pour a half gallon or so of fresh water into the bowl and flush it through the system. Incorporating the task into your buttoning-up-the-boat routine before leaving will solve most odor problems.

► If you do your boating in salt water and your toilet uses raw water for flushing, follow the procedure in item number one (no pun intended): pour a gallon of fresh water into the bowl and flush it through the system at the end of your trip. Salt water contains tiny organisms that will die, decay and

While your system may look slightly different than this one, keeping hose runs short and straight and ensuring proper head cleaning is part of the buttoning-up procedure will keep head odors to a minimum.





Clean your head after each trip, especially the sink and the areas around and behind the toilet, unless you enjoy mid-cruise emergency repairs.

smell. Flushing the salt water from your bowl will help keep it odor free.

- ▶ Clean your head after each trip. Giving sinks, counters, and the areas around and behind the toilet (particularly if you have boating friends with bad aim) a good cleaning with disinfecting wipes or other such cleaners will leave Neptune's throne room smelling clean and ready for your next adventure.
- ▶ Shut all sanitation system seacocks when not in use (to prevent possible back siphoning and flooding).

#### YEARLY...

- ▶ Shock your holding tank at least once a year (spring or fall) to de-scale the inside and flush the system. Shock treatments (such as the Head-O-Matic Shock Treatment) help prevent odor buildup and can be used a second time if odors are noted mid-season. It is also recommended to shock the tank when you haul your boat out for the winter. Add shock treatment a week or so before the last pumpout, while still

using the boat, which gives the treatment time to slosh around in the holding tank to help de-scale the tank for the winter (it also helps ensure a clean final pumpout).

- ▶ Replace or blow out your vent hose. A clogged vent hose can promote smells and can damage your system due to the buildup of pressure each time the head is flushed. A clogged vent also creates negative pressure when pumping out, which can cause damage and possible collapse of the holding tank.
- ▶ Inspect your shower sump box. Opening it up allows you to clean the strainers, check the float switch for proper operation and check all electrical connections for corrosion and potential failure.

#### AS NEEDED...

- ▶ Change your hoses. Sewage will eventually permeate your sanitation system hoses, and while the frequency will depend on a number of factors (e.g., quality of hose, installation, use),

five years is probably the maximum time you want to go between changes. To see if your hose is permeated, wipe a section with a warm, damp cloth, drop it in a Ziploc bag, carry it above-decks into fresh air, open the bag and give a sniff.

- ▶ It's a fact: The more poop you have around, the worse things stink. Pump out your holding tank early and often, well before it hits the full mark.
- ▶ Check the holding tank vent line regularly for blockages. Mud daubers and other such insects love to build nests in vent lines, and if the tank is filled to overflowing, bits of sewage can clog the vent line.
- ▶ Rinse and flush the holding tank after each pumpout to dilute residual sewage and reduce odors. After pumping and rinsing, pour a mixture of one cup of liquid Calgon Water Softener to two gallons of hot water into the empty tank, then use the tank and pumpout when needed as you normally would. You can do this after each pumpout; however, the longer the water softener remains in the tank, the better, so try to time it between periods of heavy holding tank use and pumpouts (a week is ideal).
- ▶ Rebuild your toilet (new gaskets, seals, valves, impellers) every two years. The soft parts of your toilet will eventually dry out and become brittle, which leads to cracks and leaks. By replacing these parts on your own terms before they have a chance to fail, you've eliminated a boat owner's number-one nightmare: toilet failure (it never happens at a good time) and the emergency repairs necessary to fix them.
- ▶ To keep your toilet pump operating smoothly, follow your monthly vinegar flush with a dose of oil. The best choice for this is a lubricant specifically designed for use in marine toilets, which not only lubricates the pump wall (for easier pumping) but also helps keep the internal rubber parts oiled and supple. 🐙