MARLOW-HUNTER, LLC

Chapter 6

Underwater Gear

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This section will detail those components which are submerged or generally under water. We will organize these components into the following categories:

1. Mechanical propulsion components
2. Steering components
3. Intakes and discharge skin fittings
4. Monitoring equipment
5. Anchoring and Windlass (optional)
6. Keel

6.1 Mechanical Propulsion Components

⚠ DANGER ⚠

Keep clear of moving parts at all times. Protect moving parts from impact during normal use.

Propulsion components are those involved in the movement of your boat.

6.1.1 Propeller

The propeller supplied with your boat (Fig. 6.1 saildrive example) has been selected as the best propeller for average use. Propellers use “pitch” as part of its specifications and determines the amount of power exerted from your engine. Pitch is the displacement resulting from a 360 degree revolution of the propeller. A 16” pitch means a 16” advancement from a complete spin of the propeller. Do not change the pitch of your propellers without getting your dealer’s recommendations first. If you change to a different propeller pitch, do NOT use a propeller which allows the engine to operate at a higher than recommended RPM. Your engine OEM manual will specify the maximum recommended RPM.

To maintain rated power, propellers should be free of nicks, excessive pitting and any distortions that alter them from their original design. Badly damaged propellers should be replaced, but those that are chipped, bent or merely out of shape can be reconditioned by your marine dealer.

Consider keeping an extra propeller on your boat (see Fig. 6.2 for propeller specs). If the installed propeller becomes damaged, it can be replaced with the spare without major disruption to your outing. We recommend the replacement procedure be performed by competent professionals.

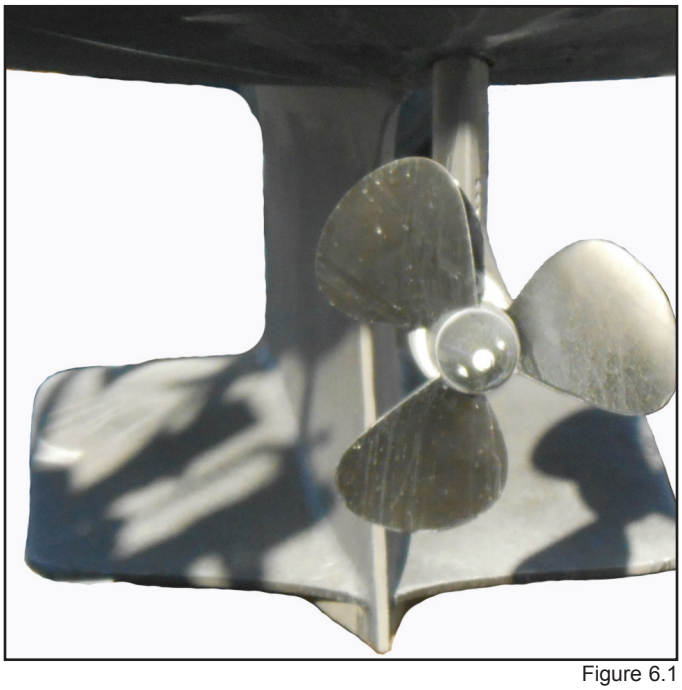

Figure 6.1

CONFIGURATION	BLADES	DIAMETER	PITCH
29 HP	2	16"	11"
40 HP	2	17"	16"
40 HP	3	16"	15"

Figure 6.2

6.1.2 Shaft Drive

The 29HP engine (see the Engines and Transmissions chapter of this manual for additional details about the engine) utilizes the traditional shaft method of propulsion. The shaft is made of 1 1/4” diameter Aquamet 19 or equivalent stainless steel which has excellent corrosion resistance and very high strength. The coupling at one end of the shaft is bolted to the transmission. The other end of the shaft is tapered, threaded, and keyed for installation of the propeller.

The propeller shaft passes through the hull via a shaft seal followed by a strut mounted to the underside of the hull which holds and stabilizes the propeller shaft in position. Refer to Fig 6.3 for details of the shaft, shaft seal strut and propeller assembly.

6.1.2.1 Shaft Alignment

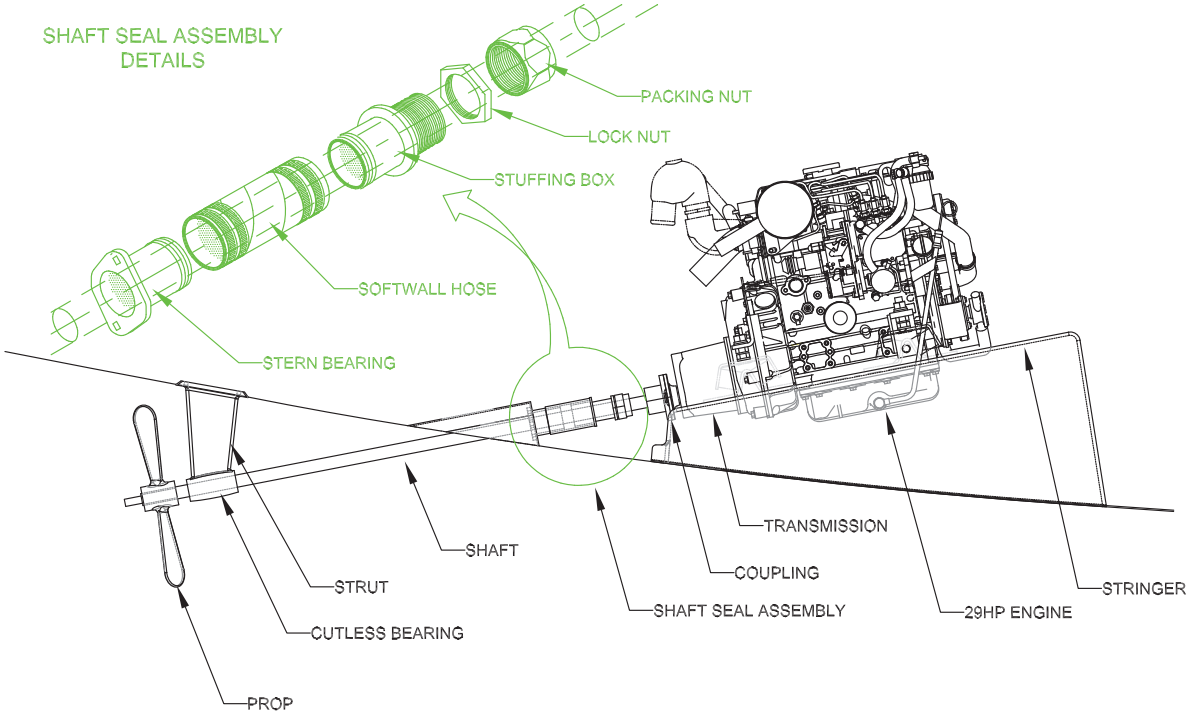

Figure 6.3

Aligning the engine with the propeller shaft is critical for smooth operation of your boat. Your dealer should check alignment as part of commissioning. However, shaft alignment may shift slightly after your boat is in use and may need to be realigned, particularly if there is vibration, drumming sound, or loss of RPM's. See Fig. 6.4 for an illustration of the alignment steps.

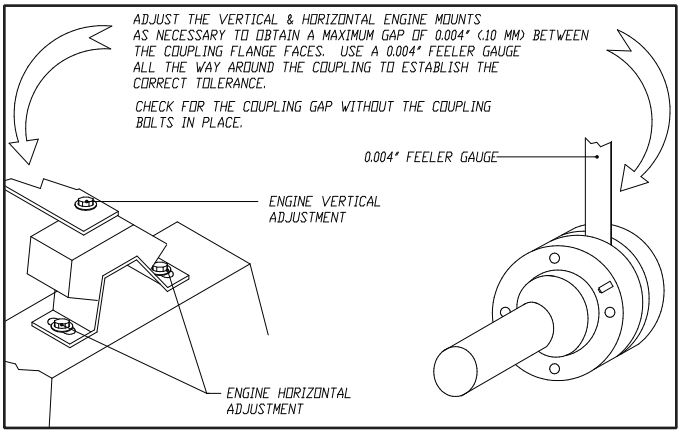

Figure 6.4

We recommend the alignment procedure be performed by competent professionals.

6.1.2.2 Cutless Bearing

The propeller shaft is supported by the strut. The strut houses a replaceable bearing (Fig. 6.3) to minimize wear and to protect the shaft at the point where it passes through and contacts the strut. The bearing should be inspected annually and replaced as necessary. We recommend the replacement procedure be performed by competent professionals.

6.1.2.3 Shaft Seal Assembly

The shaft seal assembly consists of the stern bearing, hose, stuffing box, lock nut and packing nut (Fig. 6.3). This assembly acts as the union between water and hull, allowing the propeller shaft to extend from the hull and rotate without a water breach. The stuffing box incorporates a replaceable packing system which is calibrated to allow a specific number of drips per minute. This water provides the proper environment to control the frictional impact between the rotating shaft and packing material. Your stuffing box should produce 1 to 2 drips per minute. Inspect your shaft seal assembly annually.

6.1.3 Sail Drive

The 40HP engine (see the Engines and Transmissions chapter of this manual for additional details about the engine) utilizes the saildrive method of propulsion. For reference purposes, Fig. 6.5 illustrates the sail drive leg and gear assembly and Fig. 6.6 illustrates the full sail drive/engine assembly.

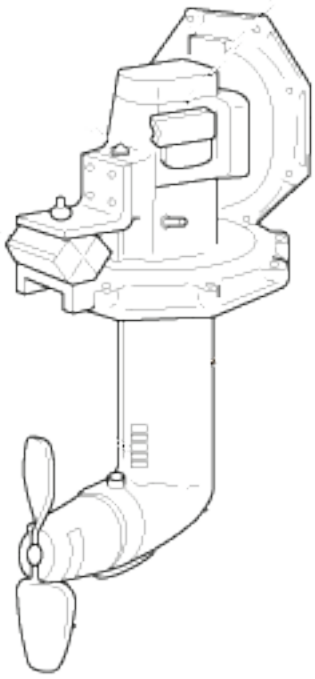

Figure 6.5

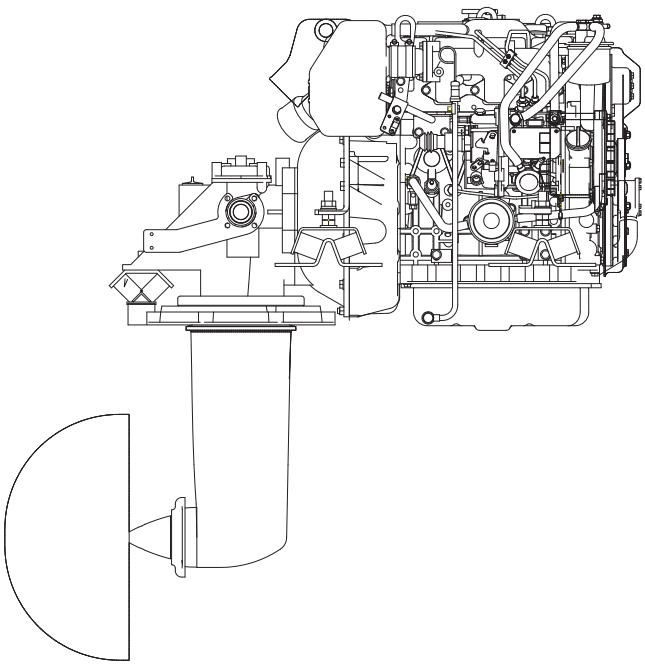

Figure 6.6

The saildrive has some advantages over the traditional shaft drive. It is quieter with less vibration and it offers higher efficiency due to the foil shaped sections of the drive leg and lack of any shaft angle.

It is extremely important to regularly check the sacrificial zinc anode attached to your saildrive. The anode provides protection against galvanic corrosion. Refer to the manufacturer's OEM manual for a complete listing of regular maintenance items and schedules for your saildrive.

6.2 Steering Components

⚠ DANGER ⚠

Keep clear of moving steering parts at all times. Protect moving parts from impact during normal use.

6.2.1 Steering System

The steering system of your boat consists of a steering wheel, pedestal (with rack and pinion), output lever, drag-link, tiller arm, rudder assembly and optional autopilot (Fig. 6.7). Movement of the steering wheel is reflected in the rotation of the output lever located below the pedestal as translated by the rack and pinion gearing within the pedestal. The rotation of the output lever is transferred to the tiller arm by connection through the draglink. This assembly concludes with the rudder post bolted to the tiller arm. Thus, movement of the steering wheel translates to the rotation or swing of the rudder.

Also note that the opposite side of the tiller arm is also fastened to a drag-link. This drag-link is connected to the motor of the optional autopilot (also pictured is the autopilot's rudder reference module).

NOTE: Please refer to the steering OEM manual for specific details and maintenance specifications.

6.2.2 Rudders

The rudder blade (see Fig. 6.8) is fabricated with a stainless steel internal grid structure surrounded by foam and fiberglass. The rudder bearings are self lubricating. Inspect your rudder for free and smooth movement between rudder stock and bearings.

Obviously, your steering system is a critical component aboard your boat. However, all boat operator's should

be prepared for steering failure or loss. If the situation arises where the rudder assembly is not functioning properly and affecting your steering, your boat comes equipped with an emergency tiller to provide the required maneuverability.

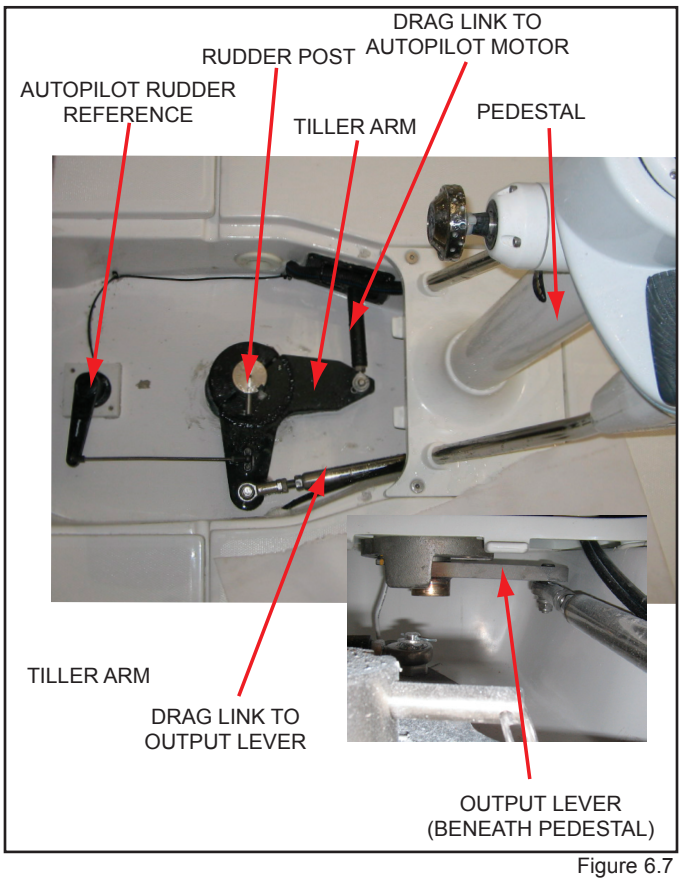

Figure 6.7

If your standard steering is experiencing a problem, inspect the rudder's upper bearing, lower bearing and drag links for damage or obstruction. If the situation can not be remedied, proceed with the following steps to assemble the emergency tiller for low-speed steering:

1. Idle the boat
2. Remove the emergency tiller handle from its storage location within the port gull-wing seat hatch (see Fig. 6.9)
3. Locate and open the access cover for the rudder shaft located in the steering assembly cover (often referred to as the quad cover)
4. Insert the notched end of the tiller handle on top of tiller base pin

You are now able to manually steer your boat. Proceed to the closest location for standard steering system review and repairs.

⚠ CAUTION ⚠

Because the backup steering system can also be lost, an operator must be able to cruise without a rudder or otherwise be prepared to assemble a makeshift rudder.

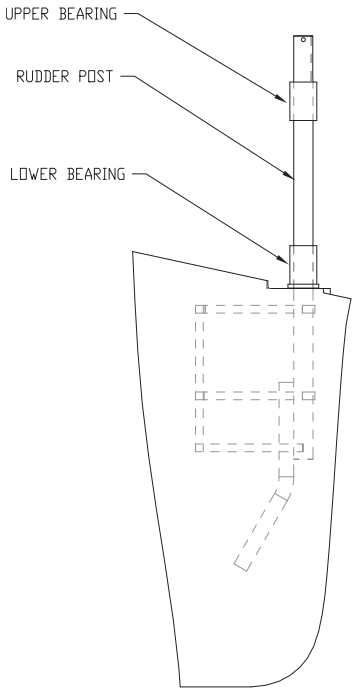

Figure 6.8

Figure 6.9

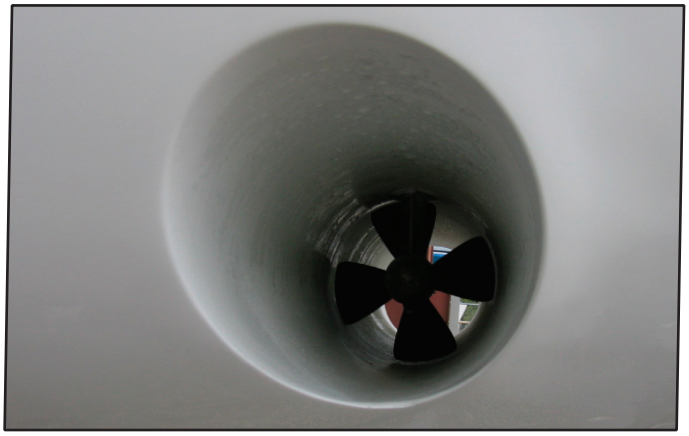

Figure 6.10

6.2.4 Bow Thruster

Your boat is offered with an optional bow thruster. If installed, the bow thruster will assist maneuvering in tight spaces or marinas and with adverse wind directions. The bow thruster is installed below your v-berth bunk into a tunnel that is build into the hull structure under the waterline (Fig. 6.10). Access to the thruster motor is through the forward v-berth bunk drop-in. The control panel (Fig. 6.11) is located on the pedestal's instrument console and is uncomplicated to use (Fig. 6.12). When engaged, the thruster forces a jet of water from one side of the bow to the other and, consequently, pushes the bow towards the opposite direction of the jet.

Figure 6.11

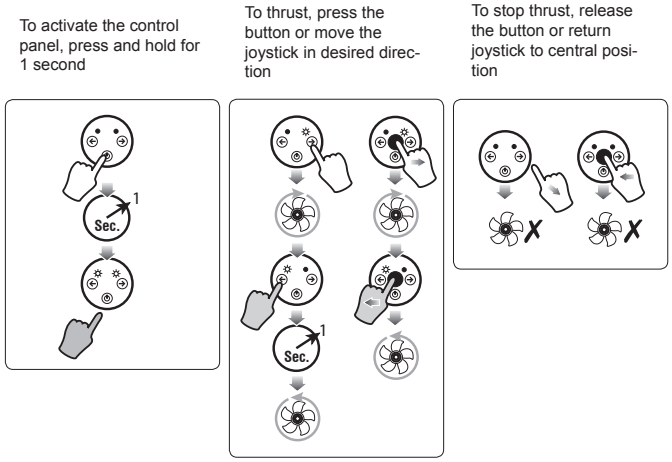

Figure 6.12

⚠ CAUTION ⚠

Do not press both directional buttons at the same time.

You should familiarize yourself with the maneuvering and operation of the bow thruster in open and still water before attempting to maneuver in tight spaces or marinas. The bow thruster is powered by the DC system and it is vital for the battery banks to be at full charge to assure full functionality.

NOTE: Please refer to the bow thruster OEM manual for specific operational details and maintenance specifications.

⚠ DANGER ⚠

DANGER OF SERIOUS INJURY:

ROTATING PROPELLER – DO NOT SWIM IN THE VICINITY OF THE BOW THRUSTER!

6.3 Intakes and Discharges

6.3.1 Below the Waterline

On the bottom of your boat, you will find skin fittings for the intakes and discharges for the supply and release of your boat's various systems (i.e. seawater for the air conditioner, waste from the waste tank, etc.). Care should be taken that these skin fittings are clear and open and should be cleaned of barnacles and other growth as specified in the maintenance section of this manual.

Refer to Figures 6.17 for skin fitting locations. Later chapters in this manual will go into further detail about the various systems that will incorporate these intakes and discharges.

6.3.2 Above the Waterline

As evidenced by the category, these skin fittings are generally above the waterline but may be below the water when sailing or in heavy seas. These fittings are associated with the discharge of water collections, engine

exhaust or the venting of tanks.

Refer to Figures 6.18 and 6.19 for thru-hull locations. Later chapters in this manual will go into further detail about the various systems that will incorporate these fittings.

6.4 Monitoring Equipment

The optional electronics package installed on your boat will vary boat to boat. However, all Hunter's will have a transducer (Fig. 6.11) installed below the waterline. In general, the transducer is the sensing device which provides desired information to your electronic equipment, such as depth, speed, temp, etc. Refer to the electronics OEM manuals for specific details about your equipment. The transducer is located beneath the compression post floor panel in the v-berth.

Figure 6.13

6.5 Anchoring and Optional Windlass

A complete anchoring assembly includes the anchor, bow roller (also a secondary bow roller), anchor rode/chain, windlass, anchor locker and padeye.

6.5.1 Anchor

The anchor option available on your boat includes a 22 lb. delta anchor (see example Fig. 6.14) with 100 feet of chain. This anchor was selected based on your boat's size and weight under normal anchoring conditions. This style is effective with a variety of sea beds and remains stable under a variety of tide and wind conditions.

Figure 6.14

⚠ WARNING ⚠

Anchoring in unusual water and/or weather conditions will require additional precautions. Consult an approved guide for suggestions.

6.5.2 Windlass

The windlass (see Fig. 6.15) facilitates the anchoring of your boat by automatically raising and lowering the anchor. To operate the windlass, the Anchor breaker switch, located on the Battery Switch Panel, must be set (refer to the DC Electrical Systems chapter of this manual).

6.5.2.1 Lowering the Anchor

1. Turn power on to the windlass at the Battery Switch Panel (see DC System chapter in this manual).
2. Set the Anchor breaker (see DC System chapter in this manual).
3. Rotate the anchor stop flapper to free up the anchor chain.

Lift the protective cap from the windlass foot switch located on the bow near the anchorwell and depress the down switch (Fig. 6.16).

Note: "Bump" the switch until the anchor clears the anchor roller and hull before letting anchor down freely or it may rock back and forth and strike the hull.

Figure 6.15

Figure 6.16

6.5.2.2 Raising the Anchor

1. Turn power on to the windlass at the Battery Switch Panel (see DC System chapter in this manual).
2. Set the Anchor breaker (see DC System chapter in this manual).
3. Start the boat engines (reduces battery load and provides boat control when anchor is freed)
4. Lift the protective cap from the windlass foot switch located on the bow near the anchorwell and depress the up switch (Fig. 6.16). Be careful as the anchor approaches the hull and anchor roller. Continue until the anchor properly rests in the anchor roller.
5. Rotate the anchor stop flapper back into position to notch the chain from an undesired deployment.

6.5.2.3 Manual Windlass Operation

In the event the windlass is not functioning normally under power, one can manually lower or raise the anchor. A winch lever is included with the windlass for manual anchor deployment and maintenance of your windlass. Please refer to OEM manual for details on manual use and maintenance instructions and schedules.

NOTE: It is important that the windlass clutch is tight for proper operation and safety. Periodically check the clutch and tighten if necessary.

6.6 Keel

The keel (Fig. 6.1) provides a greater measure of lateral stability and generally simpler and more reliable handling of your boat. The keel design is based on the boat's weight and sail plan while minimizing draft. Hunter's standard keel is the shoal keel with available options of a deep keel or bilge keels.

The keel is fabricated with a configuration of large bolts and mounted to the hull's keel sump. Keel bolt nuts should be checked periodically to counter any thread slippage (see the Maintenance chapter in this manual for details on keel bolt specs). Removal, installation and nut adjustments of the keel should be performed by trained and competent professionals.

Troubleshooting		
Problem	Possible Cause	Resolution
Excessive vibration	Material obstructing propeller	Remove material from propeller, shaft, or rudder by reversing engines. If necessary, stop engines and cut or pull material away.
	Bent prop or shaft	Replace propeller. If vibration continues, see your dealer for service.
	Excessive play in shaft seal	Check shaft seal for wear. Avoid sudden torque changes. See your dealer for repairs.
	Bent rudder	Replace. See your dealer for service.
Poor performance	Material wrapped around propeller	Run engines in reverse. If necessary, stop engines and cut or pull material away.
	Damaged propeller. Wrong propeller in use.	Replace propeller

INTAKES/DISCHARGES BELOW WATERLINE

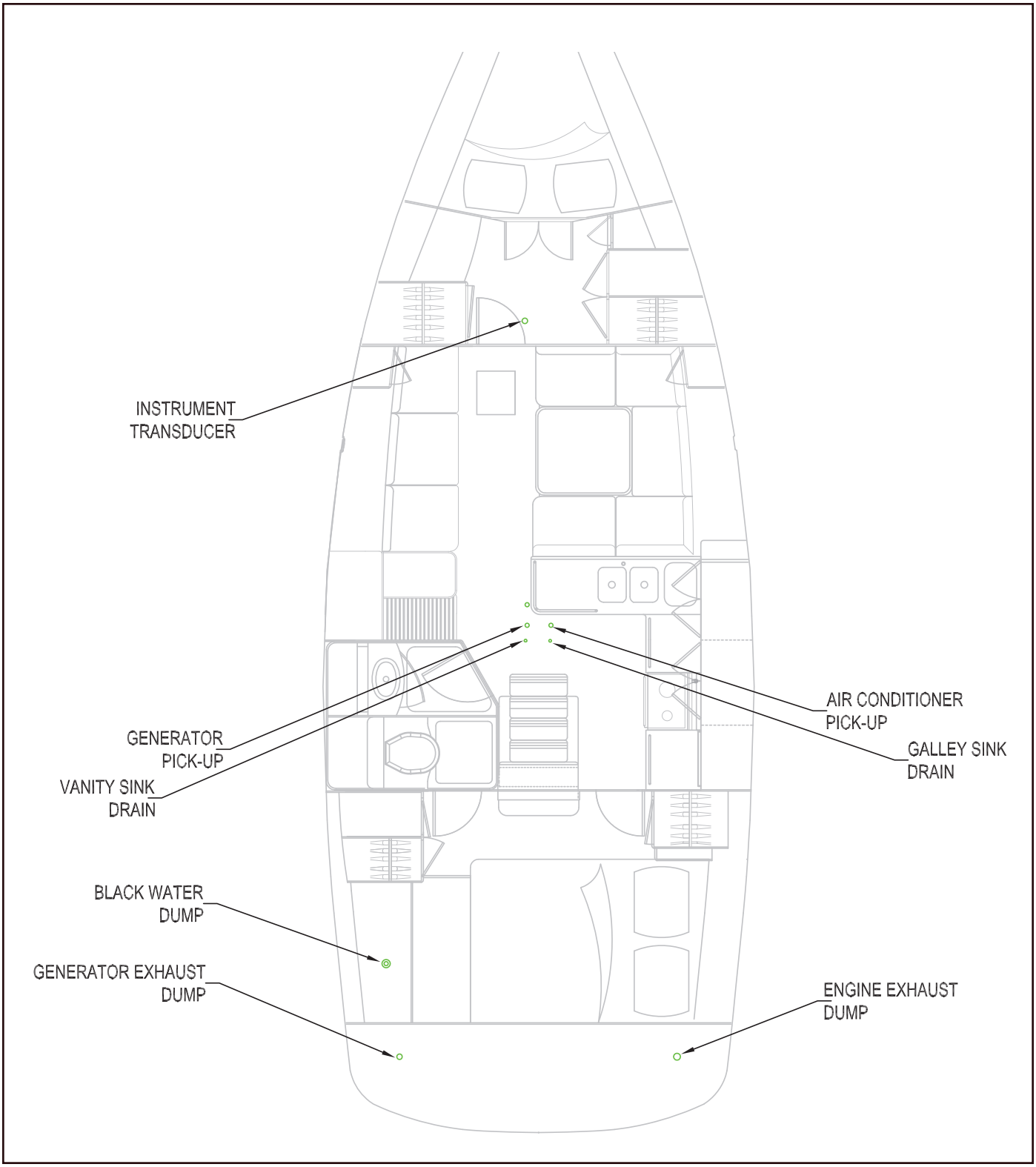

Figure 6.17

THRU-HULLS ABOVE WATERLINE - STARBOARD SIDE

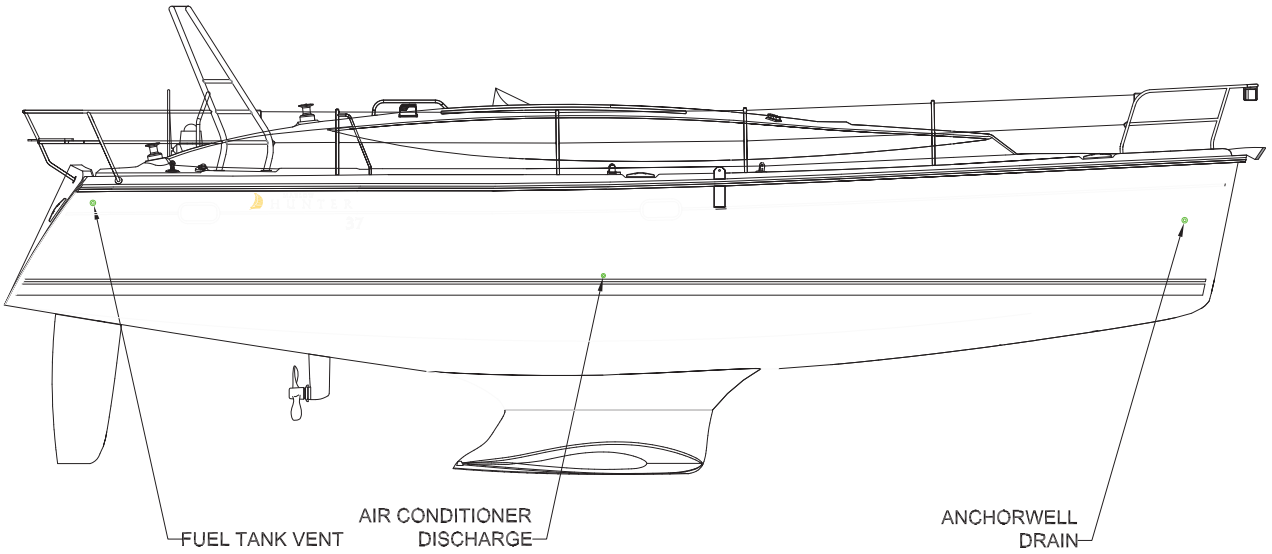

Figure 6.18

THRU-HULLS ABOVE WATERLINE - PORT SIDE

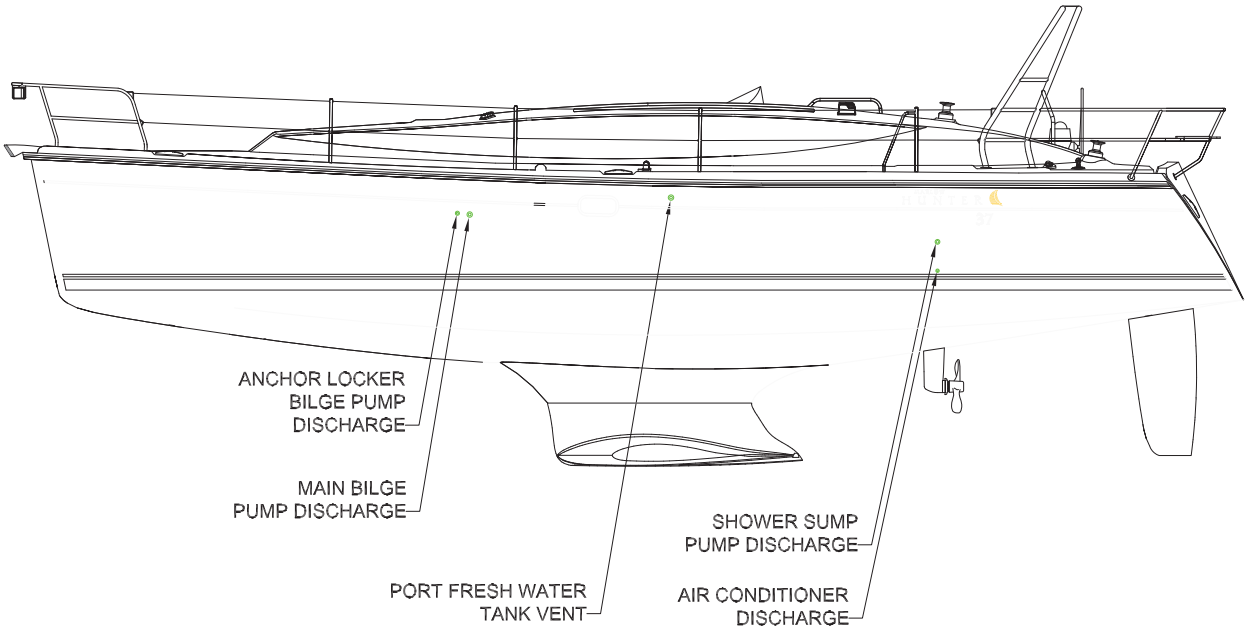

Figure 6.19

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Chapter 7

DC Electric System

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The purpose of this chapter is to provide information necessary to understand and operate the DC electrical system aboard your boat. This system comprises your boat's electrical components which are powered by battery. We will organize this section into the following topics:

1. DC Power System and Component Overview
2. DC Power Supply and Control Components
3. DC System Components and Operation
4. Other DC System Components
5. General Maintenance

The purpose of this chapter is not to educate on the repair or the expansion of the electrical systems. Nor is its purpose to educate on the basics of electricity. Again, the purpose is to provide you with the information to safely operate and maintain the DC electrical system.

⚠ WARNING ⚠

Electricity cannot be detected without the use of specialized test equipment. Never think you know whether a circuit is "live". Always have qualified, competent professionals inspect or make repairs to your electrical systems.

⚠ WARNING ⚠

Do not rely on the information in this manual as a repair guide. As always, only competent electrical service personnel should attempt to repair any electrical equipment or to expand the electrical system. Work performed by non-electrical service personnel may result in electrical shock or damage to the boats systems or components.

7.1 DC Power System and Component Overview

The source of power for the DC systems aboard your boat are battery banks. The control of that power is found in two individual master panels:

Name	Location
1. Battery Switch Panel (BSP)	Under Nav Seat
2. DC Panel (DCP)	Nav Station

Additional panels can also be found on your boat but only remotely control individual components, i.e. engines, inverter, etc..

The individual systems controlled by these master panels will depend on the options chosen on your boat. Consequently, you may or may not have a switch/breaker as noted in this manual. The following table lists the systems, location and resettable breaker amperage for the possible components installed on your boat's master panels:

System	Panel	Breaker (AMP)
Windlass (Option)	BSP	110
Winch (Option #1)	BSP	120
Winch (Option #2)	BSP	150
Battery Charger (Option)	BSP	50
High Water Bilge Pump (Option)	BSP	20
Main Bilge Pump	BSP & DCP	10
CO Detectors	BSP	5
Stereo Memory (Option)	BSP	10
Bow Thruster (Option)	BSP	20
Blower	BSP	10
LPG Panel	BSP	5
Tank Monitor	BSP	5
DC Main	BSP	75
DC Panel Volt Meter	BSP	5
Oil Changer (Option)	BSP	15
Entertainment (Option)	DCP	40
Refrigeration (Option)	DCP	15
Freezer (Option)	DCP	15
Deck Light	DCP	5
Running Lights	DCP	5
Water Pump	DCP	10
Chartplotter (Option)	DCP	10
Instruments (Option)	DCP	25
Cabin Lights #1	DCP	20
Cabin Lights #2	DCP	20
Sump Pump	DCP	10
Head (Option)	DCP	25
12V Outlets	DCP	15
Anchor/Steaming Lights	DCP	5

Figure 7.1

7.2 DC Power Supply and Control Components

Please refer to Fig. 7.18 for the basic power supply equipment and component layouts as reference for this section.

7.2.1 Batteries

The batteries speced for your boat have been selected for their ability to furnish starting power based on engine requirements, as well as their ability to power the DC system components (or house). We recommend AGM (absorbed glass mat) batteries (see Fig. 7.2 for battery specs).

Size	Volts	Function	Qty
24	12	START	1
4D	12	HOUSE	1 (+1 Optional)

Figure. 7.2

The DC system derives its power from two separate battery banks: start and house batteries. The house side is further prewired for an additional 4D battery (doubling the amp hour capacity). Batteries are located in the nav station and galley bilges. One house battery can be accessed from under the floor panel inboard of the nav station seat and the other under the floor panel aft of the galley sink. The start battery can be accessed under the floor panel aft of the 4D galley battery location.

Both banks are wired to the Battery Switch Panel (BSP) (Fig. 7.3). The batteries supply power first to the battery selector switches on the BSP then to the 12 Volt DC Panel (see Fig. 7.10), which distributes power to other subpanels and systems. (Some equipment is immediately energized from the batteries, i.e. main bilge pump.)

The negative terminal of both banks are attached to the DC ground connection on the engine. This system, known as the negative ground system, is the approved system for marine DC electrical systems. The battery wiring system has two color coded wires: yellow - negative (ground), and red - positive.

To avoid explosions, do not use jumper cables and a booster battery to start the engine. If batteries are dead, recharge them with the optional battery charger (if installed) (discussed later), optional inverter (if installed) (discussed later) or remove and recharge on shore.

Batteries produce hydrogen and oxygen gasses when being charged. If ventilation is poor, these explosive gasses escape through the vent/fill caps and may form an explosive atmosphere around the battery. This gas may remain around the battery for several hours after charging. Sparks or flame can ignite the gas and cause an explosion.

⚠ DANGER ⚠

Batteries contain Sulfuric Acid and can cause severe personal injury if mishandled.
Avoid contact with eyes, skin, or clothing. In case of contact, flush with water at least 15 minutes.
If swallowed, drink large quantities of water or Milk of Magnesia, beaten egg, or vegetable oil and seek medical attention immediately.

⚠ WARNING ⚠

Charging batteries produce gasses which can explode if ignited.

BATTERY SWITCH PANEL (BSP)

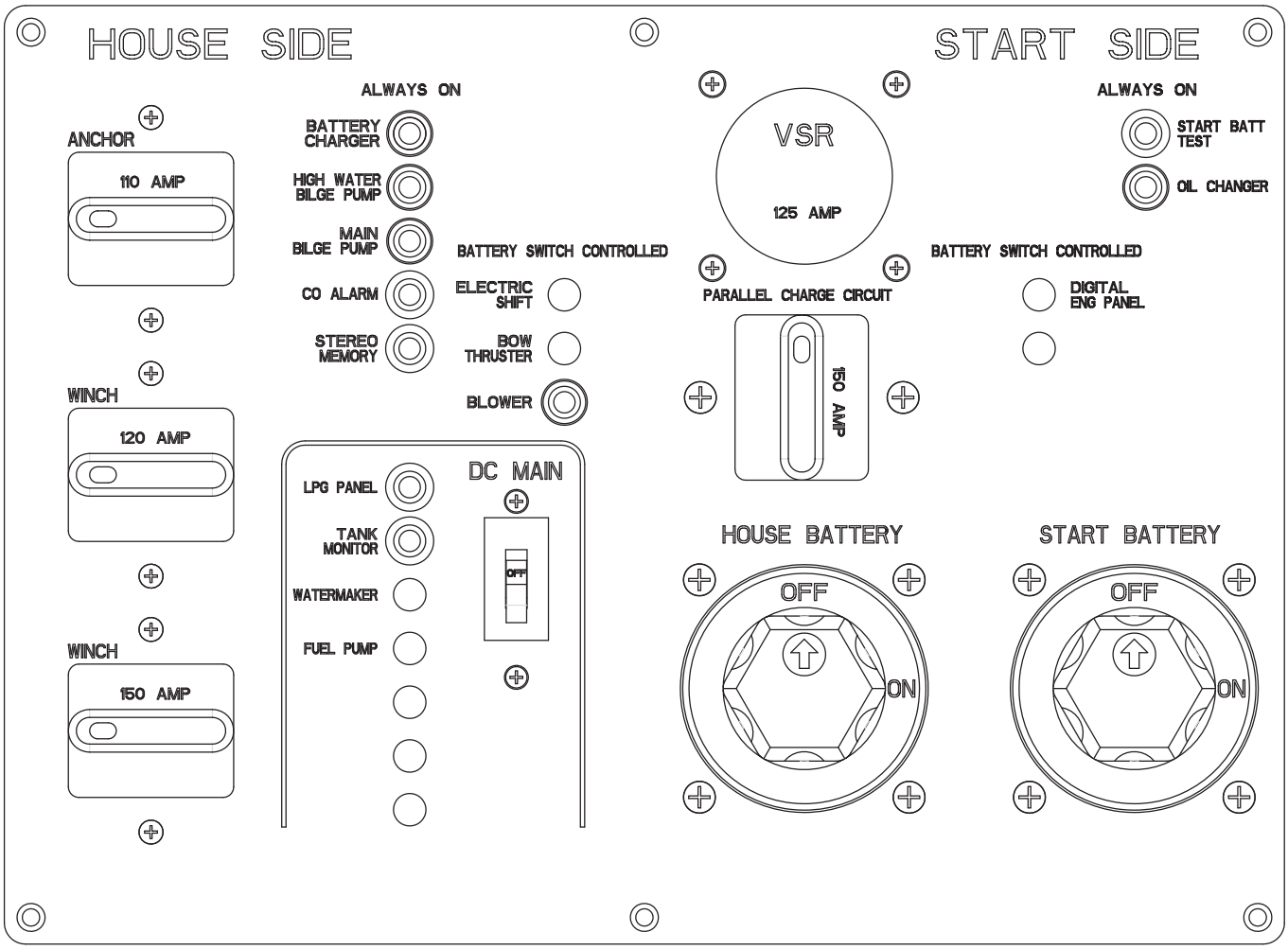

Figure 7.3

Explosion can shatter a battery.
Battery acid can cause severe personal injury such as blindness.
Keep flame, spark, and smoking materials away from batteries while charging. Charge in a well ventilated area.

⚠ WARNING ⚠

Batteries contain a large amount of potential electrical energy!
Extreme care must taken when working with batteries.
An improper connection to a battery can release enough energy to cause severe personal injury or fire.

To safely utilize the batteries stored energy, the following wiring precautions should be taken:

- The wiring to the batteries must have proper over current protection in the form of fuses or breakers.
- Use only battery chargers that have been listed by a testing agency, such as Underwriters Laboratories, Inc.
- Follow any wiring diagrams exactly.

To remove a battery, the following procedure should be

followed:

1. Turn off all power drawing breakers and isolate battery.

2. Remove negative (-) cable first, then the positive (+).

To install a battery, the following procedure should be followed:

1. Attach the positive cable to the positive (+) terminal on the battery.

2. Attach the negative cable to the negative (-) terminal on the battery.

NOTE: Batteries should always be removed and installed by trained, qualified persons to avoid potential damage.

7.2.2 Battery Switch Panel

The Battery Switch Panel (BSP) is mounted within the inboard face of the nav station seat (Fig. 7.4). The battery banks are connected to the round battery selector switches on the panel with the respective labels of "House Battery" and "Start Battery".

The Start Battery selector switch is a two position switch: "OFF" (12 o'clock) and "ON" (3 o'clock). The House Battery selector switch is a three position switch: "OFF" (12 o'clock), "ON' (3 o'clock) and "COMBINED" (5 o'clock).

Turning the selector switch to "ON" turns power on to the respective circuits. Turning the selector switch to the "OFF" position turns power off to the respective circuits. Turning the House Battery selector switch to the "COMBINED" position allows both the House and Start batteries to simultaneously source power. Consequently, power for both engine starting and house components can be sourced from a single battery or combined batteries.

The "DC Main" switch circuit breaker on the BSP provides power to the main DC Panel (see Fig. 7.9) for the house components.

The BSP also houses the breakers for some of the main components in your DC system. The breaker controls are marked on the panel and they control systems or components on your boat that require an energized connection even through the main DC Panel may be de-energized.

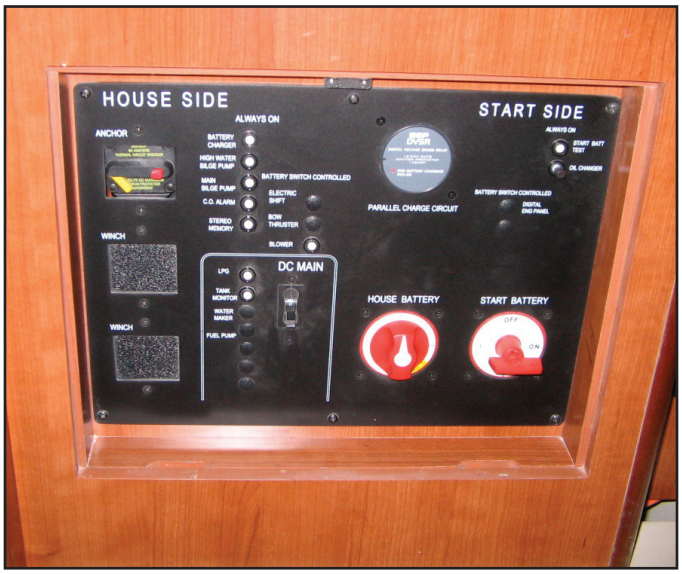

Figure 7.4

7.2.3 Battery Charger

An optional battery charger (see Fig. 7.5) is available to assist in maintaining charged batteries. It can be accessed through the port aft settee lid in the main salon. A 50 amp pop-out breaker exists on the Battery Switch Panel labeled "Battery Charger" and protects the charging system from a power fault following the AC panel. A 15 amp toggle switch breaker labeled "Battery Charger" exists for the battery charger on the AC panel which protects the battery charger from an AC system power fault (see AC Electric System chapter in this manual).

To charge the batteries, complete the following:

1. Connect the shore power cable (Fig. 7.6) to line 1 on the shore power inlet located in the transom garage (see Fig. 7.7).

2. Turn on main AC panel breaker (see AC Electric System chapter in this manual).

3. Turn on the battery charger breaker on the AC Panel (see AC Electric System chapter in this manual).

NOTE: Consult the charger manufacturer's OEM manual for charger operation, care and maintenance.

7.2.4 Engine Alternator

While your batteries can charge dock side through the battery charger or inverter (discussed later), they can

also charge when under power through the engine alternator (see Fig. 7.19).

Figure 7.5

Figure 7.6

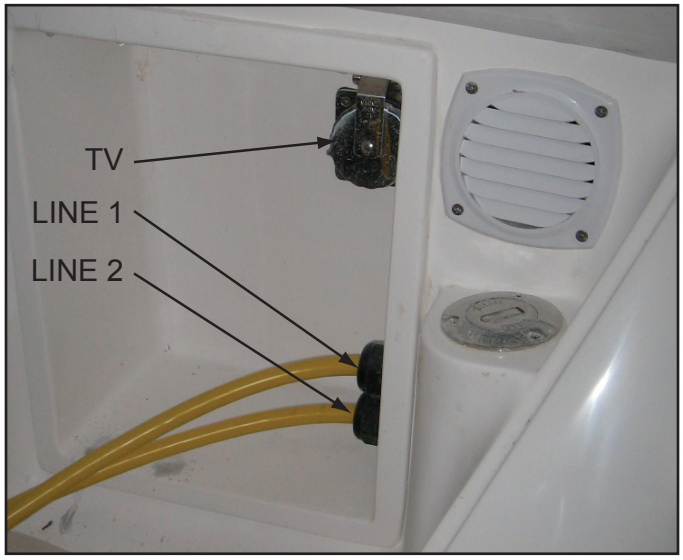

Figure 7.7

7.2.5 DC Panel

The DC panel (DCP) is located forward of the AC panel on the hull panel of the nav station (Fig. 7.8). Please refer to Fig. 7.0 and note the systems and components controlled by the main DC Panel. Notice when the battery selector switch is on, the respective battery voltage is shown in the upper right digital volt meter display. Also, indicator lights are built into the breaker switches to alert a selected system is powered.

7.2.6 Breakers, Switches and Fuses

All electrical systems aboard your boat are equipped with over-current protection in the form of breakers or fuses (Fig. 7.1 amperage table). All systems and components on the Battery Switch Panel and DC Panel are protected with breakers. Specific systems or components have been equipped with breaker switches for convenience in manually interaction.

Figure 7.8

7.2.7 Inverter

An optional inverter is available to convert DC power to AC (see the AC Electric System chapter in this manual for further details). The assembly consists of the inverter (Fig. 7.10) and a remote panel (Fig. 7.11). The inverter can be accessed through the port aft settee lid in the main salon. The remote panel is located on the hull panel of the nav station near the optional VHF radio and chart table light.

A secondary feature of the inverter is its battery charging capability. The batteries will charge if shore power or the optional generator is connected and the main AC Panel is energized.

7.2.7.1 Inverter Basic Operation

1. Choose the source battery(ies) and turn switch(es) to the “On” (3 o’clock) position (or “COMBINED” on the House Battery selector switch).
2. Turn on the inverter remote panel.
3. Turn on the main AC Panel breaker switch.
4. Turn on the appropriate appliance breaker on the AC Panel (see the AC Electric System chapter in this manual).

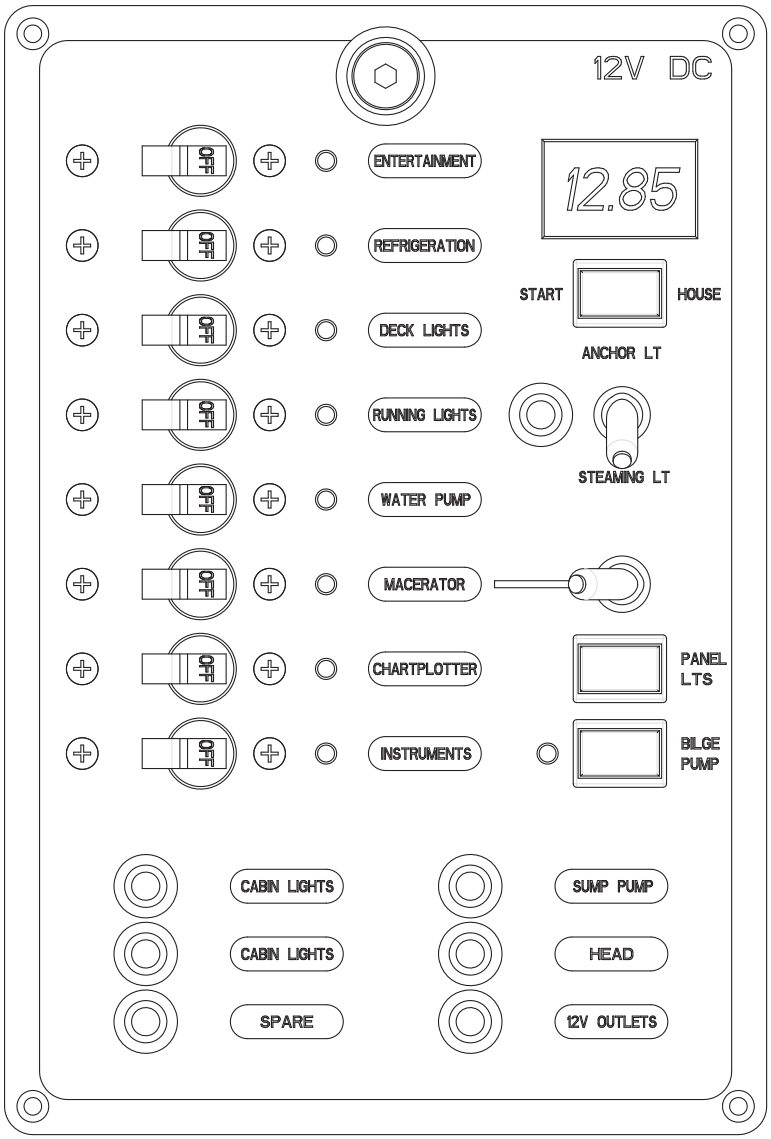

Figure 7.9

NOTE: Consult the inverter manufacturer's OEM manual for inverter operation, care and maintenance.

Figure 7.10

Figure 7.11

7.2.8 Engine Control Panel

Although the engine control panel is not a master panel, it is included in this section given the tight integration of the engine to the battery banks.

The engine control panel is located on the forward portion of the pedestal's instrument console (Fig. 7.12).

Power is provided to the engine control panel by positioning the battery selector switch(es) on the BSP to the desired setting. Either position the "Start Battery" switch

to “On” to provide power from one battery or position the “House Battery” switch to the “Combined” position to supply starting power from both batteries.

Figure 7.12

Once done, press the “Power Switch” button on the Engine Control Panel (Fig. 7.13) to energize the panel. At this point, the engine may be started or stopped. See the Engines & Transmissions section of this manual for general engine operation details and the Getting Underway chapter of this manual for engine starting and stopping.

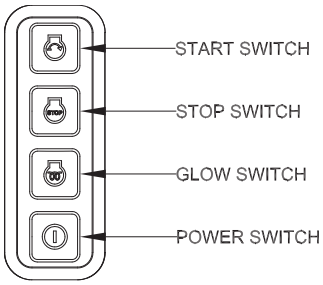

Figure 7.13

7.2.10 Generator

The optional generator supplies AC power to the boat. However, as with the boat engine, the generator engine requires power from the DC system to start and is consequently briefly mentioned here. For a full discussion of the optional generator system, please refer to the AC Electrical Systems section of this manual.

7.2.11 Grounds and Zincs

The negative ground system incorporates busbars in various locations within the boat (Fig. 7.14). These are identified by the congregation of yellow (negative) wires attached to the bar. All electrical circuits require a ground, and they are joined in sections at these busbars.

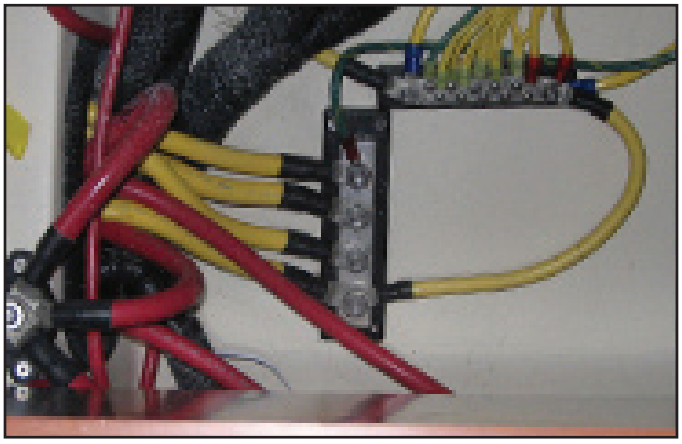

Figure 7.14

Sacrificial zinc anodes are included within some component assemblies to protect them from the effects of galvanic corrosion. Galvanic corrosion occurs primarily in salt water but can occur to a lesser degree in fresh water. Salt water allows electric current to flow from anodic to cathodic material. Any two metals from two components and their relative position in the galvanic rating table will determine which metal loses material (anode) and which metal remains largely undisturbed (cathode). The distance apart in the galvanic table of the two metals determines the rate of wear.

Consequently, zinc anodes are used as the sacrificial metal allowing corrosion of the anodes but limiting corrosion of the more costly underwater components. The sacrificial zinc anodes are considerably easier and less expensive to replace and their deterioration will not affect the performance of your boat as would the deterioration of any underwater components. The zinc anodes are replaced on a periodic basis (see the Maintenance section in this manual).

Important: DO NOT PAINT any part of the sacrificial zinc anode as it will retard the flow of electric current through them and render them ineffective.

7.3 DC System Components and Operation

The majority of the controls for DC components are located on the two master panels.

7.3.1 Battery Switch Panel (BSP) Controlled Components

Please refer to the panel layout in Fig. 7.3 for reference in the following discussion.

7.3.1.1 Windlass Breaker

The optional anchor windlass is supplied power through the BSP. The 110 amp windlass breaker on the panel is labeled “Anchor”. To operate the windlass, rotate the yellow trip lever counterclockwise into its cover flap. To de-energize the windless, depress the red breaker button (the yellow trip lever will flip downward). For additional details about the optional windlass and anchoring, please refer to the Underwater Gear chapter in this manual.

NOTE: If windlass becomes inoperable electrically, a manual winch handle is supplied (see Underwater Gear chapter in this manual for further details).

NOTE: Consult the windlass manufacturer’s OEM manual for windlass operation, care and maintenance.

7.3.1.2 Winch Breakers

Optional electric winches (helm and starboard coach winches) are supplied power through the BSP. The 120 amp and 150 amp winch breakers are labeled “Winch”. To operate the optional electric winch(es), rotate the yellow trip lever counterclockwise into its cover flap. To de-energize the winch(es), depress the red breaker button (the yellow trip lever will flip downward). For additional details about the optional electric winches, please refer to the Sails & Rigging chapter in this manual.

NOTE: Consult the winch manufacturer’s OEM manual for windlass operation, care and maintenance.

7.3.1.3 DC Main Breaker

As previously mentioned, the main DC Panel is supplied power through the Battery Switch Panel. The 75 amp breaker on the panel is labeled “DC Main”. To operate the majority of the DC components in your boat controlled from the DC Panel, this breaker must be “On”.

7.3.1.3.1 To Energize the Main DC Panel

1. Choose the single battery power source by positioning the House Battery selector switch to “ON” or the combined battery power source by positioning the House Battery selector switch to “COMBINED” (5 o’clock) and the Start Battery selector switch to “ON” (3 o’clock).
2. Toggle the “DC Main” breaker switch to “On”.

7.3.1.4 Battery Charger Breaker

As mentioned previously, a 50 amp pop-out breaker exists on the Battery Switch Panel labeled “Battery Charger”. This breaker protects the charging system from a power fault originating from the AC panel. A toggle switch breaker exists for the battery charger on the AC panel which protects the battery charger from a power fault (see the AC Electric System chapter in this manual).

7.3.1.5 Bilge Pump Breakers

The bilge pump system essentially consists of a main bilge pump together with a high-water alarm component. Additionally, an optional high water bilge pump is available. All pump systems are immediately energized from the battery banks.

Pop-out breakers are integrated within the Battery Switch Panel to protect the main bilge pump (10 amp/pump) and the optional high water alarm pump (20 amp) from a power fault.

The high water alarm system also has a control and display panel in the starboard aft cockpit (Fig. 7.15). A toggle switch allows the testing of the alarm by switching it to Test position. Its default toggle position is Auto. A red display will light and alarm will sound if rising water is detected. A 10 amp pop-out breaker exists for the high water alarm system on the panel itself for an additional level of protection.

The optional high water bilge pump is available to act as an extra layer of protection from water breach. If water collection is sufficient to overwhelm the main bilge pump and rise to a determined level, the high water alarm will sound and the high water bilge pump will activate to begin pumping at a higher rate than the standard main bilge pump.

For additional details on the bilge pump system, please refer to the Waste Systems chapter of this manual.

7.3.1.6 Carbon Monoxide (CO) Monitors Breaker

Your boat comes with CO detectors installed in all sleeping areas. The CO monitors are immediately energized from the battery banks. A 5 amp pop-out breaker labeled "CO Alarm" protects them from a power fault. Please refer to the Safety chapter of this manual for a thorough discussion on the hazards and precautions of this dangerous gas.

NOTE: Consult the CO detector manufacturer's OEM manual for detector operation, care and maintenance.

NOTE: Do not spray waxes or cleaning agents on the CO monitors.

Figure 7.15

7.3.1.7 Stereo Memory Breaker

With the optional stereo comes the need for maintaining the stereo memory for channeling and clock. The stereo memory is immediately energized from the battery banks. Consequently, a 10 amp pop-out breaker is integrated within the battery switch panel to protect the stereo from a power fault.

7.3.1.8 Electric Shift Breaker

Not used.

7.3.1.8 Bow Thruster Breaker

The breaker for the optional bow thruster protects the thruster system from a power fault. This 20 amp pop-out breaker is labeled "Bow Thruster".

7.3.1.8.1 Basic Thruster Operation

Refer to Underwater Gear section of this manual for additional details about the bow thruster installed on your boat.

1. Choose the single battery power source by positioning the House Battery selector switch to "ON" or the combined battery power source by positioning the House Battery selector switch to "COMBINED" (5 o'clock) and the Start Battery selector switch to "ON" (3 o'clock).
2. Position the "DC Main" breaker switch on the Battery Switch Panel to the "On" position.
3. Press the Enablement Button on the thruster control panel.
4. Press the Left or Right Directional Buttons to maneuver your boat the desired direction.

NOTE: Consult the bow thruster manufacturer's OEM manual for component operation, care and maintenance, including zinc replacement.

7.3.1.9 Engine Compartment Blower Breaker

The breaker for the engine compartment blower protects this ventilation system from a power fault. The 10 amp pop-out breaker is labeled "Blower".

Ventilation is very important within your boat. Given the potential hazards of Carbon Monoxide buildup (See Boating Safety chapter in this manual) on one hand, and the simple comfort of fresh air or air conditioning on the other, ventilation is a necessary standard.

On your boat, there are essentially three categories of ventilation:

1. Air conditioning system
2. Hatches and dorade vents
3. Engine compartment blower

The air conditioning system is AC powered (see AC Electric chapter in this manual). The hatches are manual and require no power.

The engine compartment blower is an exhaust fan which removes exhaust fumes and hot air from the engine compartment. This in-line blower pushes air from the engine compartment through a 4" hose to a vent located in the

transom garage (refer to the Waste Systems chapter in this manual for additional information on the blower).

⚠ WARNING ⚠

Fuel fumes in the engine compartment can explode. Before working on electrical wiring, ventilate engine bay and disconnect battery cables to prevent sparks.

7.3.1.10 LPG Panel Breaker

The breaker for the LPG panel protects the panel from a power fault. The 5 amp pop-out breaker is labeled “LPG Panel”. The LPG panel is an on/off switch allowing for remote control of LPG flow to the stove.

Please see the Fuel chapter in this manual for information on LPG hazards and use of the LPG system.

7.3.1.11 Tank Monitoring Panel

The monitoring of the fresh water and waste tanks is combined on a single panel (Fig. 7.16). This multi-tank monitoring panel is located on the hull panel of the nav station near the chart table light. Labels will be placed on the panel to map each tank to a number. To check the status of a tank, press the corresponding tank number to illuminate the tank type indicator which activate the gauge on the left.

Once the DC Panel is energized, the tank monitor panel is also energized. A 5 amp pop-out breaker labeled “Tank Monitor” protects the panel circuitry from a power fault.

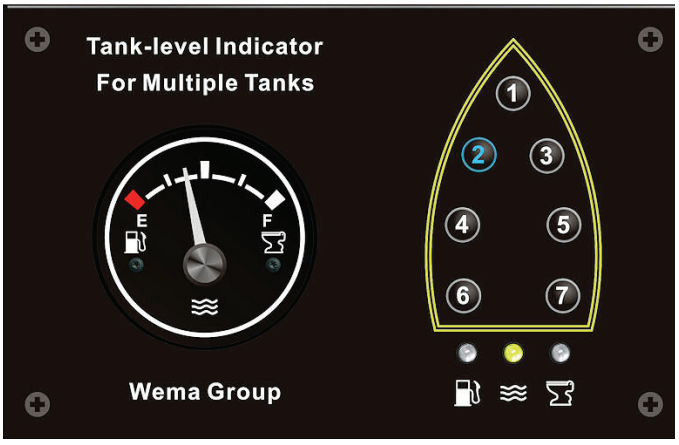

Figure 7.16

7.3.1.12 Watermaker Breaker

Not used.

7.3.1.13 Fuel Pump

Not used. The fuel pump is part of the engine assembly.

7.3.1.14 DVSR Module

The DVSR (Digital Voltage Sensing Relay) is a fully automatic subsystem within the DC system and requires no interaction by the boat operator and is only mentioned to explain its purpose.

The DVSR allows charging of two independent battery banks from a single charging source. When the voltage on the start battery rises to a charged level, the DVSR engages and allows the 2nd battery to charge. When charging stops and voltage falls, the DVSR will disengage, isolating the two batteries from each other. Dual sensing functionality enables the sensing of two battery banks, allowing two way charging.

7.3.1.15 Parallel Charge Circuit

Not used.

7.3.1.16 Digital Engine Panel

Not used.

7.3.1.17 Start Battery Test Breaker

The digital volt meter display in the upper right hand corner of the DC Panel is immediately energized from the battery banks to provide feedback on the battery status. A 5 amp pop-out breaker exists on the Battery Switch Panel labeled “Start Battery Test” to protect the battery banks from a power fault originating from the meter component.

7.3.1.18 Oil Changer Breaker

The purpose of the optional oil changer component is to allow automatic oil draining and filling of boat and generator engines (Fig. 7.17). A 15 amp pop-out breaker exists on the Battery Switch Panel labeled “Oil Changer” to protect the oil changer from a power fault.

7.3.1.19 Spare Breaker Positions

The BSP has spare positions available for the installation

of additional components.

Figure 7.17

7.3.2 DC Panel Controlled Components

Please refer to the panel layout in Figure 7.9 for reference in the following discussion. Please also note all switch breakers discussed below will have a corresponding LED light to the side of the switch to indicate an energized system if the switch is in the "On" position.

NOTE: Always turn off circuit breaker switches when leaving your boat unattended.

7.3.2.1 Volt Meter Battery Selector Switch

Immediately below the digital volt meter, located at the top-right corner of the panel, is a three-position rocker switch ("On-Off-On") for selecting the battery for voltage display. One side of the switch is labeled "Start" and other is labeled "House". Position the switch to the desired battery for a power level display. A charged battery will display a reading over 12 volts. The voltmeter will display the voltage of the battery banks regardless if the DC panel is energized or not.

7.3.2.2 Entertainment Breaker

This 40 amp switch breaker controls the optional entertainment components of your boat. The breaker is labeled "Entertainment" and protects the stereo, DVD, speakers and TV circuitry from a power fault.

NOTE: Consult the entertainment component manufacturer's OEM manual for component operation, care and maintenance.

7.3.2.3 Refrigerator Breaker

This 15 amp switch breaker provides power to the refrigerator. It is labeled "Refrigerator" on the panel and protects it from a power fault.

7.3.2.3.1 Basic Refrigerator Operation

1. Choose the single battery power source by positioning the House Battery selector switch to "ON" or the combined battery power source by positioning the House Battery selector switch to "COMBINED" (5 o'clock) and the Start Battery selector switch to "ON" (3 o'clock).
2. Position the "DC Main" breaker switch on the Battery Switch Panel to the "On" position.
3. Position the "Refrigerator" breaker switch to the "On" position.
4. To turn your refrigerator on, turn the fridge's internal temperature control knob clockwise to the desired cool level.
5. To turn your refrigerator off, turn the fridge's internal temperature control knob fully counterclockwise.

NOTE: If leaving the refrigerator on when away from the boat, ensure the shore power cables are connected. (If equipped with a battery charger, turn it on to prevent battery drain. If equipped with an inverter, the batteries will automatically charge if the AC panel is energized.)

NOTE: Consult the refrigerator manufacturer's OEM manual for fridge operation, care and maintenance.

7.3.2.4 Freezer Breaker

The freezer information is the same as the refrigerator. Please refer to the previous section.

7.3.2.5 Lighting Systems - Deck Light, Running Lights, Anchor Light, Steaming Lights & Cabin Lights Breakers

For consistency, we will discuss all switch breakers and reset breakers for lighting systems aboard your boat. There are basically two distinct lighting systems:

1. Navigational lighting

2. Boat based visibility lighting

7.3.2.5.1 Safety and Navigational Lighting - Running Lights, Anchor Light & Steaming Light Breakers

The navigational lighting consists of the following individual light components (see also the Boating Safety chapter of this manual for additional information on navigational lighting):

1. Running lights - the standard starboard (green), port (red) lights and stern (white) lights located on the deck
2. Anchor light - the 360 degree light located on the top of the mast
3. Steaming light - the 225 degree light located on the forward mast near the upper shroud spreader (see the Sails & Rigging chapter in this manual for spreader details)

A 5 amp switch breaker provides power to the running lights. It is labeled “Running Lights” on the panel and protects this system from a power fault.

Control of the anchor light and steaming light is through a vertical 3-position toggle switch. Setting the switch in the up position will illuminate the anchor light; middle position is off; down position will illuminate the steaming light. When either light is illuminated, an LED light on the toggle switch will illuminate to indicate an energized system. A 5 amp pop-out breaker located to the left of the toggle switch protects the anchor light/steaming light circuitry from a power fault.

The nav light configuration will depend on the status of the boat at night:

1. Anchored - anchor light only
2. Under sail - running lights and steaming light
3. Under power - running lights and anchor light

7.3.2.5.2 Boat Based Visibility Lighting - Deck Light & Cabin Light Breakers

The deck light, located half way up the mast, provides foredeck illumination for safety and convenience. It is controlled by a 5 amp switch breaker labeled “Deck Lights” on the panel and protects this circuitry from a power fault.

Cabin lights, courtesy lights and optional arch speaker pod light are all energized once the DC panel is energized. Circuitry for these lights are grouped into two 20 amp pop-out breakers labeled “Cabin Lights” which protect these systems from a power fault.

Individual wall or fixture switches allow lights on/off. One 3-switch wall light plate (Fig. 7.18) exists in the galley and is located on the sink cabinet face. The left switch controls the 3” main salon lights. The middle switch controls the 3” galley lights. The right switch controls the dish rack mini light and fan, located in the forward upper galley cabinet.

The balance of the interior light fixtures (also cockpit storage and optional arch speaker pod light) have on/off switches on the fixture. Refer to Figure 7.20 for light fixture location and details.

Figure 7.18

7.3.2.6 Fresh Water Pump Breaker

This 10 amp switch breaker controls power to the fresh water pump. It is labeled “Water Pump” on the DC Panel and protects it from a power fault. The water pump pressurizes the fresh water system (refer to the Water Systems chapter in this manual for additional details).

NOTE: Consult the pump manufacturers’ OEM manual for pump operation, care and maintenance.

7.3.2.7 GPS/Chartplotter Switch/Breaker

This 10 amp switch breaker controls power to the optional chartplotter (wide-screen display). It is labeled “GPS” on the panel and protects the chartplotter from a power fault. The GPS is generally bundled with the chartplotter (with or without radar).

NOTE: Consult the chartplotter manufacturers’ OEM manual for instrument operation, care and maintenance.

7.3.2.8 Autopilot/Instruments Switch/Breaker

This 25 amp switch breaker controls power to the stan-

dard knot/depth display and/or the optional Autopilot component and protects them from a power fault. It is labeled “Instruments” for only the knot/depth display and “Autopilot” for the optional autopilot and knot/depth display (unless the optional chartplotter is installed).

NOTE: Consult the instrument manufacturers’ OEM manual for instrument operation, care and maintenance.

7.3.2.9 Shower Sump Pump Breaker

Once the DC panel is energized, the sump pump is also energized. A 10 amp pop-out breaker labeled “Sump Pump” protects it from a power fault.

For additional details on the sump pump system, please refer to the Waste Systems chapter of this manual.

NOTE: Consult the pump manufacturers’ OEM manual for instrument operation, care and maintenance.

7.3.2.10 Electric Toilet Breaker

Once the DC panel is energized, the optional electric toilet electrical components are also energized. A 25 amp pop-out breaker labeled “Head” protects them from a power fault.

For additional details on the toilet system, please refer to the Waste Systems chapter of this manual.

NOTE: Consult the electrical toilet manufacturer’s OEM manual for component operation, care and maintenance.

7.3.2.11 12V Outlet Breaker

Your boat comes equipped with 3 12v outlets (see Fig. 7.21 for outlet locations). Once the DC panel is energized, these outlets are also energized. A 15 amp pop-out breaker labeled “12V Outlets” protects the system from a power fault.

7.3.2.12 Spare Breaker Positions

The DC panel has spare positions available for both a switch breaker and pop-out breaker.

7.3.2.13 Panel Lights Switch

Half way down the right side of the panel is the two-position rocker switch (“On-Off”) for panel lights. The power for the panel backlights for both the DC panel and AC panel are provided by the DC system and controlled with the rocker switch labeled “Panel Lts”. This circuitry is protected by a 5 amp fuse located on the back of the panel.

7.3.2.14 Bilge Pump Switch

Half way down the right side of the panel, immediately below the Panel Lights switch, is the momentary rocker switch for the main bilge pump. This switch allows manual control of the bilge pump and is energized regardless if the DC Panel is not energized. Pressing the right side of the switch engages the bilge pump and illuminates the LED to the left of the switch, indicating an energized state.

The circuit breaker for the main bilge pump is located on the Battery Switch Panel.

For additional details on the bilge pump system, please refer to the Waste Systems chapter of this manual.

NOTE: Consult the pump manufacturers’ OEM manual for instrument operation, care and maintenance.

7.3.2.14.1 To manually operate your bilge pump

To manually operate the bilge pump, one can do either of the following:

NOTE: The power to the DC panel does not need to be energized in order to manually operate your bilge pumps.

1. Flip and hold the rocker switch on the DC panel to the right until the pump out is complete. The toggle will spring back upon release.
2. For extreme circumstances, locate the float switch on the pump and manually rotate the float handle to simulate the float switch being under water. This will energize the pump. Hold until the pump out is complete.

7.4 Other DC System Components

The following components do not have a dedicated switch or fuse on the main panels and are generally protected within the OEM wiring or separate breakers/fuses. We will introduce these components and the method and location of power and circuit protection.

7.4.2 Engine Compartment Automatic Fire Extinguishing System

The optional automatic fire extinguishing system consists of a cylinder, mounting bracket, relay and a remote panel. It is powered through direct connection to the engine starter and incorporates a 5 amp in-line fuse located near the engine starter within the engine compartment.

The remote is part of the safety panel (Fig. 7.15) located on the aft lower inboard face of the starboard cockpit seat. If the engine starter is energize but the fire extinguisher remote panel “Ready” light is not illuminated, check the system wiring and in-line fuse and replace if necessary.

When a fire is detected on your boat, the automatic system will sound an alarm, discharge the extinguisher and illuminate the “Discharge” LED on the safety panel. The relay will shut down the engine, the blower and the optional generator.

When the critical portion of the emergency has passed, the alarm and illuminated “Discharge” light can be turned off by setting the switch to the “Override” position. To reset the system, a full extinguisher cylinder must be installed. Set the switch to “Normal” and verify the “Ready” LED is illuminated.

NOTE: Consult the automatic fire extinguisher system manufacturer’s OEM manual for system operation and maintenance.

7.5 General Maintenance

Maintenance of your DC system simply involves ensuring all connections are clean, tight, and covered with a corrosion inhibiting compound.

Troubleshooting		
Problem	**Cause**	**Solution**
12 volt equipment not working	Battery selector switch turned off	Check battery selector switches and ensure they are on.
Battery not charging with engine running	Check alternator, belt, etc.	Change alternator, tighten belt.
Battery not holding a charge	Faulty Battery Faulty battery charger	Replace battery. Have your dealer check battery charger.
12 volt DC device not working	Circuit breaker for device is off Weak or dead battery Faulty electrical connection	Switch breaker to on. Change battery selector switch position and recharge battery. Check 12 volt DC connections, tighten or repair as needed.
Cabin lights not working (off or dim)	Cabin reset breaker for device is off Weak or dead battery Light bulb burned out	Push in reset. Change battery selector switch position and recharge battery. Replace bulb.
Blower inoperative	Tripped reset breaker Weak or dead battery	Push in reset. Recharge or replace battery.

DC SYSTEM MAJOR COMPONENT GENERAL LAYOUT

WITH OPTIONAL BATTERY CHARGER (OPTIONAL INVERTER IS SIMILAR)

⚠ DANGER ⚠

Never reset a breaker that has tripped without first correcting the problem. Electrical system devices can be damaged and be faulty which can cause fire. Always correct the problem causing the tripped breaker before re-energizing.

Alterations or extensions to your electrical system can cause electrical fire or shock.

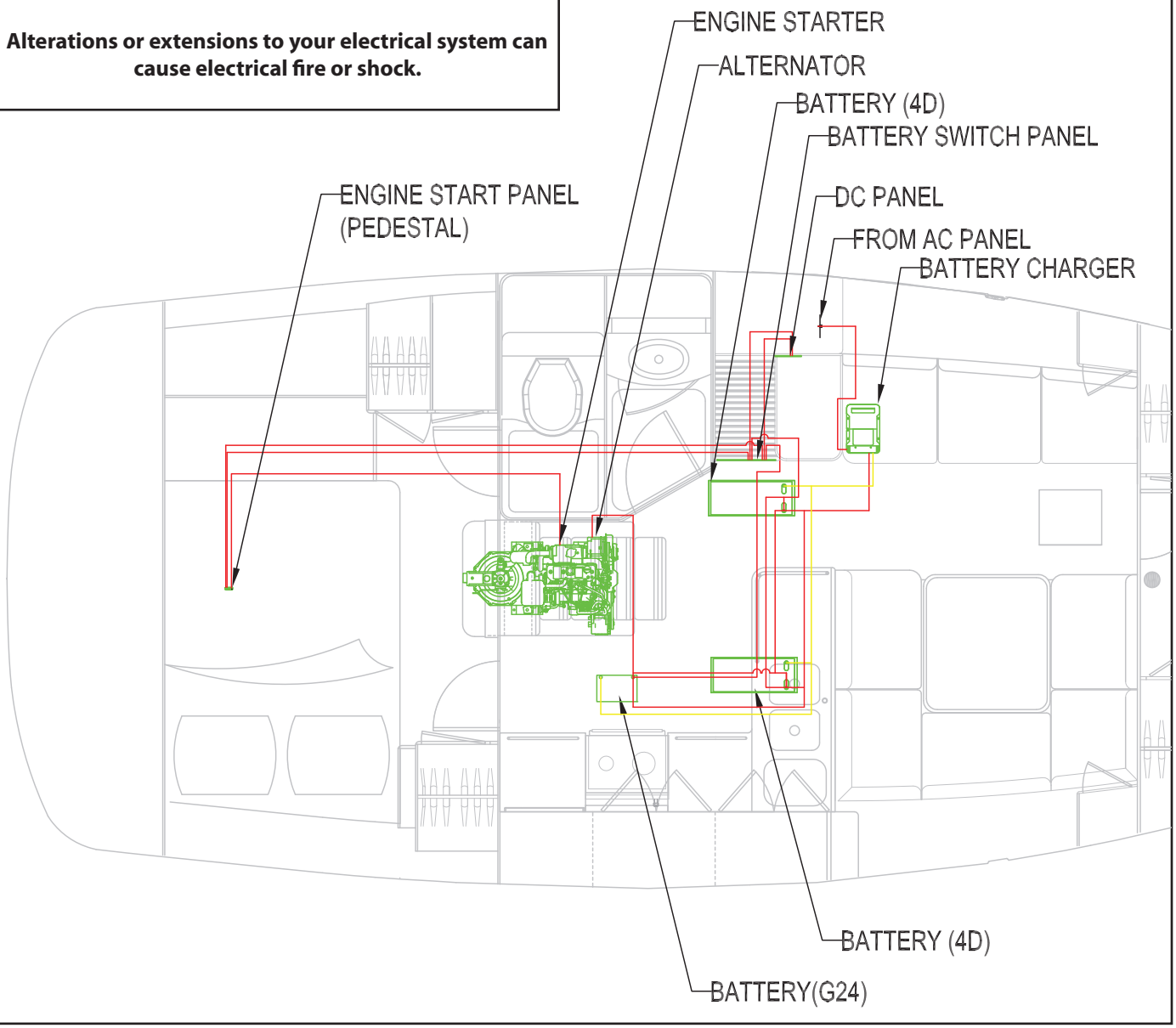

Figure 7.19

INTERIOR/EXTERIOR LIGHTING LAYOUT

#	TYPE	QTY	PIC
1	3” CIR-CULAR / CHROME W/O SWITCH	12	
2	3” CIR-CULAR / CHROME W/ SWITCH	12	
3	6” READ-ING	6	
4	5 1/2” LIGHT (COCKPIT STOR-AGE)	1	
5	18” FLUO-RESCENT (VANITY)	1	
6	MINI (DISH RACK)	1	
7	FLEX LIGHT (NAV STA-TION)	1	
8	BOW LIGHT (BOW-RAIL)	1	

#	TYPE	QTY	PIC
9	ANCHOR LIGHT (MAST-HEAD)	1	
10	STEAM-ING LIGHT/ DECK LIGHT (MID MAST)	1	

Figure 7.20

DC OUTLET LAYOUT

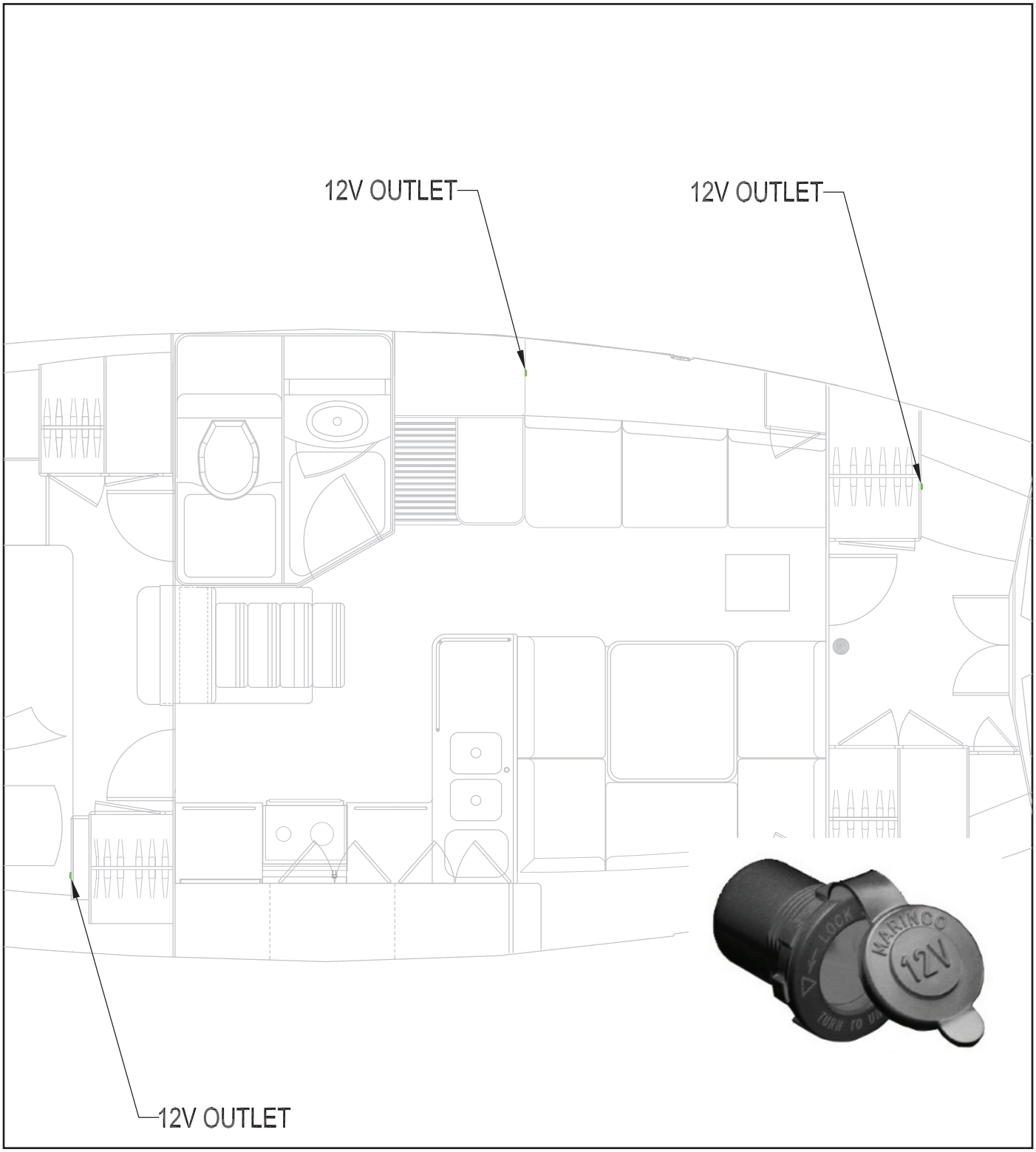

Figure 7.21

Notes:

Notes: