



MARLOW-HUNTER, LLC

Chapter 10

Waste Systems

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Waste and Sanitation Systems

Your boat has waste systems designed to fit the most demanding environment and feature the latest innovations in sanitation. These systems process waste based on the following general categories:

- A. Liquid, with subcategories of:
 - 1. Black water - raw sewage
 - 2. Gray water - waste not considered raw sewage
 - 3. Raw water - cooling water that is taken in through pickups, etc. and discharged back
- B. Gaseous - exhaust, tank ventage and ventilation

With these categories in mind, we will discuss the waste and sanitation systems organized into the following components:

- 1. Drains and Discharges
- 2. Pumps
- 3. Engine & Generator Waste
- 4. Head System
- 5. Holding Tank
- 6. Blower

IMPORTANT: U.S. Coast Guard regulations require that boats have a sanitation system on board to control pollution. Waste is to be stored in a holding tank or other device so it can be properly disposed of at a shore facility. Discharging this waste overboard in U.S. lakes, rivers, bays, and sounds, and within three miles of shore in international waters is prohibited. Check with the Coast Guard regarding regulations in your area.

10.1 Drains and Discharges

Any liquid waste removal system that is gravity fed would be termed a drain. Likewise, any waste removal system incorporating a pump would be termed a discharge. The passage of waste from the boat into the external environment is by thru-hulls or thru-decks. These exchange points are connected by hose or pipe to a collection point or point of waste origin.

10.1.1 Thru Hulls

There has to be an exchange point or outlet to release liquid waste. These outlets are called thru-hulls and are openings in the hull of your boat and generally incorporate bronze or plastic fittings. Thru-hulls can either drain or discharge from a single source, such as a holding

tank or bilge pump, or a common drain fed from multiple sources.

Thru-hulls are typically fitted to drain hoses or pipes and sized to be compatible with the system they drain. Hoses that feed the thru-hulls or common drains are generally looped over the fitting in order to prevent any water or waste from leaking or draining back into your boat. Fig. 10.1 gives you a summary view of some thru-hulls. Please refer to the Underwater Gear chapter in this manual for specific details on thru-hull locations on your boat.



Figure 10.1

Vents, shown second from the left in Fig. 10.1, are another type of thru-hull or thru-deck and represent another method of waste disposal. These thru-hulls are limited to allowing over-flow or air to escape the fuel, holding and water tanks aboard your boat. This is one way that gaseous waste products, and in some instances liquids, are properly disposed. However, avoid using the fuel tank vent as a method to determine if your tanks are full when fueling. Fuel spills are a dangerous hazard (see the Fuel System chapter in this manual for additional information). Please refer to the Underwater Gear chapter in this manual for specific details on vent locations on your boat.

10.1.2 Overboard Discharge

Some discharges have valves associated with them. The black water, or raw sewage system from the head, is one such system (although technically this system is a drain, it is generally discussed as a discharge). This ball valve or Y-valve is the overboard discharge valve which allows the discharge of the solid waste from the holding tank when at sea (discussed in greater detail within the Holding Tank section).

NOTE: The black water overboard discharge valve should remain closed at all times except during a purposeful discharge in lawful waters.

10.2 Pumps

Basically, all pumps are in some way associated with the waste/sanitation system, but this section will only focus on pumps that are directly associated with the process of pumping waste overboard. The supply function of these pumps are discussed in other sections.

Please refer to Figure 10.17 for the bilge/sump pump and drain layouts as reference to the subsequent discussions. Please reference the DC Electric System chapter of this manual for details regarding control and circuit protection of the waste related pumps.

10.2.1 Bilge Pumps

The safety of those on board your boat is a primary objective. Therefore, we strongly encourage you review all information contained in this manual, as well as the manufacturer's OEM manuals concerning all systems on your boat. Specifically, the bilge pump system will be one that is crucial to fully understand. These pumps have the critical function of removing water from the bilges of your boat. They must be kept clean and functional to ensure they complete their task.

Your boat is equipped with 2 bilge pumps. The forward bilge pump (Fig. 10.2) is installed in the anchor chain compartment and accessed through the forward bunk port drop-in. It has a pumping capacity of 4.2 gallons per minute and functions to remove water from the anchor chain locker generally due to anchoring. The main bilge pump (Fig. 10.3) is installed in the main salon and accessed through the main bilge floor panel. It has a pumping capacity of 26.7 gallons per minute and is the first responder in the event of water collection.



Figure 10.2



Figure 10.3

10.2.1.1 Main Bilge Pump Operations

NOTE: Power to the DC panel is not required in order to manually operate your bilge pumps.

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

1. Flip and hold the toggle 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 near 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.

10.2.1.2 Maintenance on Bilge Pumps

No maintenance is required beyond ensuring that the float switches are operational and pump intakes are debris free.

10.2.2 Emergency High Water Alarm

The high water alarm will sound if your boat is taking on water sufficient to overwhelm the ability of the main bilge pump to properly discharge. Should the water level rise above the high water mark, you will hear the high water alarm sounding from the Safety Panel, located in the starboard cockpit, together with a solid red light displayed (Fig. 10.4). This alarm means high water exists in the bilges and it is time to take action.

For reference on possible courses of action, we recommend reading (prior to your initial launch) Chapman's Piloting, Seamanship and Boat Handling for recommendations on responding to a high water situation. If you do not have a copy of this book, we strongly encourage purchasing a copy and keeping it handy; it is full of useful safety and navigational information.

The high water mark is determined by the placement of the high water float switch (Fig. 10.7 - shown with the high water bilge pump - see next section) located in the companionway landing and accessed through the largest floor panel in the landing area.

The alarm system can be periodically tested using the two-position toggle switch located on the High Water Alarm Panel. Positioning the switch to TEST will activate the audible alarm and light display to verify proper operation. Positioning the switch to AUTO is the standard operating position.



Figure 10.4

10.2.3 High Water Bilge Pump

The optional high water bilge pump is a redundant system for additional protection on water accumulation within the boat. As noted above, if a high water condition exists and the optional high water bilge pump is installed (Fig. 10.5), the pump will be activated in conjunction with the alarm.

It is located in the companionway landing and accessed through the largest floor panel in the landing area. It has a pumping capacity of 66 gallons per minute and functions to remove water from the bilges in the event the main bilge pump is overwhelmed or becomes inoperable. The pump will discharge waste through the port aft thru-hull.

10.2.3 Manual Bilge Pump

The optional manual bilge pump (Fig. 10.6), located in the port cockpit, is also a redundant system for additional protection. The pump includes a manual handle to be inserted into the pump mechanism where the up and down motion on the handle will begin discharging water out the thru-hull. Pumping capacity will depend on the speed of the pump action. The actual pump can be accessed through the port gull-wing seat lid. The manual handle is stored under the port gull-wing seat lid. The receiver for the manual handle is mounted to the port cockpit seat face (includes a flip-down cover). The feed end of the hose is located in the main bilge.



Figure 10.5



Figure 10.6

10.2.4 Shower Sump Pump System

The sump pump (Fig. 10.7) serves to discharge grey water originating from the shower and collected in the sump. The pump is activated and deactivated by pressing the ON/OFF switch. The system includes a filter (shown with the pump) to collect larger waste materials and will need to be frequently checked and cleaned.

The pump is located in the aft cabin and is accessed through the port forward bunk drop-in. The ON/OFF switch is located in the shower and would remain in the ON position while the shower is running.



Figure 10.7

No maintenance is required on the pump itself. However, periodically clean the filter by removing the lid to access the filter. Remove and clean the filter. Replace the filter and lid when done.

NOTE: Consult the pump manufacturers' OEM manuals for additional details regarding operation, care and maintenance.

10.3 Engine and Generator Waste

For both the engine and optional generator, raw water is mixed with the exhaust and discharged through the exhaust system. Please note that the exhaust is a gas, carbon monoxide, and is very dangerous. Please ensure a thorough review of the Boating Safety chapter in this manual and follow all guidelines concerning this potentially lethal gas.

The engine exhaust is channeled to the mixing elbow (Fig. 10.8), located in the aft cabin's engine compartment cover, where water and exhaust gases are mixed together. The mixture then flows to the muffler (Fig. 10.9), located within the aft bunk, and exits the boat on the starboard transom below the waterline (see the Underwater Gear chapter in this manual for thru-hull locations).



Figure 10.8

The generator exhaust system is similar to the engine arrangement. The mixing of water takes place within the generator housing. The mixture then flows to the muffler (Fig. 10.10), located within the deck storage, and exits the boat on the port transom below the waterline (see the Underwater Gear chapter in this manual for thru-hull locations).

Please refer to Figure 10.19 for the engine and optional generator exhaust system layouts.



Figure 10.9



Figure 10.10

10.4 Head System

All vessels with fixed toilets operating on the waterways of the United States and some foreign countries are required to be equipped with an operable Marine Sanitation Device (MSD). The marine sanitation system aboard your boat is a waste tank system defined by the United States Coast Guard as a Type III System. Type III systems permit operation of the toilet without direct discharge of untreated waste after every flush. Type III systems can be discharged at a marina, dock side pump-out stations or, if in coastal waters, at least three miles offshore. Please refer to Fig. 10.20 for the black water plumbing layout.

NOTE: Overboard discharge capabilities must remain inoperative while within the 3 mile limit. Overboard discharge valve must remain closed.

10.4.1 Manual Head System

The manual head system (Fig. 10.11) is designed to use raw water. This marine toilet comes with a compact white vitreous china bowl and is equipped with a hand pump. (refer to the Water Systems chapter in this manual for details on raw water supply for the manual toilet).

10.4.2 Electric Head System

The optional electric head (see Fig. 10.12) is designed to use fresh water. The 12 volt electric marine toilet comes with a compact white vitreous china bowl and is equipped with a dual function pump which eliminates the need for hand pumps and dry bowl valves. With the push of a single switch, the self-priming flush pump rinses the bowl. The switch is located on the forward shower bulkhead.



Figure 10.11

The toilet is controlled by a breaker switch at the main DC panel (see the DC Electric System chapter in this manual).



Do not use chlorine-based or caustic cleaning agents, or chemicals such as a drain opening product in your head systems. Use of these products may cause serious damage to the system's seals and hoses.

NOTE: Consult the toilet manufacturer's OEM manual for additional details regarding operation, care and maintenance.



Figure 10.12

10.5 Holding Tank

The holding tank on your boat is installed to hold black water waste until you can safely dispose of or pump it overboard. The tank (left side Fig. 10.13) is installed within the recess between the hull and the shower pan and can be accessed through the upper panel behind the toilet (right side Fig. 10.13).



Figure 10.13

IMPORTANT: You must ensure it is legal to empty your holding tank in the waters you occupy. Some areas have restrictions on pumping out black water waste!

10.5.3 Holding Tank Operations

The holding tank must be emptied when it approaches a full state. There are two methods for removing waste from the holding tank:

1. Overboard discharge when in waters where it is legally permitted
2. Dock side pump-out at a waste facility.

Check with the Coast Guard and local authorities before discharging waste overboard.

10.5.3.1 Overboard Discharge Operation

To discharge the gravity feed holding tank overboard, one simply opens the overboard discharge Y-valve. The valve (Fig. 10.14) is located in the aft cabin and accessed through the port aft hanging locker drop-in.



Figure 10.14

To close the Y-valve, rotate the handle counterclockwise. To open the valve to seawater, rotate the valve to the straight up position.

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⚠ WARNING ⚠

Failure to close the overboard discharge valve when not in use could cause the holding tank to fill and possibly flood the boat.

⚠ WARNING ⚠

Waste in the holding tank can form methane gas. Use suitable precautions when any maintenance is conducted to the sanitary system.

10.5.3.2 Dock side Waste Removal

To remove waste from the holding tank at a dock side waste facility, insert the hose from the pump-out facility into the waste access (Fig. 10.15) located on the starboard aft side-deck and follow any instructions. Instructions may vary from one facility to another.

Waste and Sanitation Systems



Figure 10.15

10.5.3.3 Maintenance on Holding Tank

Maintenance on the holding tank simply entails managing odor and ensuring no methane gas leaks exist. Any deodorizer may be used as long as it contains no alcohols or strong chemicals. Do not use strong drain opening chemicals or bleaching agents as they may cause serious damage to the system's seals and hoses.

10.6 Blower

To maintain a desired range of temperature and quality of air within the engine compartment, your boat can process a continuous cycle of air with the ventilation system.

A blower (Fig. 10.16) is installed in the aft cabin and can

be accessed through the port bunk drop-in. Air is drawn in from the engine compartment and pushed out the air vent located in the transom garage. The blower is activated when the engine start panel (see Engines and Transmissions chapter in this manual) is powered. The blower circuitry is protected by a pop-out breaker located on the Battery Switch Panel (see DC Electric Systems chapter in this manual). See Figure 10.21 for the overall blower system layout.



Figure 10.16

Save Our Seas !

It is illegal to dump plastic trash anywhere into the ocean or navigable waters of the United States. Violation of these requirements may result in civil penalty up to \$25,000, a fine of \$50,000 and imprisonment for up to five years.

<p>PLASTIC - limited to : plastic bags, styrofoam cups and lids, sixpack holders, stirrers, synthetic fishing nets, ropes, lines, and bio or photo degradable plastics. Includes but is not</p>	<p>GARBAGE - Means paper, rags, glass, metal, crockery (generated in living spaces aboard the vessel-what we normally call trash), and all kinds of food, maintenance and cargo-associated waste "Garbage" does not include fresh fish or fish parts, dishwater and gray water.</p>	<p>DUNNAGE- Material used to block and brace cargo, and is considered a cargo associated waste.</p> <p>GRAYWATER- Means drainage from a dishwasher, shower, laundry, bath, and washbasin, and does not include drainage from toilets, urinals, hospitals, and cargo spaces.</p>	<p>DISHWATER- Means the liquid residue from the manual or automatic washing of dishes and cooking utensils which have been pre-cleaned to the extent that any food particles adhering to them would normally interfere with the operation of automatic dishwashers.</p>
INSIDE 3 MILES	3 TO 12 MILES	12 TO 25 MILES	12 TO 25 MILES
(and in U.S. Rivers, Bays and Sounds)	PLASTICS	PLASTICS	PLASTICS
DUNNAGE, LINING AND PACKING MATERIALS THAT FLOAT	DUNNAGE, LINING AND PACKING MATERIALS THAT FLOAT	DUNNAGE, LINING AND PACKING MATERIALS THAT FLOAT	DUNNAGE, LINING AND PACKING MATERIALS THAT FLOAT
ANY GARBAGE EXCEPT DISHWATER, GRAYWATER, FRESH FISH PARTS	ANY GARBAGE NOT GROUND TO LESS THAN ONE SQUARE INCH		

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Troubleshooting		
Problem	Cause	Solution
Electric Head Not Flushing	Head breaker Off Battery Charge Low	Switch Breaker to on. If Breaker is tripped determine cause and correct. Charge Batteries
Head Not Emptying	Blocked line to tank	Remove material from line
Shower Sump Overflowing	Sump Pump Breaker OFF Discharge line blocked Pinched Line Defective Pump	Switch Breaker to on. If Breaker is tripped determine cause and correct. Clear material from line Straighten line Replace Pump (See your dealer for service)

BILGE/SUMP PUMP & DRAIN SYSTEM LAYOUT

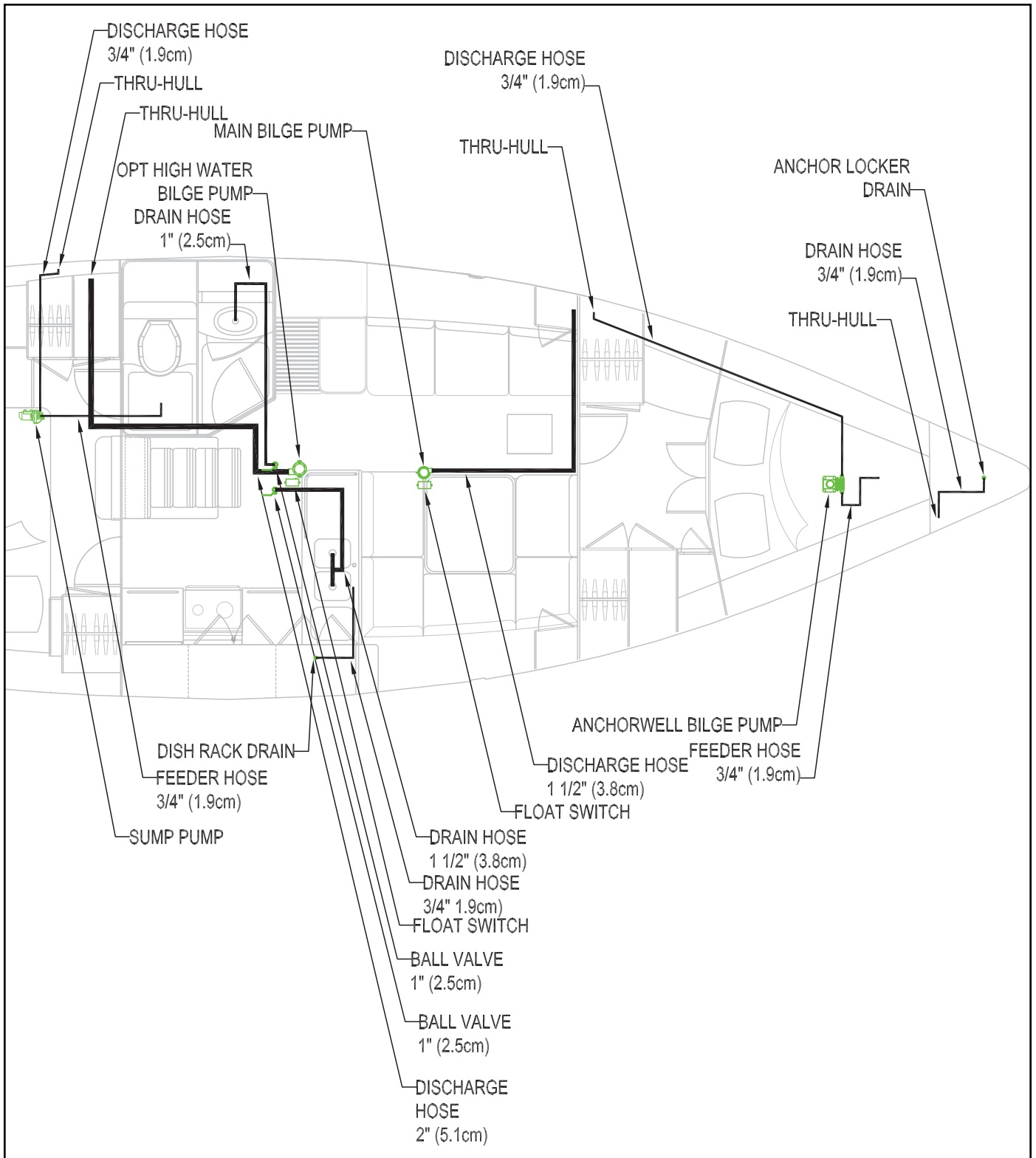


Figure 10.17

AIR CONDITIONING WASTE WATER LAYOUT

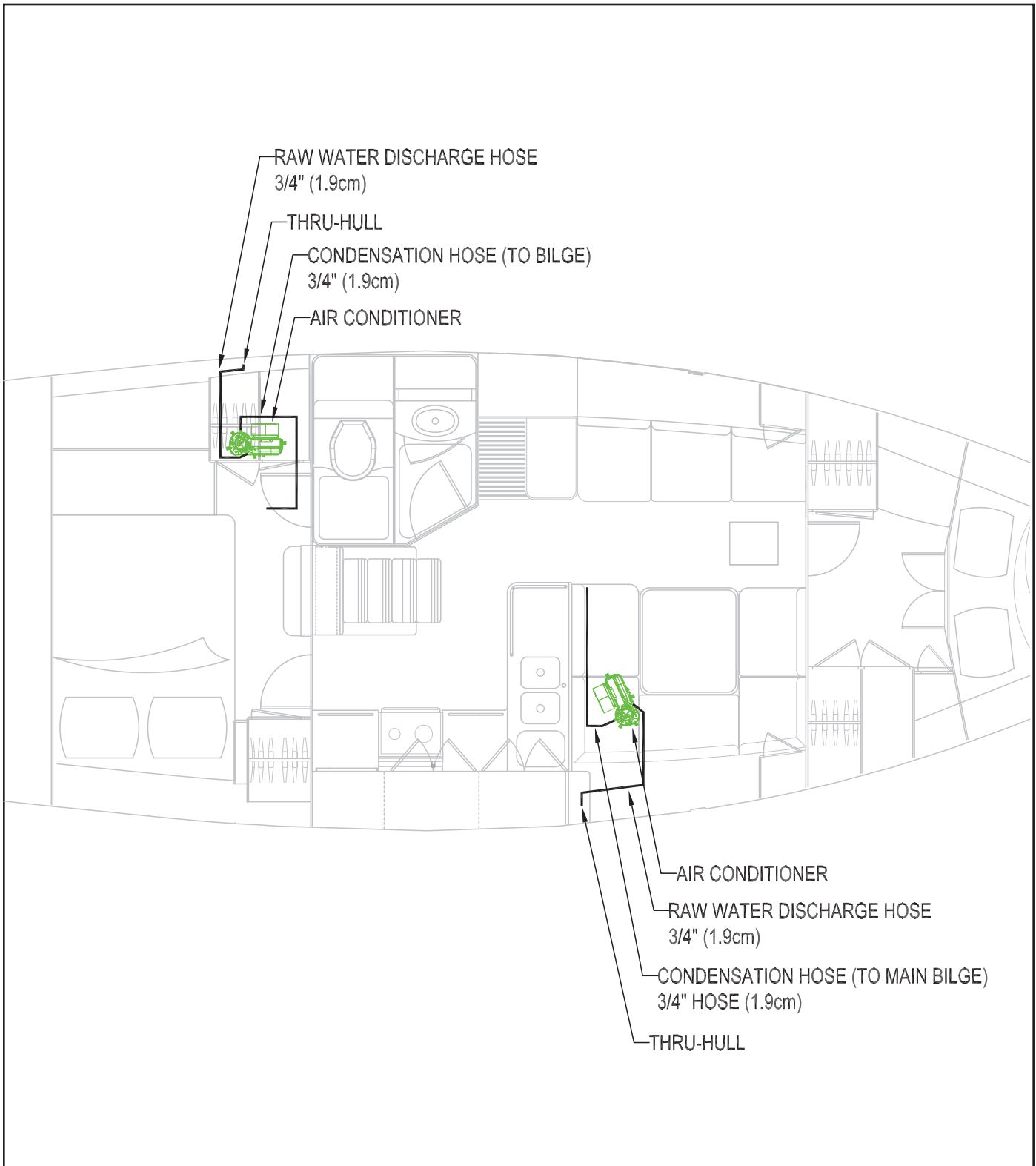


Figure 10.18

ENGINE & OPTIONAL GENERATOR EXHAUST SYSTEM LAYOUT

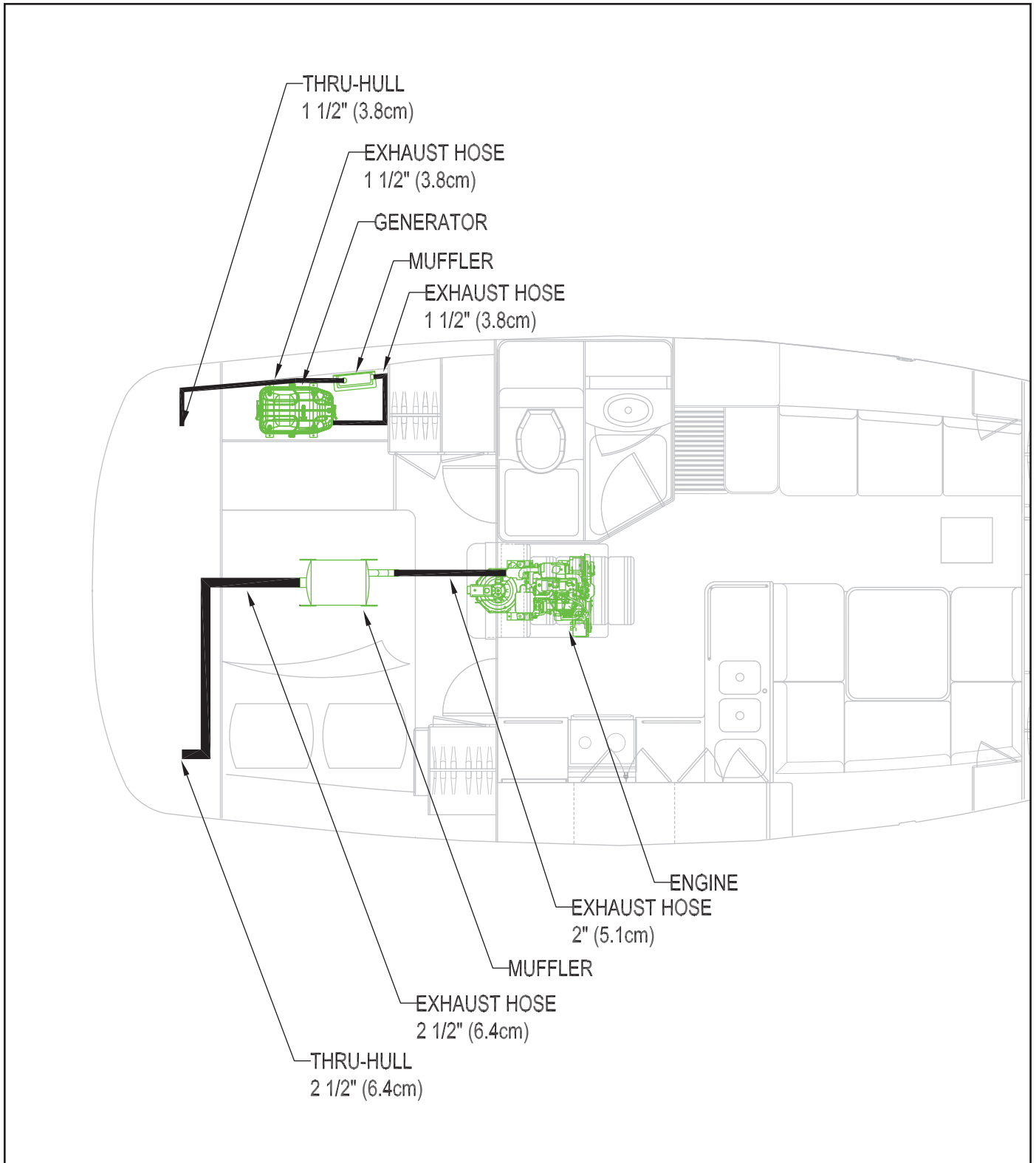


Figure 10.19

BLACK WATER PLUMBING LAYOUT

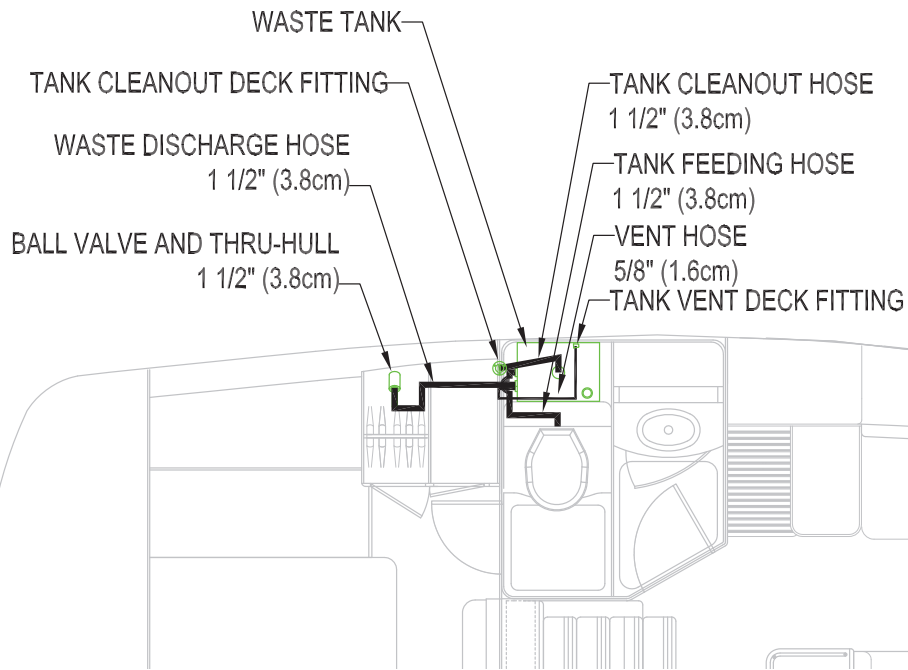


Figure 10.20

ENGINE COMPARTMENT BLOWER LAYOUT

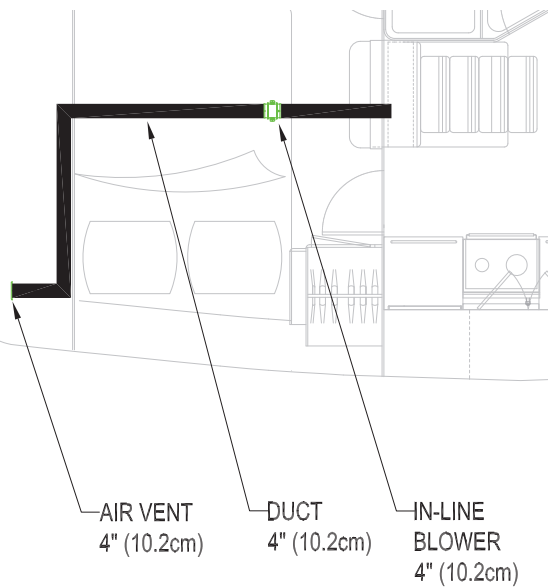


Figure 10.21



MARLOW-HUNTER, LLC

Chapter 11

***Engines
and
Transmissions***

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Engines and Transmissions

This chapter will serve as a general introduction to the engine assembly and its associated components. Specific information on part identifying, operating and maintaining your engine is found in the manufacturer's OEM manual. Our discussions will touch on the following items:

1. Engine / Transmission
2. Engine Fluids
3. Engine Operations
4. Exhaust
5. Maintenance

11.1 Engine / Transmission

Your Hunter sailboat comes equipped with auxiliary power, a diesel engine. The standard engine is a 29HP shaft drive model with an optional 40HP saildrive model available. Proper attention to and maintenance of your engine will assure you of many hours of pleasurable, safe boating, and will prevent unnecessary engine problems.

You must, therefore, become a student of your engine and be thoroughly familiar with all aspects of proper operations as outlined in the manufacturer's OEM manuals. In addition, follow their recommended maintenance and warranty schedule. Engine abuse or improper maintenance may adversely affect any possible claims made under the independent warranty provided by the engine manufacturer.

NOTE: All illustrations in this manual depict the 40HP engine.

11.1.1 Engine

The engine can be accessed through multiple locations, depending on the desired angle of approach. Points of access are from the aft cabin (lift up engine cover and remove - left side Fig. 11.1), galley (remove door with push button latch - right side Fig. 11.1), companionway (lift up hinged step - left side Fig. 11.2), and head (remove door with push button latch - right side Fig. 11.2). As a visual point of reference, each point of access picture (of the 40HP engine) is accompanied by a illustration with the same orientation. In addition, see Figure 11.3 for an profile illustration of the 29HP engine layout.

11.1.2 Transmission

In general, the engine assembly is often referred to as 2 associated components: the engine and the marine gear or transmission. The 29HP engine propulsion assembly includes the straight shaft that bolts to the marine gear. The 40HP engine propulsion assembly includes a sail drive which incorporates the marine gear in the one assembly.

The transmission has a reduction gear which drives the propeller at a slower rotation speed than that of the engine. For the 29HP engine, the propeller shaft is mounted to the transmission and passes through the hull within the stuffing box (see Underwater Gear chapter of this manual for a description of the stuffing box). For the 40HP engine, the sail drive passes through the hull and is protected from water breach with gaskets.

11.1.3 Nameplates

A nameplate is attached to the rocker arm cover (top of engine) and provides the following information:

1. model
2. gear model
3. continuous power (kw)
4. Speed of prop shaft
5. fuel stop power (kw)
6. engine number
7. manufacturing date

A nameplate is attached to the transmission and sail drive and provides the following information:

1. model
2. gear ratio
3. oil
4. manufacturer's number

This information will be important when communicating with the engine manufacturer or Marlow-Hunter regarding warranty, parts and service



When near the engine or any area where mechanical equipment is located, always be aware of moving parts or components. Death or dismemberment may result if entangled in moving machinery.



Take proper care when washing down or cleaning

Engines and Transmissions

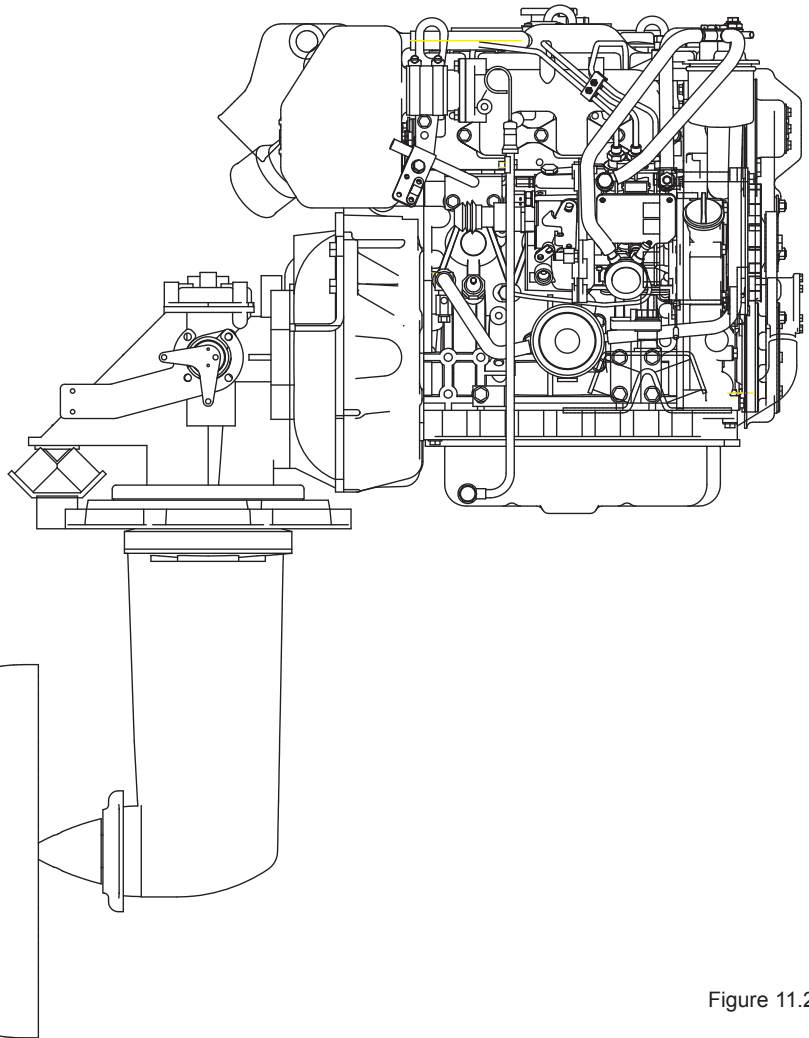
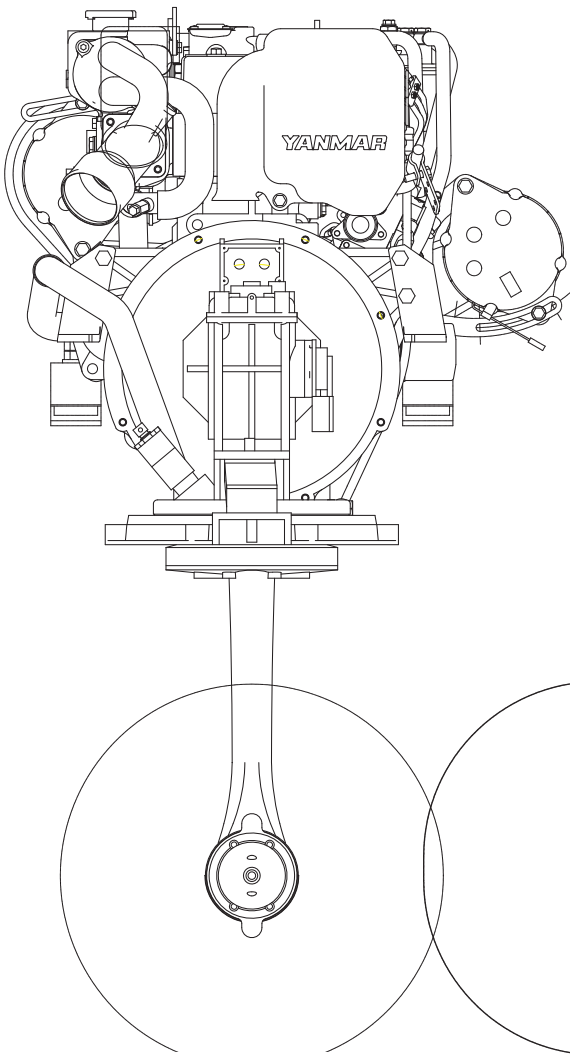


Figure 11.2

Engines and Transmissions

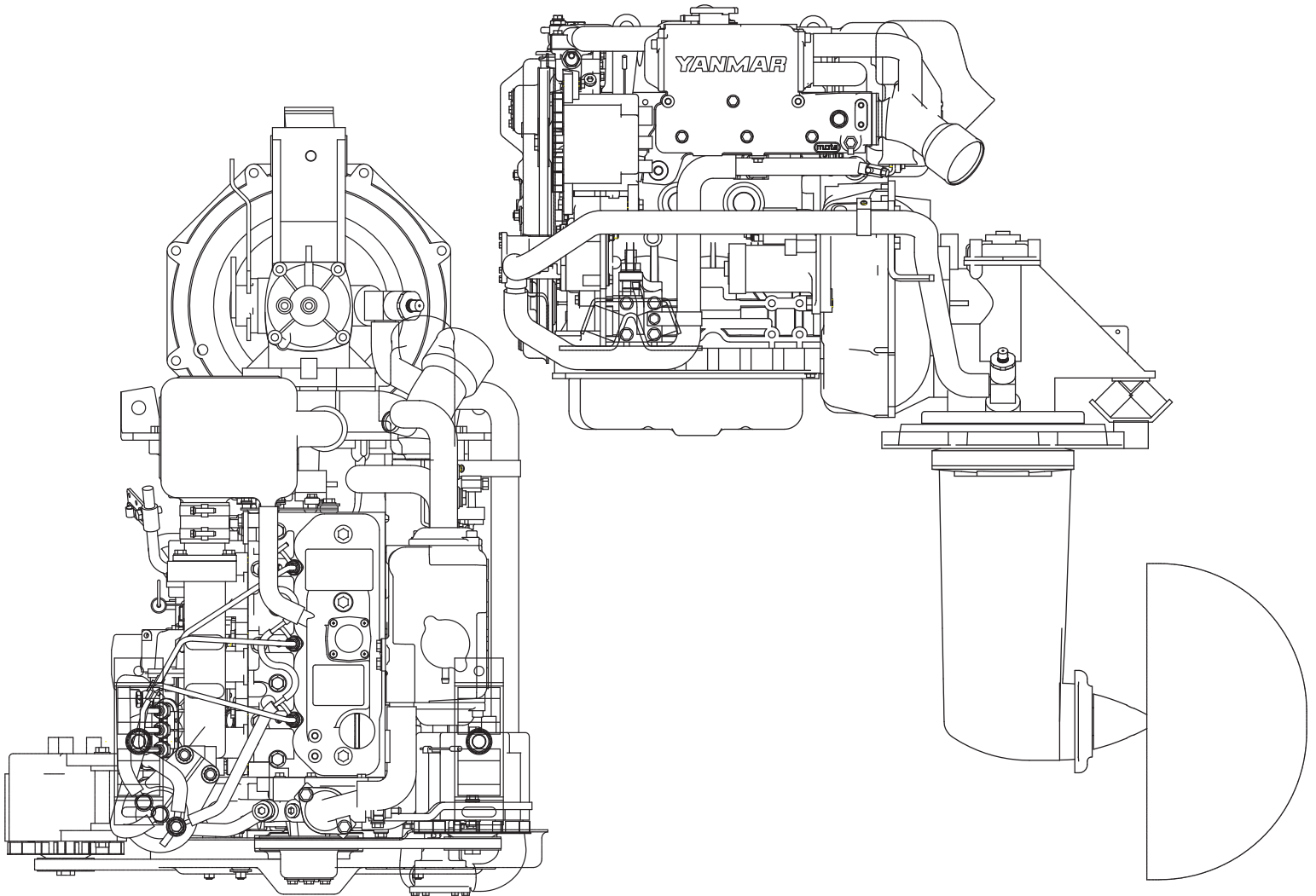
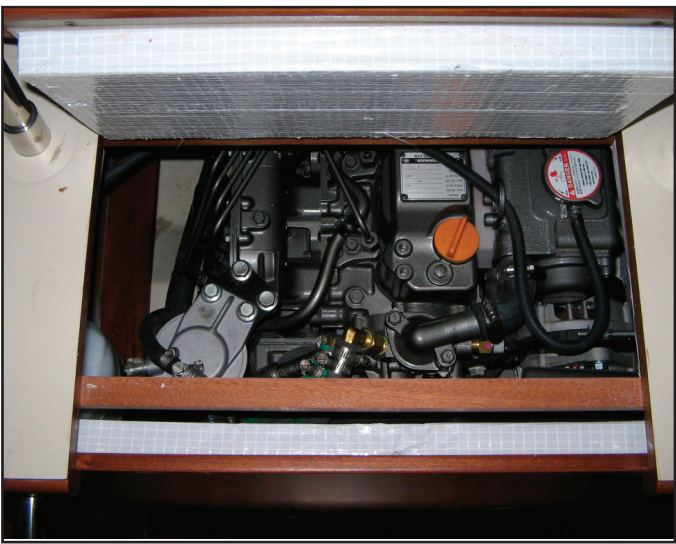


Figure 11.4

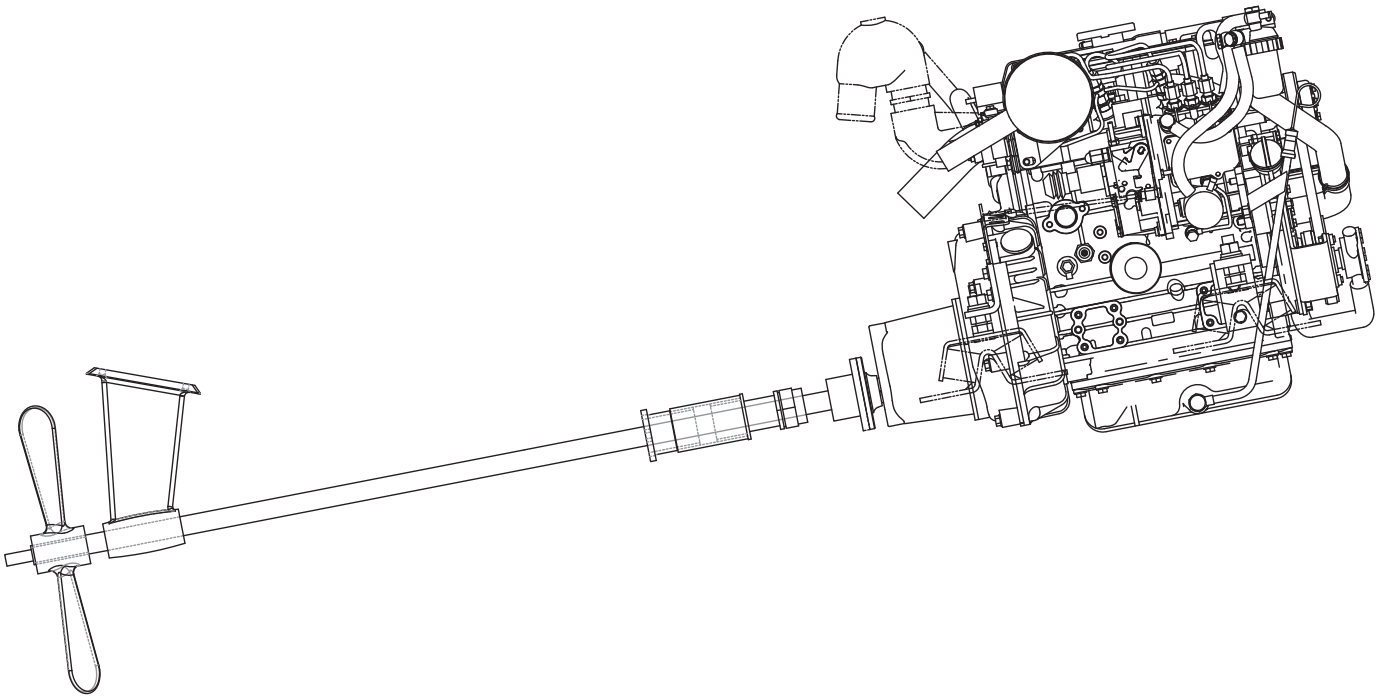


Figure 11.3

your engines and ensure water does not enter the air intakes. Water in the air intakes may go directly to the cylinders, resulting in rust and possibly internal engine damage.

IMPORTANT: The engine manual supplied by the manufacturer includes complete and detailed information about operating and maintaining your boat's engines. Be sure to read it. Do not start or operate the boat's engines until you have done so. The life and performance you receive from your engines depends greatly on the way you care for them.

IMPORTANT: Engines are not warranted by Marlow-Mainship. Engine warranties are provided by the engine manufacturer.

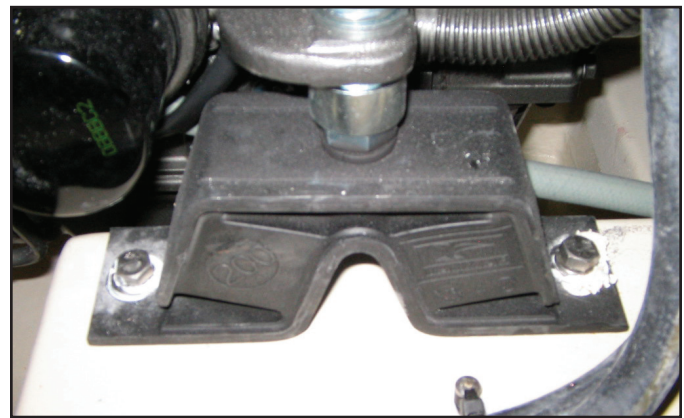


Figure 11.4

11.1.4 Engine Mounts

The engine mounts installed in your boat (Fig. 11.4 sail-drive mount) are designed by the engine manufacturer for your specific engine. These mounts affix the engines to the boat and, depending on your engine model, are adjustable vertically and/or horizontally for proper alignment. Vertical alignment is conducted by loosening or tightening the stud nut; horizontal alignment is conducted by sliding the stud side to side through the notches in the mounts.

IMPORTANT: It is advisable to spray a protective coating on the studs to prevent corrosion.

The engine mounts also contain isolators which serve to isolate the engine from the boat stringers or supports to dampen vibration, noise and other undesirable effects from engines. For more information about the engine mounts see the engine manufacturer's OEM manual and the Underwater Gear chapter in this manual.

11.2 Engine Fluids

Monitoring the status of your engine fluids on a consistent basis is critical. Follow the engine manufacturer's guidelines and procedures for managing your fuel, engine oil, gear or saildrive oil and coolant.

11.2.1 Fuel

In addition to the OEM manual, refer to the Fuel System chapter in this manual for information on the fueling process and other details.

11.2.2 Oil

Refer to the OEM manual.

11.2.3 Coolant

The engine cooling system involves two separate but related systems:

1. The raw water cooling system - refer to the Water Systems and Waste Systems chapters of this manual for a detailed description of the raw water system supply and removal.
2. The internal engine cooling system - supplied by the engine manufacturer. This closed system features an antifreeze coolant reservoir attached to the engine. Internal coolant is circulated through the engine in separate channels from the raw water cooling system.

The raw water cooling system works with the internal engine cooling system by cooling the internal system's coolant through the heat exchanger. Additionally, the antifreeze coolant cycles through the water heater where it heats the fresh water system through its heat exchanger, taking advantage of the engine operation (see the Waste Systems chapter in this manual for a heat exchanger hose layout).

NOTE: Ensure the raw water engine intake valves are open (refer to the Water Systems chapter in this manual) before you start the engine. Failure to open them will cause damage to the water pump impeller.

NOTE: Refer to the engine manufacturer's OEM manual for details on monitoring and maintaining your engine's coolant system.

⚠ DANGER ⚠

Hot coolant under pressure may boil over and cause burns or other personal injury if the pressure cap is removed when hot. Allow engine to cool. Open pressure cap slowly to allow pressure to vent before removing cap.

11.3 Engine Operations

11.3.1 Start / Stop

The engine start panel is located on the pedestal's instrument pod (Fig. 11.5).



Figure 11.6

For instructions on starting/stopping your engine, please refer to the Getting Underway chapter of this manual.

NOTE: Excessive cranking could cause seawater to enter the cylinders and damage the engine, also known as hydrolock. If the engine does not start after cranking for 15 seconds, close the thru-hull water intake valve to avoid filling the muffler with water. Crank for 10 seconds at a time until the engine starts. When the engine does start, stop the engine immediately and turn off the power switch. Be sure to re-open the seacock and restart the engine. Operate the engine normally.

⚠ WARNING ⚠

Engine manufacturers do not warranty items damaged by hydrolock.

Engines and Transmissions

Also, refer to the DC Electric section of this manual for details on the controls and protection of engine circuitry including the engine start panels.

11.3.2 Controls

The boat's engine controls (throttle) is located on the starboard side of the pedestal (Fig. 11.6).

Neutral is in the center or vertical position. Moving the lever forward will engage the engines forward. Moving the lever backward will engage the engines in reverse. Additional movement of the lever in a direction will increase power in that direction.



Figure 11.6

IMPORTANT: Shift the transmission only when the engine speed is at or below 1000 rpm. Shifting at higher engine speeds could severely damage the boat, the transmission and the engine. Allow the transmission to remain in neutral for a few seconds before reversing the rotation of the propeller.

11.3.3 Monitoring and Emergency Response

Engine status and performance alerts will be communicated through the engine start panel gauge (left side

Fig. 11.5). Alerts will be conveyed by red lighted panel symbols and an accompanying audible buzzer. Fig. 11.7 illustrates the engine start panel gauge with the potential alerts noted.

The engine manual states the maximum RPM rating established by the engine manufacturer. Do not exceed this rating as indicated by the tachometer. Check the manual for additional information about maximum RPM's.

If alerts are communicated, immediately shut down the engines and determine the source of the alert. Consult the engine manufacturer's OEM manual for the proper procedures to correct.

CAUTION

Always monitor your boats engine panel for alert displays while underway, even if your engine systems are equipped with an alert alarm.

Immediately shut down the engines if gauges are not in normal ranges or an alarm sounds.

Do not restart your engines until all alerts are corrected.

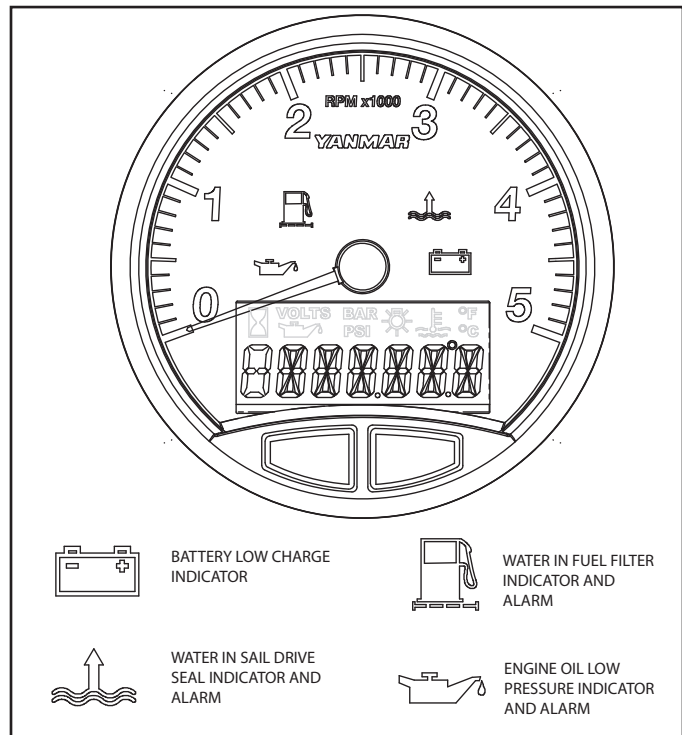


Figure 11.7

11.4 Engine Exhaust

Engine exhaust must be properly routed and vented externally. Please refer to the Waste Systems chapter in this manual for your boat's exhaust system layout. The engine exhaust contains Carbon Monoxide (CO). Please read and understand the Boating Safety Chapter of this manual and know the dangers of CO and how to avoid them. Carbon Monoxide will kill you, and in most situations, by the time you know something is wrong, it could be too late. Be proactive and know what to look for and what to do before a situation becomes critical.

Inspect your boat's exhaust system frequently, or have a qualified service technician service the system to ensure that there are no leaks. Always verify the exhaust clamps are tightened throughout the system. Keep the necessary tools on hand to perform this action.

11.4.1 Hydrolock

Hydrolock is caused by water entering the engine cylinders through the exhaust. The following conditions can cause hydrolock.

- Engine shutdown: A sudden engine shutdown while the boat is moving may force water into the exhaust system.
- Anchored or adrift: When anchored from the stern, pulling a sea anchor or adrift, rough seas may rock your boat severe enough to cause water to splash out of the mufflers into the engine while the engines are shut down.
- Improper hoisting: Operators are sometimes tempted to reduce hoisting time for propeller changes by hoisting only the boat stern. Such hoisting can cause residual water in the exhaust system to enter the engine cylinders.
- Engine start problems: Repeated attempts to start the engine will cause water to collect but without sufficient pressure to eject it. Refer to the Water Systems chapter of this manual for water control when starting.

Be aware of the potential of hydrolock and avoid these conditions.

DANGER

Avoid the exhaust outlets, lines, hoses or equipment when the engines have been run for a period of time. These areas may be very hot! You can be seriously burned by the exhaust system after the engines have ran for a period of time. To avoid injury, allow the exhaust system to cool before handling or making adjustments to avoid injury.

11.5 Maintenance

As with automobile engines, your marine engine requires specific maintenance within certain periods of time, such as the engine break-in period. Again, become thoroughly familiar with and perform these maintenance procedures as scheduled and specified by the engine manufacturer. Such an approach will only positively affect your engine's life.

Should you have any questions regarding engine maintenance or operations not found in the OEM manuals, please contact your boat dealer or Customer Service.

Engines and Transmissions

Troubleshooting		
Problem	Possible Cause	Solution
Engine not starting	<p>No fuel reaching engine</p> <p>Improper starting procedures</p> <p>Contaminated fuel</p>	<p>Fuel tank vent blocked. Clean hose and fitting to remove material. Make sure hose is not pinched.</p> <p>Fuel line obstructed. Check fuel lines. Make sure line is not pinched Clogged engine fuel filter. Refer to engine manual for instructions on cleaning filter.</p> <p>Fuel supply valve closed at tank. Open valve. Review starting procedures in engine manual. Inspect for water or other contaminants in fuel. If contaminated, drain tank and flush with fresh fuel.</p>
Engine starter not cranking	<p>Discharged battery</p> <p>Corroded battery terminals</p> <p>Loose battery terminals</p> <p>Bad starter switch</p> <p>Hydrolock</p> <p>Jammed "starter drive."</p>	<p>Recharge or replace battery.</p> <p>Clean battery terminals.</p> <p>Tighten connections.</p> <p>Test switch continuity. Replace switch if required. See your dealer for service. Replace switch.</p> <p>See instructions in this Section under "Hydro-Lock". Contact your dealer immediately.</p> <p>Loosen starter motor, then free stuck gear.</p>
Engine speed erratic	<p>Pinched or clogged fuel lines</p> <p>Contaminated fuel</p>	<p>Replace line or remove obstruction. See your dealer for service.</p> <p>Drain fuel tank and lines. Flush with clean fuel and replace fuel filters. See your dealer for service.</p>
Engine running rough	<p>Defective fuel pump</p> <p>Idle speed too low</p> <p>Faulty ignition system components</p> <p>Clogged fuel filter</p> <p>Pinched fuel lines</p> <p>Clogged fuel lines</p> <p>Blocked fuel vent</p>	<p>Have your dealer check pump. Check idle speed and adjust as needed.</p> <p>See your dealer for service.</p> <p>Clean or replace filter.</p> <p>Straighten lines.</p> <p>Remove obstruction.</p> <p>Clean vent.</p>

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Engine overheating	Cooling water seacock closed Seacock pickup blocked Collapsed water pump suction hose	Open seacock. Remove obstruction. Replace hose.
Sudden increase in	Cooling water intake system blocked	Clean seacock strainer.
Engine temperature	Water intake hose leaking or ruptured	Remove material blocking line.
	Water pump failure	See your dealer for service.
Drop in oil pressure (engine running at constant speed)	Lubrication system leaking Defective oil pump Pinched oil lines to remote filters	Repair if possible. See your dealer for service. See your dealer for service. Reroute if possible. See your dealer for service.
Excessive vibration	Loose engine mounting bolts Engine not timed properly or misfiring Engine-to-shaft couplings out-of-round or off-center Engine misaligned Worn strut or transmission	Inspect and tighten as required. See your dealer for service. See your dealer for service. See your dealer for service. Replace bearings if needed. See your dealer for service.
Poor performance	Boat overloaded Weight poorly distributed Excess bilge water Damaged or incorrect propeller Fouled or damaged hull bottom Engine misaligned	Reduce load. Distribute weight evenly. Trimming may help. Pump out water. Check for leaks. Inspect propeller. Replace if necessary. Inspect, clean, or repair. See your dealer.
Low cranking speed	Loose or dirty electrical connections Low battery charge Defective battery Engine oil too heavy for prevailing temperatures	Check all related electrical connections and wires. Charge battery. Replace battery. Drain oil and refill with correct grade viscosity oil. See engine manual for correct grade and viscosity.
Poor acceleration	Throttle not full open Engine overheating	Inspect cables and linkage for binding, obstructions, and loose fasteners. See solutions under "Engine Overheating" problem.
Excessive fuel consumption	Restriction in air filter	Remove filter and clean or replace

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Low oil pressure	<p>Insufficient oil in crankcase</p> <p>Excess oil in crankcase</p> <p>Diluted or improper grade and viscosity oil</p> <p>Oil leak in pressure line</p>	<p>Check and add correct grade and viscosity oil. Visually check engine for leaks.</p> <p>Check and remove required amount of oil. Check for cause of excessive oil (improper filling, bad fuel pump, etc.).</p> <p>Change oil and oil filter. Be sure to use the correct grade and viscosity oil.</p> <p>Inspect all oil lines and tighten all connections as necessary.</p>
No oil pressure	<p>Defective gauge, gauge tube, or oil line</p> <p>No oil in engine</p>	<p>Replace gauge or gauge sender</p> <p>Refill crankcase. See engine manual for proper grade and viscosity.</p>
High oil pressure	<p>Too heavy grade of oil</p> <p>Dirt or obstruction in oil line</p>	<p>Drain oil and replace. See engine manual for proper grade.</p> <p>Drain and clear oil system.</p> <p>Check for bent or flattened oil lines and replace as necessary</p>
Sludge in oil	<p>Infrequent oil changes</p> <p>Dirty oil filter</p> <p>Water in oil</p>	<p>Drain oil and refill with oil of proper grade and viscosity.</p> <p>Replace filter.</p> <p>Drain oil and refill. See your dealer if problem persists.</p>
Transmission shifts hard	<p>Corroded or pinched linkage</p>	<p>Lubricate or replace linkage as needed.</p>

