

11 ENGINES & TRANSMISSIONS

This section is important for enjoyable and safe operation of your yacht. It summarizes information about the MS 390 PT engines, transmissions, and related equipment. Troubleshooting guides are located at the end of the section.

ENGINES

The MS 390 PT is equipped with (depending on the model) one or two marine diesel engines. This chapter will deal with the single engine option. The engine drives a propeller through a transmission and a propeller shaft. The engine is started with controls at the helm using batteries as a power source. Mounted on the engine is an alternator that keeps the batteries charged. Access to the engine is through the salon sole.

Important: Engines require air to operate. The air intakes are located in the cockpit. For this reason do not operate the engines or generator with a full enclosure canvas installed.

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

The engine manual states the maximum RPM rating established by the engine manufacturer for your yacht's engines. Do not exceed this rating. Check the manual for other information about maximum RPMs.

The engine manual also specifies a safe oil pressure rating for the engines. Do not operate an engine if its pressure is below the minimum rating. The oil pressure will change as the engine's speed changes. However, if the pressure gauge indicates a gradual or sudden drop in pressure while you are maintaining a constant speed, the lubrication system may be leaking or the oil pump may have failed. Shut the engine down immediately. Do not operate the engine until the problem is corrected. Refer to the engine manual for complete information.

MAINSHIP engines are designed to meet or exceed industry standards set by marine engine manufacturers. However, we want to call your special attention to the possibility of engine damage caused by the following two conditions.

Hydrolock



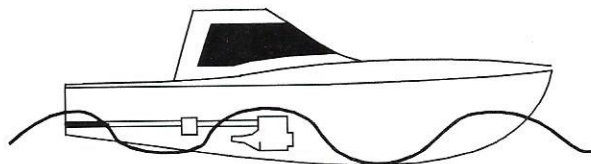
CAUTION

CAUTION: Water entering engine cylinders from exhaust system can cause hydrolock and damage engine. Operate boat properly to keep water from entering engine. Damage caused by hydrolock is not covered under warranty.

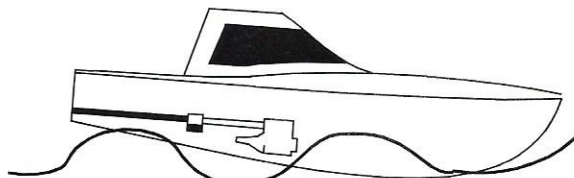
Hydrolock is caused by water entering the engine cylinders through the exhaust. See Figure 9-1. The following conditions can cause hydrolock:

- **Following wakes:** If you slow your boat down suddenly, the boat's wake can flow over your boat's transom.
- **Engine shutdown:** A sudden engine shutdown while the boat is moving may force water into the exhaust system.
- **Anchored or adrift:** Rough seas may cause rocking severe enough to cause water to splash out of the mufflers into the engine while you are fishing with the engines shut down, anchored from the stern or pulling a sea anchor, or drift fishing.
- **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.

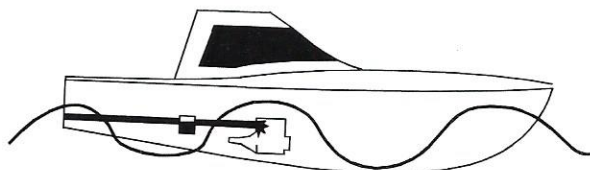
Engine manufacturers do not warranty items damaged by hydrolock!



IF VESSEL IS IN ROUGH SEAS AND ROCKING BACK AND FORTH SEVERELY ENOUGH, IT IS POSSIBLE THAT THE OUTLET COULD BE IMMERSSED AND THE EXHAUST LINE FLOODS



THEN AS THE VESSEL PITCHES DOWN AT THE BOW SOME OF THIS WATER DRAINS INTO THE MUFFLER



THE HIGH WATER LEVEL PLUS THE SURGING ACTION CAUSED BY THE ROCKING MOTION CAN RESULT IN WATER ENTERING THE EXHAUST HEADER.

Figure 9-1

TRANSMISSIONS

On the single engine trawler the single lever controls are to the starboard side of the helm wheel. They operate the transmission and the throttle.

With respect to transmission control, each lever has three relative positions: FORWARD (up), NEUTRAL (center), and REVERSE (down). The neutral position has a detent positioning pin. You can feel the pin drop into the detent when a lever is in exact neutral. A safety switch allows you to start the engine only when the lever is in the neutral position.

Once in a while, an engine may not start even if the lever is in neutral. The reason may be that the neutral safety switch is slightly out of adjustment.

While you are turning the ignition key, move the lever up and down slightly over the detent until the starter kicks in. Have your MAINSHIP dealer check the switch as soon as possible.



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

The transmission has a reduction gear which drives the propeller at a slower rotation speed than that of the engine. The transmission also has a hydraulic sump and pump separate from the engine. Transmission oil level can be checked using the filler cap and dipstick assembly. Refer to the transmission manual for more detailed information about transmission operation and maintenance.

CONTROLS AND INDICATORS

Helm Switches

The starter switches at the helm turn on the power to the engine. The ON position on the switch provides power to open the fuel shutoff solenoid. Do not leave the switch turned on when the engine is not running. A green light for each switch illuminates to indicate the switches are on.

Additional switches at the helm control the following devices or equipment:

- Electric trim tabs (power)
- Courtesy, panel, and navigation light
- Horn power switch and button

- Two (2) accessory switches.

Engine Gauges

Each engine has a set of gauges and indicators at the helm.

- The tachometer tells you how fast the engine is turning in RPMs (revolutions per minute). Multiply the reading by 100 for actual engine speed. The "tachs" may not read zero when the engines are off. Refer to the engine manual for the maximum RPM rating established by the engine manufacturer.
- The OIL pressure gauge indicates the pressure of the engine oil. The engine manual specifies a safe oil pressure rating for the engines.
- The TEMP gauge indicates the temperature of the engine coolant. The engine manual specifies a safe operating temperature for your yacht's engines.
- The FUEL gauges indicate the amount of fuel in their respective fuel tanks.
- The engine hourmeter records engine operating time in hours.
- The VOLT meter indicates battery status. Readings below 11 volts indicate a low battery charge or a heavy load on the battery. (A heavy load means that many systems and components are operating off the battery). If you do not plan to use your yacht for a time, keep the batteries charged. If you are connected to shore power, leave the battery charger on. Otherwise, turn on the engines periodically. Readings between 12 and 14 volts indicate that the condition of the battery is good. Readings above 14 volts are normal when you have increased engine speed. If this high reading continues for more than 15 minutes, have your dealer check the regulator.

Note: Instruments have a tolerance for accuracy. In addition, each engine may operate at differing values at the same RPM. As long as the instruments are reading within the proper operating

range, the engine is operating properly.

Throttle Controls

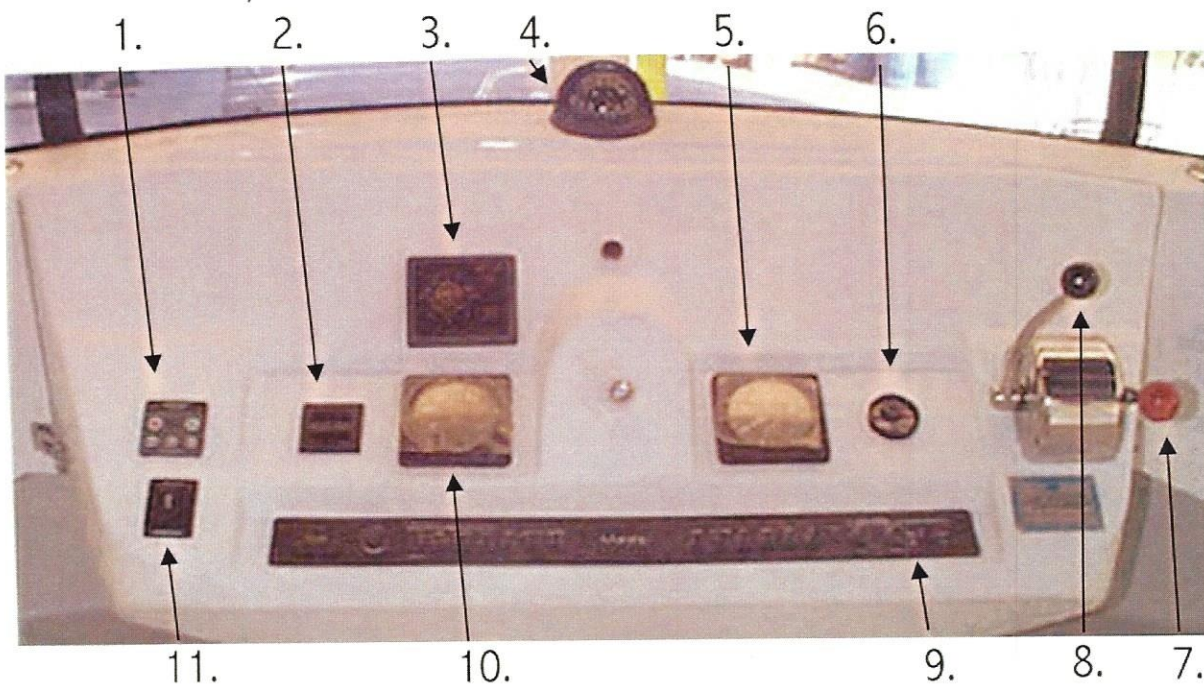
Hard operation of the controls is not normal. At the first sign of difficult or stiff operation, examine the cable and linkage for distortion or misalignment at the control head or the engine and terminals. If you cannot get them to work smoothly, have your dealer service them.

Be careful when you are in the engine room. Stepping on the cables and linkage may cause them to bind. Ordinarily, they require very little service after your dealer has adjusted them.

Marine Compass

You will find that the marine compass is a useful, but sensitive, instrument. In order for the compass to be accurate, it must be adjusted to compensate for the effects of iron or magnets and wires carrying electricity in the vicinity of the compass. MAINSHIP recommends that you have your dealer make the initial and subsequent periodic adjustments.

Upper Helm Station



1. BOW THRUSTER CONTROL
2. TRIM TAB SWITCHES
3. OPTIONAL SPOT LIGHT CONTROL
4. MARINE COMPASS
5. TACHOMETER AND HOUR METER
6. HALON INDICATOR
7. THROTTLE CONTROL
8. TRANSMISSION CONTROL
9. IGNITION SWITCHES
10. ENGINE GAUGES
 - A. OIL PRESSURE
 - B. TEMPERATURE GAUGE
 - C. FUEL GAUGE
 - D. VOLT METER
11. OPTIONAL WINDLASS SWITCH

EXHAUST SYSTEM

Your MS 390 PT has a uniquely designed exhaust system intended to reduce the operating noise of the engine. The exhaust is expelled through mufflers that exit the rear of the boat.

Important: The engine cooling system sea water is discharged overboard through the exhaust system. Monitor the engine water temperature gauge to ensure the system is operating properly.

If you must shut the engine down, be very careful when slowing down. **Under these conditions water can enter the exhaust system and possibly the engine.** Refer to the hydrolock information on page 11.1 for detailed information.

COOLING SYSTEM

The engines have a fresh water cooling system. This is a closed cooling system. This type of system cools the engine by transferring heat from the engines to sea water pumped through a heat exchanger. The raw water pump takes in sea water through the seacocks and circulates it through sealed chambers in the heat exchanger (cold side).

Engine coolant is pumped through opposing sealed chambers (hot side). Heat is transferred through the chamber wall from the coolant on the hot side to the sea water on the cold side. The heated sea water is then discharged through the exhaust outlet.

Note: Be sure the engine seacock is open before you start the engines.



Engine Sea Cock

WARNING

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

The engine manual specifies a safe operating temperature for your yacht's engine. Do not operate an engine if its temperature is above the range. Refer to the engine manual for complete information.

A sudden increase in engine temperature indicates a cooling system problem. The cooling water seacock may be clogged or its intake blocked, a cooling water hose may have ruptured, or the engine water pump may have failed. Stop the

engine immediately to prevent damage by overheating. Do not run the engine until the problem has been corrected.

SAFETY SEACOCKS (OPTIONAL)

Your boat may be equipped with safety seacocks. Safety seacocks enable the boats engine(s) to act as high capacity bilge pumps in an **emergency**. Please read and understand the following information about the safety seacocks before launching your boat.

WARNING

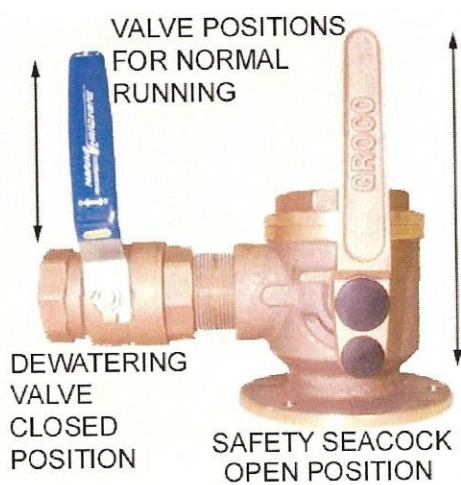
WARNING: Damage to engine(s) will occur if the safety seacocks are not operated properly before starting your boats engine(s).

In this case leave the engine(s) running and close the safety seacock. Immediately open the emergency dewatering valve. Your engine(s) will now be drawing their cooling water through the bilge and discharging it overboard through the exhaust. Only operate in case of bilge flooding, or engine over heating will occur.

WARNING

WARNING: Bilge flooding will occur if the safety seacock and emergency dewatering valve is left in the opened position.

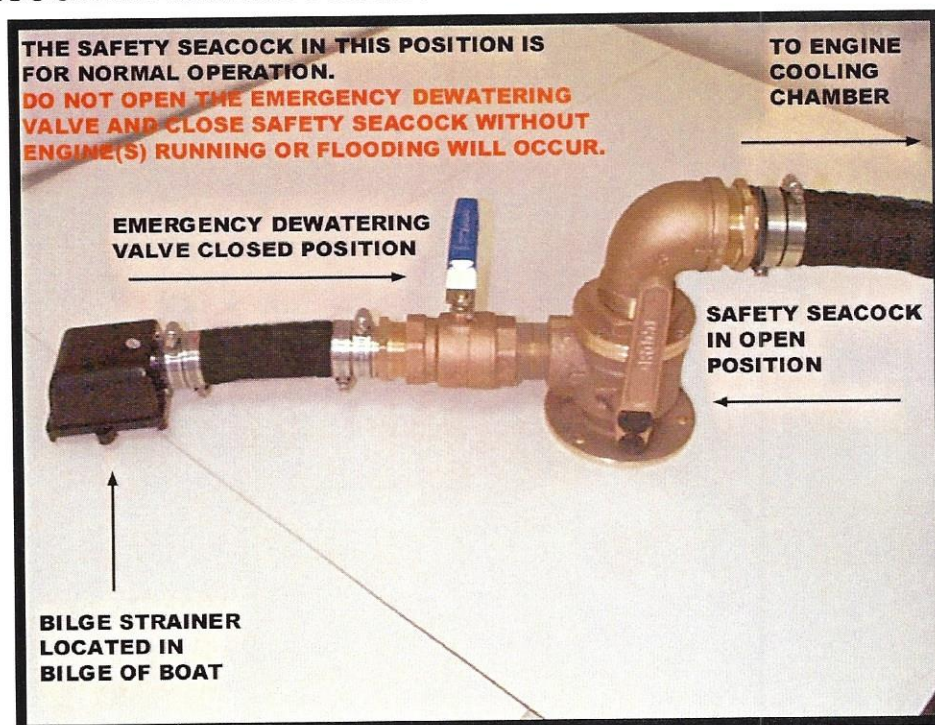
Refer to the next page for the operating procedures for the safety seacock and emergency dewatering valve.



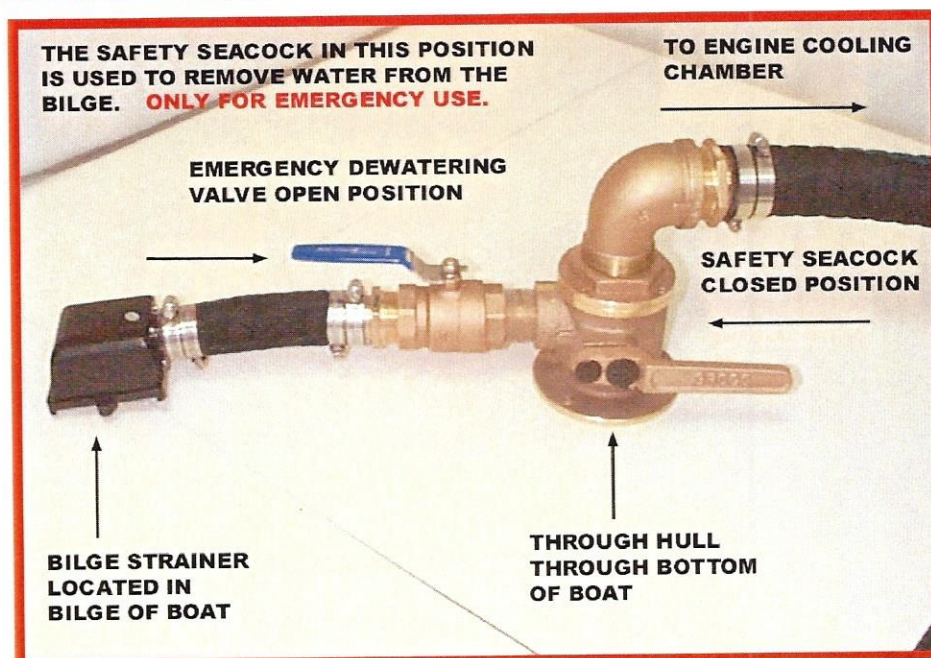
VALVE POSITIONS FOR EMERGENCY
DEWATERING OF BILGE ONLY



SAFETY SEACOCK IN NORMAL POSITION



SAFETY SEACOCK IN EMERGENCY DEWATERING POSITION



ENGINE TROUBLESHOOTING

These troubleshooting guides recommend specific maintenance or repairs which should be done by your MAINSHIP dealer. These "solutions" are included here only to assist you in an emergency. If

you do not know how to complete a procedure or if you do not have proper tools and parts, do not attempt to perform the maintenance or repairs. A "quick fix" may cost you more over the long run.

Problem	Possible Cause	Solution
Engine not starting	No fuel reaching engine	Fuel tank vent blocked. Clean hose and fitting to remove material. Make sure hose is not pinched.
		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.
		Fuel supply valve closed at tank. Open valve.
	Improper starting procedures	Review starting procedures in engine manual.
	Contaminated fuel	Inspect for water or other contaminants in fuel. If contaminated, drain tank and flush with fresh fuel.

Problem	Possible Cause	Solution
Engine starter not cranking	Discharged battery	Recharge or replace battery.
	Neutral safety switch misaligned	Move throttle lever up and down slightly over the detent while moving ignition switch. (Have dealer check switch as soon as possible.)
	Corroded battery terminals	Clean battery terminals.
	Loose battery terminals	Tighten connections
	Bad starter switch	Test switch continuity. Replace switch if required. See your dealer for service. Replace switch. Clean, adjust, gap, or replace. If wet or dirty, wipe with cloth and cleaning solvent. Inspect cap for cracks, carbonized paths (inside and out). Replace cap as required.
	Improper timing	Check timing and adjust as required. See your dealer for service.
	Hydrolock	See instructions in Section 9.1 under "Hydrolock." See your dealer immediately.
	Jammed "starter drive"	Loosen starter motor; then free stuck gear.
Engine speed erratic	Pinched or clogged fuel lines	Replace line or remove obstruction. See your dealer for service.
	Contaminated fuel	Drain fuel tank and lines. Flush with clean fuel and replace fuel filters. See your dealer for service.

Problem	Possible Cause	Solution
Engine running rough	Defective fuel pump	Have your dealer check pump.
	Idle speed too low	Check idle speed and adjust as needed.
	Faulty ignition system components	See your dealer for service.
	Clogged fuel filter	Clean or replace filter.
	Pinched fuel lines	Straighten lines.
	Clogged fuel lines	Remove obstruction.
	Blocked fuel vent	Clean vent
Engine knocking or pinging	Incorrect type fuel	Drain tank and replace with proper fuel.
	Overheated engine	Check engine timing.
		Refer below.
Engine overheating	Cooling water seacock closed	Open seacock.
	Seacock pickup blocked	Remove obstruction.
	Collapsed water pump suction hose	Replace hose.
Sudden increase in engine temperature	Cooling water intake system blocked	Clean seacock strainer.
	Water intake hose leaking or ruptured	Remove material blocking line. Replace hose.
	Water pump failure	See your dealer for service.
Drop in oil pressure (engine running at constant speed)	Lubrication system leaking	Repair if possible. See your dealer for service.
	Defective oil pump	See your dealer for service.
	Pinched oil lines to remote filters	Reroute if possible. See your dealer for service.

Problem	Possible Cause	Solution
Excessive vibration	Loose engine mounting bolts	Inspect and tighten as required.
	Engine not timed properly or misfiring	See your dealer for service.
	Engine-to-shaft couplings out-of-round or off center	See your dealer for service.
	Engine misaligned	See your dealer for service.
	Worn strut or transmission	Replace bearings if needed. See your dealer for service.
Poor performance	Boat overloaded	Reduce load.
	Weight poorly distributed	Distribute weight evenly. Trimming may help.
	Excess bilge water	Pump out water; check for leaks.
	Damaged or incorrect propeller	Inspect propeller. Replace if necessary.
	Fouled or damaged hull bottom	Inspect, clean or repair.
	Engine misaligned	See your dealer
Low cranking speed	Loose or dirty electrical connections or damaged wiring	Check all related electrical connections and wires.
	Low battery charge	Charge battery.
	Defective battery	Replace battery.
	Engine oil too heavy for prevailing temperatures	Drain oil and refill with correct grade and viscosity oil. See engine manual for correct grade and viscosity.
Poor acceleration	Throttle not full open	Inspect cables and linkage for binding, obstructions, and loose fasteners.
	Engine overheating	See solutions under Engine Overheating problem.
Engine misfiring	Defective fuel pump	See your dealer for service.
	Contaminated fuel	Drain fuel tank, flush clean and replace fuel filter.

Problem	Possible Cause	Solution
Excessive fuel consumption	Faulty fuel pump	See your dealer for service.
Exhaust smoke	Lube level too high	Drain off excessive oil.
	Oil too thin	Drain and replace oil. See engine manual for proper grade and viscosity.
	Oil overheated	Check cooling system.
White exhaust smoke	Engine misfiring	See solutions under Engine Misfiring problem.
	Spark plugs dirty or not gapped correctly	Clean, adjust gap, or replace.
Low oil pressure	Insufficient oil in crankcase	Check and add correct grade and viscosity oil. Visually check engine for leaks.
	Excess oil in crankcase	Check and remove required amount of oil. Check for cause of excessive oil (improper filling, bad fuel pump, etc.).
	Diluted or improper grade and viscosity oil	Change oil and oil filter. Be sure to use the correct grade and viscosity oil.
	Oil leak in pressure line	Inspect all oil lines and tighten all connections as necessary.
No oil pressure	Defective gauge, gauge tube, or oil line	Replace gauge or gauge tube and tighten or replace line as necessary.
	No oil in engine	Refill crankcase. See engine manual for proper grade and viscosity.
High oil pressure	Too heavy grade of oil	Drain oil and replace. See engine manual for proper grade.
	Dirt or obstruction in oil lines	Drain and clear oil system. Check for bent or flattened oil lines and replace as necessary.

Problem	Possible Cause	Solution
Sludge in oil	Infrequent oil changes	Drain oil and refill with oil of proper grade and viscosity.
	Dirty oil filter	Replace filter.
	Water in oil	Drain oil and refill. See your dealer if problem persists.
Transmission shifts hard	Corroded or pinched linkage	Lubricate or replace linkage as needed.