

FIRE EXTINGUISHER DISCHARGE PORT  
(FIG. 1.28.1)



- Get clear of danger, account for all who were on board and render assistance.
- Keep everyone together and use distress signals.

### WARNING

**BURN HAZARD** – Swim against the current or wind if you abandon ship. Leaking fuel will float with the current and may ignite.

## FLOODING, SWAMPING

Operator disregard for hazardous weather and water conditions is one of the most common causes of flooding or swamping, along with improper loading, handling and anchoring. Be aware of the possible consequences of your actions. Insist everyone wear a personal flotation device (PFD) when boating.

Remember:

- The bilge ventilation vents are the first areas where downflooding type water ingress occurs.
- Match speed and operation of the boat to sea conditions.
- Strictly adhere to the amount of weight and number of persons for safe operation under normal conditions.
- Adjust weight/number of persons to compensate for water conditions.
- Ensure proper bilge pump operation.
- Anchor from bow if using only one anchor.
- Adjust trim and close openings in rough weather.
- Reverse engine(s) only when forward speed is sufficiently slow to prevent following sea from swamping boat.
- The speed of operation should never exceed the ability to maneuver the craft safely.

### IN THE EVENT OF SWAMPING OR CAPSIZING

- Shut off engines, generators and blowers.
- Account for all who were on board.

- Do not attempt to swim to shore. It is farther away than it looks.
- **Stay with the boat.** It will float even with major damage. Hang onto or climb up on the hull and signal for help.

A swamped or overturned boat is much easier for rescuers to locate than a person in the water. Leave the safety of the boat only as a last resort and only after carefully assessing the situation.

## COLLISIONS AND LEAKING

Keep a sharp lookout for other boats, especially on the way back to port and at night. Be aware that fatigue caused by glare, motion, noise and vibration will reduce reaction time. Know and obey the rules of the road and be courteous. If a collision occurs:

- Account for everyone on board and check for injuries.
- Immediately switch on bilge pumps and operate manual bilge pumps if needed to reduce water intake.
- Check for structural damage and assess the extent of leaks.
- Slow down or stop to reduce water intake, unless maintaining speed would keep the hole above water.

**Stay with the boat** and signal for help if damage is serious. Otherwise, patch the hole from the outside with whatever means are available.

## WATER RESCUE

A person who has fallen overboard must be rescued before hypothermia or drowning occurs. The amount of time they stay afloat may be determined by rough water conditions, bulky boating clothing, swimming ability, intoxication, any injuries sustained and exhaustion.

Successful recovery of a person in the water depends on boat handling skills (being familiar with your boat's speed and turning ability) and practicing rescue procedures.

Rescue is a combination of returning to the victim, making contact and getting them back on board.

### RETURNING TO THE VICTIM

- Immediately sound an alarm and keep the victim in sight.
- Slow the boat and keep pointing toward the person overboard. At night, direct the best available light source at the person.

- Throw a life preserver, even if the person is wearing a PFD. It will serve as another marker.

### MAKING CONTACT

- Stop or slow the boat and circle toward the victim.
- Try to approach from downwind or into the waves.
- Keep the victim on the helm side so the boat operator has the victim constantly in sight.
- When almost alongside, stop the engine in gear to prevent propeller "windmilling".

### GETTING BACK ABOARD

- Assist the person in boarding the boat. The person should normally be brought in over the stern.
- If the person is injured, a capable rescuer may put on a PFD with a safety line attached and enter the water to assist the victim.

### DROWNING

- Try to reach to the drowning victim or throw a life preserver. Swim to rescue a drowning victim only as a last resort.
- Handle with care. Spinal injuries may have occurred.
- Try to resuscitate. At least two people on board should be CPR certified.
- Keep the victim warm and signal for help as soon as possible.

### GROUNDING

Running aground may be avoided by paying attention to marker buoys or indicated by waves as they form into breakers when passing over a sand bar.

If you do run aground, the course of action depends on how hard the boat hits bottom and whether the boat remains stranded. If it is a simple touch, you may need only to inspect the hull and propulsion. If you are aground, assess the situation before reacting. In some cases, throwing the boat into reverse can cause more damage.

### IN THE EVENT OF RUNNING AGROUND

- Inspect for damage to the hull, propulsion and steering systems.

- Check for leaks. If water is coming in, stopping the intake of water takes priority over getting free.
- Determine water depth all around the boat and type of bottom (sand, mud, rocks, etc.). This will help you decide which way to move the boat.
- Determine if tide, wind or current will drive the boat harder aground or will help free it.

### TOWING

A recreational boat towing another is usually a last resort because of possible damage to one or both boats. The Coast Guard or a private salvage company is better equipped. A recreational boat may assist by standing by, and possibly keeping the disabled boat's bow at a proper angle until help arrives. Only when conditions are ideal – that is, seas are calm, disabled boat is small, and one or both skippers know correct technique – should a recreational boat tow another.

**PERSONAL INJURY HAZARD** – Towing or being towed stresses the boat's hardware and lines. Failure of any part can seriously injure people or damage the boat.

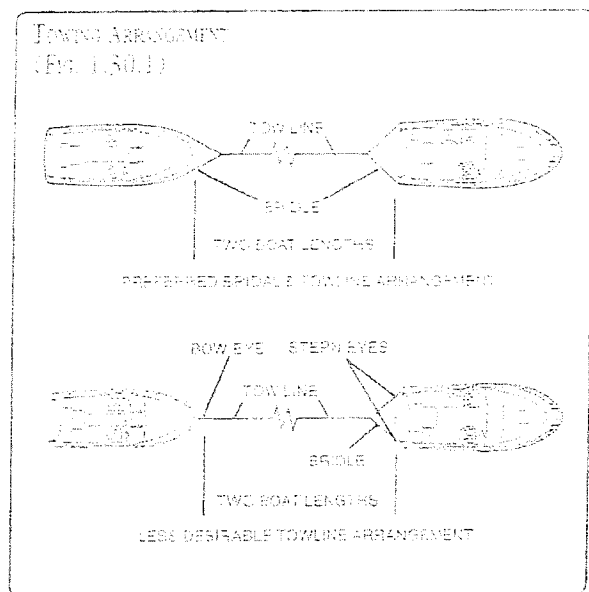
### TOWING VESSEL

- Be sure your boat will not run aground too.
- Because you are maneuverable and the grounded boat is not, you should pass the towline to the grounded boat.
- Use double-braided or braid-on-braid line. Never use three-strand twisted nylon; it has too much elasticity and can snap back dangerously.
- Fasten the towline as far forward as possible on the upwind or up-current side of the towing boat. Fastening it to the stern will restrict maneuverability of the towing boat.
- If possible, use a bridle.
- Move slowly to prevent sudden strain on slack line.
- Be ready to cast loose or cut the line if the towing situation becomes hazardous.

### VESSEL BEING TOWED

Use extreme caution:

- If it is necessary to be towed after being freed, keep someone at the wheel to steer.



## BOTH VESSELS

Use extreme caution:

- Creating a bridle with a line around the hull or superstructure will distribute the load over a wide area; pad pressure points. This technique can be used on both the towing and towed boat.
- Leave at least two (2) boat lengths between vessels to allow for adequate movement.
- Keep lines clear of propellers on both boats.
- Keep hands and feet clear of the other boat.
- Never hold a towline after it is pulled taut.

## PROPULSION, CONTROL OR STEERING

### FAILURE

- Shut off engine.
- Put out an anchor to prevent drifting.
- Determine if you can fix the problem yourself. See engine operator's manual if engine is flooded.
- Signal for help.

## EXHAUST EMISSIONS

You can be overcome by fumes from your own engine or from neighboring boats. Ensure continuous movement of fresh air.

DANGER

**EXTREME HAZARD** – Ensure adequate ventilation. Engines, cooking and heating appliances produce carbon monoxide gas (CO). Prolonged exposure can cause serious injury or death. To reduce CO accumulation, increase air movement by opening windows or adjusting canvas. The following conditions require special attention:

- Operating at slow speed or dead in the water.
- Operating with the bow high.
- Operating engine in confined spaces.
- Using canvas curtains.
- Blocking engine exhaust.
- Winds blowing exhaust toward boat occupants.

## CARBON MONOXIDE

Carbon monoxide is an odorless, colorless, extremely toxic gas that is the product of any type of combustion produced by engines, heaters, stoves or generators. Symptoms of carbon monoxide poisoning are dizziness, ears ringing, headaches, nausea and unconsciousness. A poisoning victim's skin often turns cherry red. CO is a major threat because its presence is not likely to be noticed until its effects are felt.

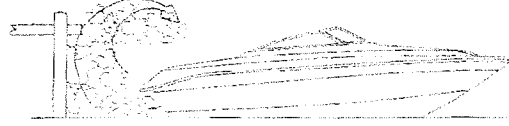
CO concentrations can occur when there are exhaust system leaks, inadequate ventilation or poor air circulation from the motion of the boat (also known as backdrafting).

To minimize the danger of CO accumulation:

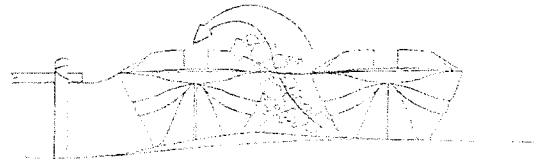
- Operate without the canvas installed.
- Operate with the center windshield open (or, for closed bow boats, the forward hatch open) if the convertible top is installed.
- Operate all combustion devices in well ventilated areas.
- Use fans or forced air if necessary.
- Avoid idling for long periods of time.
- Inspect the exhaust system regularly.

If CO poisoning is suspected, have the victim breathe fresh air deeply. If breathing stops, resuscitate. A victim often revives, then relapses because organs are damaged by lack of oxygen. Seek immediate medical attention.

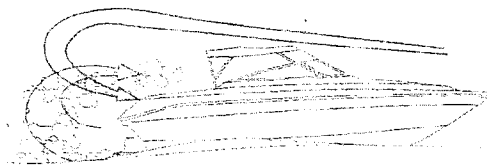
EXAMPLES OF HOW HIGH LEVELS OF CARBON MONOXIDE  
MAY ACCUMULATE  
(FIG. 1.31.1)



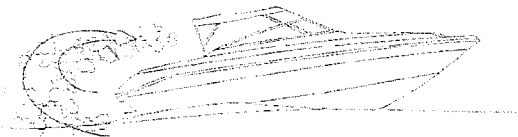
Blocking hull exhausts. Operating at slow speed or dead in the water. (Illus. A)



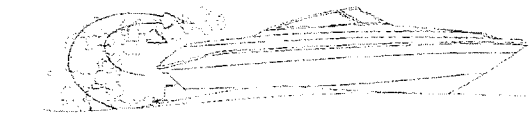
Operating engine in confined spaces. (Illus. D)



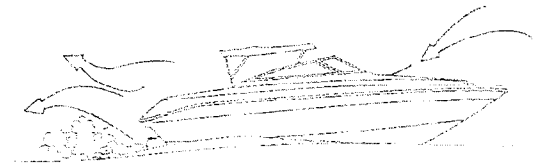
Using canvas curtains. (Illus. B)



Operating with the bow high. (Illus. E)



Winds blowing exhaust toward boat occupants. (Illus. C)



Good ventilation. (Illus. F)

## MEDICAL EMERGENCY

In an emergency, you may be far from professional medical assistance. Be prepared. Take a first aid course, and carry a first aid kit. Be aware of any special conditions that may affect anyone on board.

## ACCIDENT REPORT

Contact the state boating agency where the accident occurs. In the absence of a state enforcement agency, contact the nearest Coast Guard office. Other countries may have differing requirements for reporting an accident. Consult the nation which you are visiting for accident requirements.

The master or person in charge of a vessel is obligated by law to provide assistance that can be safely provided to any individual at sea. The master or person in charge is subject to a fine and/or imprisonment for failure to do so.

## NOTICE

The U.S. Coast Guard and state agencies require a report to be filed by the operator of a boat involved in an accident involving loss of life, disappearance, injury requiring treatment beyond first aid, loss of boat or property damage exceeding \$500.

## TRAILERING

When selecting a trailer for your boat, ensure that the structure conforms to the shape of your hull, provides support near the keel, and good fore and aft support.

## WARNING

The trailer selected must conform to the boats weight and hull shape.

The towing vehicle must have the capability of pulling the load. Towing a load which exceeds the vehicles towing capacity may cause loss of control.

The certification label on the trailer shows the Gross Vehicle Weight Rating (GVWR). Make sure that the total weight of your boat, engine, gear, and trailer does not exceed the GVWR.

Consult your state authority (Dept. of Motor Vehicles) for requirements regarding registration, lights, brakes, GVWR, etc. Compliance with other states through which you may be traveling would be prudent as these requirements vary widely from state to state.

The following will help to ensure a safe and pleasurable trip when trailoring your boat.

- Check brakes on towing vehicle for fluid levels and proper operation before you depart.
- Inspect trailer springs and undercarriage for loose or missing parts.
- Ensure that the tires are inflated properly. Under-inflated tires heat up rapidly causing damage or failure.
- Check wheel bearings and lug nuts.
- Tail lights and turn signals should be in proper working order.
- It is important that the tongue weight is between 5% and 10% of the total weight of your boat and trailer. Too much or too little tongue weight will cause the towing vehicle to sway.

To determine tongue weight:

- Weigh your trailered boat on a commercial scale.
- Park boat and trailer on a level, paved surface.
- Place a sturdy box on a bathroom scale.
- Position the scale under the tongue jack, ensuring that the trailer tongue is exactly parallel to the ground.
- Read tongue weight on the scale.
- Adjust weight if necessary by rearranging equipment, changing the position of the boat on the trailer, or rearranging the axle on the trailer frame.
- Stow convertible top, if equipped.
- A spare tire for the trailer as well as the towing vehicle and the appropriate tools should be carried.
- Ensure that any covers or hatches are secured before towing.

## HITCHES

There are two basic types of hitches, weight-carrying and weight-distributing. Consult local regulations for the type(s) of hitch which is allowable in your area.

**Weight-Carrying** – This is an inexpensive, somewhat simple bumper hitch. The entire tongue weight is supported at the hitch (bumper). This type of hitch is adequate for light trailers however, its use is not allowed in some areas.

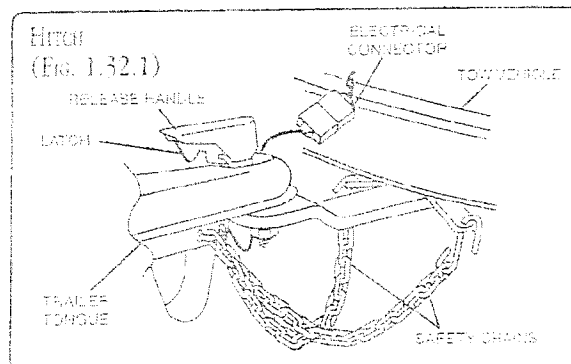
**Weight-distributing** – A necessity for tongue weights which exceed 350 pounds, this hitch is designed to distribute the load to all wheels of both the towing vehicle and the trailer. Heavier loads can be hauled with less wear on the towing vehicle. Some types of weight distributing hitches are equipped with anti-sway bars which improve control of towing vehicle and trailer.

- The hitch coupler **MUST** match the size of the hitch ball. Check the trailer coupler for the correct diameter of ball to be used.
- Always use a hitch with the same or greater class number as the trailer.

## SAFETY CHAINS

Properly installed safety chains prevent the trailer from becoming completely detached while you are traveling. Crossing the chains under the tongue will prevent the trailer from dropping to the road in the unlikely event that it becomes separated from the hitch.

- Safety chains should have a breaking strength of at least the gross weight of the trailer.
- Secure the safety chains to the trailer tongue with bolts.
- Hook the chains in the form of an "X" to the towing vehicle (Fig. 1.32.1)



## MANEUVERING WITH A TRAILER

Exercise caution when towing by allowing extra following distances to avoid having to make sudden stops. Be aware of decreased acceleration capability and allow more room for overtaking slower traffic. Be prepared for trailer sway caused by the air turbulence of larger overtaking vehicles.

Remember that the trailer will turn inside the track of the towing vehicle, so corners, curbs and other obstructions must be given wider clearance. The boat will probably obstruct the rear view of the driver and additional mirrors may be required on the towing vehicle.

Some basic considerations when towing are:

- Become familiar with accelerating, slowing and stopping smoothly.
- Signal your intentions well ahead of time when turning or passing and allow for the extra length of the vehicle and trailer.
- Periodically stop and examine tires and wheel bearings for overheating. Check connections and test tiedowns, covers and fastenings for tightness.

Familiarize yourself with backing up by practicing with an empty trailer in an empty parking lot. Get a feel for backing up straight by making small steering corrections and remember that the trailer will turn in the opposite direction of the towing vehicle.

- Back the trailer slowly. Avoid oversteering and do not rush.
- Turn the steering wheel in the opposite direction that you want the trailer to turn. If you want the trailer to back to the left, turn the towing vehicle's wheels to the right and vice versa.
- As the trailer begins to turn, move the steering wheel back toward center. The trailer will continue to turn at an increasing rate and the steering wheel must now be turned in the opposite direction to slow the turning rate.
- If the trailer does not turn sharply enough, or "jackknifes" (turns too sharply), stop. Pull ahead and try again.

If possible, have someone outside of the towing vehicle to give guidance. Remember that proficiency in backing up a trailer comes with practice.

## LAUNCHING AND LOADING

### PRIOR TO LAUNCHING

Prepare the boat for launch in the parking lot, away

from the ramp. Try to observe other launchings and take note of any effects of current and wind or problems on the ramp. Allow adequate time for the trailer wheel bearings to cool and check for the following:

- Boat cover removed.
- Garboard drain plug(s) installed.
- Fuel and water tanks filled.
- Equipment loaded and distributed for proper trim.
- All tiedowns removed.
- Bow and stern docking lines fastened and fenders rigged.
- Outboard or stern drive tilted up.
- Electrical connections to tow vehicle disconnected.

### LAUNCHING

Check that wheel chocks are available and recheck to be sure that the drain plugs are installed. Do not release the winch line until the boat is in the water. When approaching the ramp, back the trailer to the left whenever possible to provide better launching visibility. Position someone outside of the tow vehicle to provide guidance and back straight down the ramp (See Fig. 1.34.1.-1.34.4).

- Proceed backing down the ramp, keeping tow vehicle/trailer as straight as possible and stop with the trailer wheels at the water's edge.

### CAUTION

Allow sufficient time for trailer wheel bearings to cool before submerging.

- Set tow vehicle parking brake and place wheel chocks behind tow vehicle wheels.
- Release trailer tilt latch (if equipped) and have

### CAUTION

Never leave the tow vehicle unattended on the ramp with only the parking brake set.

a helper hold bow line from the ramp.

- Tighten the trailer winch brake and release the anti-reverse lock, but do not unhook the winch cable from the bow eye.
- Let the boat slide off the trailer into the water, then unhook the winch cable from the bow eye.

Hook the winch cable to the trailer or rewind onto winch. Use gloves when handling cable.



## WARNING

### PERSONAL INJURY HAZARD

Severe injury is possible if the winch system malfunctions or the cable breaks. Do not allow anyone to stand near the winch or cable.

- Use bow and stern lines to pull boat to pier and tie off lines.
- Return trailer tilt to horizontal position and lock in place. Remove wheel chocks and drive tow vehicle and trailer up the ramp to a parking area.
- Lower outboard or stern drive, start engine and allow to warm up.
- Cast off lines and slowly depart from the launch area.

## LOADING

Begin preparing to load the boat onto the trailer before approaching the ramp by stopping engine, disconnecting and securing fuel lines (outboards only) and tilting outboard or stern drive unit to the up position. Loading the boat onto the trailer is almost the reverse procedure as launching the boat:

- Back the trailer down the ramp following the same procedures and safety precautions as for launching.
- Release tilt latch (if equipped) and maneuver the boat onto the trailer using the bow and stern lines.
- Hook the winch cable to the boat's bow eye. Use gloves when handling cable.



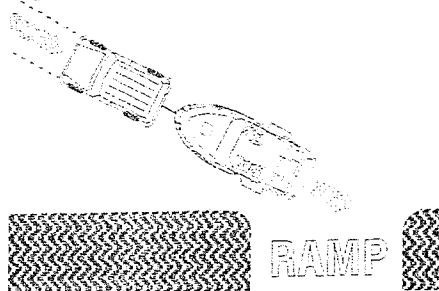
## WARNING

### PERSONAL INJURY HAZARD

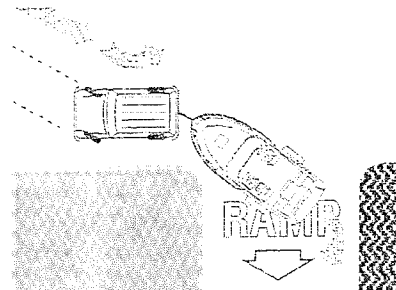
Severe injury is possible if the winch system malfunctions or the cable breaks. Do not allow anyone to stand near the winch or cable.

- Set winch anti-reverse lock and crank boat onto trailer.
- While trailer is tilted and boat/trailer is still inclined on the ramp, open the garboard drain plugs.
- Lock trailer tilt in horizontal position and secure boat with tiedowns.
- Remove wheel chocks and drive tow vehicle and trailer up the ramp to a parking area.

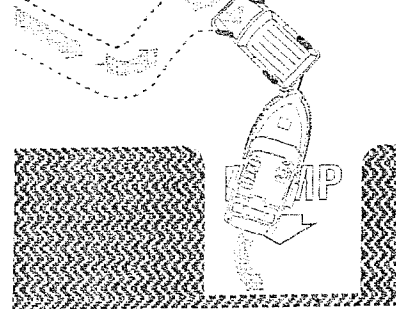
(Fig. 1.34.1)



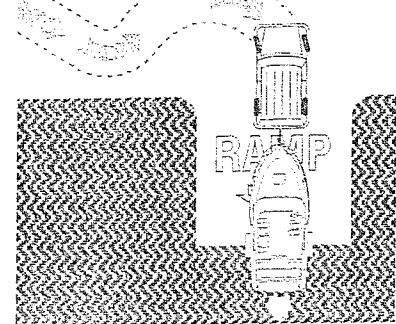
(Fig. 1.34.2)



(Fig. 1.34.3)



(Fig. 1.34.4)



## AFTER LOADING

Inspect the hull and particularly the propeller for nicks or other damage. If the boat has been in salt water, wash down the hull and trailer as soon as possible and wipe down the hardware and canvas with a soft clean cloth and protectorant.

Reconnect electrical connections from trailer to tow vehicle, stow equipment, replace boat cover and complete securing the tiedowns.

## ENVIRONMENTAL CONSIDERATIONS

### FUEL & OIL SPILLAGE

Regulations prohibit discharging fuel or oily waste in navigable waters. Discharge is defined as any action which causes a film, sheen or discoloration on the water surface, or causes a sludge or emulsion beneath the water surface. A common violation is bilge discharge. Use rags or sponges to soak up fuel or oily waste, then dispose of it properly ashore. If there is much fuel or oil in the bilge, contact a knowledgeable marine service to remove it. Never pump contaminated bilge overboard. Help protect your waters.

Fill tank(s) less than rated capacity. Allow for fuel expansion.

### WASTE DISPOSAL

#### NOTICE

- There is a possibility of being fined for having an operable direct overboard discharge of waste in some waters. Removing seacock handle, in closed position, or other means must be used to avoid fine.
- It is illegal for any vessel to dump plastic trash anywhere in the ocean or navigable waters of the United States.
- Many areas prohibit overboard sewer discharge. Close and disable flow-through waste systems to prevent discharge in such areas.
- Bag all refuse until it can be disposed of ashore. Regulations prohibit disposal of plastic anywhere in the marine environment and restrict other garbage disposal within specified distances from shore.

The Coast Guard is requiring any ocean-going boats 40 feet or larger to have a written "waste management" plan on board. While the requirement is aimed at commercial and passenger ships, there is no exception for recreational boats. "Ocean-going" means any boat going beyond the three-mile coastal U.S. boundary. The written plan can be as simple as:

All vessel refuse is placed in trash bags which are stored on board until they can be disposed of in dumpsters on shore. This policy is reviewed by all crew and passengers. The person in charge of carrying out the plan is:

Name: \_\_\_\_\_

#### CAUTION

##### FOR BOATS WITH VACUFLUSH® HEADS ONLY

Do not place facial tissues, paper towels or sanitary napkins in head. Such material can damage the waste disposal system and the environment.

### EXCESSIVE NOISE

Many areas regulate noise limits. Even if there are no laws, courtesy demands that boats operate quietly.

### WAKE/WASH

#### ! WARNING

**SPEED HAZARD** – Watch your wake. It might capsize a small craft. You are responsible for damage caused by your wake.

Power boat wakes can endanger people and vessels. Each power boat operator is responsible for injury or damage caused by the boat's wake. Be especially careful in confined areas such as channels or marinas. Observe "no wake" warnings.

#### CAUTION

Reduce speed in congested waterways.  
Be alert for No Wake markers.



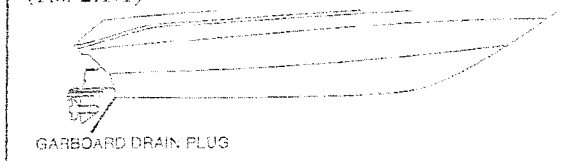
## SECTION 2 • BILGE & UNDERWATER GEAR

### BILGE

#### DRAIN PLUG

Your Sea Ray® is fitted with a brass garboard drain plug. This is a threaded plug which is installed through the outside of the transom. We recommend that you remove the drain plug when dry docking your boat. **MAKE SURE TO REPLACE THE DRAIN PLUG BEFORE LAUNCHING.**

GARBOARD DRAIN PLUG LOCATION  
(FIG. 2.1.1)



#### BILGE PUMP

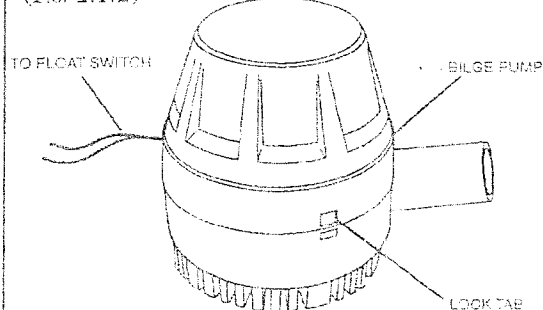
A bilge pump and float switch is located in the bilge sump.

The bilge pump is equipped with a switch on the dash with a "MANUAL" and "AUTO" position. When the switch is in the "MANUAL" position, the pump will run continuously. When in the "AUTO" position, the pump is activated when there is enough water in the bilge to raise the float switch to its highest position; and deactivated when the water recedes. **The pump should NOT be left in the "MANUAL" mode unless the bilge is being pumped out for servicing.**

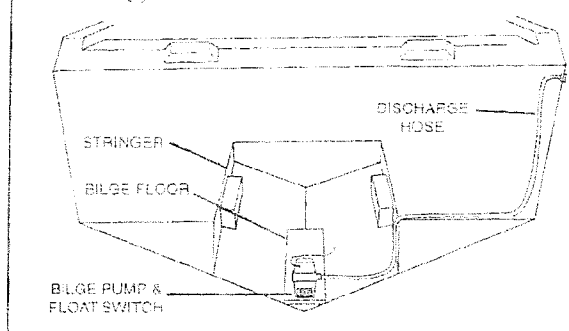
The pump is protected by a fuse located under the dash and in the bilge (see Section 5 -- *Electrical*).

Some bilge pumps may be fitted with an in-line check valve. Bilge pumps that must be equipped with very

BILGE PUMP  
(FIG. 2.1.2)



TYPICAL BILGE PUMP INSTALLATION  
(FIG. 2.1.3)



long discharge hoses are equipped with the check valve. The check valve prevents the residual water in the hose from coming back into the bilge which would cause the pump to cycle on and off trying to pump out the same water.

Because of the weight of water, 8.3 pounds per gallon (1 kilogram per liter), it is important to keep the bilge as free of water as possible.

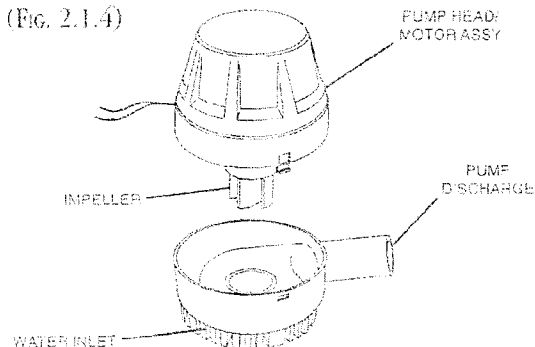
#### MAINTENANCE

Frequently inspect the area under the float switch to ensure it is free from debris and gummy bilge oil. To clean, soak in heavy duty bilge cleaner for 10 minutes, agitating several times. Check for unrestricted operation of the float. Repeat the cleaning procedure if necessary.

Inspect the bilge pump intake and keep it free of dirt or material which may impede the flow of water through the pump. To clean the pump, remove the pump head and inspect the impeller and water inlet in the base of the pump.

Inspect the check valve located in the discharge line.

BILGE PUMP ASSEMBLY  
(FIG. 2.1.4)



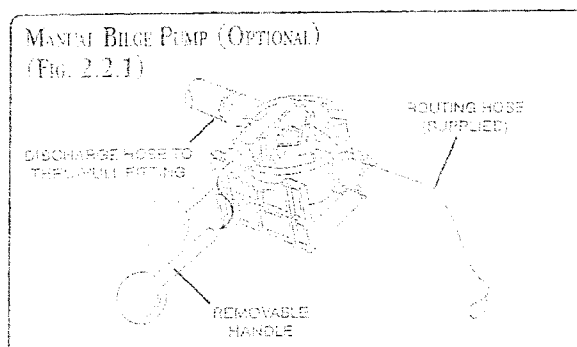
## TROUBLE SHOOTING

If water does not come out of discharge hose:

1. Inspect the fuse in the bilge. Replace if the fuse is blown. Be sure to replace with the correct size fuse.
2. Remove the motor module to see if the impeller rotates with the power on.
3. Remove any debris that may have accumulated in the nozzle section or strainer base.
4. Check hose and connection on hull side for debris and proper connections.

If an optional manual bilge pump is installed on your boat, it is equipped with a hose which can be routed to any area which is in need of attention.

To operate, make sure that the open end of the hose is completely submerged in the water to be removed. Insert the removable handle into the pump and begin pumping. (See the specific information section for location of optional manual bilge pump (if supplied) in your vessel.



## NOTICE

The Federal Water Pollution Control Act prohibits the discharge of oil or oily waste into or upon the navigable waters and contiguous zones of the United States. Violators are subject to a fine of \$5,000.

## BILGE BLOWER

Your Sea Ray® is equipped with an in-line bilge blower to provide bilge ventilation. The blower is wired through a fuse located under the dash with a switch on the dash panel.

With gasoline engine: Run the blower for four minutes before starting the engines or when operating below cruising speed.

**! DANGER**

**GASOLINE VAPORS CAN EXPLODE**

Before Starting Engine:

- Check engine compartment for gasoline vapors.
- Operate blower for 4 minutes. Run blower when moving below cruising speed.

With diesel engine: Run the blower when operating below cruising speed to dissipate bilge heat build-up.

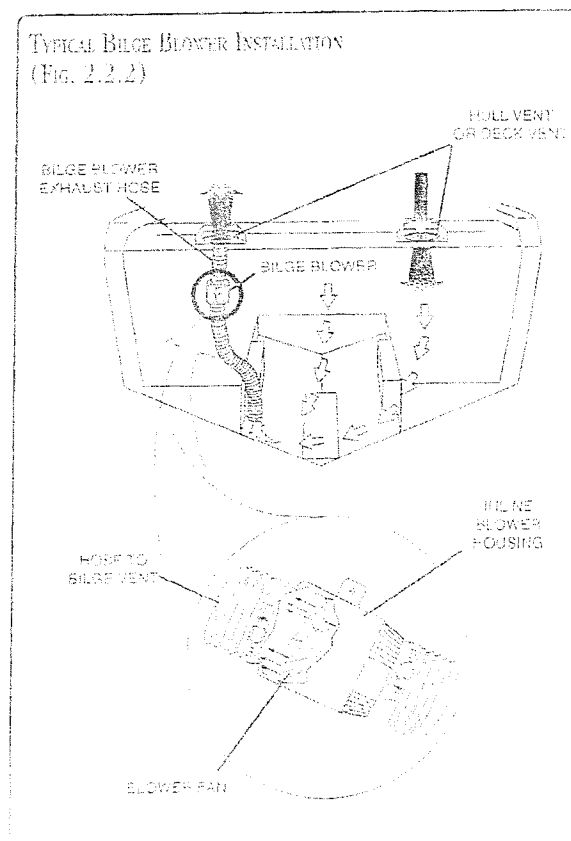
## MAINTENANCE

The bilge blower should be checked periodically to ensure that the hose is securely fastened to blower. Check for corrosion of wires and make sure 12 volt wires are secured in place.

## TROUBLE SHOOTING

If your bilge blower fails to operate:

1. Check the fuse on the electronic interface module or the fuse block under the dash to ensure that the fuse has not blown.
2. Check to see if the blower hose is fastened to the blower.



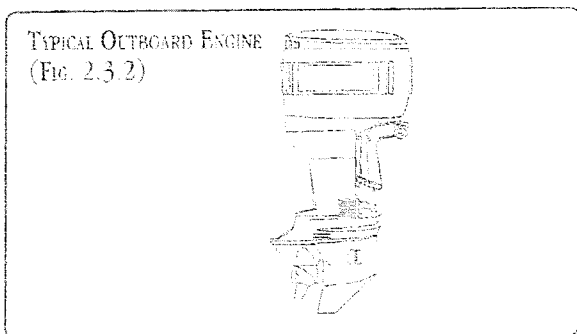
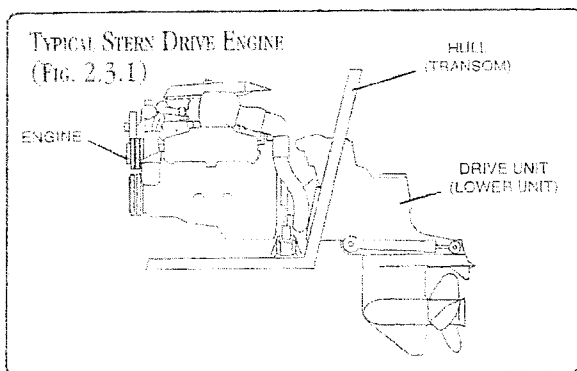
## ENGINES

The engine is the heart of your Sea Ray® boat. Proper attention to and maintenance of your engine will assure you of many hours of pleasurable, safe boating and will prevent unnecessary engine problems. A general maintenance program consists of proper lubrication, cleaning of fuel filters, fuel lines and air filters. When washing down, or at any other time, take care that water does not enter the air inlet on fuel injection systems. Water entering the air inlet when the engine is not operating may go directly into the cylinders, resulting in rust and possibly internal engine damage.

### CAUTION

Avoid the contact of flammable materials with hot engine parts.

You must fully comply with the manual provided by the engine manufacturer. Follow the recommended maintenance and warranty schedule in your Engine Operator's Manual included in the Owner's Manual Packet.



## ENGINE EXHAUST SYSTEM

The exhaust system used on Sea Ray® boats with stern drive engines is designed so that the water from the raw water cooling system is pumped through the engine and then overboard through the exhaust outlet through the propeller hub.

Prior to every boat use, examine the exhaust system fittings to ensure tightness. Leaks in the exhaust system may permit carbon monoxide exposure.

### WARNING

Hose clamps must be tight at all times to avoid exhaust leaks and possible carbon monoxide exposure.

## VIBRATION & CAUSES

Some vibration is to be expected in your boat because of the action of the engines and the propeller. But excessive vibration indicates conditions which must be promptly corrected to avoid damage. The following are some conditions which may cause vibrations.

### FOREIGN OBJECT INTERFERING WITH PROPELLER ACTION

Weeds, ropes, fishing lines or nets can become wrapped around the propeller and/or shaft, causing vibration and loss of speed. Always stop and then reverse the propeller after going through a weedy area to unwrap and clear away any weeds which may have accumulated. Although reversing will sometimes help to unwrap lines and nets, they are difficult to remove without hauling.

Always check for loose or trailing dock lines before getting underway. When towing a dinghy or surfboard, remember that a long line may easily become entangled with the propeller when backing down.

### BENT PROP (AND/OR SHAFT)

A badly damaged or distorted prop is an obvious cause of vibration.

### ENGINE PART HITTING BOAT STRUCTURE

Engines are flexibly mounted to reduce transmission of vibration to the hull structure. If some part of the engine, such as the oil pan, contacts a stringer, brace, or part of the hull, vibration will result.

## OTHER CAUSES

Other causes of vibration could be related to the engine being out of tune.

## UNDERWATER GEAR

### OUTDRIVE IMPACT PROTECTION

Impact damage can occur in either a forward or reverse direction. It can occur while trailoring or in the water. When trailoring, make certain outdrive unit is in its highest position. If an underwater object is struck while boat is moving forward, the hydraulic system cushions the kick-up of the drive unit as it clears the object, thereby preventing or greatly reducing damage to the drive unit.



#### CAUTION

Impact protection systems cannot be designed to ensure total protection from impact damage under ALL operating conditions. If an object is struck at a severe angle or high rate of speed, damage naturally can occur. Use extreme caution when operating in shallow water areas where known underwater obstacles are present. Use extreme care to prevent striking an underwater object with drive unit while operating boat in reverse, as no impact protection is afforded to the drive unit in this position.

If engine should strike a submerged object, STOP THE ENGINE as soon as possible and examine drive unit for damage. If damage is present or suspected the boat should be taken to an authorized dealer for thorough inspection and necessary repair. Operating a damaged drive unit could cause additional damage to other parts of engine, or could affect controllability of the boat. If continued running is necessary, do so at greatly reduced speeds.

## PROPELLER

The propeller should be free of nicks, excessive pitting and any distortions that alter the propeller from its original design. A badly damaged prop should be replaced, but one that is chipped, bent or merely knocked out of shape can be reconditioned by your marine dealer.

When doing extensive cruising, it is advisable to carry extra propellers aboard.

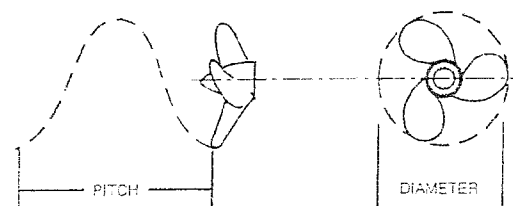
## BASIC PROPELLER CHARACTERISTICS

Propellers have two basic characteristics:

- Diameter
- Pitch.

Diameter is that distance measured across the propeller hub line from the outer edge of the 360° that is made by the propeller's blade during a single rotation. Pitch is that distance in inches that a propeller will travel if rotated one revolution without any slippage (see Fig. 2.4.1).

PROPELLER PITCH AND DIAMETER  
(Fig. 2.4.1)

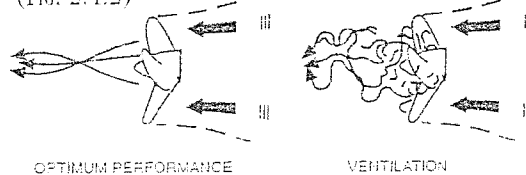


For example, a propeller with a 12-inch pitch, when rotated 360° would, theoretically, advance 12 inches through the water. Actually, no propeller applied to any boat is 100% efficient. No 12-inch pitch blade will, in a single rotation, advance a boat 12 inches. This variance is referred to as slippage.

## VENTILATION, ITS CAUSES AND CORRECTIONS

While often called "cavitation," ventilation is really a different effect. At times when a boat enters or leaves a sharp turn, the propeller seems to slip and lose thrust and the engine may over-speed (see Fig. 2.4.2). This problem is normally caused by air or

PROPELLER VENTILATION  
(Fig. 2.4.2)



aerated water entering the propeller. (A damaged propeller can also cause ventilation.) Ventilation can usually be corrected by one or more of the following:

1. Replace the damaged or incorrect propeller with the recommended one.

2. Set the outdrive at a lesser trim angle (trim the unit downward).

### CAVITATION, ITS CAUSES AND CORRECTIONS

Cavitation is a phenomenon that occurs in all propeller-driven craft under certain conditions. The surface of propeller blades are not perfectly flat, and as water is drawn through the blades to be discharged aft into the propeller's slip stream, the water flowing over the curved surface of the blade encounters areas of greater and less pressure.

In those areas of reduced pressure, air bubbles are formed. When they move out of the low pressure area these bubbles collapse. If they collapse while in contact with an object, such as part of the propeller blade or trim plane, the bubbles create such highly localized forces that they erode the surface of the object. In the case of the propeller, such damage is sometimes called a "burn." It may be caused by an irregularity in the propeller's leading edge, and it should be corrected by reconditioning the propeller or by replacement.

Cavitation is a normal occurrence in modern sport boats, and prop inspection should be part of routine maintenance.

### PROPELLER TORQUE AND ITS CORRECTION

Some of the more powerful motors create a considerable torque effect; that is, a twisting motion causing the boat to ride with one sheer lower than the other. This twisting reaction is caused by the direction of propeller rotation lifting one side of the boat. This causes an uneven drag, so that a boat's bow may tend to fall off in one direction or the other from the intended course given by the wheel.

Stern drive and inboard units are equipped with adjustable trim tabs which may be adjusted to balance "steering torque" so that the steering wheel will turn with equal ease in each direction. Follow the trim plane adjustment instructions in the Engine Owner's Manual.

Torque action may occur when maximum or close to maximum rated horsepower is applied. Any slight torque may be offset by shifting passenger or gear weight laterally to the high side of the boat.

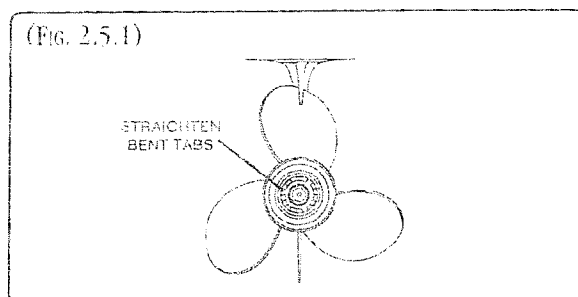
## PROPELLER REMOVAL AND INSTALLATION

**WARNING**

**PERSONAL INJURY HAZARD** – Always shift to **NEUTRAL** position, remove ignition key and spark plug wire to prevent propeller rotation from accidental engine startup while performing propeller maintenance.

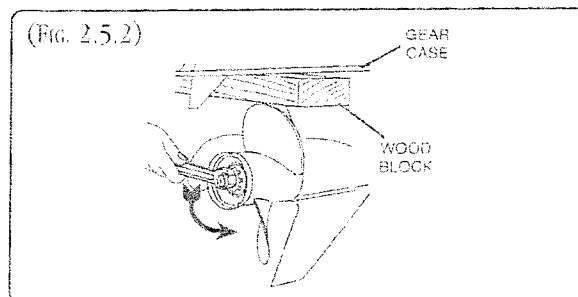
1. Shift throttle control/gear shift to NEUTRAL.
2. Straighten the bent tabs on the propeller nut retainer (see Fig. 2.5.1).

(Fig. 2.5.1)



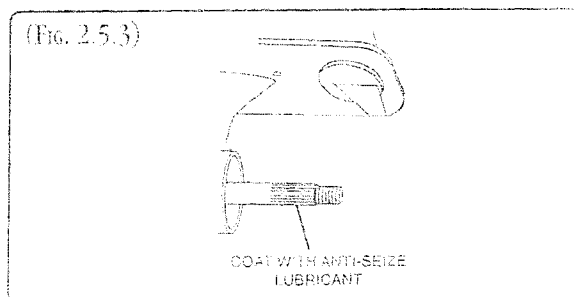
3. Place a block of wood between the gear case and propeller to stop propeller from rotating and remove propeller nut (see Fig. 2.5.2).

(Fig. 2.5.2)



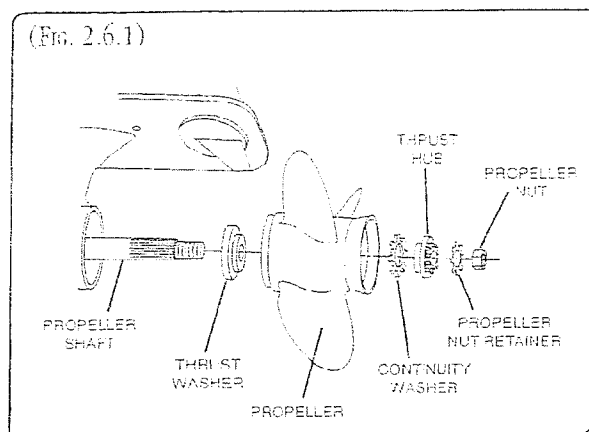
4. Pull the propeller straight off the shaft. If the propeller is seized to the shaft and cannot be removed, have the propeller removed by an authorized dealer.
5. Coat the propeller shaft with an anti-seize lubricant (see Fig. 2.5.3).

(Fig. 2.5.3)



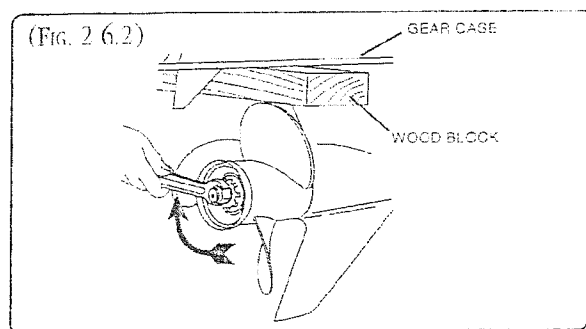
6. Install the thrust washer, propeller, continuity washer, thrust hub, propeller nut retainer and propeller nut onto the shaft (see Fig. 2.6.1).

(Fig. 2.6.1)



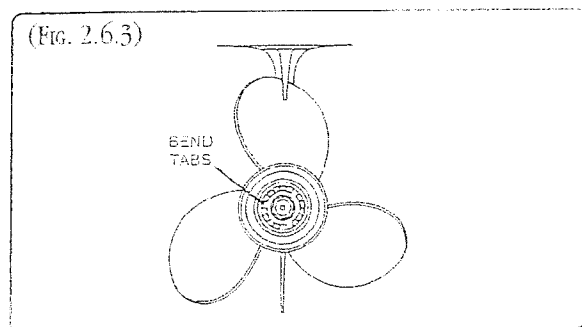
7. Place a block of wood between the gear case and propeller and torque propeller nut to recommended manufacturer's specifications (see Fig. 2.6.2). To find correct torque, refer to your Engine Owner's Manual in the Owner's Manual Packet.

(Fig. 2.6.2)



8. Secure the propeller nut by bending three (3) of the tabs of the propeller nut retainer into the thrust hub grooves (see Fig. 2.6.3).

(Fig. 2.6.3)



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## SECTION 3 • INSTRUMENTS & CONTROLS

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### STEERING SYSTEM

Steering system integrity and control is imperative when engaging in recreational water activities. Constant attention must be paid to the continued proper performance of the steering system. Strict adherence to the following guidelines must be followed to ensure safe recreational boating.

#### CAUTION

Boat steering is not self-centering. Steering is affected by engine and propeller torque, trim plane setting, wave and current action, and the speed of the hull through the water. Constant attention and control of the direction of the boat is required for safe operation.

### POWER STEERING

(INBOARD/OUTBOARD ENGINES)

The power steering used with stern drives is a mechanical system with enclosed cable. The steering wheel is connected to the stern drive power steering unit by cable. **THE CABLE CONNECTIONS AT THE HELM AND AT THE RUDDER TIE BAR SHOULD BE INSPECTED AT LEAST TWICE A YEAR. A loose connection can result in a sudden loss of steering and control.**

Push-pull cable steering should be checked for proper lubrication of the cable, proper alignment, with no binding or looseness, and no interference in the system. Cable and attachment to the outdrive should be checked for wear, rust or corrosion on a regular basis and be properly lubricated. Check the anchor post at the aft end of the cable to be sure it is secured and free from rust and corrosion.

A routine maintenance schedule for the power steering system should be set up to include a normal service for every 50 hours of operation or 60 days (whichever comes first); under severe service – every 25 hours of operation or 30 days (whichever comes first). **NOTE: Operation in salt water is considered severe service.**

#### SERVICE SHOULD INCLUDE:

- Lubricate the control valve through the grease fitting with multipurpose lubricant until grease appears around the rubber boot.
- Coat power assist steering output shaft and exposed steering cable end with appropriate lubricant.
- Lubricate cable end guide pivot point with SAE 30W engine oil.
- Check power assist steering fluid level and add type "A" automatic transmission fluid as required to bring level up to "FULL" mark on the dipstick, which is attached to fill cap.
- Inspect all hydraulic lines and hoses as part of routine maintenance for leaks. Be certain that lines and hoses are free from friction and extreme heat and adjoining parts. Tighten fittings and clamps as needed.
- Check all bolts for tightness on a regular basis.
- Check pump pulley drive belt often for wear and proper tension. Overtight belts may cause bearing failure. Loss of the belt compounds affect steering severely.

REFER TO THE ENGINE OPERATOR'S MANUAL FOR PROPER FLUID LEVELS AND LUBRICANTS.

Sea Ray® recommends that all repairs and/or replacements to steering systems be made by qualified dealers authorized by manufacturer of the steering system of your boat.

REFER TO OWNER'S PACKET FOR INSTRUCTIONS AND WARRANTY INFORMATION.

### HYDRAULIC STEERING

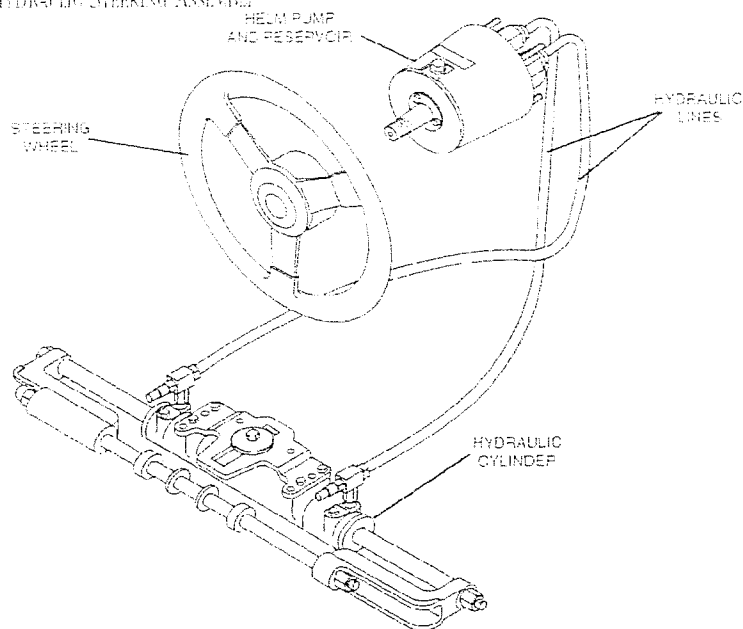
(INBOARD/OUTBOARD AND OUTBOARD ENGINES)

Most Sea Ray® Boats fitted with outboard engines and some inboard/outboard engine boats use a hydraulic steering system. Periodically remove the plug in the helm unit and check the oil level visually. The oil level should be within 1/2" of the filler hole.

The system must be filled with hydraulic oil meeting Mil Spec H-5606 A. Refer to steering system owner's information in the Owner's Packet for specific hydraulic oils that can be used.

Periodically check the mechanical connections and linkages at the cylinder. Replace worn parts, tighten loose parts and lubricate as needed. The steering system is protected against over-pressure situations by a pressure relief valve. Sometimes when returning the wheel from a hard-over position, a slight resistance may be felt and a clicking noise may be heard. This is a completely

TYPICAL SPORT BOAT HYDRAULIC STEERING ASSEMBLY  
(FIG. 3.2.1)



normal situation caused by the releasing of the lockspool in the system.

REFER TO OWNER'S PACKET FOR INSTRUCTIONS AND WARRANTY INFORMATION.

## MECHANICAL STEERING SYSTEM

(SOME OUTBOARD ENGINES)

The steering wheel is connected to the steering tie bar on outboard engines by a cable. THE CABLE CONNECTIONS AT THE HELM AND AT THE RUDDER ARM OR TIE BAR SHOULD BE INSPECTED AT LEAST TWICE A YEAR. A loose connection can result in sudden loss of steering and control.

Push-pull cable steering should be checked for proper lubrication of the cable, proper alignment, with no binding or looseness, and no interference in the system. Cable and attachment to the rudder arm or tie bar should be checked for wear, rust or corrosion on a regular basis and be properly lubricated. Check the anchor post at the aft end of the cable to be sure it is secured and free from rust and corrosion.

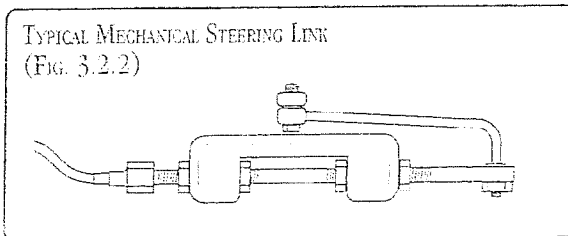
A routine maintenance schedule for the mechanical steering system should be set up to include a Normal Service for every 50 hours of operation or 60 days (whichever comes first); and a Severe Service (after operation in saltwater) every 25 hours of operation or 30 days (whichever comes first).

### SERVICE SHOULD INCLUDE:

- Inspection of components and fasteners for wear and replacement of parts if worn.
- Lubrication of steering cable, by (FULLY EXTENDING) transom end of cable out of housing and applying Quicksilver 2-4C Multi-Lube on the exposed end.
- Pivot point lubrication with SAE 30W engine oil.
- Inspection and lubrication of the steering head should be made annually by an authorized dealer or whenever unusual sounds or changes in operation develop.

Sea Ray® recommends that all repairs and/or replacements to steering systems be made by qualified dealers authorized by manufacturer of the steering system of your boat.

TYPICAL MECHANICAL STEERING LINK  
(FIG. 3.2.2)



REFER TO OWNER'S PACKET FOR INSTRUCTIONS AND WARRANTY INFORMATION.



## GEAR SHIFT & THROTTLE CONTROL

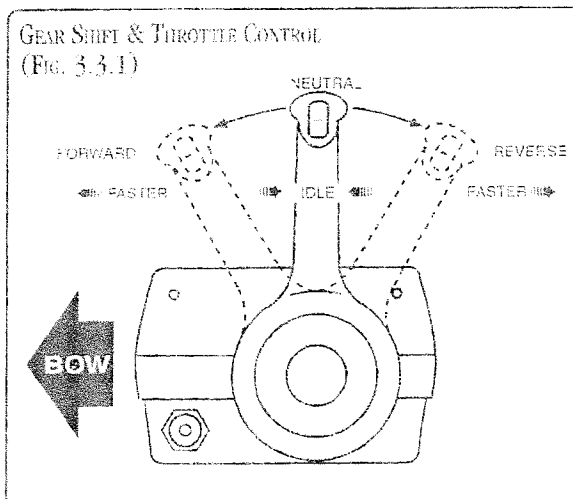
The shift/throttle control unit for the engine activates both the shifting mechanism and the throttle. The control must be in the neutral position to start your engine. Moving the lever forward engages the forward gear and then the throttle advance. To reverse power, bring the control lever back to neutral position, then move it further back to engage the reverse gear and increase reverse thrust.

Throttle controls are equipped with a "throttle only" mechanism which allows the shift mechanism to be disengaged from the throttle. This allows the throttle to be advanced without shifting the transmission when starting. The "throttle only" mechanism may differ from one style gear shift/throttle unit to another, refer to your Gear Shift & Throttle Manual for proper operation of this feature.

The throttle control regulates the RPM of the engine. Regulating the RPM of the engine will control the speed of the boat.

Reversing the shift mechanism will act as a braking action, as sudden slowing of the boat from forward motion will create a following wake which may rise above the transom and flood the boat if the boat is moving at too great a speed. All propellers are designed to provide maximum forward thrust, so the reverse thrust of the propeller will not be as efficient.

Controls may vary slightly depending on the particular Sea Ray® model and engine combination.



### WARNING

- Shift selector to **NEUTRAL** before starting engine.
- Shift only when engine is at idle.
- Reversing at high speeds can cause flooding/swamping due to water being pushed over the transom (stern).

### CAUTION

- Shift quickly; easing into gear can damage the transmission.

## MAINTENANCE

Periodically check and seasonally lubricate the linkages with medium weight oil.

Occasionally it will be necessary to adjust the tension on the cables to ensure a positive and direct response of the control lever action.

**REFER TO OWNER'S PACKET FOR INSTRUCTIONS AND WARRANTY INFORMATION.**

## POWER TRIM & TILT OPERATION

The Power Trim & Tilt System allows the operator to raise and lower the drive unit for trailering, launching, beaching, shallow water operation, and while underway to provide the ideal boat angle (in relation to water surface) for a given load and water condition. In most cases, best all-around performance is obtained with the drive unit adjusted so that the boat will run at a 3° - 5° angle to the water (front of hull just slightly out of the water). The Power Trim and Tilt switch is located on the shift/throttle control lever.

**NOTE:** Boats can be operated in a manner and at certain speeds causing trim angles such that visibility is partly or completely obscured. Motor trim angles, hull trim plane angles (if equipped), and boat load distribution as well as hull speed are factors affecting a boat's trim angle. This standard cannot assure visibility such that a boat can be operated without some loss of visibility from the helm during high trim angles. High trim angle will result from operation at speeds during the transition from displacement mode to planing mode, rapid accelerations, incorrect loading, improper motor trim angles and improper hull trim plane angles. During these conditions it is expected that a lookout will be