

# **Service Manual Outline**

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## Notice

Throughout this publication, “Dangers,” “Warnings” and “Cautions” are used to alert the mechanic to special instructions concerning a particular service or operation that may be hazardous if performed incorrectly or carelessly. Observe them carefully!

These “Safety Alerts” alone cannot eliminate the hazards that they signal. Strict compliance to these special instructions when performing the service, plus “common sense” operation, are major accident prevention measures.

### DANGER

**DANGER - Immediate hazards which will result in severe personal injury or death.**

### WARNING

**WARNING - Hazards or unsafe practices which could result in severe personal injury or death.**

### CAUTION

**CAUTION - Hazards or unsafe practices which could result in minor personal injury or product or property damage.**

## Notice to Users of This Manual

This service manual has been written and published by the service department of Mercury Marine to aid our dealers, mechanics and company service personnel when servicing the products described herein.

It is assumed that these personnel are familiar with the servicing procedures of these products, of like or similar products manufactured and marketed by Mercury Marine, and that they have been trained in the recommended servicing procedures for these products which include the use of mechanic’s common hand tools and the special Mercury Marine or recommended tools from other suppliers.

We could not possibly know of and advise the service trade of all conceivable procedures by which a service might be performed and of the possible hazards and/or results of each method. We have not undertaken any such wide evaluation. Therefore, anyone who uses a service procedure and/or tool, which is not recommended by the manufacturer, first must completely satisfy himself that neither his nor the product’s safety will be endangered by the service procedure selected.

All information, illustrations and specifications contained in this manual are based on the latest product information available at time of publication.

It should be kept in mind, while working on the product, that the electrical system is capable of violent and damaging short circuits or severe electrical shocks. When performing any work where electrical terminals could possibly be grounded or touched by the mechanic, the battery cables should be disconnected at the battery.

Any time the intake or exhaust openings are exposed during service they should be covered to protect against accidental entrance of foreign material which could enter the cylinders and cause extensive internal damage when the engine is started.

It is important to note that, during any maintenance procedure, replacement fasteners must have the same measurements and strength as those removed, whether metric or customary. Numbers on the heads of the metric bolts and on surfaces of metric nuts indicate their strength. Customary bolts use radial lines for this purpose, while most customary nuts do not have strength markings. Mismatched or incorrect fasteners can result in damage or malfunction, or possible personal injury. Therefore, fasteners removed should be saved for re-use in the same locations whenever possible. Where the fasteners are not satisfactory for re-use, care should be taken to select a replacement that meets the same specifications as the original.

## Engine Mechanical Components

Many of the engine mechanical components are designed for marine applications. Unlike automotive engines, marine engines are subjected to extended periods of heavy load and wide-open-throttle operation and, therefore, require heavy-duty components. Special marine engine parts have design and manufacturing specifications which are required to provide long life and dependable performance. Marine engine parts also must be able to resist the corrosive action of salt or brackish water that will rust or corrode standard automotive parts within a short period of time.

Failure to use recommended Quicksilver service replacement parts can result in poor engine performance and/or durability, rapid corrosion of parts subjected to salt water and possibly complete failure of the engine.

Use of parts other than recommended service replacement parts, will void the warranty on those parts which are damaged as a result of the use of other than recommended replacement parts.

## Replacement Parts

### **⚠ WARNING**

**Electrical and fuel system components on Mer-Cruiser Engines and Stern Drives are designed and manufactured to comply with U.S. Coast Guard Rules and Regulations to minimize risks of fire or explosion.**

**Use of replacement electrical or fuel system components, which do not comply to these rules and regulations, could result in a fire or explosion hazard and should be avoided.**

**When servicing the electrical and fuel systems, it is extremely important that all components are properly installed and tightened. If not, any electrical component opening would permit sparks to ignite fuel vapors from fuel system leaks, if they existed.**

## In-Line Diesel Models Covered in This Manual

| <b>MCM (Stern Drive) MODEL</b> | <b>SERIAL NUMBER</b> |
|--------------------------------|----------------------|
| D3.0L/150                      | D0725150 and Above   |
| D3.6L/180                      | D0850125 and Above   |
| D4.2L/220                      | D0554730 and Above   |

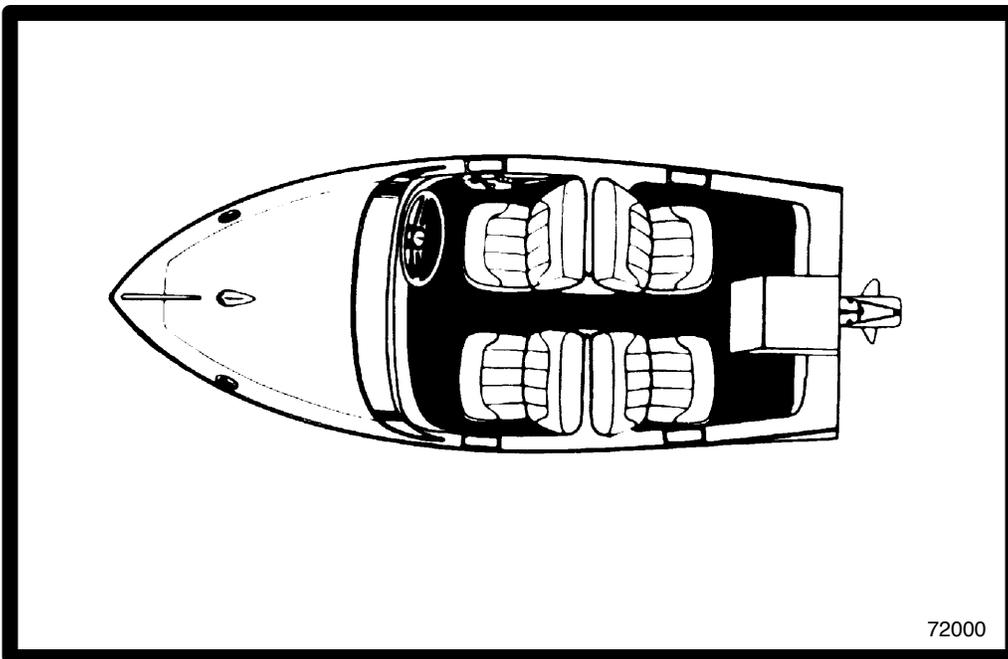
| <b>MIE (Inboard) MODEL</b> | <b>SERIAL NUMBER</b> |
|----------------------------|----------------------|
| D3.0L/150                  | D0725150 and Above   |
| D3.6L/180                  | D0850125 and Above   |
| D4.2L/220                  | D0554730 and Above   |

**NOTICE**  
Refer to appropriate "Stern Drive Service Manual"  
for Transom Assembly and Stern Drive Unit Repair.

# IMPORTANT INFORMATION

1

A



## GENERAL INFORMATION

**Note:** Refer to the following Service Bulletins regarding this section.

- SB 97-13 Service/Repair of Electrical Test Equipment
- SB 96-13 Official Recall Notification Federal Boat Safety Act  
Commander 3000 Remote Control
- SB 96-5 Troubleshooting Shift Problems
- SB 95-2 Oildyne Trim Pump Adaptor Connectors
- SB 91-14 Replacement Trim Pump for the Prestolite Style Pump

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**NOTICE**

**For information and procedures on troubleshooting, refer to SECTION 1C.**

**NOTICE**

**Refer to appropriate Stern Drive Service Manual for transom assembly and stern drive unit repair.**

# Introduction

This comprehensive overhaul and repair manual is designed as a service guide for the models previously listed. It provides specific information, including procedures for disassembly, inspection, assembly and adjustment to enable dealers and service mechanics to repair and tune these engines.

Before attempting repairs, it is suggested that the procedure first be read through to gain knowledge of the methods and tools used and the cautions and warnings required for safety.

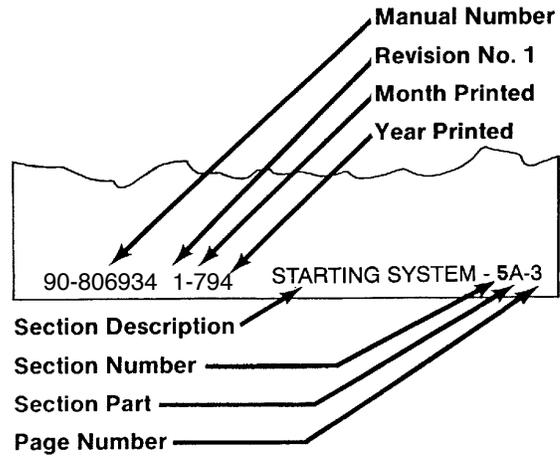
# How to Use This Manual

This manual is divided into sections which represent major components and systems.

Some sections are further divided into parts which more fully describe the component.

# Page Numbering

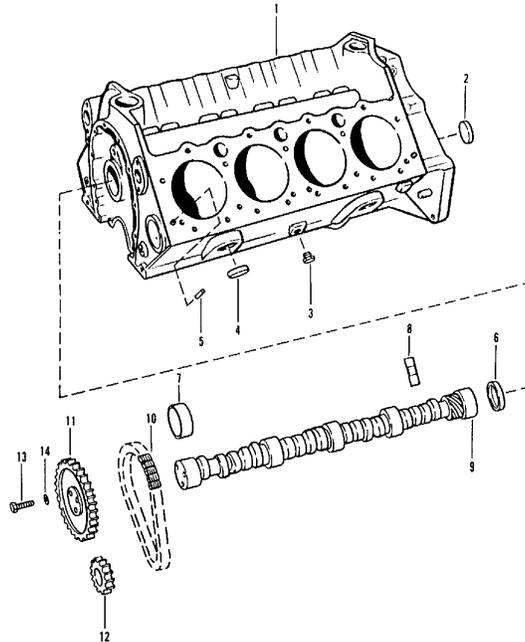
Two number groups appear at the bottom of each page. Following is an example and description.



72426

# How to Read Parts Manual

**NOTE:** The following is representative of a page from a MerCruiser Parts Manual and is not intended to be an actual page from a specific Parts Manual.



73287

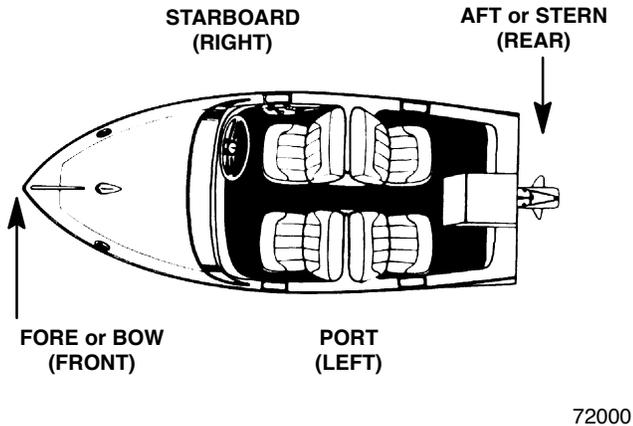
| PART NO.  | REF. NO. | DESCRIPTION  | QUAN. |
|-----------|----------|--|-------|
| 841-81631 | 1        | CYLINDER BLOCK ASSEMBLY                            | 1     |
| N.S.S.    | 2        | PLUG, expansion (1-1/4") (GM #3738306)             | 2     |
| 22-87238  | 3        | DRAIN COCK, cylinder block                         | 2     |
| 19-34270  | 4        | PLUG, expansion - cylinder block (1-5/8" Diameter) | 8     |
| 17-35465  | 5        | PIN, dowel - block to head (5/16" Diameter)        | 4     |
| 22-72640  | 6        | PLUG, expansion - camshaft bearing hole            | 1     |
| 23-85674  | 7        | BEARING UNIT, camshaft (set)                       | 1     |
| 72638     | 8        | LIFTER, hydraulic valve                            | 16    |
| 431-5943  | 9        | CAMSHAFT   | 1     |
| 35378     | 10       | CHAIN, camshaft timing                             | 1     |
| 43-35338  | 11       | SPROCKET, camshaft timing                          | 1     |
| 43-48338  | 12       | SPROCKET, crankshaft timing                        | 1     |
| 10-34505  | 13       | BOLT, camshaft timing sprockets (3/4")             | 3     |
| 12-39167  | 14       | WASHER, camshaft timing sprocket bolt              | 3     |

841-8163 Cylinder Block Assembly includes only standard pistons, piston rings, crankshaft bearings and camshaft bearings.

- A. **Part Number:** For part ordering - Note N.S.S. for Reference Number 2, Plug, expansion - that means Not Sold Separately by Mercury Marine; however, in this case, the G.M. Part Number (for the plug) is given in the Description Column.
- B. **Reference Number:** For part shown on exploded parts view.
- C. **Description:** This is the most important column because it gives:
  - 1) Description of Part: Ref. No. 1 is a Cylinder Block Assembly, No. 9 is a Camshaft, etc.
  - 2) What parts are included with a certain part: Notice how the Description of Part, for Ref. Nos. 1 and 8 through 14, are at the left side of the column. Description of Part for Ref. Nos. 2 through 7 are indented under "Cylinder Block Assembly." If Ref. No. 1 (Cylinder Block Assembly) was ordered, all indented parts (Ref. Nos. 2 through 7) would come with the part. Ref. Nos. 8 through 14 would not come with Ref. No. 1 and would have to be ordered separately. If two Cylinder Blocks were listed, both cylinder blocks would come with the indented parts. In some cases, an indented part will have another part indented under it. The second indented part will come with the first indented part.
  - 3) Serial number break: If serial number information is listed, check product serial number to ensure that correct part is ordered.
  - 4) Special information: Many times special information will be shown after description, such as: L.H. Rotation, R.H. Rotation, Filter Up, Filter Down, etc. This will help in selecting the correct part.
- D. **Quantity:** Quantity that has to be ordered.
- E. **Special Information Block:** Additional information, part numbers for gasket sets, etc.

## Directional References

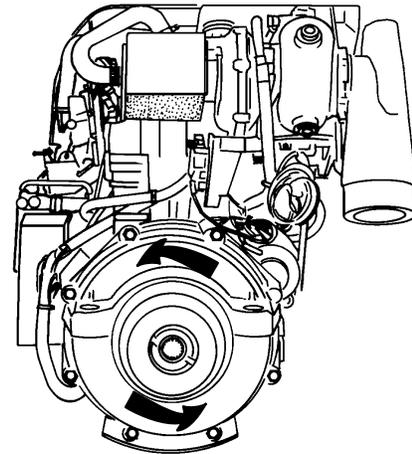
Front of boat is bow; rear is stern. Starboard side is right side; port side is left side. In this maintenance manual, all directional references are given as they appear when viewing boat from stern looking toward bow.



72000

## Engine Rotation

Engine rotation is determined by observing flywheel rotation from the rear (stern end) of the engine looking forward (toward water pump end). Propeller rotation is not necessarily the same as engine rotation. When ordering replacement engine, short blocks or parts for engine, be certain to check engine rotation. Do not rely on propeller rotation in determining engine rotation.



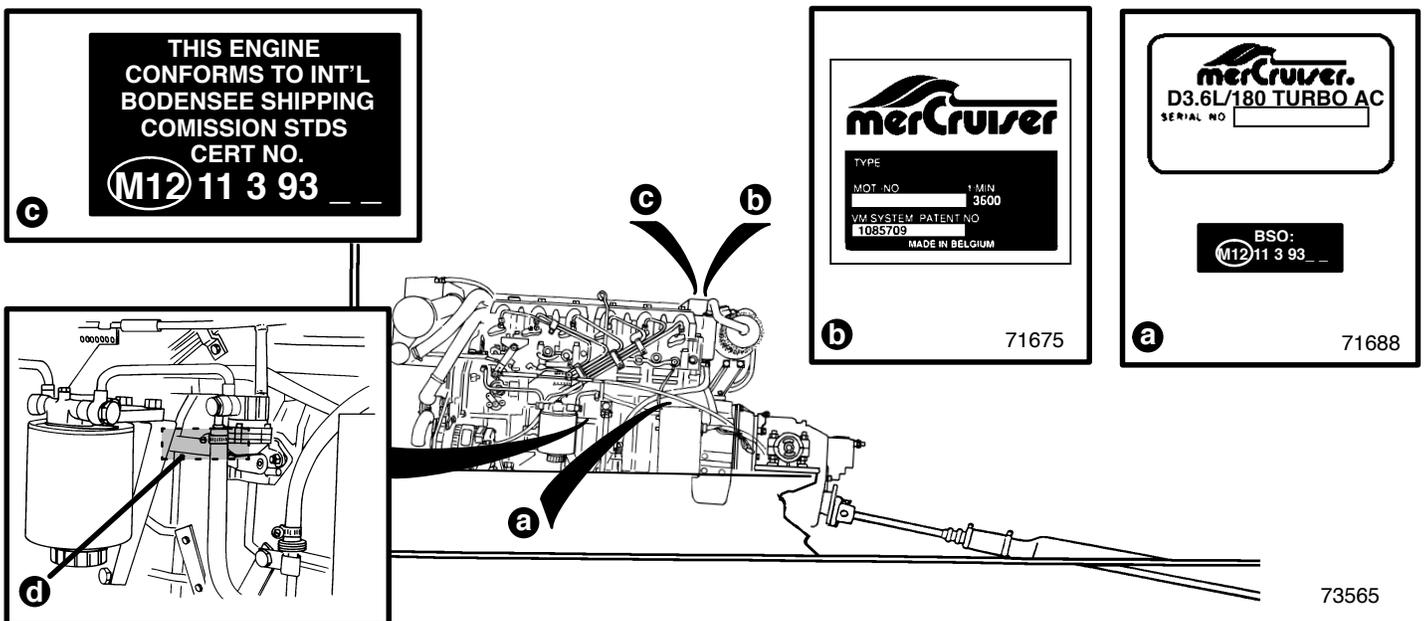
73330

a - Standard Left-Hand Rotation

## Engine Serial Number and Identification Locations

Engine model and serial numbers are located on two plates attached on the engine where shown. Emission Certification Decals are placed where shown.

### MIE (Inboard) Engine Shown [MCM (Stern Drive) Similar]



73565

- a - Riveted Serial Number Plate, and Emission Certification Decal If Applicable (Port Side of Engine Block, Near Top of Electrical Box)
- b - Self-Adhesive Serial Number Plate (Applied to Top of Intercooler Duct)
- c - Self-Adhesive Emission Certification Decal, If Applicable (Applied to Top of Intercooler Duct)
- d - VM Serial Number (Stamped in Block)

## Propeller Information

Refer to the “Propeller” section in appropriate MerCruiser Stern Drive Service Manual, or order publication P/N 90-86144-92, “Everything you need to know about propellers.”

Changing diameter, pitch or coupling of a propeller will affect engine RPM and boat performance. The blade configuration also will affect performance. Two like propellers, same pitch and diameter, from two different manufacturers also will perform differently.

It is the responsibility of the boat manufacturer and/or selling dealer to equip the boat with the correct propeller to allow the engine to operate within its specified RPM range at wide-open-throttle (W.O.T.).

Because of the many variables of boat design and operation, only testing will determine the best propeller for the particular application.

To test for correct propeller, operate boat (with an average load onboard) at W.O.T. and check RPM with an accurate tachometer. Engine RPM should be near top of the specified range so that, under heavy load, engine speed will not fall below specifications.

If engine exceeds the specified RPM, an increase in pitch and/or diameter is required.

If engine is below rated RPM, a decrease in pitch and/or diameter is required.

Normally, a change of approximately 100 to 150 RPM will be achieved for each single pitch change of a propeller.

### CAUTION

**If a propeller is installed that does not allow engine RPM to reach the specified full-throttle RPM range, the engine will “labor” and will not produce full power. Operation under this condition will cause excessive fuel consumption and engine overheating. On the other hand, installation of a propeller, that allows engine to run above the specified RPM limit, will cause excessive wear on internal engine parts which will lead to premature engine failure.**

## Water Testing New Engines

Use care during the first 20 hours of operation on new MerCruiser engines or possible engine failure may occur. If a new engine has to be water-tested at full throttle before the break-in period is complete, follow this procedure **ONLY AFTER** the engine **INITIAL BREAK-IN PROCEDURE** has been completed.

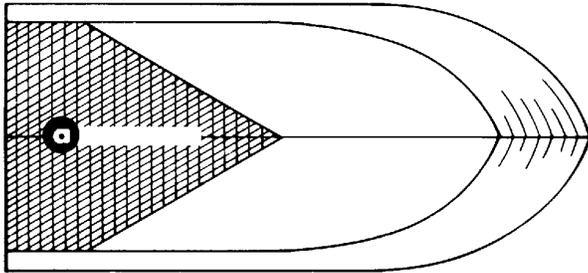
1. Start engine and run at idle RPM until normal operating temperature is reached.
2. Run boat up on plane.
3. Advance engine RPM (in 200 RPM increments) until engine reaches its maximum rated RPM.

**IMPORTANT: Do not run at maximum RPM for more than 2 minutes.**

# Boat and Engine Performance

## Boat Bottom

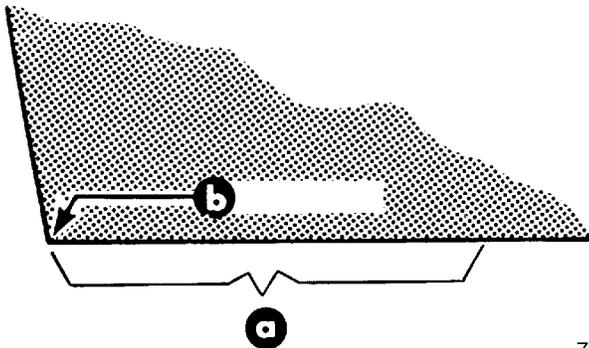
For maximum speed, a boat bottom should be as flat as possible in a fore-aft direction (longitudinally) for approximately the last 5 ft. (1.5 m).



72002

a - Critical Bottom Area

For best speed and minimum spray, the corner between the bottom and the transom should be sharp.

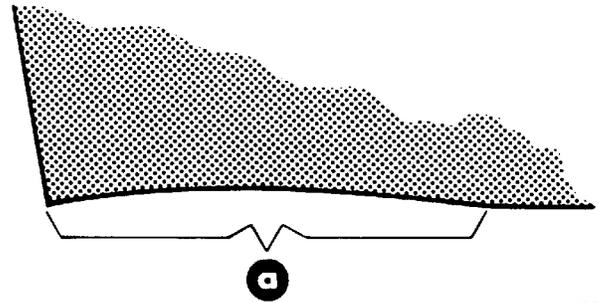


72003

a - Flat  
b - Sharp Corner

The bottom is referred to as having a “hook” if it is concave in the fore-and-aft direction. A hook causes more lift on the bottom near the transom and forces the bow to drop. This increases wetted surface and reduces boat speed. A hook, however, aids in planing

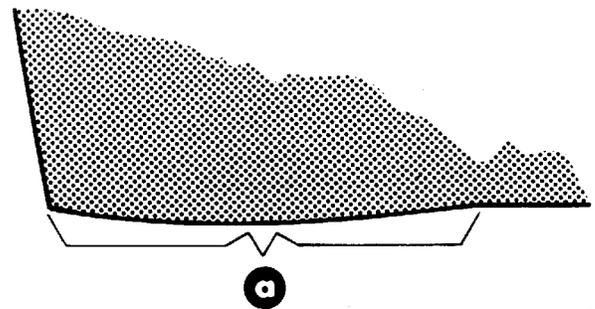
and reduces any porpoising (rhythmical bouncing) tendency. A slight hook is often built in by the manufacturer. A hook also can be caused by incorrect trailering or storing the boat with support directly under the transom.



72004

a - Hook

A “rocker” is the reverse of a hook. The bottom is convex or bulged in the fore-and-aft direction. It can cause the boat to porpoise.



72005

a - Rocker

Any hook, rocker or surface roughness on the bottom, particularly in the all-important center-aft portion will have a negative effect on speed, often several miles per hour on a fast boat.

## Marine Fouling

Fouling is an unwanted build-up (usually animal-vegetable-derived) occurring on the boat's bottom and drive unit. Fouling adds up to drag, which reduces boat performance. In fresh water, fouling results from dirt, vegetable matter, algae or slime, chemicals, minerals and other pollutants. In salt water, barnacles, moss and other marine growth often produce dramatic build-up of material quickly. Therefore, it is important to keep the hull as clean as possible in all water conditions to maximize boat performance.

Special hull treatments, such as anti-fouling paint, will reduce the rate of bottom fouling. However, due to the fact that drive units (outboard or stern drive) are made primarily of aluminum, be sure to select an anti-fouling paint having a copper-free, organo-tin base. The BIS (Tri Butyl Tin) Adipate (TBTA) base paint will not set up a galvanic corrosion "cell" as it is completely compatible with aluminum and avoids any electrolysis problems connected with many other paints. Applied according to instructions, it also is very effective.

## Weight Distribution

Weight distribution is extremely important; it affects a boat's running angle or attitude. For best top speed, all movable weight - cargo and passengers - should be as far aft as possible to allow the bow to come up to a more efficient angle (3 to 5 degrees). On the negative side of this approach is the problem that, as weight is moved aft, some boats will begin an unacceptable porpoise.

Secondly, as weight is moved aft, getting on plane becomes more difficult.

Finally, the ride in choppy water becomes more uncomfortable as the weight goes aft. With these factors in mind, each boater should seek out what weight locations best suit his/her needs.

Weight and passenger loading placed well forward increases the "wetted area" of the boat bottom and, in some cases, virtually destroys the good performance and handling characteristics of the boat. Operation in this configuration can produce an extremely wet ride, from wind-blown spray, and could even be unsafe in certain weather conditions or where bow steering may occur.

Weight distribution is not confined strictly to fore and aft locations, but also applies to lateral weight distribution. Uneven weight concentration to port or starboard of the longitudinal centerline can produce a severe listing attitude that can adversely affect the boat's performance, handling ability and riding comfort. In extreme rough water conditions, the safety of the boat and passengers may be in jeopardy.

## Water in Boat

When a boat loses performance, check bilge for water. Water can add considerable weight to the boat, thereby decreasing the performance and handling.

Make certain that all drain passages are open for complete draining.

## Elevation and Climate

Elevation has a very noticeable effect on the wide-open-throttle power of an engine. Since air (containing oxygen) gets thinner as elevation increases, the engine begins to starve for air. Humidity, barometric pressure and temperature do have a noticeable effect on the density of air. Heat and humidity thin the air. This phenomenon can become particularly annoying when an engine is propped out on a cool dry day in spring and later, on a hot, sultry day in August, doesn't have its old zip.

Although some performance can be regained by dropping to a lower pitch propeller, the basic problem still exists. The propeller is too large in diameter for the reduced power output. The experienced marine dealer or a Quicksilver Propeller Repair Station can determine how much diameter to remove from a lower-pitch propeller for specific high-elevation locations. In some cases, a gear-ratio change to the drive unit to more reduction is possible and very beneficial. It is a known fact that weather conditions exert a profound effect on power output of internal combustion engines. Therefore, established horsepower ratings refer to the power that the engine will produce at its rated RPM under a specific combination of weather conditions.

## Recommended Operation/Duty Cycle

It is the operator's responsibility to operate within the following recommended operational capability, or duty cycle, as applicable to engine and installation:

- **Pleasure Duty -**

1.) Operated at rated power and rated speed for short periods of time.

- **Light Duty -**

1.) Operated such that full rated power at maximum rated RPM is limited to 10% of operating time and continuous cruising RPM is limited to 90% of Wide-Open-Throttle RPM (when propped within specified RPM range).

2.) Annual operating time is not to exceed 500 hours.

**NOTE:** *Pleasure duty rating applies to high performance-type boats, or boats with planing hulls where acceleration and top speed are of primary importance. This rating is reserved for privately-owned yachts, or recreational power boats in non-revenue applications.*

*Light duty rating applies to planing boats where the use of full rated power at maximum rated RPM is limited (as stated above). Examples of Light Duty applications include, but are not limited to: search and rescue craft, fast patrol boats, fire boats, dive boats, and limited season fishing boats such as sport-fish charter boats. Application to common commercial crafts having full-displacement or semi-displacement hulls exceeds the recommended operational capability, or duty cycle.*

**IMPORTANT:** Damage caused by improper application or failure to operate within the operational capability, or duty cycle, will not be covered by the MerCruiser Diesel Limited Warranty.

## Pre-Lubricating Turbocharger

**IMPORTANT:** After a lengthy lay-up (several months or more), it is necessary to pre-lubricate the turbocharger and engine. To do this, move the "STOP" switch toggle lever DOWN and hold in this position while you turn the key switch to "START" position. Doing this TOGETHER turns the engine without starting it. DO NOT engage starter for more than 15 seconds; allow at least one minute cool down time before re-engaging starter for another 15 seconds. Watch that starter does not overheat.

# IMPORTANT INFORMATION

1

B

| To Be Done by Owner                                |  |
|--|--|
| Task   | Interval   |
| Battery - Check fluid level                        | Refer to Manufacturer Specifications   |
| Cooling System - Flush seawater section            | Saltwater use: After Each Use<br><br>Before Operation  |
| Engine Crankcase Oil - Check level                 |  |
| Drive Unit Remote Oil Reservoir - Check level      |  |
| Closed Cooling Coolant - Check level               |  |
| Seawater Strainer - Check/clean                    |  |
| Seawater Coolant Circuit - Inspect                 |  |
| Water Pickups - Check for marine growth and debris |  |
| Fuel Filter/Water Separator - Drain                |  |
| Inspect for External Leakage                       |  |
| Drive Unit Zinc Alloy Anodes - Inspect for erosion |  |
| Power Steering Fluid - Check level                 | Weekly or As Required<br>(Replace When Over 50% Eroded)  |
| Air Filter - Check                                 | Every 50 Hours of Operation  |
| Power Trim Pump Oil - Check level                  |  |
| Drive Belts - Inspect condition and check tensions |  |
|  | Every 50 Hours of Operation or<br>60 Days, Whichever Occurs First  |
|  | Saltwater use: Every 50 Hours of<br>Operation or 60 Days,<br>At Least Once Yearly<br>Freshwater use: Every 100 Hours<br>or 120 Days. |

## MAINTENANCE

**Note:** Refer to the following Service Bulletin regarding this section.

SB 91-7 New Engine Break-In Procedure for Diesel Engines

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## NOTICE

**For information and procedures on troubleshooting, refer to SECTION 1C.**

# Maintenance Schedule

## ⚠ WARNING

Always disconnect battery cables from battery BEFORE working around electrical system components to prevent injury to yourself or damage to electrical system should a wire be accidentally shorted.

**NOTE:** Refer to appropriate Stern Drive Service Manual for information and procedures on stern drive maintenance items listed.

### SCHEDULED MAINTENANCE TO BE PERFORMED BY OWNER/OPERATOR

| REQUIRED SERVICE  | INTERVAL  |
|---|---|
| Check engine oil level.   | Before Operation  |
| Check drive unit gear lube monitor  |   |
| Check transmission fluid level.   |   |
| Check closed coolant level.   |   |
| Check water pickups for marine growth or debris.                            |   |
| Drain fuel filter.  |   |
| Check / Clean seawater strainer.  | Before Operation / Clean As Required  |
| Inspect drive unit alloy anodes for erosion (Replace when over 50% eroded). | Weekly or As Required   |
| Flush seawater section of cooling system.                                   | <b>Saltwater Use:</b> After Each Use  |
| Check power trim pump oil level.  | Every 50 Hours of Use   |
| Check power steering fluid level.   |   |
| Clean air filter element.   | Every 50 Hours of Operation, or as Conditions Require   |
| Inspect condition and check tension of drive belts.                         | Every 50 Hours of Operation or 60 Days - Whichever Occurs First   |
| Lubricate propeller shaft.  | <b>Saltwater Use:</b> Every 50 Hours of Operation or 60 Days, Whichever Occurs First<br><b>Freshwater Use:</b> Every 100 Hours of Operation or 120 Days, Whichever Occurs First |
| Replace fuel filter.  | Every 100 Hours of Operation or Once A Year, Whichever Occurs First   |
| Replace air filter element.   | Every 200 Hours of Operation, or Once a Year, Whichever Occurs First  |
| Check sacrificial anode (in heat exchanger) - Replace when over 50% eroded. | Once a Year   |
| Check sacrificial anode (in intercooler) - Replace when over 50% eroded).   |   |
| Spray power package exterior surfaces with Quicksilver Corrosion Guard.     |   |
| Clean and paint power package exterior surfaces.                            | As Necessary  |
| Check battery fluid level.  | Refer to Battery Manufacturer Specifications  |