

© 1999 Mercury Marine

## **Gasoline Engines - Bravo Models**

90-860171990 799



## Identification Record

PLEASE RECORD THE FOLLOWING INFORMATION:

1.

Engine Model and Horsepower	Engine Serial Number
--------------------------------	-------------------------

2.

Transom Assembly Serial Number (Sterndrive)	Gear Ratio	Sterndrive Unit Serial Number
--	---------------	----------------------------------

3.

Transmission Model (Inboard)	Gear Ratio	Transmission Serial Number
---------------------------------	---------------	-------------------------------

4.

Propeller Number	Pitch	Diameter
------------------	-------	----------

5.

Hull Identification Number (HIN)	Purchase Date
-------------------------------------	------------------

6.

Boat Manufacturer	Boat Model	Length
-------------------	---------------	--------

7.

Exhaust Gas Emissions Certificate Number (Europe Only)
--

### SERIAL NUMBERS

The serial numbers are the manufacturer's keys to numerous engineering details which apply to your MerCruiser® power package. When contacting your Authorized MerCruiser Dealer about service, **always specify model and serial numbers.**

The description and specifications contained herein were in effect at the time this guide was approved for printing. Mercury Marine, whose policy is one of continuous improvement, reserves the right to discontinue models at any time, or to change specifications or designs, without notice and without incurring obligation.

Mercury Marine, Fond du Lac, Wisconsin, U.S.A.

Printed in U.S.A.

©1999, Mercury Marine

The following are registered trademarks of Brunswick Corporation: AutoBlend, Jet-Prop, Mariner, Merc, MerCathode, MerCruiser, Mercury, Mercury Marine, Quicksilver, RideGuide, and Thruster.

CA469



**MERCURISER**  
 Division of Mercury Marine  
 Stillwater, OK, U.S.A.

**SPECIFICATIONS**  
 MODEL . . . . . MCM 4.3LX4.3LX1 GEN+  
 DISPLACEMENT . . . . . 282 CID  
 IGNITION TIMING . . . . . 10 BTDC  
 CYL. FIRING ORDER . . . . . 1-6-5-4-3-2  
 SPARK PLUGS . . . . . AC-MR43LTS  
 ENGINE ROTATION . . . . . LH  
 MAX. W.O.T. RPM . . . . . 4400-4800  
 IDLE RPM IN NEUTRAL . . . . . 650  
 PLUG GAP . . . . . .045

For Fuel and Oil requirements refer to  
 Operators & Maintenance Manual

**SERIAL NUMBERS**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

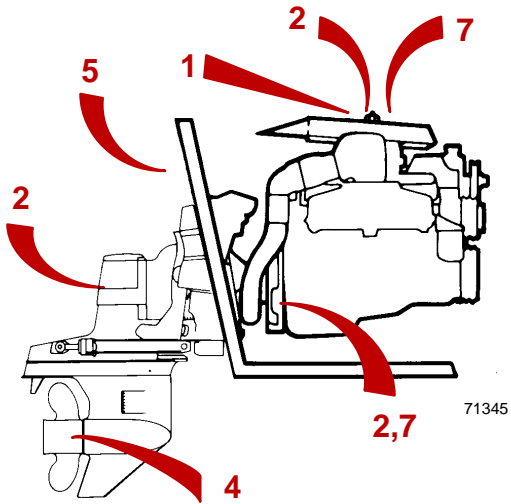
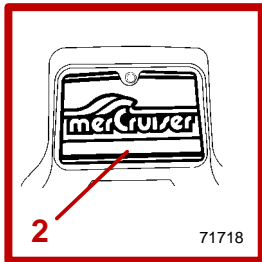
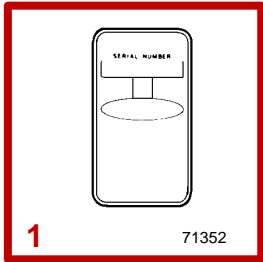
**COLOR CODE**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**1,2** 74677



**ABC12345Z123**

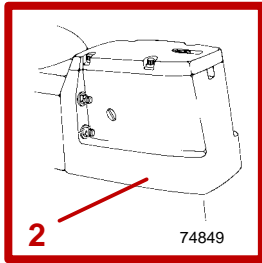
**5**

**-19**

**4**

**48-12345**

**4**



CA753

## Welcome!

You have selected one of the finest marine power packages available. It incorporates numerous design features to assure operating ease and durability.

With proper care and maintenance, you will thoroughly enjoy using this product for many boating seasons. To ensure maximum performance and carefree use, we ask that you thoroughly read this manual.

The Operation, Maintenance and Warranty Manual contains specific instructions for using and maintaining your product. We suggest that this manual remain with the product for ready reference whenever you are on the water.

Thank you for purchasing one of our MerCruiser products. We sincerely hope your boating will be pleasant!

Consumer Affairs Department

CA741

## Warranty Message

The product you have purchased comes with a **limited warranty** from Mercury Marine; the terms of the warranty are set forth in the *Warranty* Sections of this manual. The warranty statement contains a description of what is covered, what is not covered, the duration of coverage, how to best obtain warranty coverage, **important disclaimers and limitations of damages**, and other related information. Please review this important information.

# TABLE OF CONTENTS



Page

## **Warranty Information 6**

Owner Warranty Registration . . . . .	6
International Owner Registration . . . . .	7
MerCruiser Limited Warranty - Gasoline Engines . . . . .	8
MerCruiser International Warranty - Gasoline Engines . . . . .	10
3 Year Limited Warranty Against Corrosion Failure . . . . .	13

## **Read This Manual Thoroughly 20**

## **General Information 21**

Lanyard Stop Switch . . . . .	21
Exhaust Emissions . . . . .	23
Wave And Wake Jumping . . . . .	25
Impact With Underwater Hazards . . . . .	26
Operating With Low Water Inlets . . . . .	28
Safe Boating Suggestions . . . . .	29
Protecting People In The Water . . . . .	32
High-Speed And High-Performance Boat Operation . . . . .	32

## **Conditions Affecting Operation 33**

## **Important Information 38**

Operation And Maintenance . . . . .	38
Freezing Temperature Operation . . . . .	39
Drive Unit Impact Protection . . . . .	39
Drain Plug and Bilge Pump . . . . .	39
Emissions Information (Europe Only) . . . . .	40
Attention Required After Submersion . . . . .	40
Trailing Boat . . . . .	40
Launching And Boat Operation Care . . . . .	41
Stolen Power Package . . . . .	41
Replacement Service Parts . . . . .	42
Do-It-Yourself Maintenance Suggestions . . . . .	43
Multiple EFI Engine Battery Precautions . . . . .	44
Diagnosing EFI Problems (If Equipped) . . . . .	45
Water Separating Fuel Filter . . . . .	45
20-Hour Break-In Period . . . . .	46
After Break-In Period . . . . .	47
End of First Season Checkup . . . . .	47



	<b>Page</b>
<b>Operation</b>	<b>49</b>
Instrumentation .....	49
Audio Warning System .....	51
Electrical System Overload Protection .....	53
Remote Controls .....	57
Power Trim .....	63
Starting, Shifting And Stopping .....	70
Operation Chart .....	73
<b>Specifications</b>	<b>74</b>
Fuel Recommendations .....	74
Crankcase Oil .....	76
Engine .....	77
<b>Maintenance</b>	<b>82</b>
Maintenance Aids .....	82
Maintenance Chart .....	83
Checking Fluid Levels .....	87
Changing Fluids .....	91
Changing Water Separating Fuel Filter .....	95
Cleaning Flame Arrestor and Related Components .....	99
Lubrication .....	101
Propeller .....	105
Drive Belts .....	113
Corrosion And Corrosion Protection .....	117
Emissions (Europe Only) .....	121
Battery .....	124
Bottom Of Boat .....	125
Inspection And Maintenance .....	125
<b>Cold Weather or Extended Storage</b>	<b>126</b>
Power Package Lay Up .....	126
Battery Winter Storage .....	131
Draining Instructions .....	133
Flushing Cooling System .....	140
Power Package Recommissioning .....	142
<b>Troubleshooting</b>	<b>143</b>
<b>Owner Service Assistance</b>	<b>150</b>



CA175

**THIS PAGE IS INTENTIONALLY BLANK**

## Warranty Information

### Owner Warranty Registration

#### UNITED STATES AND CANADA ONLY

- It is important that your selling dealer fills out the Warranty Registration Card completely and mails it to the factory immediately upon sale of the new product.
- It identifies name and address of the original purchaser, product model and serial number(s), date of sale, type of use and selling dealer's code, name and address. The dealer also certifies that you are the original purchaser and user of the product.
- Upon receipt of the Warranty Registration Card at the factory, you will be issued a plastic Owner Warranty Registration Card which is your only valid registration identification. It must be presented to the servicing dealer should warranty service be required. Warranty claims will not be accepted without presentation of this card.
- A temporary Owner Warranty Registration Card will be presented to you when you purchase the product. It is valid only for 30 days from date of sale while your plastic Owner Warranty Registration Card is being processed. Should your product need service during this period, present the temporary registration card to the dealer. He will attach it to your warranty claim form.
- Because of your selling dealer's continuing personal interest in your satisfaction, the product should be returned to him for warranty service.
- If your plastic card is not received within 30 days from date of new product sale, please contact your selling dealer.
- The product warranty is not effective until the product is registered at the factory.
- NOTICE: Registration lists must be maintained by factory and dealer on marine products sold in the United States, should notification under the Federal Boat Safety Act be required.





## International Owner Registration

### OUTSIDE THE UNITED STATES AND CANADA

- It is important that your selling dealer fills out the Warranty Registration Card completely and mails it to the distributor or Marine Power Service Center responsible for administering the warranty registration/claim program for your area.
- The Warranty Registration Card identifies your name and address, product model and serial number(s), date of sale, type of use and the selling distributor's/dealer's code number, name and address. The distributor/dealer also certifies that you are the original purchaser and user of the product.
- A copy of the Warranty Registration Card, designated as the "Purchaser's Copy", MUST be given to you immediately after the card has been completely filled out by the selling distributor/dealer. This card represents your factory registration identification, and should be retained by you for future use when required. Should you ever require warranty service on this product, your dealer may ask you for the Warranty Registration Card to verify date of purchase and to use the information on the card to prepare the warranty claim form(s).
- In some countries, the Marine Power Service Center will issue you a permanent (plastic) Warranty Registration Card within 30 days after receiving the "Factory Copy" of the Warranty Registration Card from your distributor/dealer. If you receive a plastic Warranty Registration Card, you may discard the "Purchaser's Copy" that you received from the distributor/dealer when you purchased the product. Ask your distributor/dealer if this plastic card program applies to you.
- For further information concerning the Warranty Registration Card and its relationship to Warranty Claim processing, refer to the "International Warranty." Refer to "Table of Contents."

**IMPORTANT: Registration lists must be maintained by the factory and dealer in some countries by law. It is our desire to have ALL products registered at the factory should it ever be necessary to contact you. Make sure your dealer/distributor fills out the warranty registration card immediately and sends the factory copy to the Marine Power International Service Center for your area.**

## Warranty Policies

### MerCruiser Limited Warranty - Gasoline Engines

#### UNITED STATES AND CANADA ONLY

- I. We warrant each new production (not those made for high performance purposes) MerCruiser Sterndrive Power Package, Inboard Engine and accessories attached thereto, (hereafter referred to as "Product") to be free from defects in material and workmanship, but only when the customer purchases or obtains predelivery service from a Dealer authorized by us to distribute MerCruiser Product in the country in which the sale or predelivery service occurred.
- II. This warranty shall become effective only upon our receipt of a completed Warranty Registration Card, which shall identify the Product so registered by serial number. This warranty shall remain in effect for a period of one (1) year from date of purchase.
- III. Since this warranty applies to defects in material and workmanship, it does not apply to normal worn parts, adjustments, tune-ups or to damage caused by:  
1) Neglect, lack of maintenance, accident, abnormal operation or improper installation or service;  
2) Use of an accessory or part not manufactured or sold by us;  
3) Operation with fuels, oils or lubricants which are not suitable for use with the Product;  
4) Participating in or preparing for racing or other competitive activity or operating with a racing type lower unit;  
5) Alteration or removal of parts; or  
6) Water entering engine cylinder/s through the exhaust system or carburetor/s.
- IV. Reasonable access must be provided to the Product for warranty service. This warranty will not apply to:  
1) Haul-out, launch, towing and storage charges; telephone or rental charges of any type, inconvenience, or loss of time or income; or other consequential damages; or  
2) Removal and/or replacement of boat partitions or material because of boat design for necessary access to the Product.



- V. Claim shall be made under this warranty by delivering the Product for inspection to a MerCruiser dealer authorized to service the Purchaser's product. If purchaser cannot deliver Product to such authorized dealer, he may give notice in writing to the Company. We shall then arrange for the inspection and repair, provided such service is covered under this warranty. Purchaser shall pay for all related transportation charges and/or travel time. If the service is not covered by this warranty purchaser shall pay for all related labor and material and any other expenses associated with that service. Any Product or parts shipped by purchaser for inspection or repair must be shipped with transportation charges prepaid. The Warranty Registration Card is the only valid registration identification and must be presented at the time warranty service is required. Warranty claims will not be accepted without presentation of the Warranty Registration Card.
- VI. Our sole and exclusive obligation under this Warranty shall be limited to repairing a defective part, or at our option, refunding the purchase price or replacing such part or parts with new or Mercury certified remanufactured parts as shall be necessary to remedy any malfunction resulting from defects in material or workmanship as covered by this Warranty. We reserve the right to improve the design of any Product without assuming any obligation to modify any Product previously manufactured.

**VII. ALL INCIDENTAL AND/OR CONSEQUENTIAL DAMAGES ARE EXCLUDED FROM THIS WARRANTY. WARRANTIES OF MERCHANTABILITY AND FITNESS ARE EXCLUDED FROM THIS WARRANTY. IMPLIED WARRANTIES ARE LIMITED TO THE LIFE OF THIS WARRANTY. SOME STATES OR COUNTRIES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS OR THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSIONS MAY NOT APPLY TO YOU.**

- VIII. This warranty gives you specific legal rights, and you may also have other legal rights which vary from state to state.



## **MerCruiser International Warranty - Gasoline Engines**

### **OUTSIDE THE UNITED STATES AND CANADA**

- I. We warrant each new production (not those made for high performance purposes) MerCruiser Sterndrive Power Package, Inboard Engine and accessories attached thereto, (hereafter referred to as "Product") to be free from defects in material and workmanship, but only when the customer purchases or obtains predelivery service from a Dealer authorized by us to distribute MerCruiser Product in the country in which the sale or predelivery service occurred. This warranty shall remain in effect for a period of one (1) year from date of purchase.
- II. Since this warranty applies to defects in material and workmanship, it does not apply to normal worn parts, adjustments, tune-ups or to damage caused by: 1) Neglect, lack of maintenance, accident, abnormal operation or improper installation or service; 2) Use of an accessory or part not manufactured or sold by us; 3) Operation with fuels, oils or lubricants which are not suitable for use with the Product; 4) Participating in or preparing for racing or other competitive activity or operating with a racing type lower unit; or 5) Alteration or removal of parts or 6) Water entering engine cylinder/s through exhaust system or carburetor/s.
- III. Reasonable access must be provided to the Product for warranty service. This warranty will not apply to: 1) Haul-out, launch, towing and storage charges, telephone or rental charges of any type, inconvenience, or loss of time or income or other consequential damages or 2) Removal and/or replacement of boat partitions or material because of boat design for necessary access to the Product.



- IV. Claim shall be made under this warranty by delivering the Product for inspection to a MerCruiser dealer authorized to service the Product. If purchaser cannot deliver Product to such authorized dealer, he may give notice in writing to the Marine Power Service Center or distributor. The Marine Power Service Center or distributor shall then arrange for the inspection and repair, provided such service is covered under this warranty. Purchaser shall pay for all related transportation charges and/or travel time. If the service is not covered by this warranty purchaser shall pay for all related labor and material, and any other expenses associated with that service. Any Product or parts shipped by purchaser for inspection or repair must be shipped with transportation charges prepaid.
- V. Purchaser must provide "proof of purchase" and substantiate "date of purchase" by presenting the "Purchaser's Copy" of the "Warranty Registration Card" or the plastic "Warranty Registration Card" to the dealer authorized to service the Product. If either of these items is not available purchaser must provide a copy of the original "Bill of Sale" (Sales Contract) for the Product to be serviced. Warranty claims will not be accepted until adequate "proof of purchase" is presented by purchaser and "date of purchase" has been substantiated.



VI. Our sole and exclusive obligation under this Warranty shall be limited to repairing a defective part or AT OUR OPTION, refunding the purchase price or replacing such part or parts with new or Mercury certified remanufactured parts as shall be necessary to remedy any malfunction resulting from defects in material or workmanship as covered by this Warranty. We reserve the right to improve the design of any Product without assuming any obligation to modify any Product previously manufactured.

**VII. ALL INCIDENTAL AND/OR CONSEQUENTIAL DAMAGES ARE EXCLUDED FROM THIS WARRANTY. WARRANTIES OF MERCHANTABILITY AND FITNESS ARE EXCLUDED FROM THIS WARRANTY. IMPLIED WARRANTIES ARE LIMITED TO THE LIFE OF THIS WARRANTY. SOME COUNTRIES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS OR THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSIONS MAY NOT APPLY TO YOU.**

VIII. This warranty gives you specific legal rights, and you may also have other legal rights which vary from country to country.

**MARINE POWER INTERNATIONAL  
Division of Brunswick Corporation  
Fond du Lac, Wisconsin 54935 U.S.A.**



CA457

## **3 Year Limited Warranty Against Corrosion Failure**

**(Applicable In The United States, Canada And Australia)**

- I. We warrant parts and assemblies of each 1988 and newer production MerCruiser (Product) sold with a one year limited Product warranty or the Bravo and TRS Drive Units on performance Products that have a 90 day limited warranty rendered inoperative as a direct result of corrosion, provided the following simple precautionary steps which are specified in Owner's Manuals have been taken:
  1. Specified maintenance procedures (such as replacement of sacrificial anodes, specified lubrication and touch-up of nicks and scratches) have been implemented on a timely basis.
  2. Recommended corrosion prevention devices have been employed (details below).
- II. This warranty shall become effective upon receipt of a completed standard Product warranty registration card and shall remain effective for a period of three years from the date of purchase.
- III. This warranty does not cover: (1) electrical system corrosion; (2) corrosion resulting from damage, abuse or improper service; (3) corrosion to accessories, instruments, steering systems; (4) damage due to marine growth; (5) Product sold with less than a one year limited Product warranty except for Bravo and TRS Drive Units; nor (6) Product used in commercial application.



**IV. ALL INCIDENTAL AND/OR CONSEQUENTIAL DAMAGES ARE EXCLUDED FROM THIS WARRANTY. WARRANTIES OF MERCHANTABILITY AND FITNESS ARE EXCLUDED FROM THIS WARRANTY. IMPLIED WARRANTIES ARE LIMITED TO THE LIFE OF THIS WARRANTY. SOME STATES (OR COUNTRIES) DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS OR THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.**

- V. This warranty gives you specific legal rights, and you may also have other legal rights which vary from state to state (or country to country).
- VI. Other details of this warranty are contained in paragraphs IV, V and VI of the (United States and Canada) Product Warranty, and paragraphs III, IV, V and VI of the (International) Product Warranty, contained in this manual, which paragraphs are incorporated herein by reference.

Mercury Marine products are built using the most advanced corrosion protection process available. This manufacturing system, complemented by dealer and customer participation in an anti-corrosion preventive maintenance program, provides protection against repair costs incurred by the effects of marine corrosion.





## **OWNER'S RESPONSIBILITY**

Protection against certain types of corrosion damage must be provided by using such systems as the Quicksilver MerCathode System and/or Galvanic Isolator. These certain types of corrosion damage are: damage due to stray electrical currents (on-shore power connections, nearby boats, submerged metal), or improper application of copper base anti-fouling paint.

If anti-fouling protection is required, Tri-Butyl-Tin-Adipate (TBTA) base anti-fouling paints are recommended on MerCruiser boating applications. In areas where Tri-Butyl-Tin-Adipate base paints are prohibited by law, copper base paints can be used on the boat hull and transom. Do not apply paint to the MerCruiser drive unit or transom assembly. In addition, care must be taken to avoid an electrical interconnection between the MerCruiser Product and the paint. Corrosion damage that results from the improper application of copper base paint will not be covered by this limited warranty.

## **TRANSFER OF WARRANTY**

This Limited Warranty is transferable to subsequent purchasers for the remainder of the unused portion of the 3-year limited corrosion warranty.

CA458

# **Warranty Coverage**

The purpose of this section is to help eliminate some of the more common misunderstandings regarding warranty coverage. The table explains some of the types of services that are not covered by warranty.

Keep in mind that warranty covers repairs that are needed within the warranty period because of defects in material and workmanship. Installation errors, accidents, normal wear, and a variety of other causes that affect the product are not covered.

Warranty is limited to defects in material or workmanship, but only when the consumer sale is made in the country to which distribution is authorized by us.

Should you have any questions concerning warranty coverage, contact your authorized dealer. They will be pleased to answer any questions that you may have.



## **Warranty Does Not Apply To The Following:**

- Minor adjustments and tune-ups, including checking, cleaning or adjusting spark plugs, ignition components, carburetor settings, filters, belts, controls, and checking lubrication made in connection with normal services.
- Damage caused by neglect, lack of maintenance, accident, abnormal operation or improper installation or service, or freezing temperatures.
- Haul-out, launch, towing charges; removal and/or replacement of boat partitions or material because of boat design for necessary access to the product; all related transportation charges and/or travel time, etc. Reasonable access must be provided to the product for warranty service. Customer must deliver product to an Authorized Dealer.
- Additional service work requested by customer other than that necessary to satisfy the warranty obligation.
- Labor performed by other than an Authorized Dealer may be covered only under following circumstances: When performed on emergency basis (providing there are no Authorized Dealers in area who can perform the work required or have no facilities to haul out, etc., and prior factory approval has been given to have the work performed at this facility).
- All incidental and/or consequential damages (storage charges, telephone or rental charges of any type, inconvenience or loss of time or income) are the owner's responsibility.
- Use of other than Quicksilver replacement parts when making warranty repairs.
- Oils, lubricants or fluids changed as a matter of normal maintenance is customer's responsibility unless loss or contamination of same is caused by product failure that would be eligible for warranty consideration.
- Participating in or preparing for racing or other competitive activity.



- Engine noise does not necessarily indicate a serious engine problem. If diagnosis indicates a serious internal engine condition which could result in a failure, condition responsible for noise should be corrected under the warranty.
- Lower unit and/or propeller damage caused by striking a submerged object is considered a marine hazard.
- Water entering the engine via the carburetor or exhaust system or submersion. Also water in the starter motor.
- Starter motors and/or armatures or field coil assembly, which are burned, or where lead is thrown out of commutator because of excess cranking.
- Valve or valve seat grinding required because of wear.
- Failure of any parts caused by lack of cooling water, which results from starting power package out of water, foreign material blocking inlets or power package being mounted too high.
- Use of fuels and lubricants which are not suitable for use with or on the product.
- Our limited warranty does not apply to any damage to our products caused by the installation or use of parts and accessories which are not manufactured or sold by us. Failures which are not related to the use of those parts or accessories, are covered under warranty, if they otherwise meet the terms of the limited warranty for that product.

## Transferable Warranty

The product warranty is transferable to a subsequent purchaser, but only for the remainder of the unused portion of the limited warranty. This will not apply to products used for commercial applications.

### Direct Sale By Owner

- The second owner can be registered as the new owner and retain the unused portion of the limited warranty by sending the former owner's plastic Owner Warranty Registration Card and a copy of the bill of sale to show proof of ownership. In the United States and Canada, mail to:

**Mercury Marine**  
**Attn: Warranty Registration Department**  
**W6250 West Pioneer Road**  
**P.O. Box 1939**  
**Fond du Lac, WI 54936-1939**

- A new Owner Warranty Registration Card will be issued with the new owner's name and address. Registration records will be changed on the factory computer registration file.
- There is no charge for this service.

**Outside the United States and Canada, please contact the distributor in your country, or the Marine Power International Service Center closest to you, for the transferable warranty procedure that would apply to you.**



CA765

## **Mercury Product Protection Plan**

### **United States And Canada Only**

(Certain performance products, triple engine installations, and commercial applications are excluded)

The Mercury Product Protection Plan provides coverage against unexpected mechanical and electrical breakdowns that may occur beyond the standard limited warranty.

The optional Mercury Product Protection Plan is the only Factory Plan available for your engine.


Two, three or four - year term plans can be purchased up to 12 months after the original engine registration date.

See your participating MerCruiser dealer for complete program details.

## Read This Manual Thoroughly

**IF YOU DON'T UNDERSTAND ANY PORTION, CONTACT YOUR DEALER FOR A DEMONSTRATION OF ACTUAL STARTING AND OPERATING PROCEDURES.**

### NOTICE

Throughout this publication, and on your power package, **WARNINGS** and **CAUTIONS**, accompanied by the International Hazard Symbol , may be used to alert the installer/user 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 with these special instructions while performing the service, plus "common sense" operation, are major accident prevention measures.

### **WARNING**

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

### **CAUTION**

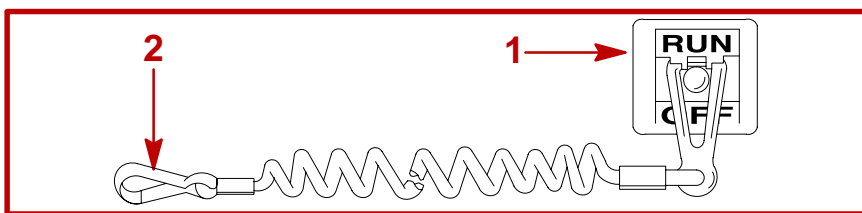
**CAUTION-Hazards or unsafe practices which could result in minor personal injury or product or property damage.**

**IMPORTANT:** - Indicates information or instructions that are necessary for proper operation and/or maintenance.

### **WARNING**

**The operator (driver) is responsible for the correct and safe operation of the boat, the equipment aboard and the safety of all occupants aboard. We strongly recommend that the operator read this Operation, Maintenance and Warranty Manual and thoroughly understand the operational instructions for the power package and all related accessories before the boat is used.**

## General Information



### Lanyard Stop Switch

The purpose of a lanyard stop switch (1) is to turn off the engine when the operator moves far enough away from the operator's position (as in accidental ejection from the operator's position) to activate the switch. Some remote control units are equipped with a lanyard stop switch. A lanyard stop switch can be installed on the dashboard or side adjacent to the operator's position.

The lanyard is a cord usually between 4 and 5 feet (1220 and 1524 mm) in length when stretched out with an element on one end made to be inserted into the switch and a snap (2) on the other end for attaching to the operator. The lanyard is coiled to make its at-rest condition as short as possible so as to minimize the likelihood of lanyard entanglement with nearby objects. It is made as long as it is in its stretched condition to minimize the likelihood of accidental activation should the operator choose to move around in an area close to the normal operator's position. If it is desired to have a shorter lanyard, wrap the lanyard around the operator's wrist or leg, or tie a knot in the lanyard.

**IMPORTANT: The purpose of a lanyard stop switch is to stop the engine when the operator moves far enough away from the operator's position to activate the switch. This would occur if the operator accidentally falls overboard or moves within the boat a sufficient distance from the operator's position. Accidental ejections and falls overboard are more likely to occur in certain types of boats such as low sided sport boats or bass boats, and high-performance boats. Accidental ejections and falls overboard are also likely to occur as a result of poor operating practices such as sitting on the back of the seat or gunwale at planing speeds, standing at planing speeds, sitting**

on elevated fishing boat decks, operating at planing speeds in shallow or obstacle-infested waters, releasing your grip on a steering wheel that is pulling in one direction, drinking alcohol or consuming drugs, or daring, high-speed boat maneuvers.

While activation of the lanyard stop switch will stop the engine immediately, a boat will continue to coast for some distance depending upon the velocity and degree of any turn at shut-down. However, the boat will not complete a full circle. While the boat is coasting, it can cause injury to anyone in the boat's path as seriously as the boat would when under power.

We strongly recommend that other occupants be instructed on proper starting and operating procedures should they be required to operate the engine in an emergency (e.g. if the operator is accidentally ejected).

**⚠ WARNING**

**Should the operator fall out of the boat, the possibility of serious injury or death from being run over by the boat can be greatly reduced by stopping the engine immediately. Always properly connect both ends of the stop switch lanyard to the stop switch and the operator.**

Accidental or unintended activation of the switch during normal operation is also a possibility. This could cause any, or all, of the following potentially hazardous situations:

- 1 Occupants could be thrown forward due to unexpected loss of forward motion - a particular concern for passengers in the front of the boat who could be ejected over the bow and possibly struck by the gear case or propeller.
- 2 Loss of power and directional control in heavy seas, strong current or high winds.
- 3 Loss of control when docking.

**⚠ WARNING**

**Avoid serious injury or death from deceleration forces resulting from accidental or unintended stop switch activation. The boat operator should never leave the operator's station without first disconnecting the stop switch lanyard from the operator.**





CA766

## Exhaust Emissions

CA641



1

Courtesy of ABYC

CA767

## Be Alert To Carbon Monoxide Poisoning

Carbon monoxide is present in the exhaust fumes of all internal combustion engines including the outboards, stern drives and inboard engines that propel boats, as well as the generators that power various boat accessories. Carbon monoxide is a deadly gas that is odorless, colorless and tasteless.

Early symptoms of carbon monoxide poisoning, which should not be confused with seasickness or intoxication, include headache, dizziness, drowsiness, and nausea.

### **WARNING**

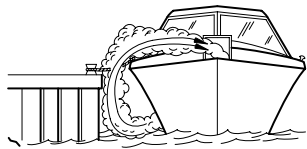
**Avoid the combination of a running engine and poor ventilation. Prolonged exposure to carbon monoxide in sufficient concentration can lead to unconsciousness, brain damage or death.**

### **GOOD VENTILATION**

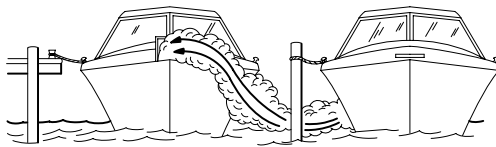
Ventilate passenger area, open side curtains, or forward hatches to remove fumes.

1 Example of desired air flow through the boat.

CA642



2A



2B



3A



3B

Courtesy of ABYC

CA643

## POOR VENTILATION

Under certain running and/or wind conditions, permanently enclosed or canvas enclosed cabins or cockpits with insufficient ventilation may draw in carbon monoxide. Install one or more carbon monoxide detectors in your boat.

Although the occurrence is rare, on a very calm day, swimmers and passengers in an unclosed area of a stationary boat that contains or is near a running engine may be exposed to a hazardous level of carbon monoxide.

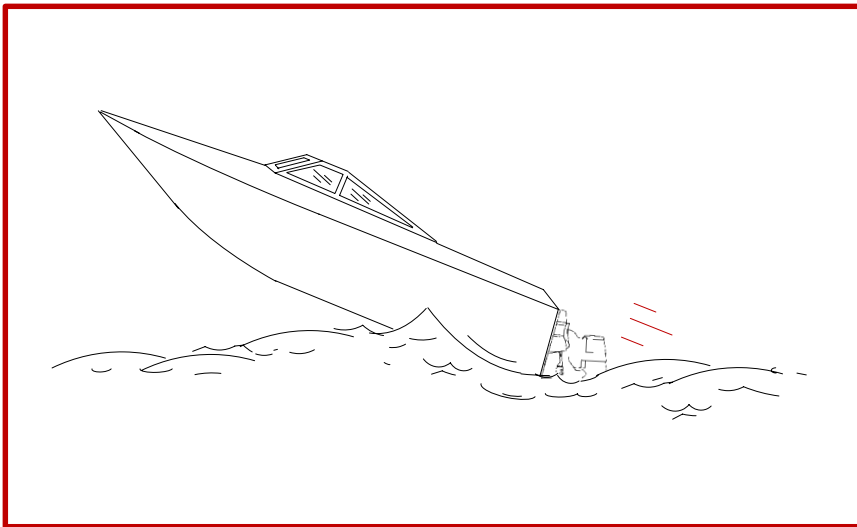
**2** Examples of poor ventilation while boat is stationary:

- A** Running the engine when the boat is moored in a confined space.
- B** Mooring close to another boat that has its engine running.

**3** Examples of poor ventilation while boat is moving:

- A** Running the boat with the trim angle of the bow too high.
- B** Running the boat with no forward hatches open (station wagon effect).

## Wave And Wake Jumping



Operating recreational boats over waves and wakes is a natural part of boating. However, when this activity is done with speed to force the boat hull partially or completely out of the water, certain hazards arise, particularly when the boat re-enters the water.

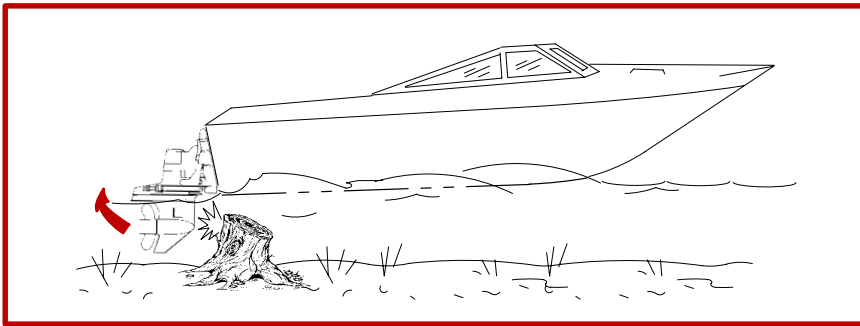
The primary concern is the boat changing direction while in the midst of the jump. In such case the landing may cause the boat to violently veer in a new direction. Such a sharp change in direction or turn can cause occupants to be thrown out of their seats or out of the boat.

There is another less common hazardous result from allowing your boat to launch off a wave or wake. If the bow of your boat pitches down far enough while airborne, upon water contact it may penetrate under the water surface and “submarine” for an instant. This will bring the boat nearly to a stop in an instant and can send the occupants flying forward. The boat may also steer sharply to one side.

### **⚠ WARNING**

**Avoid serious injury or death from being thrown within or out of a boat when it lands after jumping a wave or wake. Avoid wave or wake jumping whenever possible. Instruct all occupants that if a wake or wave jump occurs, get low and hang on to any boat hand hold.**

## Impact With Underwater Hazards



Reduce speed and proceed with caution whenever you're driving a boat in shallow water areas or in areas where the waters are suspected of having underwater obstacles that could be struck by the sterndrive or the boat bottom. **The most important thing you can do to help reduce injury or impact damage from striking a floating or underwater object is control the boat speed. Under these conditions, boat speed should be kept to a minimum planing speed of (15 to 25 MPH).**

Striking a floating/underwater object may result in an infinite number of situations. Some of these situations could result in the following:

- The boat could move suddenly in a new direction. Such a sharp change in direction or turn can cause occupants to be thrown out of their seats or out of the boat.
- A rapid reduction in speed. This will cause occupants to be thrown forward, even out of the boat.
- Impact damage to the sterndrive and/or boat.



Keep in mind, one of the most important things you can do to help reduce injury or impact damage in these situations is control the boat speed. Boat speed should be kept to a minimum planing speed when driving in waters known to have underwater obstacles.

After striking a submerged object, stop engine as soon as possible and inspect the sterndrive unit for any broken or loose parts. If damage is present or suspected, the power package should be taken to an authorized dealer for a thorough inspection and necessary repair.

The boat should also be checked for any hull fractures, transom fractures, water leaks.

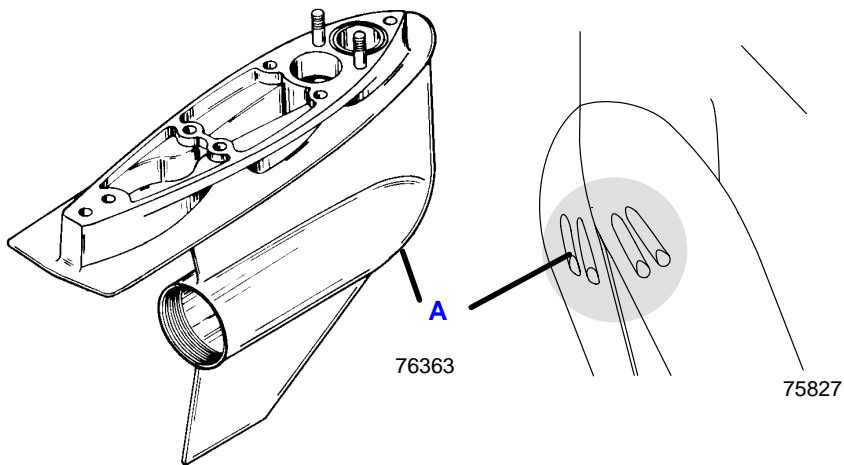
Operating a damaged sterndrive could cause additional damage to other parts of the power package, or could affect control of the boat. If continued running is necessary, do so at greatly reduced speeds.

 **WARNING**

**Avoid serious injury or death from loss of boat control. Continued boating with major impact damage can result in sudden component failure with or without subsequent impacts. Have the power package thoroughly inspected and any necessary repairs made.**

CA802

## Operating With Low Water Inlets In Shallow Water



### **⚠ CAUTION**

**Serious engine damage could occur by failing to follow these instructions. Sand, silt or mud could be sucked into the water inlets restricting or shutting off the water supply to the engine.**

Extreme care should be exercised when operating a boat equipped with low water inlets (A) while maneuvering in shallow water. Also, avoid beaching the boat with the engine(s) running.

## Safe Boating Suggestions

In order to safely enjoy the waterways, familiarize yourself with local and other governmental boating regulations and restrictions, and consider the following suggestions.

- **Know and obey all nautical rules and laws of the waterways.** Boat operators should complete a boating safety course. Courses are offered in the U.S.A. by (1) The U.S. Coast Guard Auxiliary, (2) The Power Squadron, (3) The Red Cross and (4) your state or provincial boating law enforcement agency. Inquiries may be made to the Boating Hotline, 1-800-368-5647 or the Boat U.S. Foundation information number 1-800-336-BOAT.

We strongly recommend that all powerboat operators attend one of these courses.

You should also review the NMMA Sources of Waterway Information booklet. It lists regional sources of safety, cruising and local navigation and is available at no charge by writing to:

Sources of Waterway Information  
National Marine Manufacturers Association  
410 N. Michigan Avenue  
Chicago, IL 60611 U.S.A.

- **Perform safety checks and required maintenance.** Follow a regular schedule and ensure that all repairs are properly made.
- **Check safety equipment on board.** Here are suggestions of the types of safety equipment to carry when boating:
  - 1 Approved fire extinguisher(s); paddle or oar.
  - 2 Signal devices: flashlight, rockets or flares, flag and whistle or horn.
  - 3 Spare propeller, thrust hubs and an appropriate wrench.
  - 4 Tools for necessary minor repairs; first aid kit and book.
  - 5 Anchor and extra anchor line; water-proof storage containers.
  - 6 Manual bilge pump and extra drain plugs; compass and map or chart of area.
  - 7 Spare operating equipment; batteries, bulbs, fuses, etc.
  - 8 Transistor radio.
  - 9 Drinking water.



- **Know signs of weather change and avoid foul weather and rough-sea boating.**
- **Tell someone where you are going and when you expect to return.**
- **Passenger boarding.** Stop the engine whenever passengers are boarding, unloading or are near the back (stern) of the boat. Just shifting the drive unit into neutral is not sufficient.
- **Use personal flotation devices.** Federal Law requires that there be a U. S. Coast Guard approved, wearable-type life jacket (personal flotation device), correctly sized and readily accessible for every person on board, plus a throwable cushion or ring. We strongly advise that everyone wear a life jacket at all times while in the boat.
- **Prepare other boat operators.** Instruct at least one person on board in the basics of starting and operating the engine and boat handling in case the driver becomes disabled or falls overboard.
- **Do not overload your boat.** Most boats are rated and certified for maximum load (weight) capacities (refer to your boat capacity plate). Know your boat's operating and loading limitations. Know if your boat will float if full of water. When in doubt, contact your dealer or the boats manufacturer.
- **Make sure everyone in the boat is properly seated.** Don't allow anyone to sit or ride on any part of the boat that was not intended for such use. This includes backs of seats, gunwales, transom, bow, decks, raised fishing seats, any rotating fishing seat; anywhere that sudden unexpected acceleration, sudden stopping, unexpected loss of boat control or sudden boat movement could cause a person to be thrown overboard or into the boat. See that all passengers have a proper seat and are in it before any boat movement.
- **Never be under the influence of alcohol or drugs while boating (it is the law).** They impair your judgment and greatly reduce your ability to react quickly.





- **Know your boating area and avoid hazardous locations.**
- **Be alert.** The operator of the boat is responsible by law to “maintain a proper lookout by sight (and hearing).” The operator must have an unobstructed view particularly to the front. No passengers, load, or fishing seats should block the operators view when operating the boat above idle or planing transition speed. Watch “the other guy,” the water and your wake.
- **Never drive your boat directly behind a water skier in case the skier falls.** As an example, your boat traveling at 25 miles per hour (40 km/hr) in 5 seconds will overtake a fallen skier who was 200 feet in front of you.
- **Watch fallen skiers.** When using your boat for water skiing or similar activities, always keep a fallen or down skier on the operator’s side of the boat while returning to attend the skier. The operator should always have the down skier in sight and never back up to the skier or anyone in the water.
- **Report accidents.** Boat operators are required by law to file a Boating Accident Report with their state boating law enforcement agency when their boat is involved in certain boating accidents. A boating accident must be reported if (1) there is loss of life or probable loss of life, (2) there is personal injury requiring medical treatment beyond first aid, (3) there is damage to boats or other property where the damage value exceeds \$500.00 or (4) there is complete loss of the boat. Seek further assistance from local law enforcement.

CA282

## Protecting People In The Water

### While You Are Cruising

It is very difficult for a person standing or floating in the water to take quick action to avoid a boat heading in his/her direction even at slow speed.

Always slow down and exercise extreme caution any time you are boating in an area where there might be people in the water.

Whenever a boat is moving (coasting) and the drive unit is in neutral position, there is sufficient force by the water on the propeller to cause the propeller to rotate. This neutral propeller rotation can cause serious injury.

### While Boat Is Stationary

Shift the drive unit into neutral and shut off the engine before allowing people to swim or be in the water near your boat.

#### **WARNING**

**Stop your engine immediately whenever anyone in the water is near your boat. Serious injury to the person in the water is likely if contacted by a rotating propeller, a moving boat, a moving gear case, or any solid device rigidly attached to a moving boat or gear case.**

CC828

## High-Speed And High-Performance Boat Operation

If your boat is considered a high-speed or high-performance boat with which you are unfamiliar, we recommend that you never operate it at its high speed capability without first requesting an initial orientation and familiarization demonstration ride with your dealer or an operator experienced with your boat. For additional information, obtain a copy of our "Hi-Performance Boat Operation" booklet (Part Number 90-849250--1) from your dealer, distributor, or Mercury Marine.



CA7

## Conditions Affecting Operation

### Weight Distribution

Positioning of weight (passengers and gear) inside the boat has the following effects:

#### Shifting weight to rear (stern) will:

- Generally increases speed and engine RPM.
- At extremes can cause boat to porpoise.
- Causes bow to bounce in choppy water.
- Increases danger of following wave splashing into boat when coming off plane.

#### Shifting weight to front (bow) will:

- Improve ease of planing.
- Improve rough water ride.
- At extremes, can cause boat to veer back and forth (bow steer).

CA8

### Bottom Of Boat

To maintain maximum speed, the following conditions of the boat bottom should be observed.

- A. Clean, free of barnacles and marine growth.
- B. Free of distortion; nearly flat where it contacts the water.
- C. Straight and smooth, fore and aft.

Marine vegetation may accumulate when boat is docked. This growth must be removed before operation; it may clog water inlets and cause engine to overheat.



CA9

## **Cavitation**

Cavitation occurs when water flow cannot follow the contour of a fast-moving underwater object, such as a gear housing or propeller. Cavitation permits the propeller to speed up, but the boat speed to reduce. Cavitation can seriously erode the surface of the gear housing or propeller. Common causes of cavitation are:

- A. Weeds or other debris snagged on propeller or gear housing.
- B. Bent propeller blade or damaged gear housing skeg.
- C. Raised burrs or sharp edges on propeller or gear housing.

CA10

## **Ventilation**

Ventilation is caused by surface air or exhaust gases which are introduced around the propeller resulting in propeller speedup and a reduction in boat speed. Excessive ventilation is annoying and usually caused by:

- Drive unit trimmed out too far.
- A missing propeller diffuser ring.
- A damaged propeller or gear housing, which allows exhaust gases to escape between propeller and gear housing.
- Drive unit installed too high on transom.

CA809

## Propeller Selection

**IMPORTANT:** Installed propeller must allow engine to run at its specified maximum wide-open-throttle revolutions per minute (RPM). Use an accurate service tachometer to verify engine operating RPM.

It is the responsibility of the boat manufacturer and/or the selling dealer to equip the power package with the correct propeller(s). Specified engine wide-open-throttle (WOT) and operating RPM range are listed in "SPECIFICATIONS."

**IMPORTANT:** The engines covered in this manual are equipped with an RPM rev-limiter that is set to an upper (or limited) RPM amount. This limit is slightly above the normal operating range of the engine and is designed to help prevent damage from excessive engine RPM. Once the RPM drops into the recommended operating RPM range normal engine operation resumes.

Select a propeller that will allow the engine power package to operate at or near the top end of the recommended wide-open-throttle operating RPM range with a normal load. High RPM, caused by an excessive trim angle, should not be used in determining correct propeller selection.



If full throttle operation is below the recommended range, the propeller must be changed to prevent loss of performance and possible engine damage. On the other hand, operating an engine above the recommended operating RPM range will cause higher than normal wear and/or damage. Generally, there is a 200-300 RPM change between propeller pitches.

After initial propeller selection, the following common problems may require that the propeller be changed to a lower pitch:

- Warmer weather and greater humidity cause an RPM loss.
- Operating in a higher elevation causes an RPM loss.
- Operating with a damaged propeller or dirty boat bottom causes an RPM loss.
- Operating with increased load (additional passengers, pulling skiers, etc.).

For better acceleration, such as is needed for water skiing, use the next lower pitch propeller. However, do not operate at full throttle when using the lower pitch propeller but not pulling skiers.



CA12

## **How Elevation And Climate Affect Performance**

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 condition can become particularly annoying when the propeller testing was done on a cool, dry day. Then later; on a hot, sultry day, the boat doesn't seem to have the same performance.

Although some performance can be regained by dropping to a lower pitch propeller, the basic problem still exists. In some cases, a gear ratio change to more reduction is possible and very beneficial.

Summer conditions of high temperature, low barometric pressure and high humidity all combine to reduce the engine power. This, in turn, is reflected in decreased boat speeds, as much as 2 or 3 miles per hour in some cases. Nothing will regain this speed for the boater, but the coming of cool, dry weather.

In pointing out the practical consequences of weather effects, an engine running on a hot, humid, summer day, may encounter a loss of as much as 14% of the horsepower it would produce on a dry, brisk spring or fall day. With the drop in available horsepower, this propeller will, in effect, become too large. Consequently, the engine operates at less than its recommended RPM. This will result in further loss of horsepower at the propeller with another decrease in boat speed. This secondary loss, however, can be somewhat regained by switching to a lower-pitch propeller that allows the engine to again run at recommended RPM.

For boaters to realize optimum engine performance under changing weather conditions, it is essential that the engine be propped to allow it to operate at or near the top end of the recommended maximum RPM range at wide-open-throttle with a normal boat load.

Not only does this allow the engine to develop full power, but equally important is the fact that the engine also will be operating in an RPM range that discourages damaging detonation. This, of course, enhances overall reliability and durability of the engine.

CA13

## Important Information

### Operation And Maintenance

#### OWNER/OPERATOR RESPONSIBILITIES

It is the operator's responsibility to perform all safety checks; to ensure that all lubrication and maintenance instructions are complied with for safe operation and to return the unit to an Authorized MerCruiser Dealer for a periodic checkup.

Normal maintenance service and replacement parts are the responsibility of the owner/operator and as such, are not considered defects in workmanship or material within the terms of the warranty. Individual operating habits and usage contribute to the need for maintenance service.

Proper maintenance and care of your power package will assure optimum performance and dependability, and will keep your overall operating expenses at a minimum. See your Authorized MerCruiser Dealer for service aids.

CA14

#### DEALER RESPONSIBILITIES

In general, a dealer's responsibilities to the customer include predelivery inspection and preparation such as:

- Make sure that the boat is properly equipped.
- Prior to delivery, make certain that the MerCruiser power package and other equipment are in proper operating condition.
- Make all necessary adjustments for maximum efficiency.
- Familiarize the customer with the on-board equipment.
- Explain and demonstrate the operation of the power package and boat.
- At the time of delivery, the dealer should provide you with a copy of a Predelivery Inspection Checklist.
- Your selling dealer should fill out the Warranty Registration Card completely and mail it to the factory immediately upon sale of the new product.





CA407

## Freezing Temperature Operation

**IMPORTANT:** If boat is operated during periods of freezing temperature, precautions must be taken to prevent freezing damage to power package. Damage caused by freezing **IS NOT** covered by MerCruiser Limited Warranty.

CA17

## Drive Unit Impact Protection

The Power Trim hydraulic system is designed to provide impact protection for drive unit. If a submerged object is struck while boat is moving forward, the hydraulic system will cushion the kickup of drive unit as it clears the object, reducing damage to unit. After drive unit has cleared object, the hydraulic system allows drive unit to return to original operating position, preventing loss of steering control and engine overspeed.

Use extreme caution when operating in shallow water or where underwater objects are known to be present. Use extreme care to prevent striking submerged object while operating in REVERSE. No impact protection is provided in REVERSE.

If drive unit should strike a submerged object, stop engine as soon as possible and inspect drive unit for damage. If damage is present or suspected, boat should be taken to an Authorized MerCruiser Dealer for thorough inspection and necessary repair. Operating a damaged drive unit could cause additional damage to other parts of drive unit, or could affect control of boat. If continued running is necessary, do so at greatly reduced speeds.

**IMPORTANT:** Impact protection system cannot be designed to ensure total protection from impact damage under all conditions.

CA408

## Drain Plug and Bilge Pump

The engine compartment in your boat is a natural place for water to collect. For this reason, boats are normally equipped with a drain plug and/or a bilge pump. It is very important to check these items on a regular basis to ensure that the water level does not rise to come in contact with your power package. Components on your engine will be damaged if submerged. Damage caused by submersion is not covered by the MerCruiser Limited Warranty.

CA621

## **Emissions Information (Europe Only)**

Your engine may be equipped with special design features and special tuning to minimize the emission output from the engine. If so, it is very important that you strictly adhere to the following:

- Recommended maintenance schedules particularly the ignition system.
- Proper engine tuning procedures to ensure these features remain in good operating order.
- Proper steps to maintain the engine within specifications.

Use only MerCruiser replacement parts to ensure compliance with emission regulations.

**IMPORTANT: The testing dealer or agency will be equipped with the appropriate test equipment and adapters for this engine. Refer to “Emissions Testing” procedure found later in this manual.**

CA409

## **Attention Required After Submersion**

- Before recovery, contact an Authorized MerCruiser Dealer.
- After recovery, immediate service by an Authorized MerCruiser Dealer is required to prevent serious damage to power package.

CA19

## **Trailing Boat**

Boat can be trailered with drive unit in “up” or “down” position. Adequate road clearance is required between road and gear housing skeg when trailering with drive unit in “down” position.

If adequate road clearance is a problem, place drive unit in full trailer position and support with an optional trailer kit which is available from your Authorized MerCruiser Dealer.

CA20

## Launching And Boat Operation Care

### CAUTION

During launching from a trailer, if the unloading ramp is steep or the trailer bed must be tilted, the boat may enter the water rapidly and at a steep angle. This may force water through the exhaust system into the cylinders. The more weight on the transom, the more likely this is to occur.

Slowing down rapidly or stopping suddenly may cause a following wave to “swamp” the transom. In this instance, water may enter the cylinders through the exhaust system.

When backing up rapidly, the same situation may occur as stated in the preceding paragraph.

In any of these situations, water entering the engine could cause severe damage to internal parts. Refer to “Attention Required After Submersion.”

CA21

## Stolen Power Package

If your power package is stolen, immediately advise the local authorities and Mercury Marine of the model and serial number(s) and to whom the recovery is to be reported. This “Stolen Motor” information is placed into a file at Mercury Marine to aid authorities and dealers in recovery of stolen motors.

## Replacement Service Parts

### **WARNING**

**Electrical, ignition and fuel system components on MerCruiser gasoline power packages 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, ignition 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, ignition and fuel systems, it is extremely important that all components are properly installed and tightened. If not, any electrical or ignition component would permit sparks to ignite fuel vapors from fuel system leaks, if they existed.**

Marine engines are expected to operate at or near full-throttle for most of their life. They are also expected to operate in both fresh and saltwater environments. These conditions require numerous special parts. Care should be exercised when replacing marine engine parts as specifications are quite different from those of the standard automotive engine.

For example, one of the most important, and probably the least suspected special replacement part, is the cylinder head gasket. Since saltwater is highly corrosive, the steel-type automotive head gasket cannot be used. A marine engine head gasket uses special materials to resist corrosive action.

Since marine engines must be capable of running at or near maximum RPM much of the time, special valve springs, valve lifters, pistons, bearings, camshafts and other heavy-duty moving parts are required for long life and peak performance.

These are but a few of the many special modifications that are required in MerCruiser marine engines to provide long life and dependable performance.

CA772

## **Do-It-Yourself Maintenance Suggestions**

If you are one of those persons who likes to do-it-yourself, here are some suggestions for you.

- Present-day marine equipment, such as your MerCruiser power package, are highly technical pieces of machinery. Electronic ignition and special fuel delivery systems provide greater fuel economies, but also are more complex for the untrained mechanic.
- Do not attempt any repairs which are not covered in this manual unless you are aware of the precautions (“Cautions” and “Warnings”) and procedures required. Your safety is of our concern.
- If you attempt to service the product yourself, we suggest you order the service manual for that model. The service manual outlines the correct procedures to follow. It is written for the trained mechanic, so there may be procedures you don't understand. Do not attempt repairs if you do not understand the procedures.
- There are special tools and equipment that are required to perform some repairs. Do not attempt these repairs unless you have these special tools and/or equipment. You can cause damage to the product in excess of the cost a dealer would charge you.
- Also, if you partially disassemble an engine or drive assembly and are unable to repair it, the dealer's mechanic must reassemble the components and test to determine the problem. This will cost you more than taking it to the dealer immediately upon having a problem. It may be a very simple adjustment to correct the problem.
- Do not telephone the dealer, service office or the factory to attempt for them to diagnose a problem or request the repair procedure. It is difficult for them to diagnose a problem over the telephone.
- Your Authorized Dealer is there to service your power package. They have qualified factory-trained mechanics.

It is recommended you have the dealer do periodic maintenance checks on your power package. Have them winterize it in the fall and service it before the boating season. This will reduce the possibility of any problems occurring during your boating season when you want trouble-free boating pleasure.

## Multiple EFI Engine Battery Precautions

### Situation

**Alternators:** Alternators are designed to charge the battery that supplies electrical power to the engine that the alternator is mounted on. When batteries for two different engines are connected, one alternator will supply all of the charging current for both batteries. Normally, the other engine's alternator will not be required to supply any charging current.

**EFI Electronic Control Module (ECM):** The ECM requires a stable voltage source. During multiple engine operation, an onboard electrical device may cause a sudden drain of voltage at the engine's battery. The voltage may go below the ECM's minimum required voltage. Also, the alternator on the other engine may now start charging. This could cause a voltage spike in the engine's electrical system.

In either case, the ECM could shut off. When the voltage returns to the range that the ECM requires, the ECM will reset itself. The engine will now run normally. This ECM shut down usually happens so fast that the engine just appears to have an ignition miss.

### Recommendations

**Batteries:** Boats with multi-engine EFI power packages require each engine be connected to its own battery. This ensures that the engine's Electronic Control Module (ECM) has a stable voltage source.

**Battery Switches:** Battery switches should always be positioned so each engine is running off its own battery. DO NOT operate engines with switches in **BOTH** or **ALL** position. In an emergency, another engine's battery can be used to start an engine with a dead battery.

**Battery Isolators:** Isolators can be used to charge an auxiliary battery used for powering accessories in the boat. They should not be used to charge the battery of another engine in the boat unless the type of isolator is specifically designed for this purpose.

**Generators:** The generator's battery should be considered another engine's battery.

CA623

## Diagnosing EFI Problems (If Equipped)

**NOTE:** All references to EFI models apply to EFI and MPI engines.

Your Authorized MerCruiser Dealer has the proper service tools for diagnosing problems on Electronic Fuel Injection (EFI) Systems. The Electronic Control Module (ECM) on these engines has the ability to detect some problems with the system when they occur, and store a "Trouble Code" in the ECM's memory. This code can then be read later by a service technician using a special diagnostic tool.

CA624

## Water Separating Fuel Filter

### CAUTION

**The electric fuel pump and factory installed water separating fuel filter have been carefully designed to function properly together. Do not install additional fuel filters and/or water separating fuel filters between fuel tank and engine.**

The installation of additional filters may cause:

- Fuel Vapor Locking
- Difficult Warm-Starting
- Piston Detonation Due to Lean Fuel Mixture
- Poor Driveability

CA413

## 20-Hour Break-In Period

**IMPORTANT:** The first 20 hours of operation is the engine break-in period. Correct break-in is essential to obtain minimum oil consumption and maximum engine performance. During this break-in period, the following rules must be observed:

- Do not operate below 1500 RPM for extended periods of time for first 10 hours. Shift into gear as soon as possible after starting and advance throttle above 1500 RPM **if conditions permit safe operation.**
- Do not operate at one speed consistently for extended periods.
- Do not exceed 3/4 throttle during first 10 hours. During next 10 hours, occasional operation at full throttle is permissible (5 minutes at a time maximum).
- Avoid full throttle acceleration from IDLE speed.
- Do not operate at full throttle until engine reaches normal operating temperature.
- Frequently check crankcase oil level. Add oil if needed. It is normal for oil consumption to be high during break-in period.





CA211

## **After Break-In Period**

To help extend the life of your MerCruiser power package, the following recommendations should be considered;

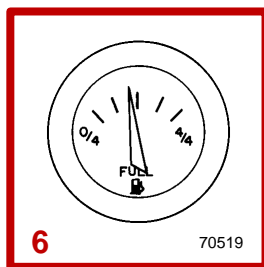
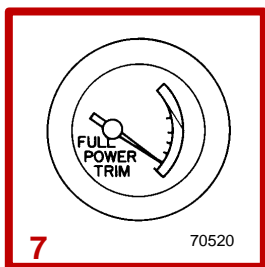
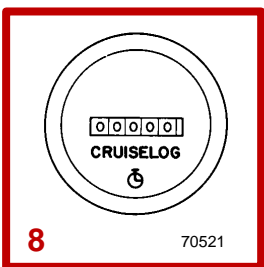
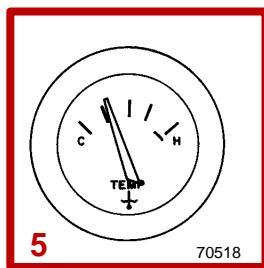
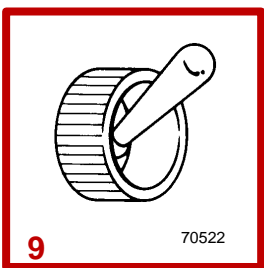
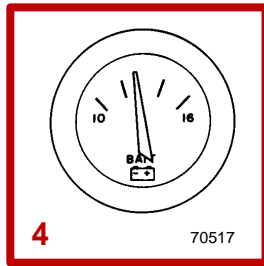
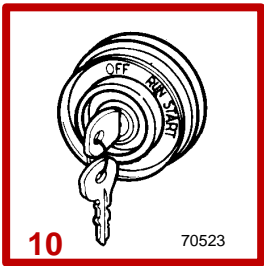
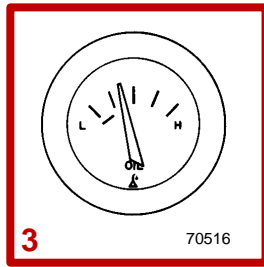
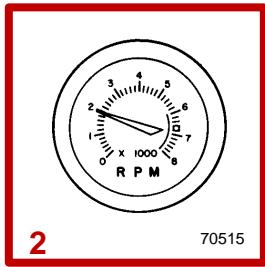
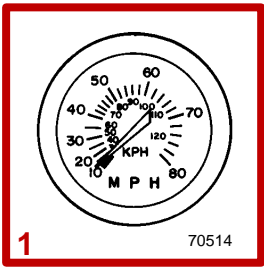
- Use a propeller that allows the engine to operate at or near the top of the maximum RPM range (See “Specifications” section) when at full throttle with a normal boat load.
- Operation at 3/4 throttle setting or lower is recommended. Refrain from prolonged operation at maximum (full throttle) RPM.

CA414

## **End of First Season Checkup**

At the end of the first season of operation, an Authorized MerCruiser Dealer should be contacted to discuss and/or perform various scheduled maintenance items. If you are in an area where the product is operated continuously (year-round operation), you should contact your dealer at the end of the first 100 hours of operation, or once yearly, whichever occurs first.

CA26

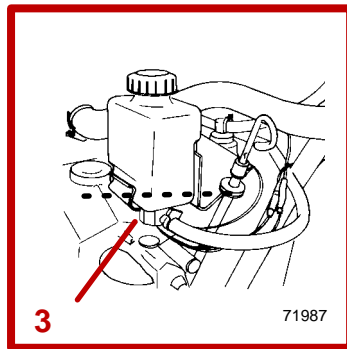
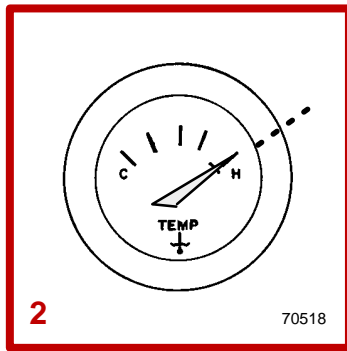
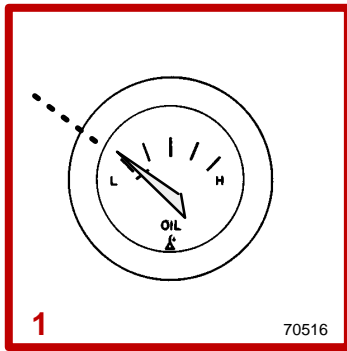


## Operation

### Instrumentation

The following is a brief explanation of instrumentation typically found on some boats. The owner/operator should be familiar with all instruments and their functions on the boat. Because of the large variety of instrumentation and manufacturers, you should have your boat dealer explain the particular gauges and normal readings that will appear on your style gauges.

- 1** Speedometer: Indicates boat speed.
- 2** Tachometer: Indicates engine RPM.
- 3** Oil Pressure Gauge: Indicates engine oil pressure.
- 4** Battery Meter: Indicates battery voltage.
- 5** Water Temperature Gauge: Indicates engine operating temperature.
- 6** Fuel Gauge: Indicates quantity of fuel in tank.
- 7** Power Trim Gauge: Indicates drive unit angle (trim up/out and down/in).
- 8** Hour Meter: Records engine running time.
- 9** Bilge Blower Switch: Operates bilge blower (If so equipped - see "Starting, Shifting and Stopping" procedure).
- 10** Ignition Switch: Allows operator to start and stop engine.



CB758

## Audio Warning System

Your MerCruiser power package may be equipped with an Audio Warning System.

The audio warning system horn will sound if one of the following occur:

- 1 Engine Oil Pressure Too Low
- 2 Engine Temperature Too Hot
- 3 Drive Oil Level Too Low

**NOTE:** *To test the system:*

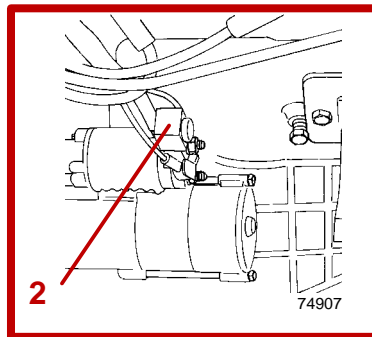
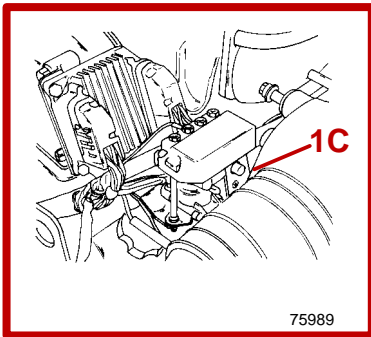
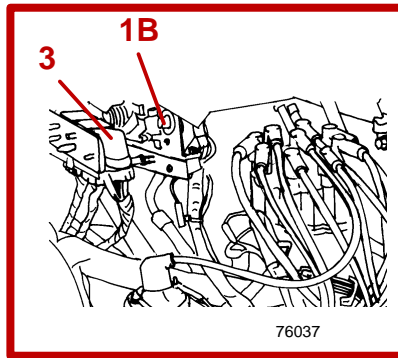
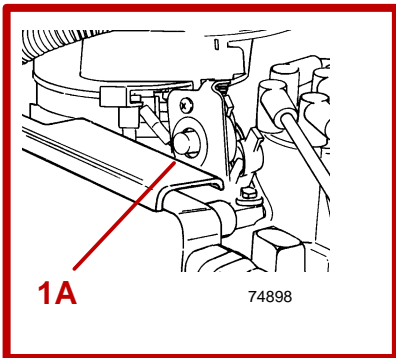
*Turn the ignition switch to the ON position without cranking the engine. The horn will sound if the system is working correctly.*

### CAUTION

**Avoid engine damage. Do not operate engine once the buzzer has sounded EXCEPT TO AVOID A HAZARDOUS SITUATION. The Audio Warning System will not protect the engine from damage. It is designed to warn the operator that a problem has occurred.**

When the horn sounds with the engine running, stop engine immediately. Investigate cause and correct it, if possible. If cause cannot be determined, consult your Authorized MerCruiser Dealer.

CB758



CB775

## Electrical System Overload Protection

If an electrical overload occurs, a fuse will blow or the circuit breaker will trip open. The cause must be found and corrected before replacing fuse or resetting circuit breaker.

**1** A circuit breaker provides protection for engine wiring harness and instrumentation power lead. Reset by pushing RESET button IN.

**A** Carburetor Models

**B** EFI Models Except 7.4L MPI

**C** 7.4L MPI

**NOTE:** *In an emergency, when engine must be operated and cause for high current draw cannot be located and corrected, turn OFF or disconnect all accessories connected to engine and instrumentation wiring. Reset circuit breaker. If breaker remains open, electrical overload has not been eliminated. Further checks must be made on electrical system.*

**2** A 90 Amp fuse is located on the large post of the starter solenoid. This fuse is designed to protect the engine wiring harness if an electrical overload occurs.

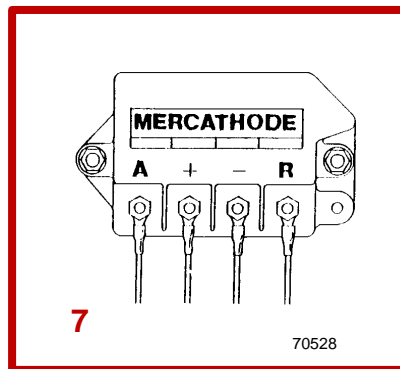
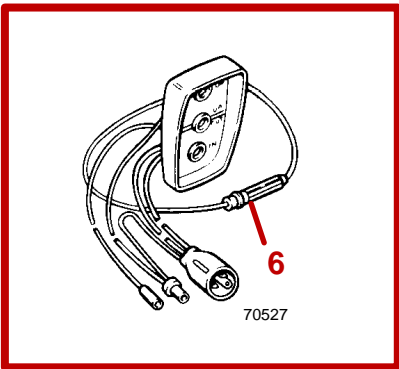
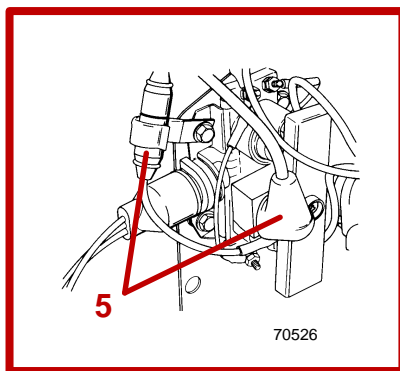
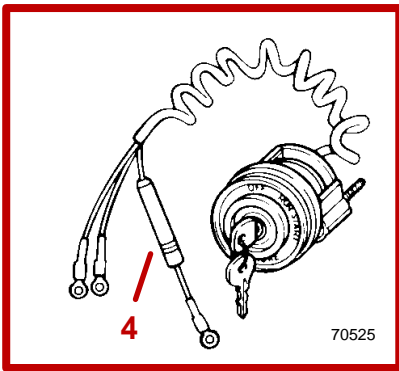
**3 On EFI Models:** Three fuses are located on the port side of the engine. These fuses control various EFI circuits.

**A** Fuel Pump Fuse - 15 Amp

**B** ECM / Injector Fuse - 10 Amp

**C** ECM / Battery Fuse - 15 Amp

CB654







CB772

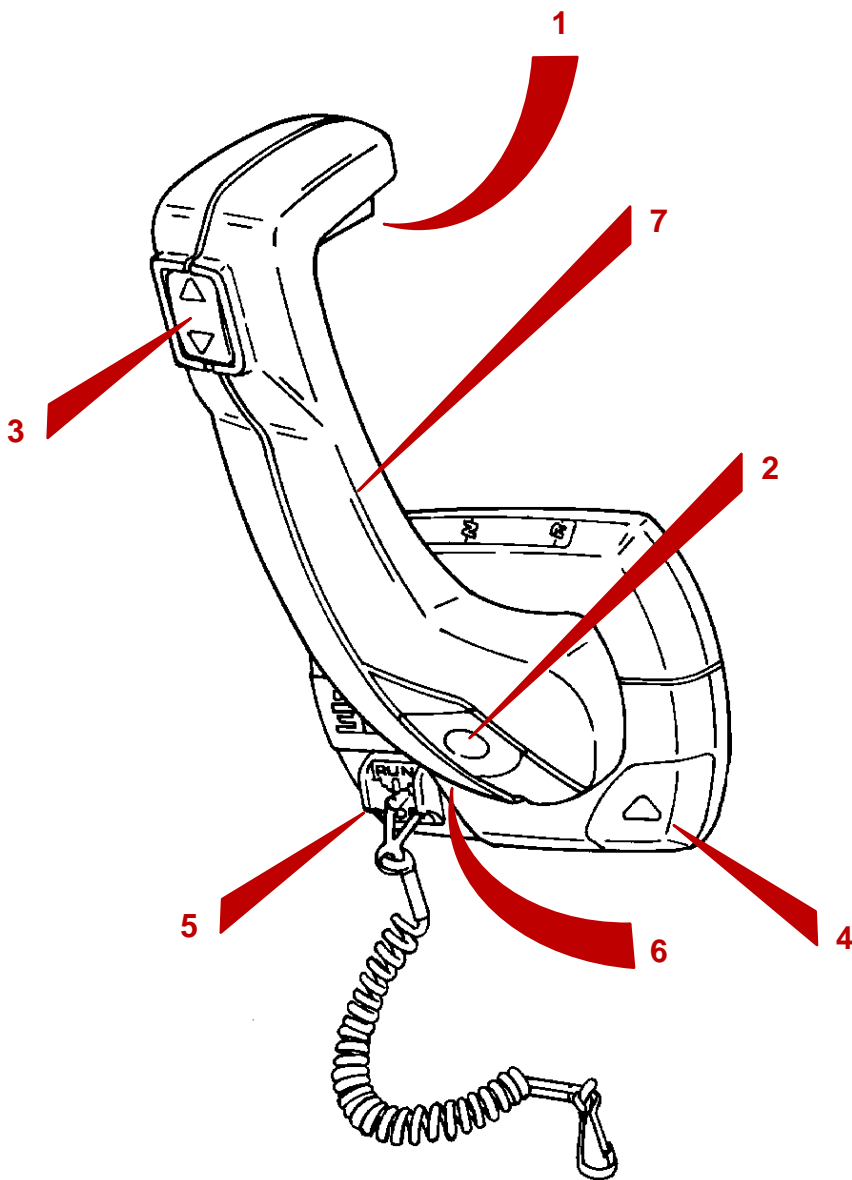
**4** A 20 amp fuse may be located in ignition switch "I" terminal lead to protect electrical system. Check for blown fuse if key is turned to START and nothing happens (and circuit breaker is not tripped).

**5** The Power Trim System is protected from overload by 110 amp fuse and a 20 amp in-line fuse on Power Trim pump.

**6** Quicksilver Three-Button Power Trim Control Panel is further protected by a 20 amp in-line fuse.

**7** The Quicksilver MerCathode System has a 20 amp in-line fuse in the wire which connects to positive (+) terminal on controller. If fuse is blown, system will not operate and a loss of corrosion protection will result.

CB181



CB182

## Remote Controls (Panel Mounted)

Your boat may be equipped with one of many Quicksilver® remote controls available. All controls feature an integral safety switch that allows starting engine in NEUTRAL only. Also, all controls may not have all features shown. If boat is equipped with a remote control other than shown, consult your dealer for a description and/or demonstration of the control.

**1 Neutral Lock Bar** - Prevents accidental shift and throttle engagement. Neutral lock bar must be pulled “Up” to move the control handle out of neutral.

**2 Throttle Only Button** - Allows engine throttle advancement without shifting the engine. This is done by disengaging the shift mechanism from the control handle. The throttle only button can be depressed only when the remote control handle is in the “Neutral” position, and should only be used to assist in starting the engine.

**3 Power Trim Switch** - See “Power Trim” for detailed power trim operating procedures.

**4 Trailer Switch** - Used to raise drive unit for trailering, launching, breaching or shallow water operation. See “Power Trim” for detailed trailer switch operation.

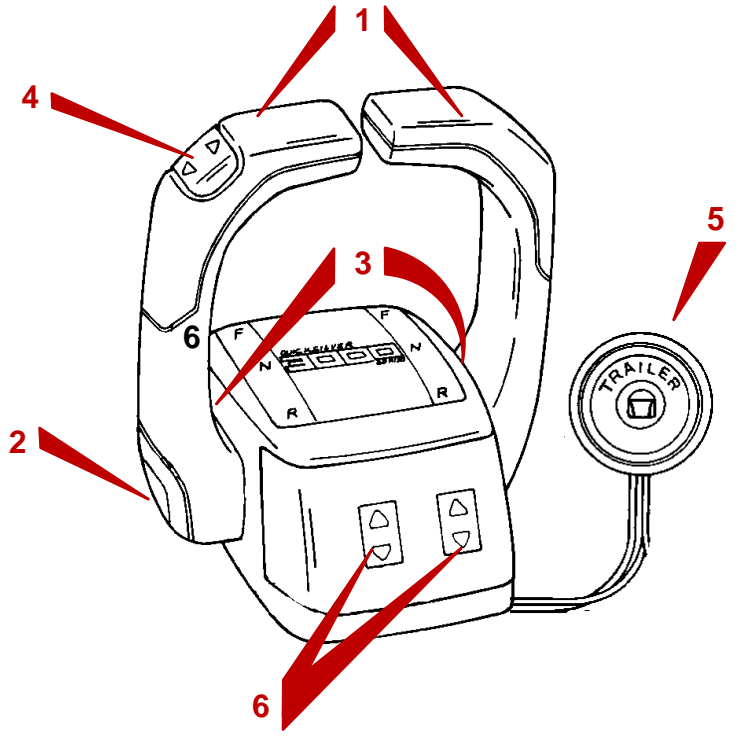
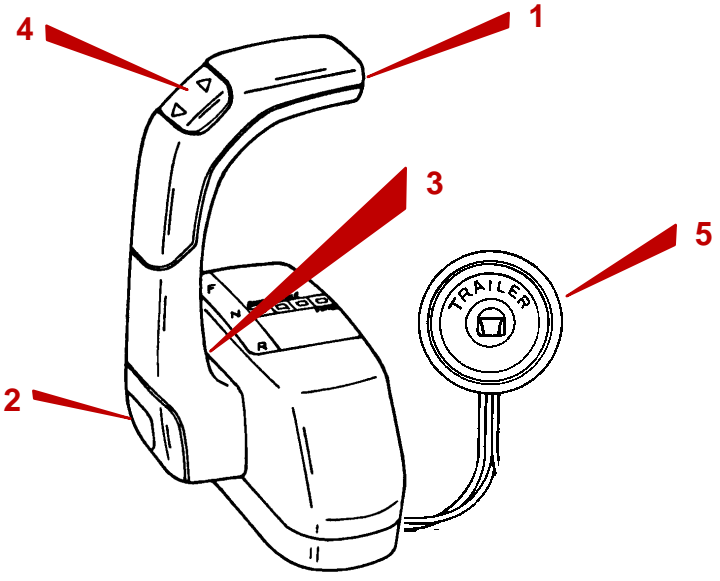
**5 Lanyard Stop Switch** - Turns ignition “Off” whenever the operator (when attached to the lanyard) moves far enough away from the operator’s position to activate the switch. See “Lanyard Stop Switch” at the front of this manual for safety warning on the use of this switch.

**6 Control Handle Tension Adjustment Screw** - This screw can be adjusted to “Increase” or “Decrease” the tension on the control handle. This will help prevent “Creep” of the remote control handle. Turn screw “Clockwise” to increase tension and “Counterclockwise” to decrease tension. Adjust to tension desired.

**7 Control Handle** - Operation of the shift and throttle are controlled by the movement of the control handle. “Push” the control handle forward from “Neutral” with a quick firm motion to the first detent for “Forward” gear. Continue pushing forward to increase speed. Pull the control handle back from “Neutral” with a quick firm motion to the first detent for “Reverse” gear. Continue pushing back to increase speed.



CB183



CB184

## Remote Controls (Console Mounted)

**1 Control Handle(s)** - Operation of the shift and throttle are controlled by the movement of the control handle. "Push" the control handle forward from "Neutral" with a quick firm motion to the first detent for "Forward" gear. Continue pushing forward to increase speed. Pull the control handle back from "Neutral" with a quick firm motion to the first detent for "Reverse" gear. Continue pushing back to increase speed.

**2 Throttle Only Button** - Allows engine throttle advancement without shifting the engine. This is done by disengaging the shift mechanism from the control handle. The throttle only button can be depressed only when the remote control handle is in the "Neutral" position, and should only be used to assist in starting the engine.

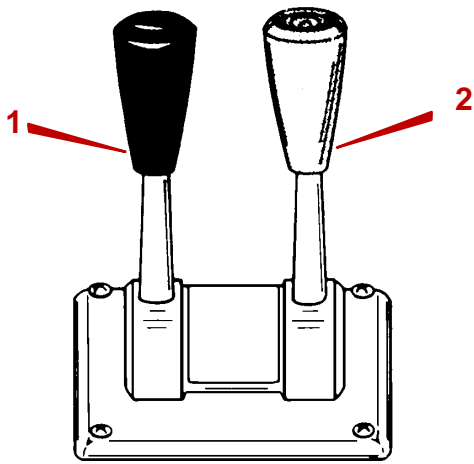
**3 Control Handle Tension Adjustment Screw** - This screw can be adjusted to "Increase" or "Decrease" the tension on the control handle (cover must be removed to adjust). This will help prevent "Creep" of the remote control handle. Turn screw "Clockwise" to increase tension and "Counterclockwise" to decrease tension. Adjust to tension desired.

**4 Power Trim Switch** - See "Power Trim" section for detailed power trim operating procedures.

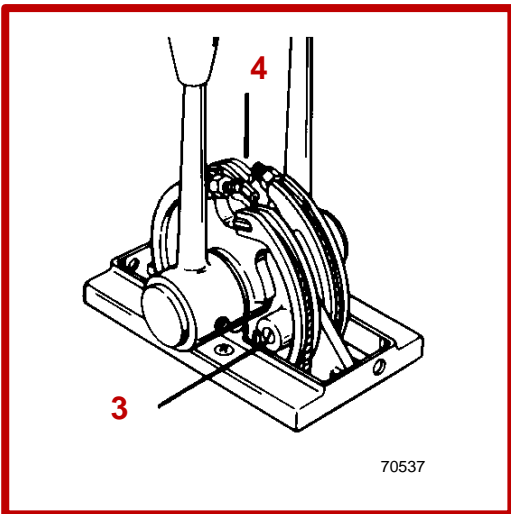
**5 Trailer Switch** - Used to raise drive unit for trailering, launching, breaching or shallow water operation. See "Power Trim" for detailed trailer switch operation.

**6 Power Trim Adjustment Switches (Used on Three Button Trim Control Only)** - See "Power Trim" section for detailed power trim operating procedures.

CB185



71339



70537

CB186

## Remote Controls (Two Lever)

**1** Shift Lever - shifts unit into gear with full lever movement. Move lever forward to shift to FORWARD gear. Move lever backward to shift to REVERSE gear. Lever in full vertical position shifts to NEUTRAL.

### CAUTION

**Never shift unit into or out of gear unless throttle lever is at idle RPM.**

**2** Throttle Lever - allows engine RPM to be increased or decreased.

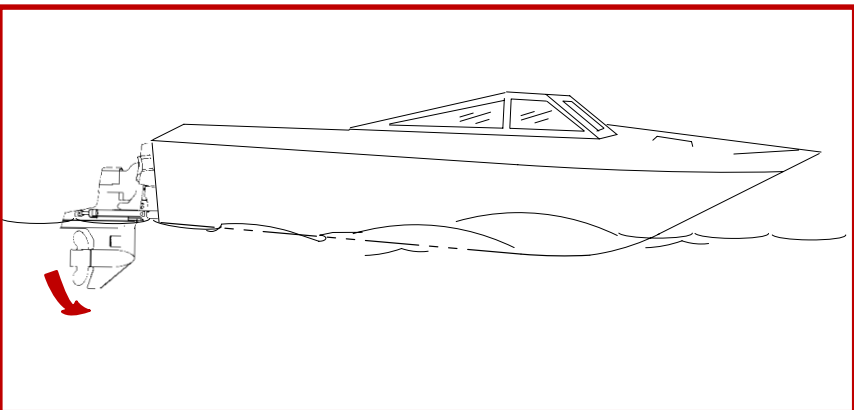
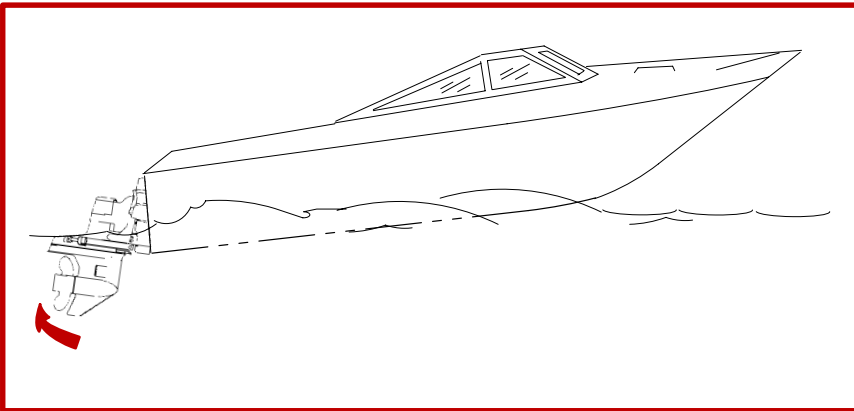
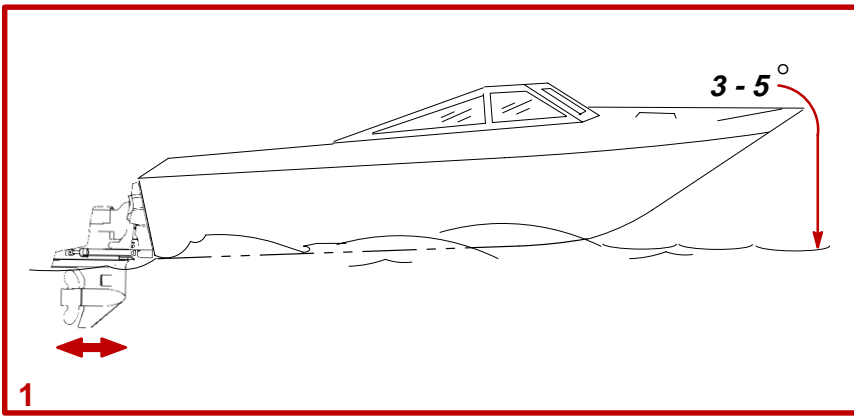
**3** FRICTION Screw - adjusts control handle friction so motor speed can be set and driver does not have to hold handle.

Turn screw clockwise to increase friction. Do not thread screw all the way out.

**4** DETENT Screw - controls the effort needed to move control handle out of NEUTRAL. To increase tension, turn screw clockwise; to decrease, turn screw counterclockwise. Do not thread screw all the way out.

**IMPORTANT: Boats equipped with dual power packages may have both shift levers on one control and both throttle levers on the other control.**

CA768





CA418

## Power Trim

Power Trim allows the operator to adjust the drive angle, while underway, to provide the ideal boat angle for varying load and water conditions. Also, the Power Trim system “Trailing” feature allows the operator to raise and lower the drive unit for trailering, beaching, launching and low speed (below 1200 RPM engine speed), shallow water operation.

### CAUTION

**Never trim the drive unit UP/OUT using TRAILER switch while boat is underway at engine speeds above 1200 RPM. Use extreme caution when operating with drive unit raised. Severe damage to the drive unit may result if unit is raised beyond the gimbal ring support flanges at engine speeds above 1200 RPM.**

1 In most cases, best overall performance is obtained with the drive unit adjusted so the boat bottom will run at a 3° to 5° angle to the water.

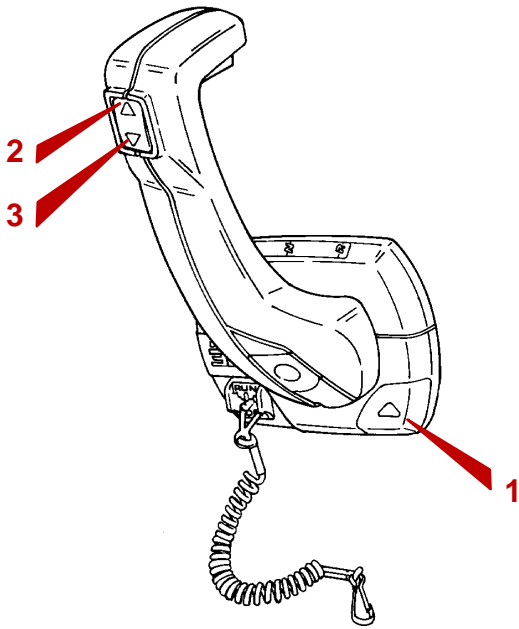
#### Trimming Drive Unit UP/OUT Can:

- Generally increase top speed.
- Increase clearance over submerged objects or a shallow bottom.
- Cause boat to accelerate and plane off slower.
- In excess, cause boat “porpoising” (bouncing) or propeller ventilation.
- Cause engine overheating if trimmed UP/OUT to a point where any cooling water intake holes are above the water line.

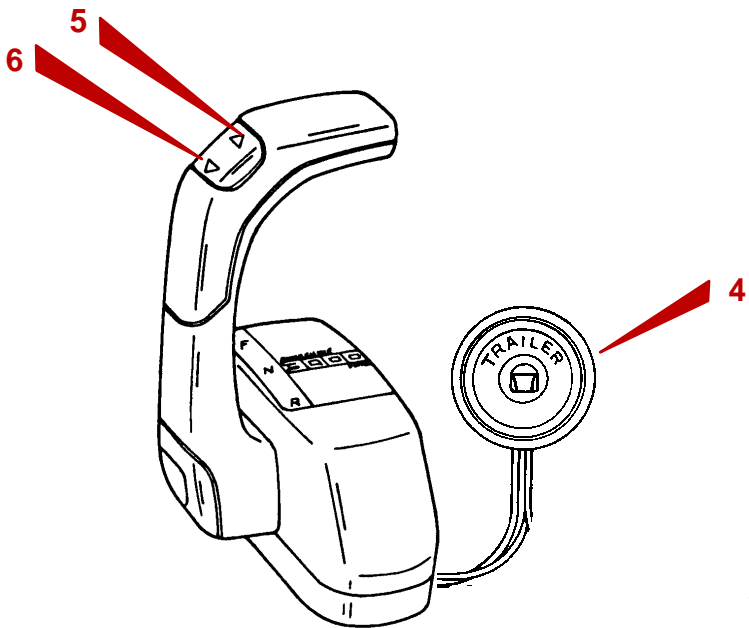
#### Trimming Drive Unit DOWN/IN Can:

- Help the boat accelerate and plane off quicker.
- Generally improve the ride in choppy water.
- In most cases, reduce boat speed.
- If in excess, lower the bow of some boats to a point at which they begin to plow with their bow in the water while on plane. This can result in an unexpected turn in either direction called “bow steering” or “over steering” if any turn is attempted, or if a significant wave is encountered.

CB187



73976



73977



CB188

### **POWER TRIM OPERATION - PANEL MOUNT REMOTE CONTROL**

**NOTE:** See Remote Control Section for illustrations.

**IMPORTANT:** If TRAILER button is held depressed after drive unit reaches end of upward travel, an internal circuit breaker will open and pump will stop. Should this happen, release button and allow motor to cool for about one minute. Circuit breaker will reset and Power Trim operation may be resumed.

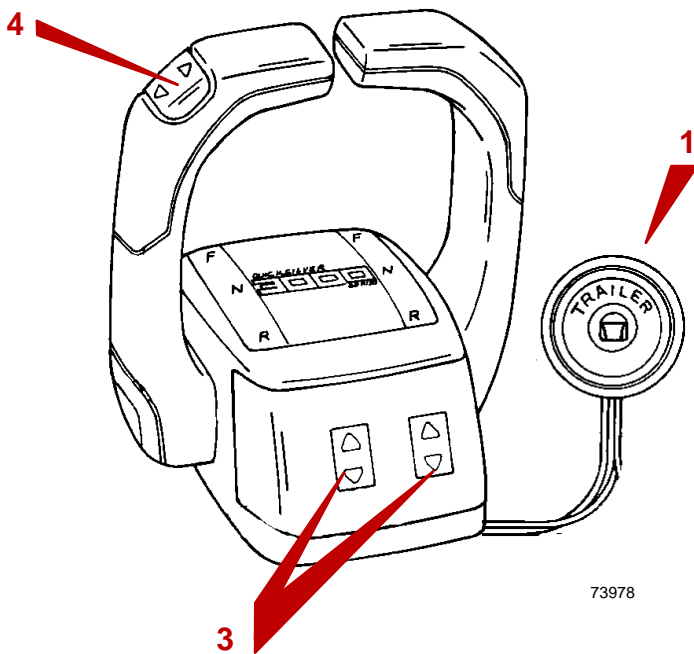
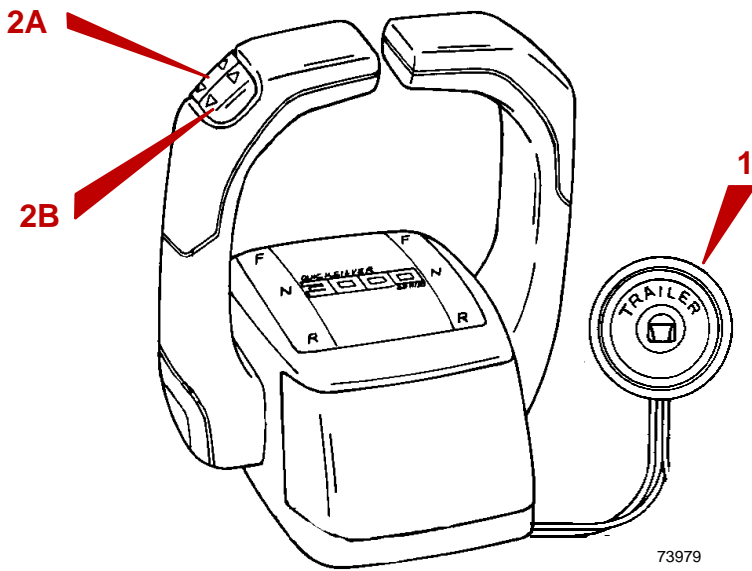
- 1** Trailer Position: Press button until drive unit reaches desired height.
- 2** Trim Up/Out: Press UP on Trim switch until drive unit reaches desired trim position.
- 3** Lower Drive Unit: Press DOWN on Trim switch until drive unit reaches desired position.

CB189

### **POWER TRIM OPERATION - CONSOLE MOUNT REMOTE CONTROL (SINGLE ENGINE VERSION)**

- 4** Trailer Position: Press button until drive unit reaches desired height.
- 5** Trim Up/Out: Press UP on Trim switch until drive unit reaches desired trim position.
- 6** Lower Drive Unit: Press DOWN on Trim switch until drive unit reaches desired position.

CB190



CA805

## **POWER TRIM OPERATION - DUAL ENGINE CONSOLE MOUNT REMOTE CONTROL (TWO BUTTON AND THREE BUTTON VERSIONS)**

**IMPORTANT:** If TRAILER button is held depressed after drive unit reaches end of upward travel, an internal circuit breaker will open and pump will stop. Should this happen, release button and allow motor to cool for about one minute. Circuit breaker will reset and Power Trim operation may be resumed.

### **⚠ CAUTION**

**When lowering or raising sterndrives equipped with a dual engine tie bar kit, the sterndrives must be raised or lowered evenly to prevent the tie bar from becoming twisted. Failure to raise or lower sterndrives evenly may result in tie bar or stern-drive damage.**

**1 Trailer Button (Both Versions)** - Press button until drive unit reaches desired height for trailering drive units.

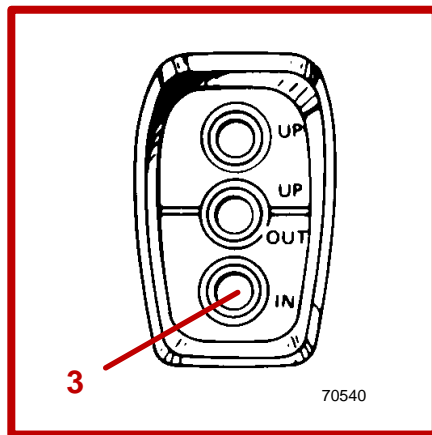
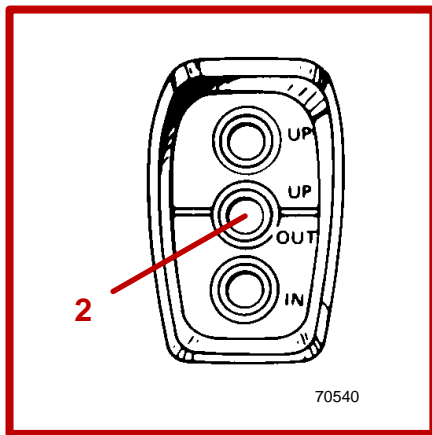
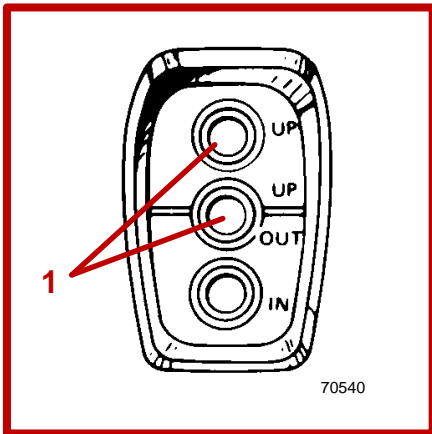
**2 Two Button Trim Control (Dual Buttons in Handle)** - used to control both drive units from the handle. Press UP on button(s) to trim drive unit UP/OUT. Press down on button(s) to trim drive unit DOWN/IN.

**A Forward Trim Button** - Used to trim the port drive unit.

**B Rear Trim Button** - Used to trim the starboard drive unit.

**3 Three Button Trim Control (Trim Adjustment Switches)** - With a single integral trim button in the handle to control two drive units simultaneously, these two switches control the fine tune adjustment of each drive unit. Using these Fine Tune Switches, set each drive unit to the desired trim angle. Then use the single trim switch in the handle to control the trim of both drive units simultaneously.

**4 Three Button Trim Control (Single Trim Switch in Handle)** - used to trim both drives simultaneously after drives have been fine-tuned as described above.



CB193

**POWER TRIM OPERATION - THREE BUTTON TRIM PANEL  
(USED ON MODELS WITH TWO-LEVER CONTROL)**

**IMPORTANT:** If TRAILER button is held depressed after drive unit reaches end of upward travel, an internal circuit breaker will open and pump will stop. Should this happen, release button(s) and allow motor to cool for about one minute. Circuit breaker will reset and Power Trim operation may be resumed.

- 1** Trailer Position: Simultaneously press the UP button (top) along with the UP/OUT button (center) until drive unit reaches desired trailer position.
- 2** Trim Drive Unit UP/OUT: Press center UP/OUT button until drive unit reaches desired trim position.
- 3** Trim Drive Unit IN/DOWN: Press IN button until drive unit reaches desired trim position.

## Starting, Shifting And Stopping

### **WARNING**

Before starting engine, operate bilge blower for at least five minutes to remove any explosive fumes from engine compartment. If boat is not equipped with a bilge blower, open engine hatch and leave open while starting engine.

**IMPORTANT:** Observe the following:

- Do not start engine without water being supplied to seawater pickup pump (to prevent pump or engine damage).
- Do not operate starter motor continuously for more than 30 seconds.
- **On Carbureted Engines:** When engine starts, quickly reduce throttle setting to avoid exceeding 1500 RPM.
- **Never shift drive unit unless engine is at Idle RPM.**

Perform the following as appropriate:

- 1 Check all items listed in OPERATION CHART.
  - 2 Perform any other necessary checks, as indicated by your dealer, or specified in your boat owner's manual.
  - 3 Place drive unit in full down/in position.
  - 4 Place control handle in NEUTRAL.
  - 5 Refer to A or B as appropriate for your model.
- A Carbureted Engine** - Push the THROTTLE ONLY button and position throttle setting as follows:
- COLD ENGINE** - Move control/throttle lever to full throttle, then return to about 1/4 throttle. In extreme cold it may be necessary to pump lever more than once.
- WARM ENGINE** - Move control/throttle lever to 1/4 throttle position.
- FLOODED ENGINE** - Move control/throttle lever to full throttle. Be prepared to decrease engine speed to 1000-1500 RPM as soon as engine starts.





**B** EFI Engine - Position throttle setting as follows:

**COLD ENGINE** - Leave in neutral/idle speed position.

**WARM ENGINE** - Leave in neutral/idle speed position.

**FLOODED ENGINE** - Turn ignition switch to ON position. Push the THROTTLE ONLY button and place the throttle lever at 50% position. Attempt to start engine. As soon as engine starts, return throttle to the idle position.

**6** Turn ignition key to START. Release key when engine starts and allow switch to return to RUN position.

**7** Carbureted Engines - Move control/throttle lever back to decrease engine RPM to 1000-1500 RPM if necessary.

**8** Check oil pressure gauge immediately after engine starts. If oil pressure is not within specified range (see SPECIFICATIONS), stop engine immediately and determine cause.

**9** If engine is cold, run engine for 1 or 2 minutes at fast idle (1000-1500 RPM).

**10** After engine has warmed up, check water temperature gauge to ensure that engine temperature is not abnormally high. If it is, stop engine immediately and determine cause.

**11** Be sure charging system is functioning correctly.

**12** Observe power package for fuel, oil, water and exhaust leaks.

**13** To shift drive unit, return control/throttle lever to NEUTRAL. Move control/shift lever with a firm, quick motion forward to shift to FORWARD gear, or backward to shift to REVERSE. After shifting drive unit, advance throttle to desired setting.

**14** Move control/shift lever to NEUTRAL and allow engine to drop to IDLE speed. If engine has been run at high speed for a long period of time, allow engine to cool by running at IDLE speed for 3 to 5 minutes.

**15** Turn ignition key to OFF.

CC829

**▲ CAUTION**

To avoid possible ingestion of water that can damage engine components:

- Do not turn the ignition key off when the engine is running above idle speed.
- Do not use the lanyard stop switch to shut off the engine above idle speed.
- When coming off plane, if a large following wave may roll over the boat's transom, apply a short, light burst of throttle to minimize the wave action against the stern of the boat.
- Do not come off plane quickly, shift into reverse and shut off engine.

CB575

**IMPORTANT:** Avoid stopping engine if the drive unit is in gear. If engine does stop with drive unit in gear, refer to the following procedure:

- 1 Push and pull repeatedly on remote control handle until handle returns to the neutral detent position. This may take several tries if the power package was operating above idle RPM when the engine stopped.
- 2 After handle returns to the neutral detent position, resume normal starting procedures.

CA41

## Operation Chart

BEFORE STARTING	AFTER STARTING	WHILE UNDERWAY	AFTER STOPPING
Open engine hatch.	Observe all gauges to check condition of engine. If not normal, stop engine.	Observe all gauges to check condition of engine. If not normal, stop engine.	Turn ignition key to OFF.
Turn battery switch ON, if so equipped.	Check for fuel, oil, water, fluid and exhaust leaks, etc.		Turn battery switch OFF, if so equipped.
Operate bilge blowers, if so equipped.	Check shift and throttle control operation.		Close fuel valve.
Open fuel shutoff valve.	Check steering operation.		Close seacock, if so equipped.
Open seacock, if so equipped.			Flush cooling system if in saltwater.
Place drive unit if full DOWN/IN position.			
Perform all other checks specified by your dealer and/or boat builder.			

## Specifications

### Fuel Recommendations

**IMPORTANT: Use of improper gasoline can damage your engine seriously. Engine damage resulting from use of improper gasoline is considered misuse of engine, and damage caused thereby will not be covered under the limited warranty.**

#### FUEL RATINGS

MerCruiser engines will operate satisfactorily when using a major brand of unleaded gasoline as follows:

**USA and Canada** - having a posted pump Octane Rating of 87 (R+M)/2 minimum. Premium gasoline [92 (R+M)/2 Octane] is also acceptable. DO NOT use leaded gasoline.

**Outside USA and Canada** - having a posted pump Octane Rating of 90 RON minimum. Premium gasoline (98 RON) is also acceptable. If unleaded gasoline is not available, use a major brand of leaded gasoline.

CA291

#### **USING REFORMULATED (OXYGENATED) GASOLINES (USA ONLY)**

This type of gasoline is required in certain areas of the USA. The two types of “oxygenates” used in these fuels is Alcohol (Ethanol) or Ether (MTBE or ETBE). If Ethanol is the “oxygenate” that is used in the gasoline in your area, refer to “Gasolines Containing Alcohol” also.

These “Reformulated Gasolines” are acceptable for use in your MerCruiser engine.

CA618

#### **GASOLINES CONTAINING ALCOHOL**

If the gasoline in your area contains either “methanol” (methyl alcohol) or “ethanol” (ethyl alcohol), you should be aware of certain adverse effects that can occur. These adverse effects are more severe with “methanol.” Increasing the percentage of alcohol in the fuel can also worsen these adverse effects.

Some of these adverse effects are caused because the alcohol in the gasoline can absorb moisture from the air, resulting in a separation of the water/alcohol from the gasoline in the fuel tank.



The fuel system components on your MerCruiser engine will withstand up to 10% alcohol content in the gasoline. We do not know what percentage your boat's fuel system will withstand. Contact your boat manufacturer for specific recommendations on the boats fuel system components (fuel tanks, fuel lines, and fittings). Be aware that gasolines containing alcohol may cause increased:

- Corrosion of metal parts.
- Deterioration of rubber or plastic parts.
- Fuel permeation through rubber fuel lines.
- Starting and operating difficulties.

 **WARNING**

**FIRE AND EXPLOSION HAZARD:** Fuel leakage from any part of fuel system can be a fire and explosion hazard which can cause serious bodily injury or death. Careful periodic inspection of entire fuel system is mandatory, particularly after storage. All fuel components including fuel tanks, whether plastic metal or fiberglass, fuel lines, fittings, fuel filters and carburetors/fuel injection components should be inspected for leakage, softening, hardening, swelling or corrosion. Any sign of leakage or deterioration requires replacement before further engine operation.

Because of possible adverse effects of alcohol in gasoline, it is recommended that only alcohol-free gasoline be used where possible. If only fuel containing alcohol is available, or if the presence of alcohol is unknown, increased inspection frequency for leaks and abnormalities is required.

**IMPORTANT:** When operating a MerCruiser engine on gasoline containing alcohol, storage of gasoline in the fuel tank for long periods should be avoided. Long periods of storage, common to boats, create unique problems. In cars alcohol-blend fuels normally are consumed before they can absorb enough moisture to cause trouble, but boats often sit idle long enough for phase separation to take place. In addition, internal corrosion may take place during storage if alcohol has washed protective oil films from internal components.

CB759

### FUEL SYSTEM ADDITIVES (V6 AND 5.0L/305 CID MODELS)

To maximize the life of valves and valve seats on your MerCruiser engine, use Quicksilver Valve Lubricant (92-826259A12) regularly.

CA693

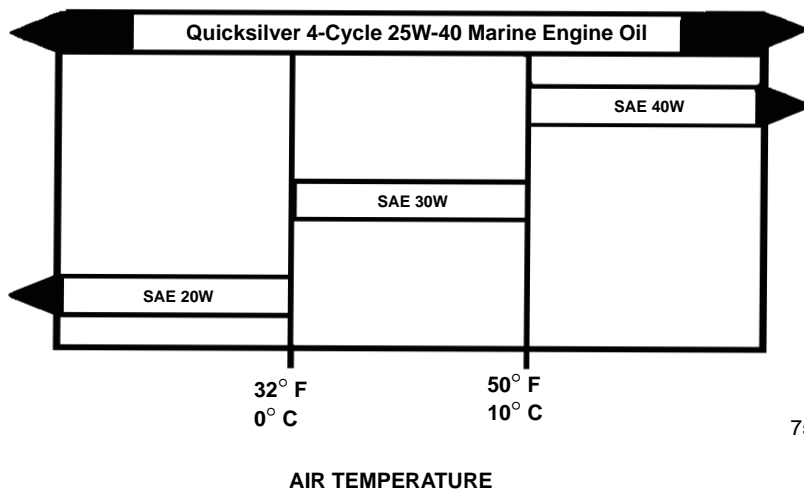
## Crankcase Oil

To help obtain optimum engine performance and to provide maximum protection, we strongly recommend the use of Quicksilver 4-Cycle 25W-40 Marine Engine Oil. This oil is a special blend of 25-weight and 40-weight oils for marine engines. If not available, a good grade, straight weight, detergent automotive oil of correct viscosity, with an API classification of SH,CF/CF-2, may be used.

In those areas where Quicksilver 4-Cycle 25W-40 Marine Engine Oil or a recommended straight weight oil are not available, a multi-viscosity 20W-40 or, as a second but less preferable choice, 20W-50, with API service ratings of SH, CF/CF-2 may be used.

**IMPORTANT: The use of non-detergent oils, multi-viscosity oils (other than Quicksilver 25W-40 or a good quality 20W-40 or 20W-50), synthetic oils, low quality oils or oils that contain solid additives are specifically not recommended.**

The chart below is a guide to crankcase oil selection. The oil filter should always be changed when changing engine oil.



75796

## Engine Specifications (V-6 Models)

Models	4.3L	4.3LH	4.3L EFI
Propshaft Horsepower (SAV1 Rating)	190 <sup>1</sup>	205 <sup>1</sup> (190 <sup>2</sup> )	210 <sup>1</sup> (188 <sup>2</sup> )
Propshaft Kilowatts (SAV1 Rating)	142 <sup>1</sup>	153 (142 <sup>2</sup> )	157 <sup>1</sup> (140 <sup>2</sup> )
Displacement	262 cid (4.3L)		
Maximum rpm @ WOT <sup>3</sup>	4400-4800 rpm		
Idle rpm in NEUTRAL	650 rpm <sup>5</sup>	600 rpm <sup>6</sup>	
Oil Pressure @ 2000 rpm	30-70 psi (207-483 kPa)		
Min. Oil Pressure @ Idle	4 psi (28 kPa)		
Thermostat	160° F (71° C)		
Timing @ Idle RPM <sup>4</sup>	10 ° BTDC	8° BTDC	
Firing Order	1-6-5-4-3-2		
Electrical System	12-Volt Negative (-) Ground		
Alternator Rating	65 Amps		
Recommended Battery Rating	Min 375 cca/ 475 mca/90 Ah	Min 550 cca/ 700 mca/120 Ah	

<sup>1</sup> Power Rated in Accordance with NMMA (National Marine Manufacturers' Association) rating procedures.

<sup>2</sup> Power Rated in Accordance with SAV 1 rating procedures. This rating procedure is used to certify that the engine complies with "Stage 1" Bodensee and Swiss Regulations. Horsepower differences shown result from differences in test RPM, allowable test tolerances, and/or installation of special kit components.

<sup>3</sup> Measured using an accurate service tachometer with engine at normal operating temperature.

<sup>4</sup> A special procedure must be followed to check or adjust timing. Consult your Authorized MerCruiser Dealer before attempting this procedure.

<sup>5</sup> A special procedure must be followed to adjust idle RPM. Consult your Authorized MerCruiser Dealer before attempting this procedure.

<sup>6</sup> Idle speed on EFI models is not adjustable.

## Engine Specifications (V-8 Models)

Models	5.0L	5.0L EFI
Propshaft Horsepower	220 <sup>1</sup>	240 <sup>1</sup>
Propshaft Kilowatts	164 <sup>1</sup>	179 <sup>1</sup>
Displacement	305 cid (5.0L)	
Maximum rpm @ WOT <sup>3</sup>	4400-4800 rpm	
Idle rpm in NEUTRAL <sup>3</sup>	650 rpm <sup>5</sup>	600 rpm <sup>6</sup>
Oil Pressure @ 2000 rpm	30-60 psi (207-414 kPa)	
Min. Oil Pressure @ Idle	4 psi (28 kPa)	
Thermostat	160° F (71° C)	
Timing @ Idle rpm <sup>4</sup>	10° BTDC	8° BTDC
Firing Order	1-8-4-3-6-5-7-2	
Electrical System	12-Volt Negative (-) Ground	
Alternator Rating	65 Amps	
Recommended Battery Rating	Minimum 375 cca/475 mca/90 Ah	Minimum 550 cca/700 mca/120 Ah

<sup>1</sup> Power Rated in Accordance with NMMA (National Marine Manufacturers' Association) rating procedures.

<sup>2</sup> Power Rated in Accordance with SAV 1 rating procedures. This rating procedure is used to certify that the engine complies with "Stage 1" Bodensee and Swiss Regulations. Horsepower differences shown result from differences in test RPM, allowable test tolerances, and/or installation of special kit components.

<sup>3</sup> Measured using an accurate service tachometer with engine at normal operating temperature.

<sup>4</sup> A special procedure must be followed to check or adjust timing. Consult your Authorized MerCruiser Dealer before attempting this procedure.

<sup>5</sup> A special procedure must be followed to adjust idle RPM. Consult your Authorized MerCruiser Dealer before attempting this procedure.

<sup>6</sup> Idle speed on EFI models is not adjustable.



## Engine Specifications (V-8 Models)

Models	5.7L	5.7L EFI	350 Mag MPI
Propshaft Horsepower (SAV1 Rating)	250 <sup>1</sup>	260 <sup>1</sup> (233 <sup>2</sup> )	300 <sup>1</sup> (259 <sup>2</sup> )
Propshaft Kilowatts (SAV1 Rating)	186 <sup>1</sup>	194 <sup>1</sup> (174 <sup>2</sup> )	224 <sup>1</sup> (193 <sup>2</sup> )
Displacement	350 cid (5.7L)		
Maximum rpm @ WOT <sup>3</sup>	4400-4800 rpm		4600-5000 rpm
Idle rpm in NEUTRAL <sup>3</sup>	650 rpm <sup>5</sup>	600 rpm <sup>6</sup>	
Oil Pressure @ 2000 rpm	30-60 psi (207-414 kPa)		
Min. Oil Pressure @ Idle	4 psi (28 kPa)		
Thermostat	160° F (71° C)		
Timing @ Idle rpm <sup>4</sup>	10° BTDC	8° BTDC	
Firing Order	1-8-4-3-6-5-7-2		
Electrical System	12-Volt Negative (-) Ground		
Alternator Rating	65 Amps		
Recommended Battery Rating	Minimum 375 cca/475 mca/90 Ah	Minimum 550 cca/ 700 mca/120 Ah	

<sup>1</sup> Power Rated in Accordance with NMMA (National Marine Manufacturers' Association) rating procedures.

<sup>2</sup> Power Rated in Accordance with SAV 1 rating procedures. This rating procedure is used to certify that the engine complies with "Stage 1" Bodensee and Swiss Regulations. Horsepower differences shown result from differences in test RPM, allowable test tolerances, and/or installation of special kit components.

<sup>3</sup> Measured using an accurate service tachometer with engine at normal operating temperature.

<sup>4</sup> A special procedure must be followed to check or adjust timing. Consult your Authorized MerCruiser Dealer before attempting this procedure.

<sup>5</sup> A special procedure must be followed to adjust idle RPM. Consult your Authorized MerCruiser Dealer before attempting this procedure.

<sup>6</sup> Idle speed on EFI models is not adjustable.

## Engine Specifications (V-8 Models)

Models	7.4L MPI	454 Mag MPI
Propshaft Horsepower (BSO/SAV Rating)	310 <sup>1</sup> (275 <sup>2</sup> )	385 <sup>1</sup>
Propshaft Kilowatts (BSO/SAV Rating)	231 <sup>1</sup> (205 <sup>2</sup> )	287 <sup>1</sup>
Displacement	454 cid (7.4L)	
Maximum RPM @ W.O.T <sup>3</sup>	4200-4600 RPM	4600-5000 RPM
Idle RPM in NEUTRAL <sup>3</sup>	600 RPM <sup>6</sup>	
Oil Pressure @ 2000 RPM	30-70 psi (207-483 kPa)	
Min. Oil Pressure @ Idle	4 psi (28 kPa)	
Thermostat	160° F (71° C)	
Timing @ Idle RPM <sup>4</sup>	8° BTDC	
Firing Order	1-8-4-3-6-5-7-2	
Electrical System	12-Volt Negative (-) Ground	
Alternator Rating	65 Amps	
Recommended Battery Rating	Minimum 650 cca/825 mca/150 Ah	

<sup>1</sup> Power Rated in Accordance with NMMA (National Marine Manufacturers' Association) rating procedures.

<sup>2</sup> Power Rated in Accordance with BSO/SAV rating procedures. This rating procedure is used to certify that the engine complies with "Stage 1" Bodensee and Swiss Regulations. Horsepower differences shown result from differences in test RPM, allowable test tolerances, and/or installation of special kit components.

<sup>3</sup> Measured using an accurate service tachometer with engine at normal operating temperature.

<sup>4</sup> A special procedure must be followed to check or adjust timing. Consult your Authorized MerCruiser Dealer before attempting this procedure.

<sup>6</sup> Idle speed on EFI models is not adjustable.

## Engine Specifications (V-8 Models)

Models	502 Mag MPI
Propshaft Horsepower (BSO/SAV Rating)	415 <sup>1</sup>
Propshaft Kilowatts (BSO/SAV Rating)	309 <sup>1</sup>
Displacement	502 cid (8.2L)
Maximum RPM @ W.O.T <sup>3</sup>	4600-5000 RPM
Idle RPM in NEUTRAL <sup>3</sup>	600 RPM <sup>6</sup>
Oil Pressure @ 2000 RPM	30-70 psi (207-483 kPa)
Min. Oil Pressure @ Idle	4 psi (28 kPa)
Thermostat	160° F (71° C)
Timing @ Idle RPM <sup>4</sup>	8° BTDC
Firing Order	1-8-4-3-6-5-7-2
Electrical System	12-Volt Negative (-) Ground
Alternator Rating	65 Amps
Recommended Battery Rating	Minimum 650 cca/825 mca/150 Ah

<sup>1</sup> Power Rated in Accordance with NMMA (National Marine Manufacturers' Association) rating procedures.

<sup>3</sup> Measured using an accurate service tachometer with engine at normal operating temperature.

<sup>4</sup> A special procedure must be followed to check or adjust timing. Consult your Authorized MerCruiser Dealer before attempting this procedure.

<sup>6</sup> Idle speed on EFI models is not adjustable.

## Maintenance

### **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.

**IMPORTANT:** Refer to **MAINTENANCE CHART** for complete listing of all scheduled maintenance to be performed. Some listings can be done by owner/operator, while others should be performed by an **Authorized MerCruiser Dealer**. Before attempting maintenance or repair procedures not covered in this manual, it is recommended that a **MerCruiser Maintenance Procedures Manual** or **Service Manual** be purchased and read thoroughly.

**NOTE:** Maintenance points are color coded for ease of identification. See the decal on engine for identification.

### Maintenance Aids

- 1 Power Steering System - Quicksilver Power Trim and Steering Fluid or Dexron III automatic transmission fluid (ATF).
- 2 Propeller Shaft - Quicksilver Special Lubricant 101.
- 3 Sterndrive Unit - Quicksilver High Performance Gear Lube.
- 4 All Exterior Surfaces - Quicksilver Primer and Spray Paint and Quicksilver Corrosion Guard.
- 5 Power Trim System - Quicksilver Power Trim and Steering Fluid, or SAE 10W-30 motor oil.
- 6 Crankcase Oil - Quicksilver 4-Cycle Marine Engine Oil (Refer to SPECIFICATIONS for alternatives and oil recommendations for varying ambient temperatures.)
- 7 Closed Cooling System Coolant - Extended Life Ethylene Glycol 5/100 Antifreeze/Coolant mixed 50/50 with purified water. If this is not available, use a 50/50 mixture of ethylene glycol antifreeze and tap water. Areas where temperatures generally do not go below 32° F (0° C), rust inhibitor and tap water is acceptable.



## Gas Sterndrive

Routine Maintenance *				
	Each Day Start	Each Day End	Weekly	Every Two Months
Check crankcase oil (interval can be extended based on experience).				
	•			
If operating in salt, brackish or polluted waters, flush cooling system after each use.				
		•		
Check drive unit oil level, trim pump oil level and power steering pump fluid level.				
			•	
Check water pickups for debris or marine growth. Check water strainer and clean. Check coolant level.				
			•	
Inspect drive unit anodes and replace if 50 percent eroded.				
			•	
Inspect fuel pump sight tube and have pump replaced if fuel is present.				
			•	
Check battery connections and fluid level.				
				•
Lubricate propeller shaft and the retorque nut (if operating in only freshwater, this maintenance may be extended to every four months).				
				•
Operating in Saltwater Only: treat engine surface with corrosion guard.				
				•

\* Only perform maintenance which applies to your particular power package.

## Gas Sterndrive(Continued)

<b>Scheduled Maintenance *</b>					
Annually	Every 100 Hours or Annually◆	Every 200 Hours or 3 Years◆	Every 300 Hours or 3 Years◆	Every 2 Years	Every 5 Years
Touch-up paint power package and spray with corrosion guard.					
•					
Change crankcase oil and filter.					
	•				
Change drive unit oil and retorque connection of gimbal ring to steering shaft.					
	•				
Replace fuel filter.					
	•				
Check steering system and remote control for loose, missing or damaged parts. Lubricate cables and linkages.					
	•				
Inspect and lubricate U-joints and splines; inspect bellows and clamps. Check engine alignment.					
	•				
Lubricate gimbal bearing and engine coupler..					
	• <sup>8</sup>				
Check continuity circuit for loose or damaged connections. Test MerCathode® unit output on Bravo models					
	•				
Retorque engine mounts.					
	•				
Check spark plug s, wires, distributor cap and ignition timing. Check and adjust idle speed.					
	•				

\* Only perform maintenance which applies to your particular power package.

◆ Whichever Occurs First

<sup>8</sup> Lubricate engine coupler ever 50 hours if operated at idle for prolonged periods of time.



## Gas Sterndrive(Continued)

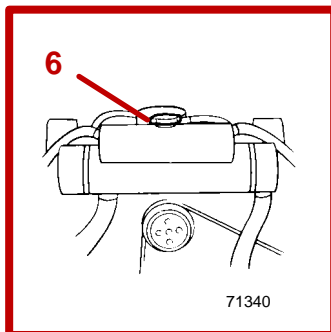
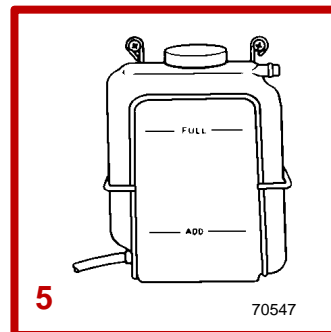
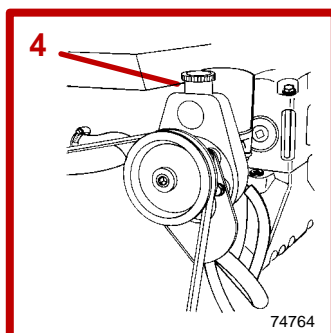
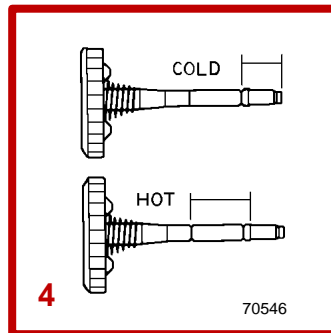
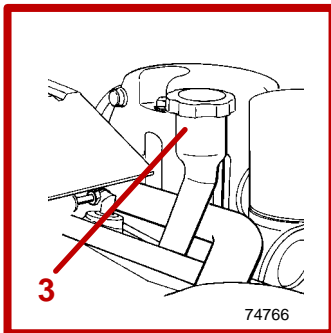
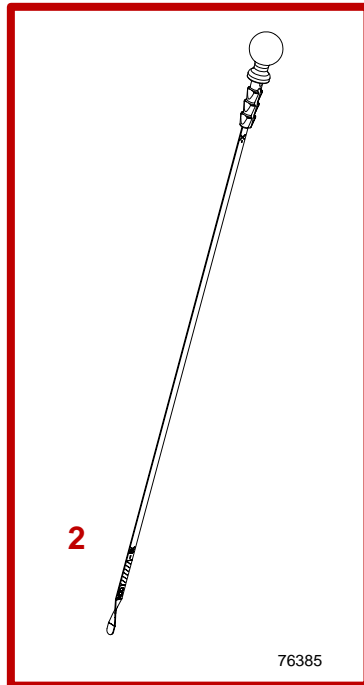
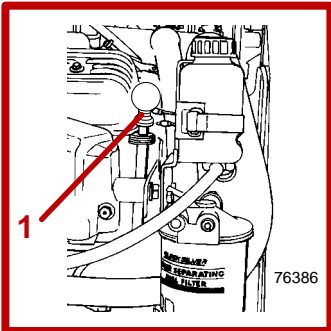
<b>Scheduled Maintenance * (Continued)</b>					
Annually	Every 100 Hours or Annually◆	Every 200 Hours or 3 Years◆	Every 300 Hours or 3 Years◆	Every 2 Years	Every 5 Years
Clean flame arrestor and crankcase ventilation hoses. Replace PCV valve.					
	•				
Check electrical system for loose, damaged or corroded fasteners.					
	•				
Inspect condition and tension of belts.					
	•				
Check cooling system and exhaust system hose clamps for tightness. Inspect both systems for damage or leaks.					
	•				
Disassemble and inspect seawater pump and replace worn components.					
	•				
Clean seawater section of closed cooling system. Clean, inspect and test pressure cap.					
	•				
Replace coolant.					
				♠	•

\* Only perform maintenance which applies to your particular power package.

◆ Whichever occurs first.

♠ Interval will be reduced if not using extended life coolant.

CA842





CA843

## Checking Fluid Levels

### CHECKING CRANKCASE OIL

Stop engine. Allow approximately five minutes for oil to drain into oil pan. Boat must be at rest in water.

- 1 Remove dipstick. Wipe clean and reinstall fully into dipstick tube.
- 2 Remove dipstick and observe oil level. Oil level must be between FULL or OK and ADD. If oil level is below ADD:
- 3 Remove oil filler cap. Add specified oil to bring level up to, but not over, OK mark on dipstick.

**IMPORTANT: Do not overfill crankcase oil.**

CA55

### CHECKING POWER STEERING PUMP FLUID

Stop engine and position drive unit straight back.

- 4 Remove FILLCAP/DIPSTICK and observe level. Add specified fluid if required. Reinstall FILLCAP/DIPSTICK.

**IMPORTANT: If fluid is not visible in pump, contact your Authorized MerCruiser Dealer.**

CA477

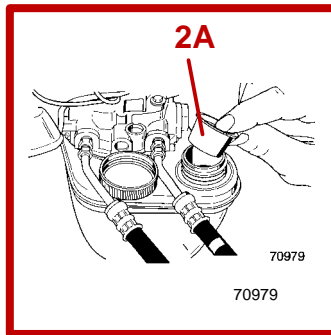
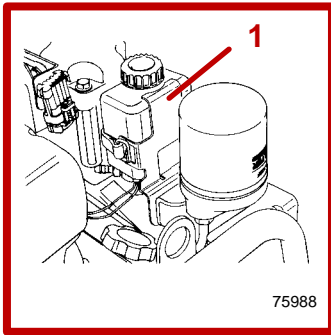
### CHECKING ENGINE COOLANT - CLOSED COOLED MODELS ONLY

#### **WARNING**

**Avoid serious injury from burns. Do not remove coolant cap when engine is hot. Coolant may discharge violently.**

- 5 Check coolant level in coolant recovery bottle. Add specified coolant as required.
- 6 Periodically remove cap from coolant reservoir to ensure that coolant recovery system is functioning properly. Coolant level must be at top of reservoir filler neck. If coolant is low, inspect gasket in cap for damage and replace if necessary. To have cap tested, contact your Authorized MerCruiser Dealer. Inspect coolant recovery system for leaks.

CB7601



CB762

### **CHECKING DRIVE UNIT OIL**

**NOTE:** *Oil level will fluctuate during operation. Oil level should be checked with cold engine before starting.*

**1** Check gear lube monitor oil level; keep oil level at or near FULL line. Check for water at bottom of monitor and/or if oil appears to be discolored, contact your Authorized MerCruiser Dealer immediately; both conditions may indicate a water leak somewhere in the drive unit.

**IMPORTANT:** **If more than 2 fl. oz. (59ml) of Quicksilver High Performance Gear Lube is required to fill monitor, a seal may be leaking. Damage to drive unit may occur due to lack of lubrication. Contact your Authorized MerCruiser Dealer for service.**

CA847

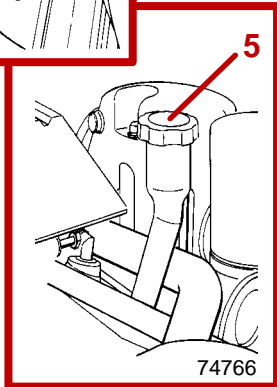
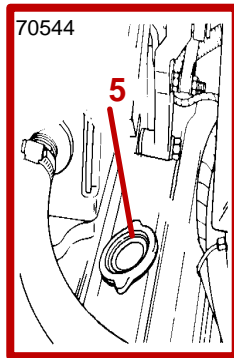
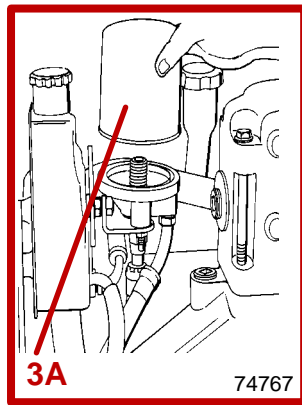
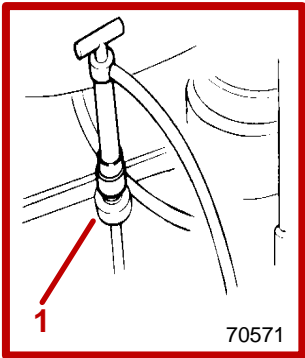
### **CHECKING POWER TRIM PUMP FLUID**

Place drive unit in full down/in position.

**2** Remove fill cap from reservoir and observe oil level. Level must be up to, but not over bottom of filler neck. Add Quicksilver Power Trim and Steering Fluid or SAE 10W-30 motor oil, if required, to bring level to bottom of filler neck. Replace cap.

**A** Check that "Cap plug" has been **removed** from filler neck and **discarded**.

CA514



## Changing Fluids

See MAINTENANCE SCHEDULE for lubricant change frequency. Lubricant should be changed before placing boat in storage.

Power Trim or Power Steering fluids do not require changing.

### Changing Crankcase Oil and Filter

**IMPORTANT:** Change oil when engine is warm from operation. Warm oil flows more freely, carrying away more impurities. Use only recommended motor oil (see SPECIFICATIONS).

**1** With engine at normal operating temperature, remove dipstick. Install Quicksilver Crankcase Oil Pump onto dipstick tube.

**2** Insert hose end of crankcase oil pump into an appropriate container and using pump handle, pump until crankcase is empty. Remove crankcase oil pump.

**NOTE:** Alternately the oil may be drained using the oil drain plug and a suitable container placed under the engine. Tighten the oil pan drain plug securely upon installation.

**3** Remove and discard old oil filter and old sealing ring.

**A** Models with remote oil filter.

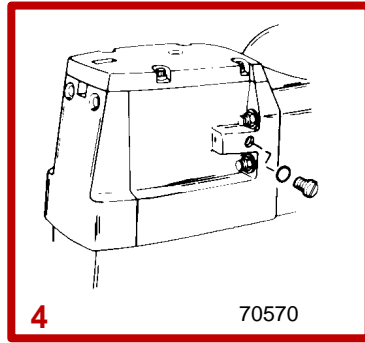
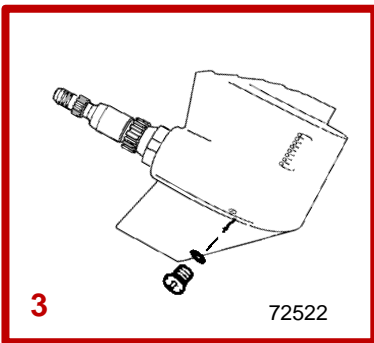
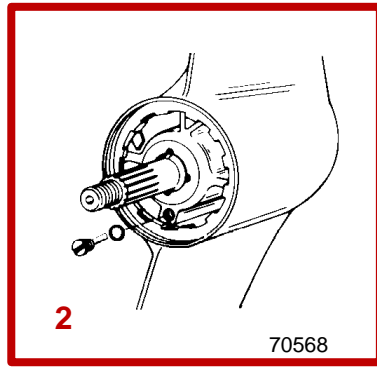
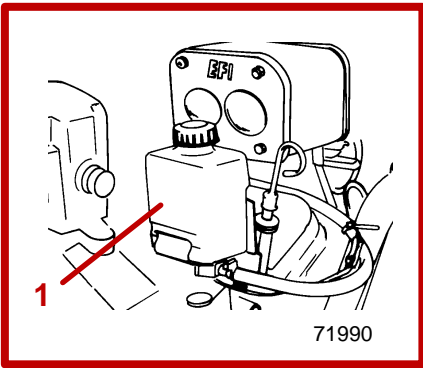
**B** Models with side mounted oil filter.

**4** Coat sealing ring on new filter with motor oil. Install new filter. Tighten filter securely. Hand tighten only, do not use a filter wrench. Do not overtighten.

**5** Remove oil filler cap. Add correct type oil (see SPECIFICATIONS) to bring level up to, but not over FULL or OK mark on dipstick.

**IMPORTANT:** Always use dipstick to determine exactly how much oil is required.

CB688



## Changing Drive Unit Oil

- 1** Remove gear lube monitor bottle from bracket. Empty contents into suitable container. Install monitor in bracket.
- 2 Bravo One Models:** Remove propeller, place drive unit in full trim limit OUT position, remove OIL FILL/DRAIN SCREW and sealing washer, and drain oil.
- 3 All Other Models:** Place drive unit in full trim limit OUT position, remove OIL FILL/DRAIN SCREW and sealing washer, and drain oil.
- 4** Remove OIL VENT screw and sealing washer. Allow oil to drain completely.

**IMPORTANT: If any water drained from OIL FILL/DRAIN hole, or if oil appears milky, drive unit is leaking and should be checked immediately by your Authorized MerCruiser Dealer.**

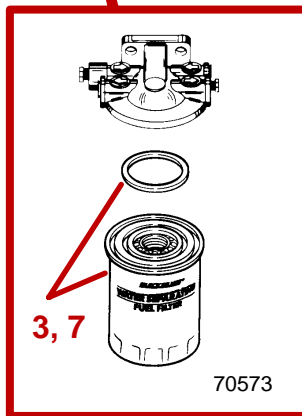
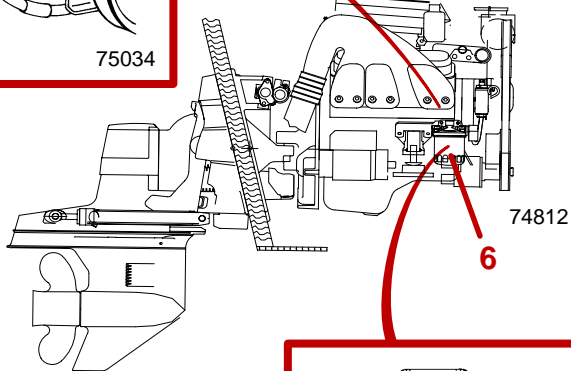
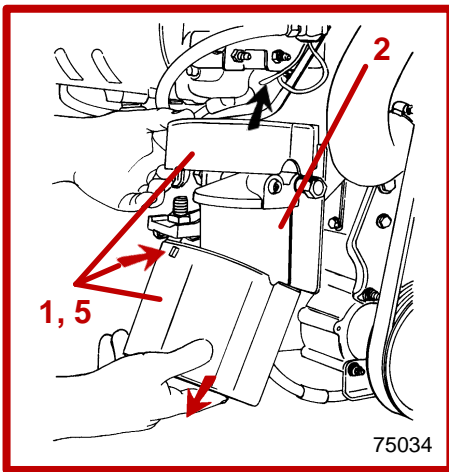
- 5** Lower drive unit so propeller shaft is level. Fill drive unit, through OIL FILL/DRAIN hole, with Specified Gear Lube until an air-free stream of lubricant flows from OIL VENT hole.

**IMPORTANT: Use only Quicksilver High Performance Gear Lube in drive unit.**

- 6** Install OIL VENT screw and sealing washer.
- 7** Continue to pump gear lube into the gear lube monitor circuit until gear lube appears in the gear lube monitor.
- 8** Fill monitor to FILL mark. Lubricate O-ring on neck with sterndrive oil. Install cap; do not overtighten.
- 9** Remove pump from OIL FILL/DRAIN hole. Quickly install sealing washer and OIL FILL/DRAIN screw. Tighten securely.
- 10 Bravo One Models:** Grease propeller shaft heavily, with specified lubricant (Refer to "Propeller Installation" if necessary). Reinstall propeller and torque nut to 55 lb. ft. (75 N·m) MINIMUM.
- 11** Recheck oil level after first use.

**IMPORTANT: Oil level in gear lube monitor will rise and fall during drive operation; always check oil level when drive is cool and engine is shut down.**

CA518





CA658

## Changing Water Separating Fuel Filter

### WARNING

Be careful when changing water separating fuel filter. Gasoline is extremely flammable and highly explosive under certain conditions. Be sure ignition key is OFF. Do not smoke or allow spark or open flame in area when changing fuel filter. Wipe up any spilled fuel immediately.

### WARNING

Make sure no fuel leaks exist before closing engine hatch.

### EFI Models

### CAUTION

The electric fuel pump and factory installed water separating fuel filter have been carefully designed to function properly together. Do not install additional fuel filters and/or water separating fuel filters between fuel tank and engine.

The installation of additional filters may cause:

- Fuel Vapor Locking
- Difficult Warm-Starting
- Piston Detonation Due to Lean Fuel Mixture
- Poor Driveability

**1** Unsnap latch and slide top and bottom cover pieces from around the water separating fuel filter and bracket.

**NOTE:** Top and bottom cover pieces are formed with a groove on each side that slides around the brackets outer edges.



- 2** Remove water separating fuel filter and sealing ring from mounting bracket and discard.
- 3** Coat sealing ring on new filter with motor oil. Thread filter onto bracket and tighten securely by hand. Do not use a filter wrench.
- 4** Start and run engine. Check filter connection for gasoline leaks. If leaks exist, recheck filter installation. If leaks continue, stop engine immediately and contact your Authorized MerCruiser Dealer.
- 5** Install cover pieces around fuel filter. Be certain top part of cover latches to lower part.

CA659

## **Carbureted Models**

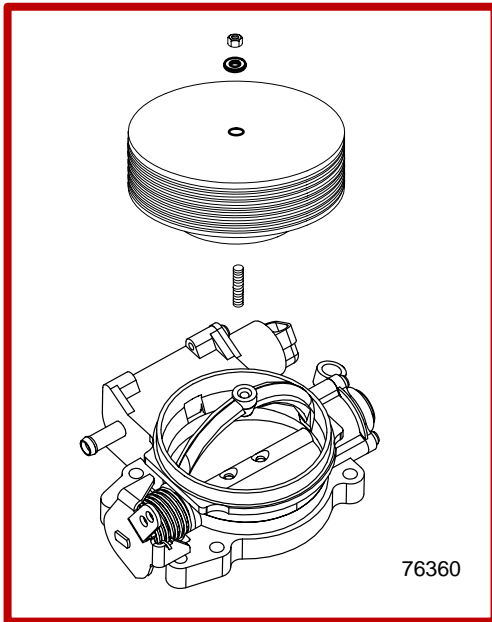
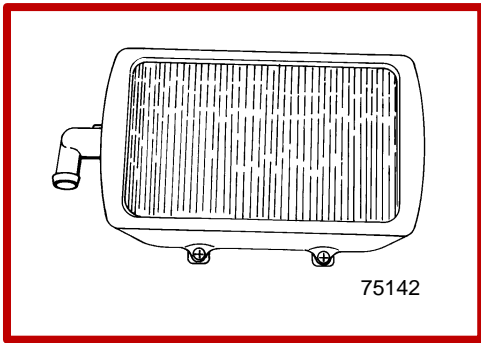
- 6** Remove water separating fuel filter and sealing ring from mounting bracket and discard.
- 7** Coat sealing ring on new filter with motor oil. Thread filter onto bracket and tighten securely by hand. Do not use a filter wrench.
- 8** Start and run engine. Check filter connection for gasoline leaks. If leaks exist recheck filter installation. If leaks continue stop engine immediately and contact your Authorized MerCruiser Dealer.



CA175

**THIS PAGE IS INTENTIONALLY BLANK**

CA831



CA806

## Cleaning Flame Arrestor and Related Components

### **WARNING**

**Avoid gasoline fire or explosion. Gasoline is extremely flammable and highly explosive under certain conditions. Be careful when cleaning flame arrestor and crankcase ventilation hoses: Be sure that ignition is OFF. DO NOT smoke or allow sources of spark or open flame in area when cleaning flame arrestor and crankcase ventilation hoses.**

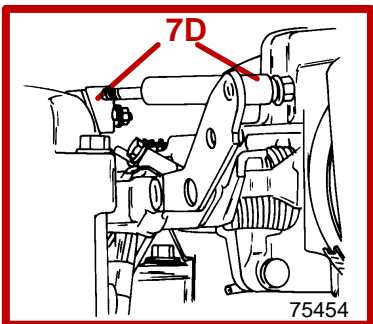
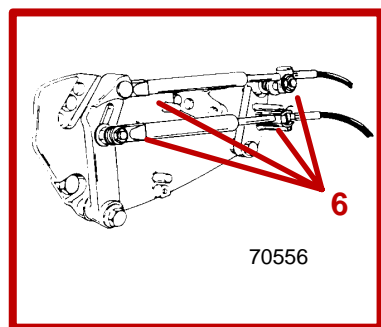
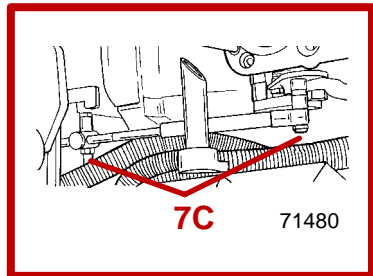
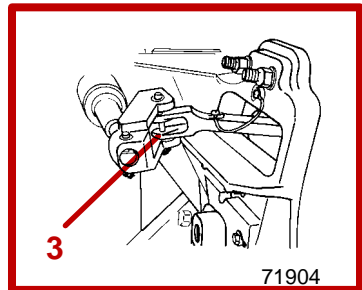
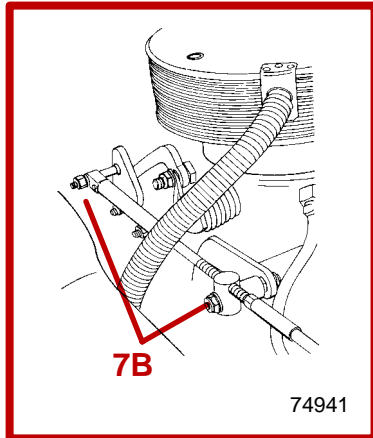
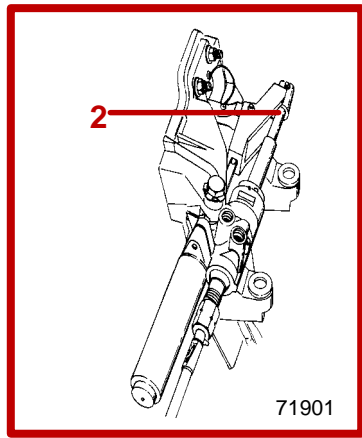
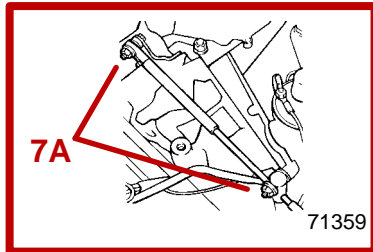
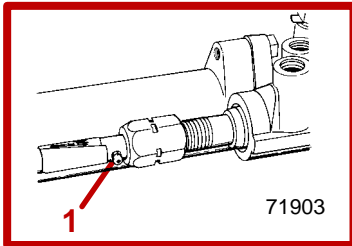
- 1 Remove flame arrestor and related components.
- 2 Clean flame arrestor in solvent. Blow dry with compressed air or allow to air dry completely.

### **WARNING**

**Avoid gasoline fire or explosion. Gasoline is extremely flammable and highly explosive under certain conditions. NEVER use gasoline as a cleaning solvent.**

- 3 Clean crankcase ventilation hoses in solvent. Blow dry with compressed air or allow to air dry completely.
- 4 Inspect crankcase ventilation hoses for cracks or deterioration and replace if necessary.
- 5 Reinstall flame arrestor and related components in reverse order.
- 6 Tighten flame arrestor nut securely.

CB612



CA524

## Lubrication

### Steering System

**1 If Steering Cable Has Grease Fittings:** Turn steering until steering cable is fully retracted into cable housing. Apply approximately 3 pumps of grease from a typical hand-operated grease gun. Lubricate at fitting with 2-4-C Marine Lubricant with Teflon.

#### **WARNING**

**Do not grease steering cable while extended. Hydraulic lock could occur and cause loss of steering control.**

**NOTE:** *If steering cable does not have grease fitting, inner wire of cable cannot be greased.*

**2** Turn steering until steering cable fully extended. Lubricate by applying a thin coat of Special Lubricant 101 on exposed part of cable.

**3** Lubricate steering system pivot points with SAE 30W motor oil.

**4** On dual engine boats: Lubricate all pivot points, including tie bar pivot points, with SAE 30W motor oil.

**5** Upon first starting engine, turn steering wheel several times to starboard, and then port, to ensure that the steering system operates properly, before getting underway.

CA72

### Shift Cable

**6** Lubricate pivot points with SAE 30W motor oil.

CB613

### Throttle Cable

**7** Lubricate pivot points with SAE 30W motor oil.

**A** Carbureted Models

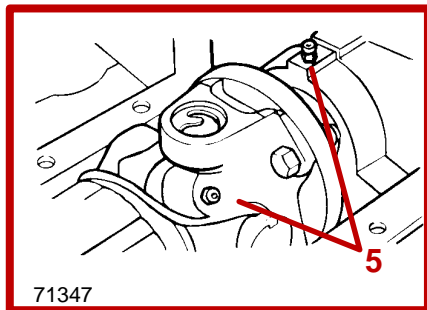
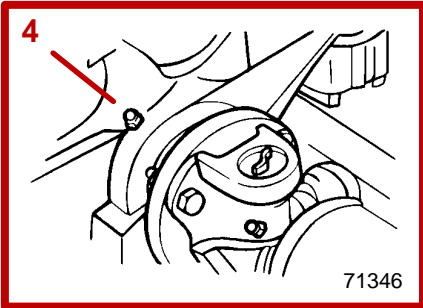
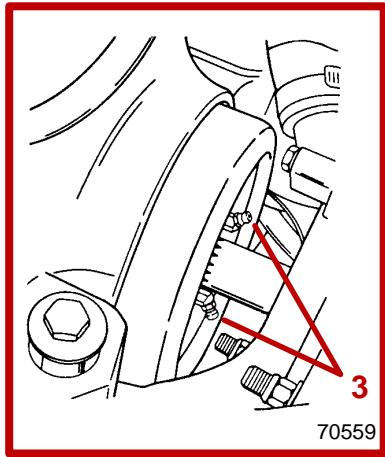
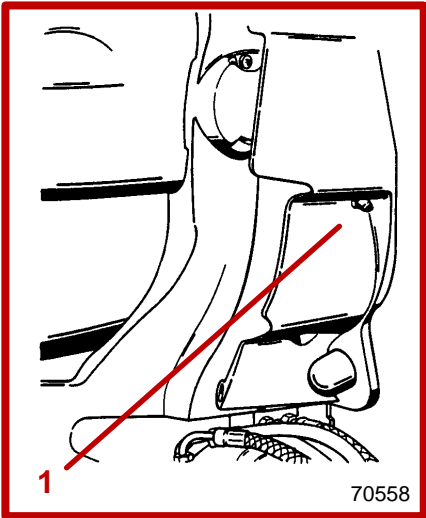
**B** EFI Models

**C** MPI Models, excluding 7.4L MPI

**D** 7.4L MPI



CB54







CA525

## **Drive Unit and Transom Assembly**

- 1** Lubricate gimbal bearing by applying approximately 8-10 pumps of grease from a typical hand-operated grease gun using Quicksilver U-Joint and Gimbal Bearing Grease.
- 2** For propeller shaft lubrication, see PROPELLER.

CB776

## **Engine Coupler**

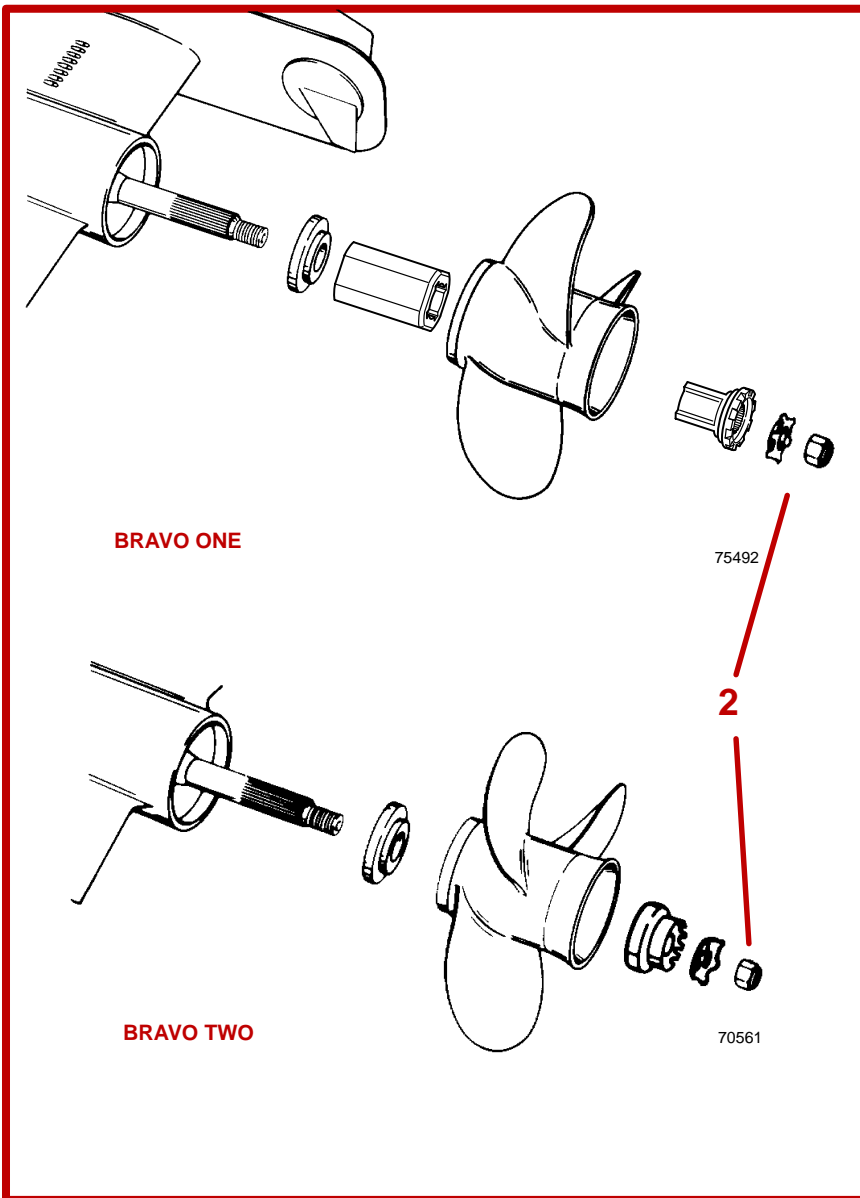
- 3** Lubricate engine coupler splines through grease fittings on coupler by applying approximately 8-10 pumps of grease from a typical hand-operated grease gun using Quicksilver Engine Coupler Spline Grease. If boat is operated at idle for prolonged periods of time, couple should be lubricated every 50 hours.

CB777

## **Drive Shaft Extension Models**

- 4** Lubricate drive shaft grease fittings, at transom end, by applying approximately 3 - 4 pumps of grease from a typical hand-operated grease gun using Quicksilver U-joint and Gimbal Bearing Grease.
- 5** Lubricate drive shaft grease fittings, at engine end, by applying approximately 3 - 4 pumps of grease from a typical hand-operated grease gun using Quicksilver U-joint and Gimbal Bearing Grease.

CB422



CB421

## Propellers (Bravo One and Two)

### **WARNING**

**Avoid Injury:** Remote Control must be in **NEUTRAL** and ignition key removed from switch before removing and/or installing propeller.

### **WARNING**

**Avoid Injury:** Place a block of wood between anti-ventilation plate and propeller to protect hands from propeller blades and to prevent propeller from rotating when removing propeller nut.

### **CAUTION**

**Avoid Injury:** Periodically check propeller nut for tightness during boating season. A minimum of 55 lbs. ft. (75 N·m) torque is required.

CA743

### **REMOVAL**

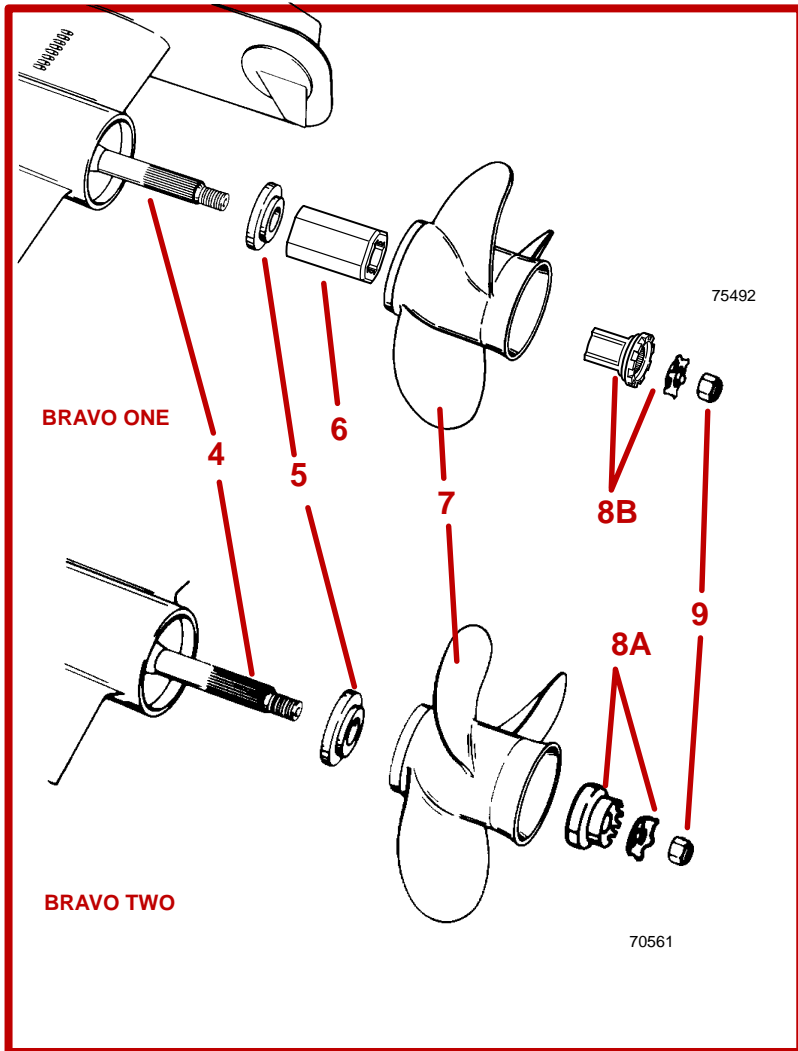
- 1** Place wood block between propeller blade and anti-ventilation plate to prevent rotation. Straighten bent tabs on tab washer.
- 2** Turn propeller shaft nut counterclockwise to remove nut.
- 3** Slide tab washer, spline washer, propeller and thrust hub off propeller shaft.

CA79

### **REPAIR**

Some damaged propellers can be repaired. See your dealer.

CB423



CA744

## INSTALLATION (BRAVO ONE AND TWO)

**IMPORTANT:** If reusing tab washer, carefully inspect tabs for cracks or other damage. Replace tab washer if condition is questionable.

**4** Apply a liberal coat of one of the following Quicksilver lubricants to propeller shaft: Anti-Corrosion Grease, Special Lubricant 101, or 2-4-C Marine Lubricant with Teflon.

**5** Slide thrust hub into propeller hub, with stepped side toward propeller hub.

**6 Bravo One:** Install Flo-Torque II Drive Hub into propeller.

**NOTE:** *The drive sleeve is tapered and will slide fully into the propeller as the nut is tightened and properly torqued.*

**7** Align splines and place propeller on propeller shaft.

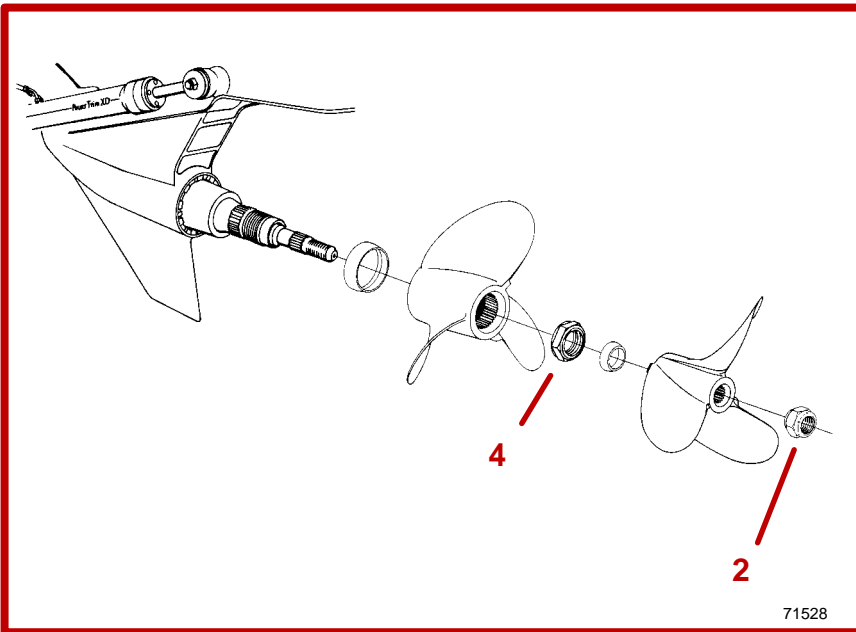
**8** Install final attaching hardware.

**A Bravo One:** Install drive sleeve adapter and locking tab washer.

**B Bravo Two:** Install spline washer and tab washer.

**9** Install propeller nut. Tighten nut securely. A minimum of 55 lbs. ft. (75 N·m) torque is required. Bend three tabs on tab washer down into grooves in spline washer. After first use, bend the three tabs straight, retighten propeller nut to minimum 55 lbs. ft. torque (75 N·m). Bend tabs back down into spline washer. Check propeller at least every 20 hours of operation. Do not operate with loose propeller.

CB139



## Propellers (Bravo Three)

### **WARNING**

**Avoid Injury:** Remote Control must be in NEUTRAL and ignition key removed from switch before removing and/or installing propeller.

### **WARNING**

**Avoid Injury:** Place a block of wood between anti-ventilation plate and propeller to protect hands from propeller blades and to prevent propeller from rotating when removing propeller nut.

### **CAUTION**

**Avoid Injury:** Periodically check propeller nut for tightness during boating season. A minimum of 55 lbs. ft. (75 N·m) torque is required.

### REMOVAL (BRAVO THREE DRIVE)

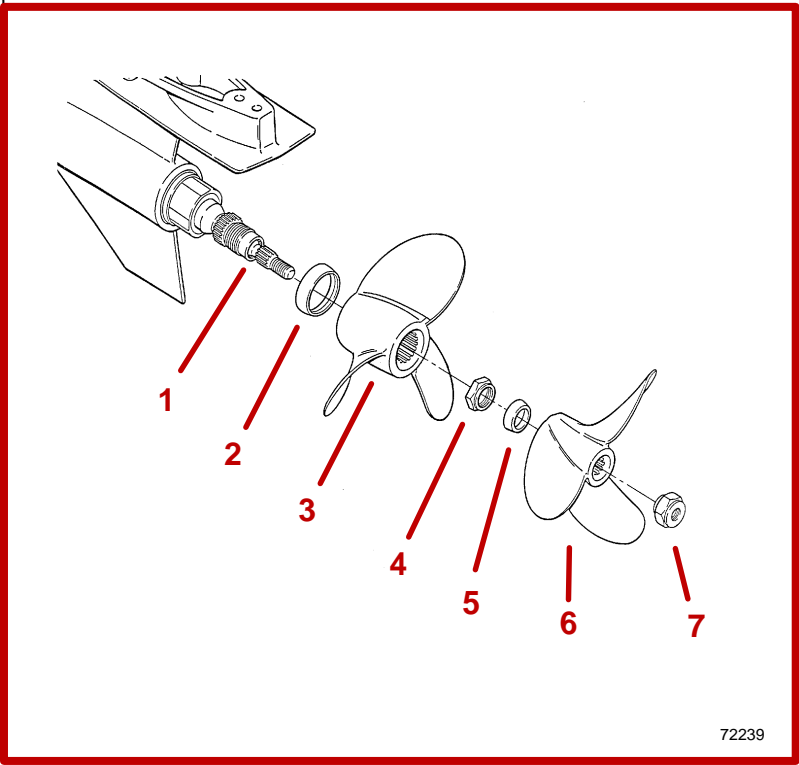
- 1 Place wood block between propeller blades and anti-ventilation plate to prevent rotation.
- 2 Turn aft propeller shaft nut counterclockwise to remove nut.
- 3 Slide propeller and thrust hub off propeller shaft.
- 4 Turn front propeller shaft nut counterclockwise to remove nut.
- 5 Slide propeller and thrust hub off propeller shaft.

### REPAIR

Some damaged propellers can be repaired. See your dealer.



CB150





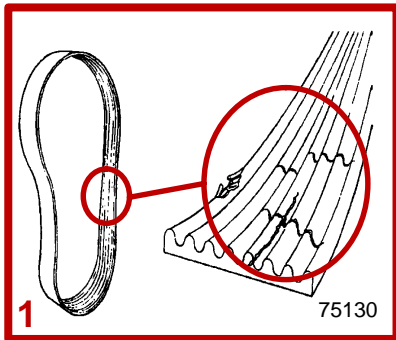
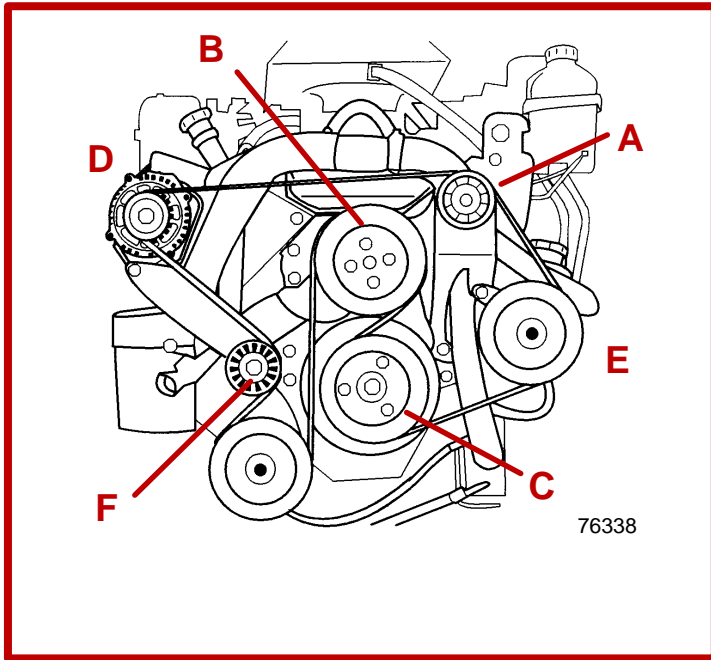


CB345

### **INSTALLATION (BRAVO THREE)**

- 1** Apply a liberal coat of one of the following Quicksilver lubricants to both propeller shafts: Special Lubricant 101, 2-4-C Marine Lubricant with Teflon, or Anti-Corrosion Grease.
- 2** Slide forward thrust hub onto propeller shaft, with tapered side toward propeller hub (toward end of shaft).
- 3** Align splines and place propeller on propeller shaft.
- 4** Install propeller nut. Tighten nut securely. A minimum of 100 lbs. ft. (136 N·m) torque is required. Check propeller at least after 20 hours of operation. Do not operate with loose propeller.
- 5** Slide aft thrust hub onto propeller shaft, with tapered side toward propeller hub (toward end of shaft).
- 6** Align splines and place propeller on propeller shaft.
- 7** Install propeller nut. Tighten nut securely. A minimum of 60 lbs. ft. (81 N·m) torque is required. Check propeller at least after 20 hours of operation. Do not operate with loose propeller.

CB779



## Serpentine Drive Belt

### **WARNING**

**Avoid possible serious injury. Make sure engine is shut off and ignition key is removed before inspecting belt.**

The various components are:

- |   |                                |
|---|--------------------------------|
| <b>A</b> Idler Pulley (Adjustment Pulley) | <b>D</b> Alternator Pulley     |
| <b>B</b> Circulating Pump                 | <b>E</b> Power Steering Pulley |
| <b>C</b> Crankshaft Pulley                | <b>F</b> Idler Pulley          |

### CHECKING

**1** Inspect drive belt for proper tension and for the following:

- Excessive wear
- Cracks

**NOTE:** Minor, transverse cracks (*across the belt width*) may be acceptable. Longitudinal cracks (*in direction of belt length*) that join transverse cracks are NOT acceptable.

- Fraying
- Glazed surfaces
- Proper tension - 1/4 in. (6 mm) deflection, with moderate thumb pressure, on the belt at location indicated by arrow and dashed lines.



## REPLACING AND / OR ADJUSTING TENSION

**IMPORTANT:** If a belt is to be reused, it should be installed in the same direction of rotation as before.

**2** Remove drive belt as follows:

**NOTE:** The upper, left (port) idler pulley is the belt adjustment pulley.

**A** Loosen 5/8 in. locking nut on adjustment stud.

**B** Turn adjustment stud and loosen belt. Remove belt.

**3** Install drive belt on pulleys and adjust tension as follows:

**4** Loosen 5/8 in. locking nut on adjustment stud. Leave wrench on adjustment stud.

**NOTE:** Belt deflection is to be measured on the belt at the location that has the longest distance between two (2) pulleys. Normally this location is between the alternator and the belt adjustment pulley. This location will be different on engines with closed cooling or models without power steering.

**5** Use 5/16 in. socket and tighten adjusting stud until the correct deflection of the belt is obtained at location specified above.

**6** While holding adjustment stud at the correct belt tension, tighten 5/8 in. locking nut.

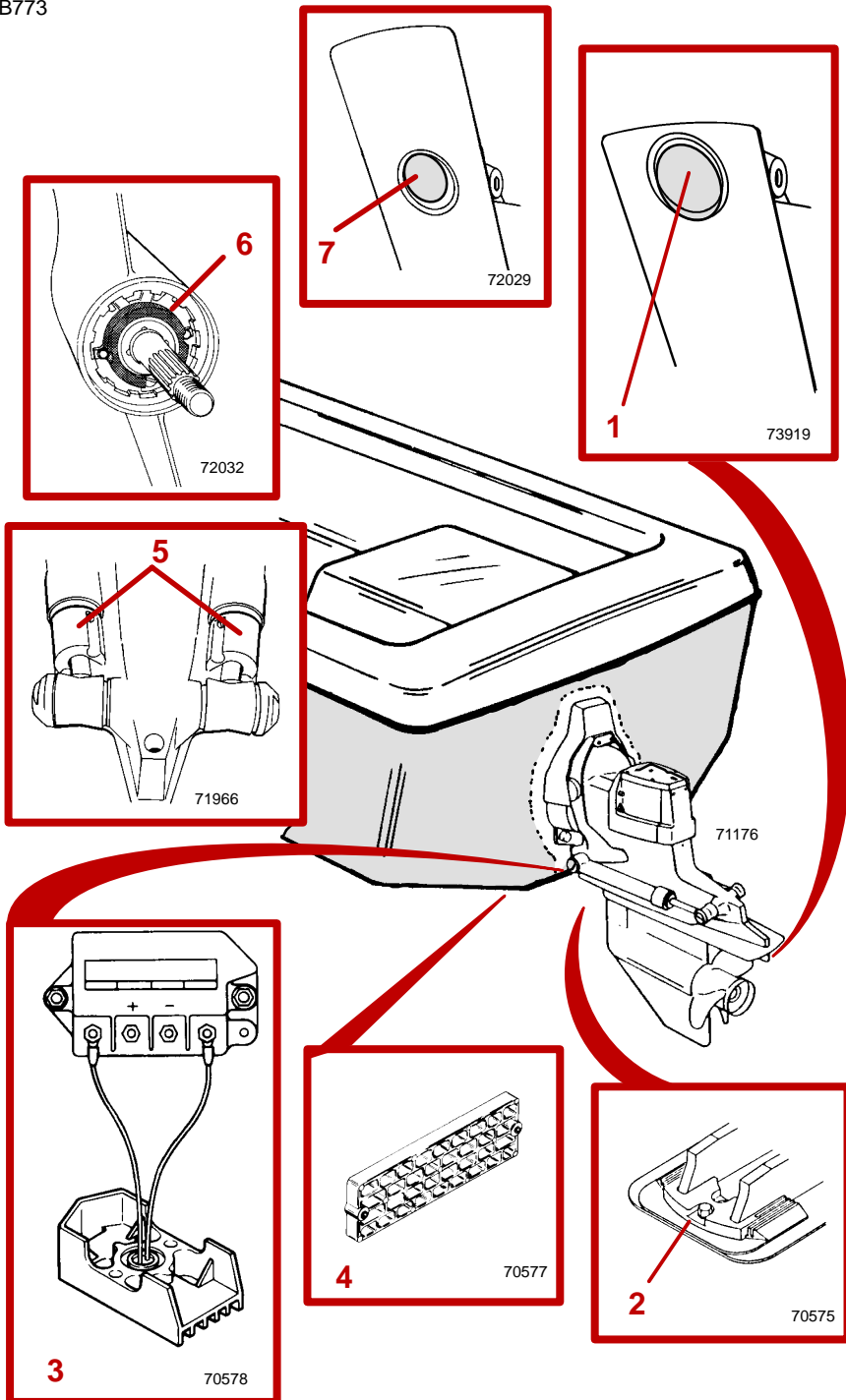
**7** Operate the engine for a short period of time. Recheck belt adjustment.



CA175

**THIS PAGE IS INTENTIONALLY BLANK**

CB773



CB588

## Corrosion And Corrosion Protection

Whenever two or more dissimilar metals (like those found on the sterndrive) are submerged in a conductive solution, such as saltwater, polluted water, or water with a high mineral content, a chemical reaction takes place causing electrical current to flow between metals. The electrical current flow causes the metal that is most chemically active, or anodic, to erode. This is known as galvanic corrosion and, if not controlled, it will in time cause the need for replacement of power package components exposed to water.

**IMPORTANT: Replace sacrificial anodes if eroded 50% or more.**

- 1 Universal Anodic Plate** - serves as a sacrificial anode.
- 2 Anodic Plate** - serves as a sacrificial anode.
- 3 MerCathode System** - should be tested to ensure adequate output.

Test should be made where boat is moored, using Quicksilver Reference Electrode and Test Meter. Contact your Authorized MerCruiser Dealer to arrange for this test.

- 4 Anode Kit (if so equipped)** - Mounted to boat transom. Acts as a sacrificial anode.

CA440

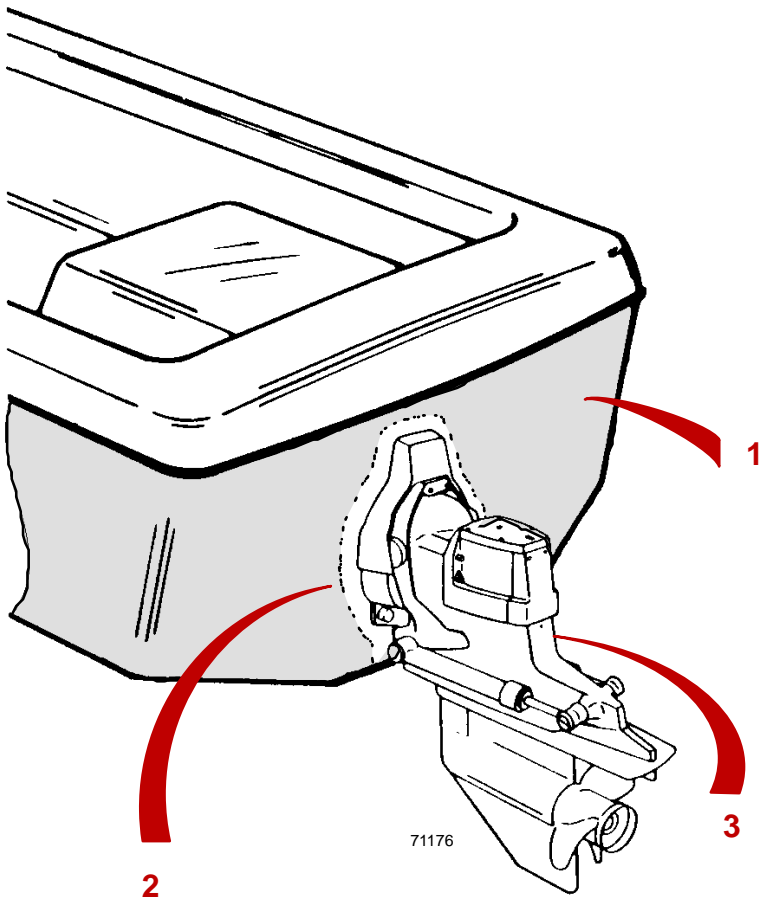
- 5 Trim Cylinder Anodes** - are mounted on each trim cylinder.

CB764

- 6 Bearing Carrier Anode (Bravo One)** - is located in front of the propeller, between the front side of the propeller and the gear housing. Refer to "Propeller" section in this manual for propeller removal and installation.

- 7 Gear Housing Anode (Bravo Two and Three)** - is located in the splash plate, just above the propellers.

CA93





CB780

In addition to the corrosion protection devices, the following steps should be taken to inhibit corrosion:

**IMPORTANT: Corrosion damage that results from the improper application of anti-fouling paint will not be covered by the limited warranty.**

**1 Painting Boat Hull or Boat Transom:** Anti-fouling paint may be applied to boat hull and boat transom but you must observe the following precautions:

**IMPORTANT: DO NOT paint anodes or MerCathode System reference electrode and anode, as this will render them ineffective as galvanic corrosion inhibitors.**

**IMPORTANT: If anti-fouling protection is required for boat hull or boat transom, copper or tin base paints, if not prohibited by law, can be used. If using copper or tin based anti-fouling paints, observe the following:**

**2 Avoid any electrical interconnection between the MerCruiser Product, Anodic Blocks, or MerCathode System and the paint by allowing a minimum of 1-1/2 in. (40mm) UNPAINTED area on transom of the boat around these items.**

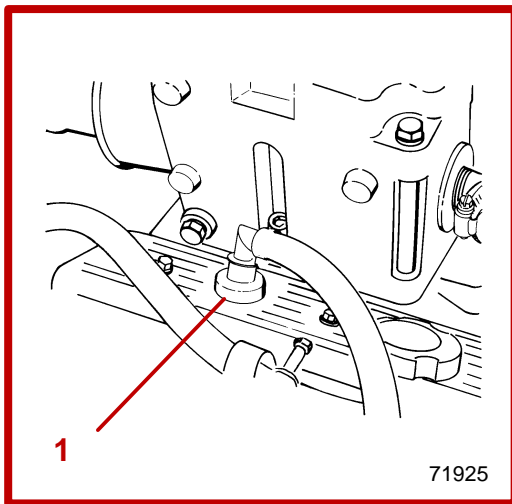
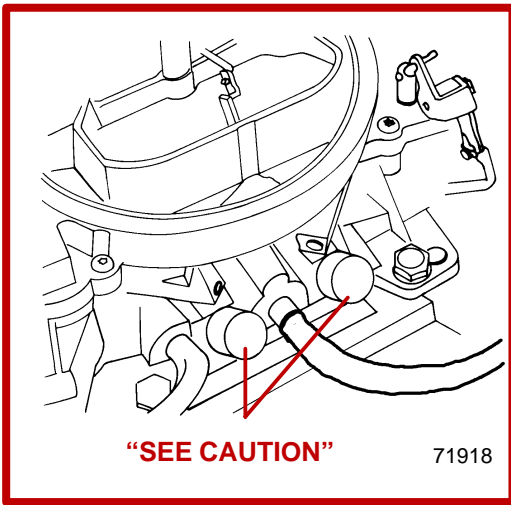
**3 Painting Drive Unit or Transom Assembly:** Drive unit and transom assembly should be painted with a good quality marine paint or an anti-fouling paint that DOES NOT contain copper, tin, or any other material that could conduct electrical current. Do not paint drain holes, anodes, MerCathode system, and items specified by boat manufacturer.

**4** Spray power package components on inside of boat every 2 months with Quicksilver Corrosion Guard to protect finish from dulling and corrosion. External power package components may also be sprayed.

**5** All lubrication points, especially steering system, shift and throttle linkages, should be kept well lubricated.

**6** Flush cooling system periodically or after each use in salty, polluted or brackish water.

CA97





CA474

## Emissions (Europe Only)

CA399

The following information applies only to engines with a special emissions kit installed. If the kit has been installed, your engine complies with “Stage 1” Bodensee and Swiss Regulations.

CA398

### Sealed Carburetor Mixture Screws

The carburetor on this engine has seals on the carburetor mixture screws. These seals prevent adjustment of the fuel mixture settings.

#### CAUTION

**Do not remove mixture screw seals and/or attempt to adjust fuel mixture setting. Tampering with the mixture setting on this engine could affect the exhaust emissions level, thus voiding the emissions certification. These seals should only be removed by an authorized dealer or emissions testing agency.**

CA99

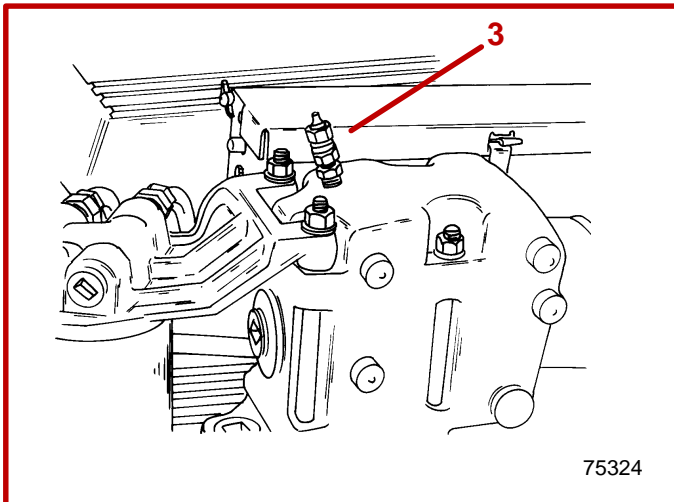
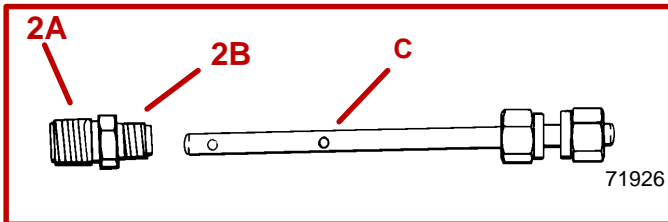
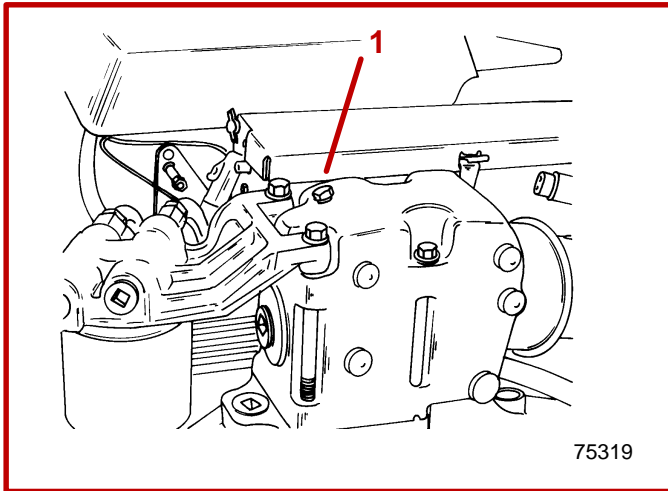
### Changing Positive Crankcase Ventilation Valve (PCV)

This engine is equipped with a positive crankcase ventilation valve (PCV). This valve should be changed every 100 hours of operation or at least once a year, whichever occurs first.

**1** Remove PCV valve from port valve cover. Disconnect it from the hose and discard valve. Install new PCV valve in valve cover and reconnect hose. Ensure valve is tightly seated in valve cover.

Use only MerCruiser replacement parts to ensure compliance with emission regulations.

CA637





CA100

## Emissions Testing

Your engine is equipped with special design features and special tuning to minimize the emission output from the engine. You should follow:

- Recommended maintenance schedules particularly as to the ignition system.
- Proper engine tuning procedures to ensure these features remain in good operating order.
- Proper steps to maintain the engine within specifications.

CA638

## Installing Test Probes

**IMPORTANT: The testing dealer or agency will be equipped with the appropriate test equipment and adapters for this engine. The test probes should be installed as follows:**

- 1** Remove plugs from both exhaust elbows.
- 2** Install exhaust elbow adapter fittings as follows.
  - A** Apply Loctite Pipe Sealant with Teflon to threads that go into elbow.
  - B** Install fittings into elbows. Tighten fittings securely.
- 3** Insert exhaust probes (**C**) into fittings and tighten securely.

The testing agency will connect their adapters and test equipment to the probes to conduct the test. Once the test is complete, they should remove the test probes and fittings, apply Quicksilver Perfect Seal to the threads of both plugs and reinstall them into elbows.

## Miscellaneous Maintenance

### Battery

All lead acid batteries discharge when not in use. Recharge every 30 to 45 days, or when specific gravity drops below battery manufacturer's specifications.

Refer to specific instructions and warnings accompanying your battery. If this information is not available, observe the following precautions when handling a battery.

#### **WARNING**

**Avoid serious injury from gasoline fire or explosion. Do not use jumper cables and a booster battery to start engine. Do not recharge a weak battery in the boat. Remove battery and recharge in a ventilated area away from fuel vapors, sparks or flames.**

#### **WARNING**

**Batteries contain acid which can cause severe burns-Avoid contact with skin, eyes and clothing. Batteries also produce hydrogen and oxygen gases when being charged. This explosive gas escapes fill/vent cell caps and may form an explosive atmosphere around the battery for several hours after it has been charged. Sparks or flames can ignite the gas and cause an explosion which may shatter the battery and could cause blindness or other serious injury.**

**Safety glasses and rubber gloves are recommended when handling batteries or filling with electrolyte. Hydrogen gases that escape from the battery during charging are explosive. When charging batteries, be sure battery compartment or area where batteries are located, is well-vented. Battery electrolyte is a corrosive acid and should be handled with care. If electrolyte is spilled or splashed on any part of the body, immediately flush the exposed area with liberal amounts of water and obtain medical aid as soon as possible.**



CA104

## **Bottom Of Boat**

To maintain maximum speed, the following conditions of the boat bottom should be observed:

- Clean, free of barnacles and marine growth.
- Free of distortion, nearly flat where it contacts water.
- Straight and smooth, fore and aft.

### **ANTI-FOULING PAINTS**

See Anti-Fouling Paint recommendations and related information on previous pages.

**IMPORTANT: Refer to CORROSION AND CORROSION PROTECTION for additional information.**

CA105

## **Inspection And Maintenance**

Inspect power package often, and at regular intervals, to help maintain its top operating performance, and correct potential problems before they occur. The entire power package should be checked carefully, including all accessible engine parts.

Check for loose, damaged or missing parts, hoses and clamps; tighten or replace as required.

Check plug leads and electrical leads for damage.

Remove and inspect propeller. If badly nicked, bent or cracked, see your dealer.

Repair nicks and corrosion damage on power package exterior finish. Use Quicksilver spray paints - see your Authorized MerCruiser Dealer.

CA574

## Cold Weather Or Extended Storage

### Power Package Lay Up

**IMPORTANT:** MerCruiser strongly recommends that this service should be performed by an Authorized MerCruiser Dealer. Damage caused by freezing IS NOT covered by the MerCruiser Limited Warranty.

#### **WARNING**

Be sure engine compartment is well ventilated and no gasoline vapors are present during the following operation to prevent a potential fire hazard.

#### **WARNING**

Fuel and gases from a battery are flammable and/or explosive. **DO NOT** smoke while working on the engine or related components.

#### **CAUTION**

**DO NOT** operate engine without water flowing thru seawater pickup pump, as pump impeller may be damaged and subsequent overheating damage to engine or stern drive unit may result.

**IMPORTANT:** Before starting engine, a water source must be attached to the seawater intake openings in gear housing, and/or seawater pickup pump. Follow all warnings, and flushing attachments procedures stated, in “FLUSHING COOLING SYSTEM.”

#### **CAUTION**

Stern drive unit should be stored in full “down” position. Universal Joint bellows may develop a “set” if unit is stored in raised position and may fail when unit is returned to service.





**1** Fill fuel tank(s) with fresh gasoline (that does not contain alcohol) and a sufficient amount of Quicksilver Gasoline Stabilizer for Marine Engines to treat gasoline. Follow instructions on container.

**2 If boat is to be placed in storage with fuel containing alcohol in fuel tanks (if fuel without alcohol is not available):** Fuel tanks should be drained as low as possible and Quicksilver Gasoline Stabilizer for Marine Engines added to any fuel remaining in the tank. Refer to “FUEL REQUIREMENTS” for additional information.

***NOTE:*** *If desired, a portable fuel tank can be used to perform the remainder of the power package lay up procedures. Be sure to add an appropriate amount of Gasoline Stabilizer to the portable tank.*

**3** Run engine sufficiently to bring it up to normal operating temperature and allow fuel with Quicksilver Gasoline Stabilizer to circulate thru fuel system. Shut off engine.

**4** Change oil and oil filter.

**5** Flush cooling system. Refer to “Flushing Cooling System” procedure shown earlier in this manual.

**6** Proceed to the following instructions appropriate for your model, for additional fuel system preparation.



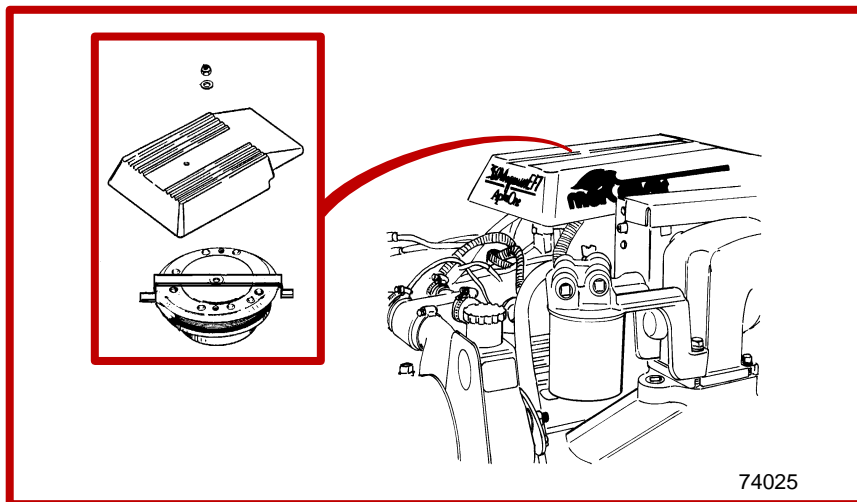
CA175

**THIS PAGE IS INTENTIONALLY BLANK**

CA575

## Power Package Lay Up (continued)

### CARBURETED MODELS



#### **⚠ WARNING**

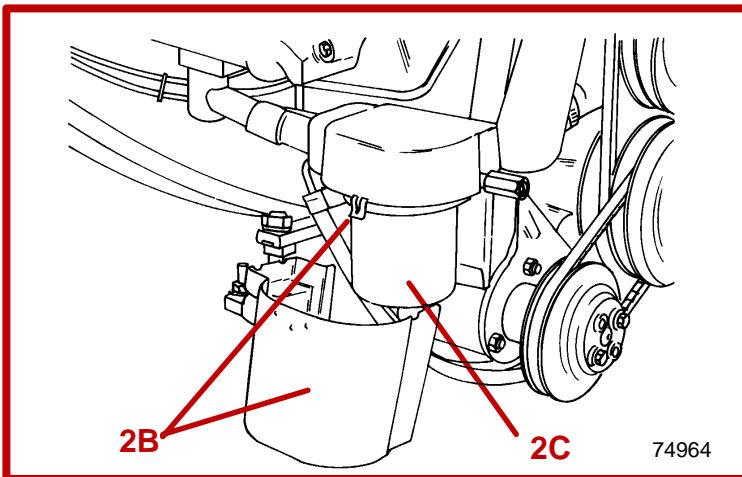
**Avoid Fire or Explosion: Be sure engine compartment is well ventilated and no gasoline vapors are present during the following operation.**

- 1** Close the fuel shut-off valve, if so equipped. If no fuel shut off valve is present, a suitable method must be employed to STOP the flow of fuel from the fuel tank to the engine before proceeding.
- 2** Remove flame arrestor and start engine. While operating engine at fast idle (1000-1500 RPM), fog internal surfaces of engine by squirting approximately 8 ounces (227 g) of Quicksilver Storage Seal (or if not available, SAE 20W motor oil) into carburetor bores. Squirt the remaining 2 ounces (57 g) of Storage Seal (or oil) rapidly into carburetor, just as the engine begins to stall, due to lack of fuel. Allow engine to stop. Turn ignition key to OFF position.

CA679

## Power Package Lay Up (continued)

### EFI MODELS



#### **⚠ WARNING**

**Avoid Fire or Explosion:** Be sure engine compartment is well ventilated and no gasoline vapors are present during the following operation.

#### **⚠ WARNING**

**Avoid Fire or Explosion:** Fuel injection system is pressurized during operation. Use care when removing water separating fuel filter. Fuel could spray on hot engine causing fire or explosion. Allow engine to cool down before attempting to remove the water separating fuel filter in the following procedure. Also, hold a clean shop towel over the water separating fuel filter when removing it to help avoid fuel spraying on the engine.



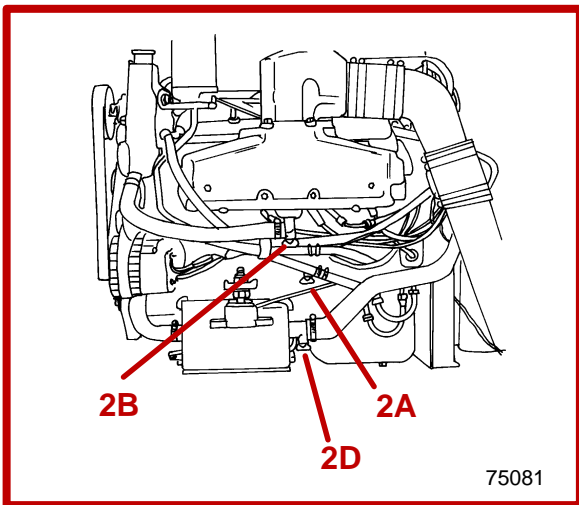
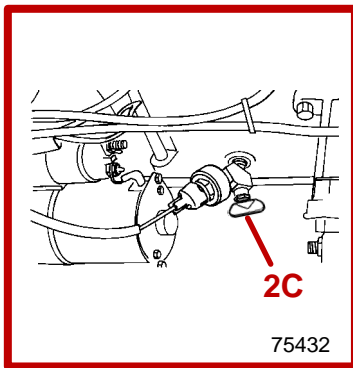
- 1** Close the fuel shut-off valve, if so equipped. If no fuel shut-off valve is present, a suitable method must be employed to STOP the flow of fuel from the fuel tank to the engine before proceeding.
- 2** Prepare fuel system for extended storage as follows:
  - A** Allow engine to cool down.
  - B** Depress latch and remove (slide down) the lower filter cover.
  - C** Remove the water separating fuel filter.
  - D** Pour out a small amount of fuel into a suitable container, then add approximately 2 fluid ounces (60 ml) of Quicksilver 2-Cycle Outboard Oil to fuel in the water separating fuel filter.
  - E** Install water separating fuel filter.
  - F** Start and run engine at idle speed until the water separating fuel filter and fuel injection system are empty and engine stops.
  - G** Remove and discard water separating fuel filter.
  - H** Install new filter.

CA115

## **Battery Winter Storage**

Follow battery manufacturer's instructions for storage.

CA790



CA798

## Draining

CA791

### Seawater (Raw-Water) Cooled Models

**NOTE:** This procedure will not work with 3.0L Single Point Drain System. See specific instructions later in this manual.

#### CAUTION

If boat is to remain in water after draining, seawater inlet hose must be removed and plugged to prevent a siphoning action that may occur, allowing seawater to flow from the drain holes or removed hoses.

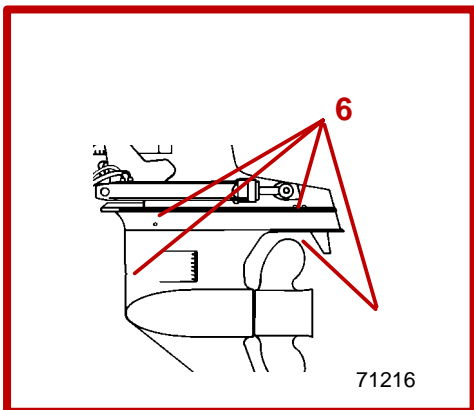
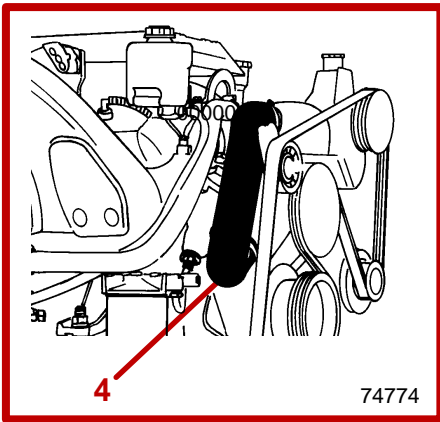
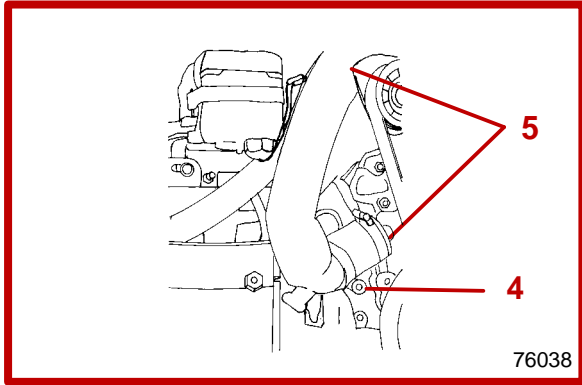
**IMPORTANT:** Boat must be as level as possible to ensure complete draining of cooling system.

#### CAUTION

Seawater section of cooling system **MUST BE COMPLETELY** drained for winter storage, or immediately after cold weather use, if the possibility of freezing temperatures exists. Failure to comply may result in trapped water causing freeze and/or corrosion damage to engine. Damage caused by freezing **IS NOT** covered by the MerCruiser Limited Warranty.

- 1 Ensure engine is as level as possible to ensure complete draining of cooling system.
- 2 Remove drain plugs from the following locations, if equipped:
  - A Port and starboard side of cylinder block.
  - B Bottom of exhaust manifold(s).
  - C Starboard side Y-fitting.
  - D Fuel cooler.
- 3 Repeatedly clean out drain holes using a stiff piece of wire. Do this until entire system is drained.

CA846





CA845

**NOTE:** *It may be necessary to lift or bend hoses to allow water to drain completely.*

**4 Models equipped with circulating pump hose drain plug:** Remove drain plug.

**5 Models without circulating pump hose drain plug:** Loosen hose clamps and disconnect hose from thermostat housing or circulating pump. Allow water to drain.

**6** Make sure gear housing water vent and drain holes, speedometer pitot hole and trim tab cavity vent and drain holes are open and unobstructed.

**7** Crank engine over slightly with starter motor to purge any water trapped in seawater pickup pump. Do not allow engine to start.

**8** After cooling system has been drained completely, install drain plugs, reconnect hoses and tighten all hose clamps securely.

**IMPORTANT:** MerCruiser recommends that propylene glycol (a nontoxic and environmentally safe) antifreeze be used in the seawater section of the cooling system for cold weather or extended storage. Make sure that the propylene glycol antifreeze contains a rust inhibitor and is recommended for use in marine engines. Be certain to follow the propylene glycol manufacturer's recommendations.

**9** For additional assurance against freezing and rust, fill the cooling system with a mixture of antifreeze and tap water mixed to manufacturer's recommendation to protect engine to the lowest temperature to which it will be exposed during cold weather or extended storage.

**A** Remove thermostat housing or hose and fill with coolant until block and head are full. If thermostat housing was removed, reinstall and tighten cover bolts securely.

**B** Remove water hose from exhaust manifold and fill manifold with coolant. Reinstall hose and tighten clamp securely.

Store boat with drive unit in full DOWN/IN position.



CA175

**THIS PAGE IS INTENTIONALLY BLANK**

CA794

## Closed Cooled (Coolant) Models

The following information outlines the procedures for draining the *seawater section* of the closed cooling systems.

**IMPORTANT:** Drain seawater section of closed cooling system only.

### CAUTION

If boat is to remain in water after draining, seawater inlet hose must be removed and plugged to prevent a siphoning action that may occur allowing seawater to flow from the drain holes or removed hoses.

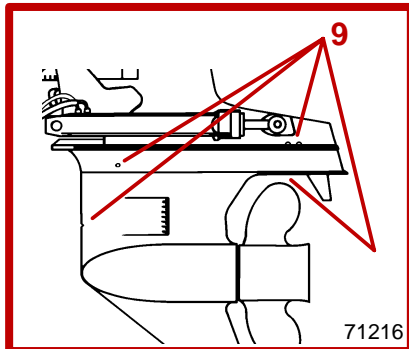
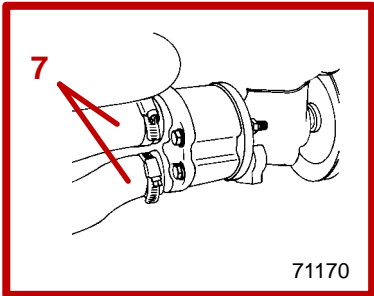
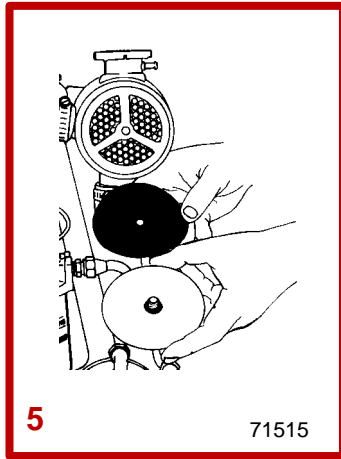
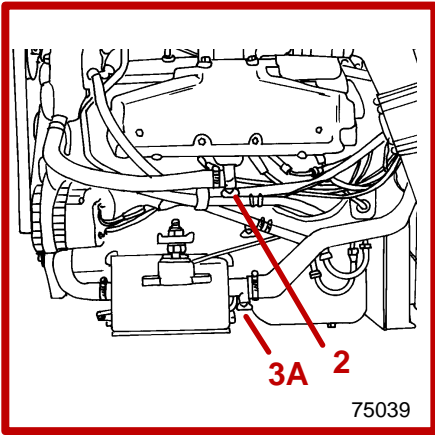
**IMPORTANT:** Boat must be as level as possible to ensure complete draining of cooling system.

### CAUTION

Seawater section of cooling system **MUST BE COMPLETELY** drained for winter storage or immediately after cold weather use if the possibility of freezing temperatures exist. Failure to comply may result in trapped water causing freeze and/or corrosion damage to engine. Damage caused by freezing **IS NOT** covered by the MerCruiser Limited Warranty.

**IMPORTANT:** Closed cooling section must be kept filled year-round with recommended coolant. If engine will be exposed to freezing temperatures, make sure closed cooling section is filled with an ethylene glycol antifreeze and water solution properly mixed to protect engine to lowest temperature to which it will be exposed. Quicksilver Premixed Marine Engine Coolant is already mixed.

CB781



CB782

**IMPORTANT: Do not use Propylene Glycol Antifreeze in the closed cooling section of the engine.**

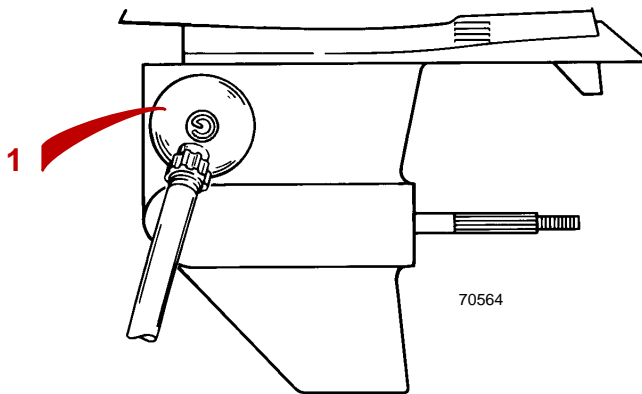
- 1** Ensure engine is as level as possible to ensure complete draining of cooling system.
- 2** Remove drain plug(s) from bottom of exhaust manifold(s).
- 3** Remove drain plug from A or B, depending on model:
  - A** Fuel cooler.
  - B** Port seawater pipe.
- 4 All Other Models:** Remove end caps, sealing washers and gaskets from heat exchangers.
- 5** Repeatedly clean out drain holes using a stiff piece of wire. Do this until entire system is drained.
- 6** On models with seawater pickup pump, loosen clamps and remove both hoses.
- 7** Crank engine over slightly with starter motor to purge any water trapped in seawater pickup pump. DO NOT allow engine to start.
- 8** Make sure gear housing water vent and drain holes, speedometer pitot hole and anodic plate cavity vent and drain holes are open and unobstructed.
- 9** After seawater section of cooling system has been drained completely, reinstall all components. Reconnect all hoses and tighten hose clamps securely.

Store boat with drive unit in full DOWN/IN position.

CA825

## Flushing Cooling System

CA824



CA827

To prevent silt and/or salt buildup in cooling system, flush with freshwater after each use and prior to storage.

If flushing cooling system with boat in water, raise drive unit to TRAILER position, install flushing attachment and lower drive unit to full DOWN/IN position.

If flushing cooling system with boat out of water, remove propeller before proceeding. If propeller is not removed observe the following precaution.

### **▲ WARNING**

**When flushing, be certain the area around propeller is clear, and no person (or animal) is standing nearby. To avoid possible injury, remove propeller.**

- 1 Install Quicksilver flushing attachment (or equivalent) over water intake openings in gear housing.
- 2 Connect hose between flushing attachment and water source valve.
- 3 With drive unit in normal operating position, partially open water source valve (about 1/2 maximum).
- 4 Place drive in NEUTRAL, idle speed position and start engine.

**⚠ CAUTION**

**Avoid possible engine damage.**

- **Do NOT run engine continuously at idle rpm.**
- **Do NOT run engine above 1500 RPM.**

**5** Slowly advance throttle until engine reaches 1300 rpm (+/- 100 rpm).

**⚠ CAUTION**

**Watch temperature gauge on dash to ensure that engine does not overheat.**

**6** Operate engine with drive in NEUTRAL, for about 10 minutes or until discharge water is clear.

**7** Slowly return throttle to idle speed position.

**8** Stop engine

**9** Shut off water and remove flushing attachment.

## Power Package Recommissioning

### **WARNING**

To prevent possible injury or damage to equipment, do not install battery until all maintenance has been performed on engine.

- 1 Check that all cooling system hoses are connected properly and hose clamps are tight.

### **CAUTION**

When installing battery, be sure to connect **NEGATIVE (-)** battery cable to **NEGATIVE (-)** battery terminal and **POSITIVE (+)** battery cable to **POSITIVE (+)** battery terminal. If battery cables are reversed, electrical system damage will result.

- 2 Install fully-charged battery. Clean battery cable clamps and terminals and reconnect cables (see CAUTION listed above). Tighten each cable clamp securely when connecting.
- 3 Coat terminal connections with a battery terminal anti-corrosion agent.
- 4 Perform all checks in OPERATION CHART in the BEFORE STARTING column.

### **CAUTION**

Refer to **FLUSHING COOLING SYSTEM** before starting engine.

- 5 Start engine and closely observe instrumentation to make sure that all systems are functioning correctly.
- 6 Carefully inspect engine for fuel, oil, fluid, water and exhaust leaks.
- 7 Check steering system, shift and throttle control for proper operation.



CA442

## Troubleshooting

### Starter Motor Will Not Crank Engine, Or Cranks Slow

Possible Cause	Remedy
Battery switch turned off.	Turn switch on.
Remote control not in neutral position.	Position control lever in neutral.
Open circuit breaker or blown fuse.	Check and reset circuit breaker or replace fuse.
Loose or dirty electrical connections or damaged wiring.	Check all electrical connections and wires (especially battery cables). Clean and tighten faulty connection.
Bad battery.	Test and replace if bad.

## Engine Will Not Start, Or Is Hard To Start

Possible Cause	Remedy
Improper starting procedure.	Read starting procedure.
Empty fuel tank or fuel shutoff valve closed.	Fill tank or open valve.
Choke not operating properly.	<b>Carburetor Models:</b> Check choke linkages for freedom of movement.
Engine Flooded.	Do not attempt to start engine for at least 5 minutes. Refer to Starting Procedures.
Faulty ignition system component.	Service ignition system.
Clogged fuel filters.	Replace filters.
Stale or contaminated fuel.	If contaminated, drain tank. Fill with fresh fuel.
Fuel line or tank vent line kinked or clogged.	Replace kinked lines or blow out lines with compressed air to remove obstruction.
EFI System Fault.	Have EFI System checked by an Authorized MerCruiser Dealer.

CA445

## Engine Runs Rough, Misses And/Or Backfires

Possible Cause	Remedy
Idle speed too low.	<b>EFI Models:</b> Have EFI system checked by an Authorized MerCruiser Dealer.
Choke not operating properly.	<b>Carburetor Models:</b> Check choke linkages for binding or an obstruction.
Faulty ignition system component.	Service ignition system.
Clogged fuel filters.	Replace filters.
Stale or contaminated fuel.	If contaminated, drain tank. Fill with fresh fuel.
Kinked or clogged fuel line or fuel tank vent line.	Replace kinked lines or blow out lines with compressed air to remove obstruction.
Flame Arrestor plugged with foreign material.	Clean Flame Arrestor.
EFI System fault (If So Equipped).	Have EFI System checked.

CA446

## Poor Performance

Possible Cause	Remedy
Throttle not fully open.	Inspect throttle cable and linkages for proper operation.
Damaged or improper propeller.	Replace propeller.
Excessive bilge water.	Drain and check for cause of entry.
Boat overloaded or load improperly distributed.	Reduce load or redistribute load more evenly.
Boat bottom fouled or damaged.	Clean or repair as necessary.
Flame Arrestor dirty.	Clean Flame Arrestor.
EFI System fault.	Have EFI System checked.

CA447

## Excessive Engine Temperature

Possible Cause	Remedy
Seacock closed.	Open.
Drive belt loose or in poor condition.	Replace or adjust belt.
Seawater pickups obstructed.	Remove obstruction.
Faulty thermostat.	Replace.
Coolant level low in closed cooling section (If Equipped).	Check for cause of low coolant level and repair. Fill system with proper coolant solution.
Heat Exchanger Cores plugged with foreign material (If Equipped).	Clean Heat Exchanger.
Loss of pressure in closed cooling section (If Equipped).	Check for leaks. Clean, inspect and test pressure cap.
Faulty seawater pickup pump.	Repair.
Seawater discharge restricted or plugged.	Clean exhaust elbows.

CA448

### Insufficient Engine Temperature

Possible Cause	Remedy
Faulty Thermostat.	Replace.

CA449

### Low Engine Oil Pressure

Possible Cause	Remedy
Insufficient oil in crankcase.	Check and add oil.
Excessive oil in crankcase (causing it to become aerated).	Check and remove required amount of oil. Check for cause of excessive oil (improper filling, bad fuel pump, etc.).
Diluted or improper viscosity oil.	Change oil and oil filter, using correct grade and viscosity oil. Determine cause for dilution (excessive idling, faulty fuel pump, etc.).

CA450

### Battery Will Not Come Up On Charge

Possible Cause	Remedy
Excessive current draw from battery.	Turn off non-essential accessories.
Loose or dirty electrical connections or damaged wiring.	Check all associated electrical connections and wires (especially battery cables). Clean and tighten faulty connections. Repair or replace damaged wiring.
Alternator drive belt loose or in poor condition.	Replace and/or adjust.
Unacceptable battery condition.	Test battery.

CA451

### **Remote Control Operates Hard, Binds, Has Excessive Free-Play Or Makes Unusual Sounds**

Possible Cause	Remedy
Insufficient lubrication on shift and throttle linkage fasteners.	Lubricate.
Loose or missing shift and throttle linkages.	Check all throttle linkages. If any are loose or missing, see Authorized MerCruiser Dealer immediately.
Obstruction in shift or throttle linkages.	Remove obstruction.
Shift or throttle cable kinked.	Straighten cable or have dealer replace cable if damaged beyond repair.

CA452

### **Steering Wheel Turns Hard Or Jerky**

Possible Cause	Remedy
Low power steering pump fluid level.	Refill system with fluid.
Drive belt loose or in poor condition.	Replace and/or adjust.
Insufficient lubrication on steering components.	Lubricate.
Loose or missing steering fasteners or parts.	Check all parts and fasteners if any are loose or missing, see Authorized MerCruiser Dealer immediately.
Contaminated power steering fluid.	Drain and replace.

CA453

### **Power Trim Does Not Operate (Motor Doesn't Run)**

Possible Cause	Remedy
Blown fuse.	Replace fuse.
Loose or dirty electrical connections or damaged wiring.	Check all associated electrical connections and wires (especially battery cables). Clean and tighten faulty connection. Repair or replace wiring.

CA454

### **Power Trim Does Not Operate (Motor Runs But Drive Unit Does Not Move)**

Possible Cause	Remedy
Trim pump oil level low.	Fill pump with oil.
Drive unit binding in gimbal ring.	Check for obstruction.

## Owner Service Assistance

### Local Repair Service

Always return your MerCruiser powered boat to your local Authorized Dealer, should the need for service arise. Only he has the factory trained mechanics, knowledge, special tools and equipment and the genuine Quicksilver parts and accessories\* to properly service your engine should the need occur. He knows your engine best.

\* Quicksilver parts and accessories are engineered and built by Mercury Marine, specifically for MerCruiser® sterndrives and inboards.

### Service Away From Home

If you are away from your local dealer and the need arises for service, contact the nearest Authorized Dealer. Refer to the Yellow Pages of the telephone directory. If, for any reason, you cannot obtain service, contact the nearest Regional Service Center. Outside the United States and Canada, contact the nearest Marine Power International Service Center.

### Parts And Accessories Inquiries

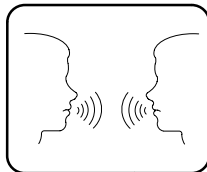
All inquiries concerning Quicksilver replacement parts and accessories should be directed to your local Authorized Dealer. The dealer has the necessary information to order parts and accessories for you should he not have them in stock. Only Authorized Dealers can purchase genuine Quicksilver parts and accessories from the factory. Mercury Marine does not sell to unauthorized dealers or retail customers. When inquiring on parts and accessories, the dealer requires the **motor model** and **serial number(s)** to order the correct parts.



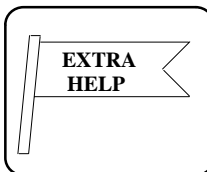
## Resolving A Problem

Satisfaction with your MerCruiser product is very important to your dealer and to us. If you ever have a problem, question or concern about your power package, contact your dealer or any Authorized MerCruiser Dealership. If additional assistance is required, take these steps.

**1** *Talk with the dealership's sales manager or service manager. If this has already been done, then contact the owner of the dealership.*



**2** *Should you have a question, concern or problem that cannot be resolved by your dealership, please contact Mercury Marine Service Office for assistance. Mercury Marine will work with you and your dealership to resolve all problems.*



*The following information will be needed by the service office:*

- Your name and address
- Daytime telephone number
- Model and serial number for your power package
- The name and address of your dealership
- Nature of problem

Mercury Marine Service Offices are listed on the next page.

CA785

## Mercury Marine Service Offices

For assistance, call, fax, or write. Please include your daytime telephone number with mail and fax correspondence.

 Telephone	 Fax	 Mail
<b>United States</b>		
(405) 743-6566	(405) 743-6570	MerCruiser 3003 N. Perkins Rd. Stillwater, OK 74075
<b>Canada</b>		
(905) 567-MERC (6372)	(905) 567-8515	Mercury Marine Ltd. 2395 Meadowpine Blvd. Mississauga, Ontario Canada L5N 7W6
<b>Australia, Pacific</b>		
(61) (3) 791-5822	(61) (3) 793-5880	Mercury Marine Australia 132-140 Frankston Road Dandenong, Victoria 3164 Australia
<b>Europe, Middle East, Africa</b>		
(32) (87) 32 • 32 • 11	(32) (87) 31 • 19 • 65	Marine Power - Europe, Inc. Parc Industriel de Petit-Rechain B-4800 Verviers Belgium
<b>Mexico, Central America, South America, Caribbean</b>		
(305) 385-9585	(305) 385-5507	Mercury Marine - Latin America & Caribbean 9010 S.W. 137th Ave. Suite 226 Miami, FL 33186 U.S.A.
<b>Japan</b>		
(81) 543/34-2500	(81) 543/34-2022	Mercury Marine - Japan No. 27-2 Muramatsu Chisaki-Shinden Shimizu City Shizuoka Prefecture Japan 424
<b>Asia, Singapore</b>		
5466160	5467789	Mercury Marine Singapore 72 Loyang Way Singapore 508762

CA463

## Customer Service Literature

### English Language

English language publications are available from:

**Mercury Marine  
Attn: Publications Department  
W6250 West Pioneer Road  
P.O. Box 1939  
Fond du Lac, WI 54936-1939**

**Outside the United States and Canada, contact the nearest Mercury Marine or Marine Power International Service Center for further information.**

When ordering be sure to:

1. List your product, model, year and serial number(s).
2. Check the literature and quantities you want.
3. Enclose full remittance in check or money order (NO C.O.D.'s).

CA781

### Other Languages

To obtain an Operation and Maintenance Manual in another language, contact the nearest Mercury Marine or Marine Power International Service Center for information. A list of part numbers for other languages is provided with your power package.

caa781

## **Andre sprog**

Kontakt det nærmeste Mercury Marine eller Marine Power International servicecenter for oplysninger om hvordan du kan anskaffe en Betjenings- og vedligeholdelsesmanual på et andet sprog. En liste med reservedelsnumre for andre sprog leveres sammen med din power-pakke.

cab781

## **Andere talen**

Voor het verkrijgen van een Handleiding voor gebruik en onderhoud in andere talen dient u contact op te nemen met het dichtstbijzijnde internationale servicecentrum van Mercury Marine of Marine Power voor informatie hierover. Een lijst met onderdeelnummers voor andere talen wordt bij uw motorinstallatie geleverd.

cac781

## **Muut kielet**

Saadaksesi Käyttö- ja huolto-ohjekirjoja muilla kielillä, ota yhteys lähimpään Mercury Marine tai Marine Power International huoltokeskukseen, josta saat lähempiä tietoja. Moottorisi mukana seuraa monikielinen varaosanumeroluettelo.

cad781

## **Autres langues**

Pour obtenir un Manuel d'utilisation et d'entretien dans une autre langue, contactez le centre de service après-vente international Mercury Marine ou Marine Power le plus proche pour toute information. Une liste des numéros de pièces en d'autres langues accompagne votre bloc-moteur.

cae781

## **Andere Sprachen**

Um eine Betriebs- und Wartungsanleitung in einer anderen Sprache zu erhalten, wenden Sie sich an das nächste Mercury Marine oder Marine Power International Service Center. Eine Liste mit Teilenummern für Fremdsprachen ist im Lieferumfang Ihres Motors enthalten.



caf781

## **Altre lingue**

Per ottenere il manuale di funzionamento e manutenzione in altra lingua, contattate il centro assistenza internazionale Mercury Marine o Marine Power più vicino. In dotazione con il gruppo motore, viene fornito l'elenco dei codici prodotto dei componenti venduti all'estero.

cag781

## **Andre språk**

Ytterligere informasjon om bruks- og vedlikeholdshåndbok på andre språk kan fås ved henvendelse til nærmeste internasjonale servicecenter for Mercury Marine eller Marine Power. En liste over delenumre for andre språk følger med aggregatet.

cah781

## **Outros Idiomas**

Para obter um Manual de Operação e Manutenção em outro idioma, contate o Centro de Serviço Internacional de "Marine Power" (Potência Marinha) ou a Mercury Marine mais próxima para obter informações. Uma lista de números de referência para outros idiomas é fornecida com o seu pacote de propulsão.

caj781

## **Otros idiomas**

Para obtener un Manual de operación y mantenimiento en otro idioma, póngase en contacto con el centro de servicio más cercano de Mercury Marine o Marine Power International para recibir información. Con su conjunto motriz se entrega una lista de los números de pieza para los otros idiomas.

cak781

## **Andra språk**

För att få Instruktions- och underhållsböcker på andra språk, kontakta närmaste Mercury Marine eller Marine Power International servicecenter, som kan ge ytterligare information. En förteckning över artikelnummer på andra språk medföljer ditt kraftpaket.

CAm781

## **Άλλες γλώσσες**

Για να αποκτήσετε ένα Εγχειρίδιο Λειτουργίας και Συντήρησης σε άλλη γλώσσα, επικοινωνήστε με το πλησιέστερο Διεθνές Κέντρο Σέρβις της Mercury Marine ή της Marine Power για πληροφορίες. Το πακέτο ισχύος σας συνοδεύεται από έναν κατάλογο αριθμών παραγγελίας για άλλες γλώσσες.



CA175

**THIS PAGE IS INTENTIONALLY BLANK**

CA752

## Ordering Literature




Before ordering literature, please have the following information about your power package available:

**Model** \_\_\_\_\_ **Horsepower** \_\_\_\_\_  
**Serial Number** \_\_\_\_\_ **Year** \_\_\_\_\_

### United States and Canada

For information on additional literature that is available for your particular MerCruiser power package and how to order that literature contact your nearest dealer or contact:

Mercury Marine

<p>Telephone</p> 	<p>Fax</p> 	<p>Mail</p> 
<p>(920) 929-5110</p>	<p>(920) 929-4894</p>	<p>Mercury Marine Attn: Publications Department P.O. Box 1939 Fond du Lac, WI 54936-1939</p>

### Outside The United States and Canada

Contact your nearest dealer or Marine Power Service Center for information on additional literature that is available for your particular MerCruiser power package and how to order that literature.

Please return with payment to:

Mercury Marine  
Attn: Publications Department  
P.O. Box 1939  
Fond du Lac, WI 54936-1939

### Ship To: (Please Print Or Type - This Is Your Shipping Label)

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ ZIP \_\_\_\_\_

-----