



Mercruiser 4.3 engine wiring diagram

Is a 4.3 mercruiser a good engine. Cost to replace mercruiser 4.3 engine.

Lubricants / Adhesives5Alpha Notice: Increased Trim-In Range Capability6Bravo Three Notice: Trim-In Limit Insert7Serial Number Decal Placement8Seawater Connections18Driveshaft Extension Models39Shift Cable Installation67Throttle Cable Installation and Adjustment76Sterndrive Unit Installation77Shift Cable Installation89Predelivery Preparation98Cold Weather and Extended Storage114Mercathode System Wiring Diagram129MCM Gasoline Engine Wiring Diagram130Predelivery Inspection137 Number 25 Printed in U.S.A. 90-861328--1 1199 1999, Mercury Marine GM V-6262 CID (4.3L) MARINE ENGINES



OBSERVE THEM CAREFULLY! These "Safety Alerts" alone cannot eliminate the hazards that they signal. Strict complianceto these special instructions when performing the service, plus "Common Sense" operation, are major accident prevention measures.

DANGERDANGER - Immediate hazards which WILL result in severe personal injury or death. WARNINGWARNING - Hazards or unsafe practices which COULD result in severe personal in-jury or death. CAUTIONHazards or unsafe practices which could result in minor personal injury or productor property damage. Notice to Users of This Manual This service manual has been written and published by the Service Department of MercuryMarine to aid our dealers' mechanics and company service personnel when servicing theproducts described herein.

It is assumed that these personnel are familiar with the servicing procedures of these products, or like or similar products manufactured and marketed by Mercury Marine, that theyhave been trained in the recommended servicing procedures of these products which in-cludes the use of mechanics' common hand tools and the special Mercury Marine or recommended tools from other suppliers. We could not possibly know of and advise the service trade of all conceivable procedures by which a service might be performed and of the possible hazards and/or results of eachmethod. We have not undertaken any such wide evaluation.



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Therefore, anyone who uses a service procedure and/or tool, which is not recommended by the manufacturer, first must completely satisfy himself that neither his nor the products safety will be endangered by theservice procedure selected.



All information, illustrations and specifications contained in this manual are based on thelatest product information available at the time of publication. As required, revisions to thismanual will be sent to all dealers contracted by us to sell and/or service these products. It should be kept in mind, while working on the product, that the electrical system and ignitionsystem are capable of violent and damaging short circuits or severe electrical shocks. Whenperforming any work where electrical terminals could possibly be grounded or touched by the mechanic, the battery cables should be disconnected at the battery. Any time the intake or exhaust openings are exposed during service they should be covered to protect against accidental entrance of foreign material which could enter the cylinders and cause extensive internal damage when the engine is started. Page ii 90-861328--1 NOVEMBER 1999 It is important to note, during any maintenance procedure replacement fasteners must have the same measurements and strength as those removed. Numbers on the heads of the met-ric bolts and on the surfaces of metric nuts indicate their strength. American nuts do not have strength markings.

Mis-matched or incorrect fasteners can result in damage or malfunction, or possibly personalinjury. Therefore, fasteners removed should be saved for reuse in the same locations when-ever possible. Where the fasteners are not satisfactory for re-use, care should be taken toselect a replacement that matches the original. We reserve the right to make changes to this manual without prior notification. Refer to dealer service bulletins for other pertinent information concerning the productsdescribed in this manual. Engine Mechanical Components are designed for marine applications. Unlikeautomotive engines, marine engines are subjected to extended periods of heavy loadand wide-open-throttle operation and, therefore, require heavy-duty components. Specialmarine engine parts have design and manufacturing specifications which are required toprovide long life and dependable performance. Marine engine parts also must be able toresist the corrosive action of salt or brackish water that will rust or corrode standard automo-tive parts within a short period of time.

Failure to use recommended Quicksilver service replacement parts can result in poor en-gine performance and/or durability, rapid corrosion of parts subjected to salt water and possibly complete failure of the engine. Use of parts other than recommended service replacement parts, will void the warranty onthose parts which are damaged as a result of the use of other than recommended replace-ment parts. Replacement Parts WARNINGElectrical, ignition and fuel system components on MerCruiser Engines and Stern-drives are designed and manufactured to comply with U.S. Coast Guard Rulesand Regulations to minimize risks of fire or explosion.



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Use of replacement electrical, ignition or fuel system components, which do notcomply to these rules and regulations, could result in a fire or explosion hazard andshould 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 opening would permit sparks to ignite fuel vapors from fuel system leaks, if they existed. 1 2 3 4 5 6 7 8 9 Important Information Removal and Installation Engine Electrical Systems Society 2 - Removal and Installation A - MCM Models Section 3 - EngineA - 262 CID / 4.3L Engines Section 4 - Electrical Systems - Starting System B - Ignition System C - Charging System D - Instrumentatione - Wiring Diagrams Section 5 - Fuel Systems - Fuel Delivery System For Carburetor B - Renoval and Installation Fuel Injection Descriptions And System Operation G - Fuel Injection Disassembly And Reassembly - Fuel Injection System - Fuel Injection System - Cooled Models Section 7 - Exhaust System A - General B - Manifolds, Elbows and Risers - Collectors Section 8 - Drives A - Drive Shaft Models Section 9 - Power Steering System A - Pump and Related Components Page iv 90-861328--1 NOVEMBER 1999 Table of Contents IMPORTANT INFORMATIONSection 1A - General Information Introduction 1A-2.



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in.)10 61990 1 CABLE TIE REF. NO. : Number shown next to part on exploded view PART NO. : Mercury Part Number for ordering. If NSS (not sold separately) sometimes GMpart number will be given in description column. QTY. : The guantity that must be ordered. DESCRIPTION : Description of part, what parts are included with a part (al indented itemscome with the main item above the indented parts), serial number information, and specialinformation. GENERAL INFORMATION SERVICE MANUAL NUMBER 25 Page 1A-4 90-861328--1 NOVEMBER 1999 Directional References Front of boat is bow; rear is stern. Starboard side is right side; port side is left side. In thismanual, all directional references are given as they appear when viewing boat from sternlooking toward bow. 72000 STARBOARD(RIGHT) PORT(LEFT) FORE or BOW(FRONT) AFT or STERN(REAR) Engine Rotation Engine Rotation is determined by observing flywheel rotation from the rear (stern end) of the engine Rotation Engine Rotation Engine Rotation Engine Rotation Engine Rotation Engine Rotation from the rear (stern end) of the engine Rotation Engine Propeller rotation is not necessarily thesame as engine rotation. When ordering replacement engine, short blocks or parts forengine, be certain to check engine rotation. Do not rely on propeller rotation. 72001 Left Hand Rotation GENERAL INFORMATIONSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1A-5 Engine Serial Number Location 72975 a b a - Serial Number Plateb - Starter Motor Propeller Information Refer to the "Propeller" section in appropriate Mercury Mercruiser Sterndrive ServiceManual, or order publication 90-8614492, "What You Should Know About QuicksilverPropellers." Changing diameter, pitch or coupling of a propeller will affect engine rpm and boatperformance. The blade configuration also will affect performance. Two like propellers, same pitch and diameter, from two different manufacturers also will perform differently. It is the responsibility of the boat manufacturers and/or selling dealer to equip the boat with the correct propeller to allow the engine to operate within its specified rpm range at wideopen throttle (WOT).

Assembly 1 2 3 4 5 6 7 8 9 10 REF.NO. PART NO. SYM. OTY. DESCRIPTION 1 90507A12 1 PUMP ASSEMBLY-Power Steering 236-95805 1 CAP3 73873A1 1 PULLEY4 16-41877 1 STUD5 57-65607T 1 V-BELT6 32-806684 1 HOSE-Pressure (FITTINGS ON BOTH ENDS)7 25-89879 1 O-RING9 13-35048 1 LOCKWASHER (3/88 1 HOSE-Pressure (FITTINGS ON BOTH ENDS)7 25-89879 1 O-RING9 13-35048 1 LOCKWASHER (3/88 1 HOSE-PRESSURE (5) 1 CAP3 73873A1 1 PULLEY4 16-41877 1 STUD5 57-65607T 1 V-BELT6 32-806684 1 HOSE-PRESSURE (5) 1 CAP3 73873A1 1 PULLEY4 16-41877 1 STUD5 57-65607T 1 V-BELT6 32-806684 1 HOSE-PRESSURE (5) 1 CAP3 73873A1 1 PULLEY4 16-41877 1 STUD5 57-65607T 1 V-BELT6 32-806684 1 HOSE-PRESSURE (5) 1 CAP3 73873A1 1 PULLEY4 16-41877 1 STUD5 57-65607T 1 V-BELT6 32-806684 1 HOSE-PRESSURE (5) 1 CAP3 73873A1 1 PULLEY4 16-41877 1 STUD5 57-65607T 1 V-BELT6 32-806684 1 HOSE-PRESSURE (5) 1 CAP3 73873A1 1 PULLEY4 16-41877 1 STUD5 57-65607T 1 V-BELT6 32-806684 1 HOSE-PRESSURE (5) 1 CAP3 73873A1 1 PULLEY4 16-41877 1 STUD5 57-65607T 1 V-BELT6 32-806684 1 HOSE-PRESSURE (5) 1 CAP3 73873A1 1 PULLEY4 16-41877 1 STUD5 57-65607T 1 V-BELT6 32-806684 1 HOSE-PRESSURE (5) 1 CAP3 73873A1 1 PULLEY4 16-41877 1 STUD5 57-65607T 1 V-BELT6 32-806684 1 HOSE-PRESSURE (5) 1 CAP3 73873A1 1 PULLEY4 16-41877 1 STUD5 57-65607T 1 V-BELT6 32-806684 1 HOSE-PRESSURE (5) 1 CAP3 73873A1 1 PULLEY4 16-41877 1 STUD5 57-65607T 1 V-BELT6 32-806684 1 HOSE-PRESSURE (5) 1 CAP3 73873A1 1 PULLEY4 16-41877 1 STUD5 57-65607T 1 V-BELT6 32-806684 1 HOSE-PRESSURE (5) 1 CAP3 73873A1 1 PULLEY4 16-41877 1 STUD5 57-65607T 1 V-BELT6 32-806684 1 HOSE-PRESSURE (5) 1 CAP3 73873A1 1 PULLEY4 16-41877 1 STUD5 57-65607T 1 V-BELT6 32-806684 1 HOSE-PRESSURE (5) 1 CAP3 73873A1 1 PULLEY4 16-41877 1 STUD5 57-65607T 1 V-BELT6 32-806684 1 HOSE-PRESSURE (5) 1 CAP3 73873A1 1 PULLEY4 16-41877 1 STUD5 57-65607T 1 V-BELT6 32-806684 1 HOSE-PRESSURE (5) 1 CAP3 73873A1 1 PULLEY4 16-418774 1 PULLEY4

Because of the many variables of boat design and operation, only testing will determine thebest propeller for the particular application. To test for correct propeller, operate boat (with an average load onboard) at WOT and checkrpm with an accurate tachometer. Engine rpm should be near top of the specified range so that, under heavy load, engine speed will not fall below specifications. If engine exceeds the specified rpm, an increase in pitch and/or diameter is required. If engine is below rated rpm, a decrease in pitch and/or diameter is required. If engine is below rated rpm, a decrease in pitch and/or diameter is required. does not allow engine rpm to reach the specifiedfull-throttle rpm range, the engine will "labor" and will not produce full power. Operation under this condition will cause excessive fuel consumption, engine to run above the specified rpm limit.will cause excessive wear on internal engine parts which will lead to prematureengine failure.

GENERAL INFORMATION SERVICE MANUAL NUMBER 25 Page 1A-6 90-861328--1 NOVEMBER 1999 Water Testing New Engines Use care during the first 20 hours of operation on new Mercury MerCruiser engines or possible engine failure may occur. If a new engine has to be water-tested at full throttlebefore the break-in period is complete, follow this procedure. 1. Start engine and run at idle rpm until normal operating temperature is reached. 2. Run boat up on plane. 3. Advance engine rpm (in 200 rpm increments) until engine reaches its maximum ratedrpm. IMPORTANT: Do not run at maximum rpm for more than 2 minutes.

Boat and Engine Performance Boat Bottom For maximum speed, a boat bottom should be as flat as possible in a fore-aft direction(longitudinally) for approximately the last 5 ft (1.5 m). 72002 a a - Critical Bottom Area For best speed and minimum spray, the corner between the bottom and the transom should be as flat as possible in a fore-aft direction(longitudinally) for approximately the last 5 ft (1.5 m). Transom GENERAL INFORMATIONSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1A-7 The bottom is referred to as having a "hook" if it is concave in the fore-and-aft direction. Abook causes more lift on the bottom near the transom and forces the bow to drop. This increases wetted surface and reduces boat speed. A hook, however, aids in planing and reduces any porpoising (rhythmical bouncing) tendency. A slight hook is often built in by themanufacturer. A hook also can be caused by incorrect trailering or storing the boat with support directly under the transom. 72004a a - Hook A "rocker" is the reverse of a hook. The bottom is convex or bulged in the fore-andaft direction. It can cause the boat to porpoise. 72005a a - Rocker Any hook, rocker or surface roughness on the bottom, particularly in the all-important center-aft portion will have a negative effect on speed, often several miles per hour on a fastboat. Marine FoulingFouling is an unwanted build-up (usually animal-vegetable-derived) occurring on the boat'sbottom and drive unit. Fouling adds up to drag, which reduces boat performance. In freshwater, fouling results from dirt, vegetable matter, algae or slime, chemicals, minerals and other pollutants.

In salt water, barnacles, moss and other marine growth often producedramatic build-up of material quickly. Therefore, it is important to keep the hull as clean aspossible in all water conditions to maximize boat performance. Antifouling paint, if required, may be applied to boat hull observing the following precautions. IMPORTANT: DO NOT paint anodes or MerCathode System reference electrode andanode, as this will render them ineffective as galvanic corrosion inhibitors. CAUTIONAvoid corrosion inhibitors. CAUTIONAvoid corrosion damage. Do not apply antifouling paint to Mercury MerCruiserdrive unit or transom assembly. GENERAL INFORMATION SERVICE MANUAL NUMBER 25 Page 1A-8 90-861328--1 NOVEMBER 1999 IMPORTANT: If antifouling protection is required, Tri-Butyl-Tin-Adipate (TBTA) baseantifouling paints are prohibited by law, copper basepaints can be used on boat hull and boat transom.

Corrosion damage that results from the improper application of antifouling paint will not be covered by the limitedwarranty. Observe the following: Avoid an electrical interconnection between the Mercury MerCruiser Product, Anodic Blocks, or MerCathode System and the paint by allowing a minimum of 1-1/2in. (40mm) UNPAINTED area on transon of the boat around these items.

71176a b a - Anti-Fouling Paintb - Minimum 1-1/2 in. (40 mm) UNPAINTED Area Weight DistributionWeight distribution is extremely important; it affects a boat's running angle or attitude. Forbest top speed, all movable weight - cargo and passengers - should be as far aft as possible to allow the bow to come up to a more efficient angle (3 to 5 degrees). On the negative side of this approach is the problem that, as weight is moved aft, some boats will begin an unacceptable porpoise. Secondly, as weight is moved aft, getting on plane becomes more difficult.

Finally, the ride in choppy water becomes more uncomfortable as the weight goes aft. With these factors in mind, each boater should seek out what weight locations best suit his/herneeds. Weight and passenger loading placed well forward increases the "wetted area" of the boatbottom and, in some cases, virtually destroys the good performance and handlingcharacteristics of the boat.

Operation in this configuration can produce an extremely wetride, from wind-blown spray, and could even be unsafe in certain weather conditions, but also applies to lateralweight distribution. Uneven weight concentration to port or starboard of the longitudinalcenterline can produce a severe listing attitude that can adversely affect the boat sperformance, handling ability and riding comfort. In extreme rough water conditions, thesafety of the boat and passengers may be in jeopardy. GENERAL INFORMATIONSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1A-9 Water in BoatWhen a boat loses performance, check bilge for water. Water can add considerable weightto the boat, thereby decreasing the performance and handling. Make certain that all drain passages are open for complete draining. Elevation and ClimateElevation has a very noticeable effect on the wide-open-throttle power of an engine. Sinceair (containing oxygen) gets thinner as elevation increases, the engine begins to starve forair. Humidity, barometric pressure and temperature do have a noticeable effect on thedensity of air. Heat and humidity thin the air. This phenomenon can become particularly apparent when an engine is propped out on a cool dry day in spring and later, on a hot, humidday in August, does not have the same performance. See chart below. Although some performance can be regained by dropping to a lower pitch propeller is too large in diameter for the reduced power output. The experienced marine dealer or a Quicksilver Propeller Repair Station can determine howmuch diameter to remove from a lower-pitch propeller for specific high-elevation locations. In some cases, a gear-ratio change to the drive unit to more reduction is possible and verybeneficial. It is a known fact that weather conditions exert a profound effect on power output of internal combustion engines. Therefore, established horsepower ratings refer to the power that the engine will produce at its rated rpm under a specific combination of weatherconditions. 72006 GENERAL INFORMATION SERVICE MANUAL NUMBER 25 Page 1A-10 90-861328--1 NOVEMBER 1999 THIS PAGE IS INTENTIONALLY BLANK 1B MAINTENANCESERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1B-1 IMPORTANT INFORMATIONSection 1B - Maintenance Table of Contents Tools 1B-2..... Lubricants / Sealants / Adhesives 1B-2..... Maintenance Schedules 1B-3.....

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92-825407A3 Loctite Pipe Sealant With Teflon Obtain Locally Quicksilver U-Joint and Gimbal Bearing Grease 92-828052A2 MAINTENANCESERVICE MANUAL NUMBER 1999 Page 1B-3 Maintenance Schedules Maintenance Intervals Maintenance intervals and the tasks to be performed, as shown in this current schedule, oras found in a previously printed schedules, are generally based on an average boating application and environment. However, individual operating habits and personal mainte-nance preferences can have an impact on the suggested intervals. In consideration of these factors, Mercury MerCruiser has adjusted some maintenance intervals and correspondingtasks to be performed. In some cases, this may allow for more individual tasks to beperformed in a single visit to the serving dealer, rather than multiple visits. Therefore, it isvery important that the boat owner and servicing dealer discuss the current MaintenanceSchedule and develop appropriate maintenance intervals to coincide with the individual operating habits, environment, and maintenance requirements. CAUTIONAlways disconnect battery cables from battery BEFORE working around electrical systemshould a wire be accidentally shorted. Gas SterndriveRoutine Maintenance \* EachDayStart EachDayEnd WeeklyEveryTwo Months Check crankcase oil (interval can be extended based on experi-ence). I for each use. I cooling sys-tem after each use. waterstrainer and clean. Check coolant level. I spresent and replace if 50 percent eroded. Check battery connections and fluid level. to every fourmonths). I contain a saltwater Only: treat engine surface with corrosion guard. Corrosion guard NOVEMBER 1999 Gas Sterndrive(Continued)Scheduled Maintenance \* Annu-ally Every100 hours or Annually Every200 hoursor 3 years Every2 years Every2 years Touch-up paint power package and spray with corrosionguard. & Change crankcase oil and filter. & Change drive unit oil and retorque connection of gimbalring to steering shaft.

**Replace fuel filter(s)**.

 Check steering system and remote control for loose, missing or damaged parts. Lubricate cables and link-ages.
 Inspect U-joints, splines and bellows. Check engine alignment. Lubricate U-joints splines.
 Lubricate gimbal bearing and engine coupler.
 Check continuity circuit for loose or damaged connections. Test MerCathode unit output on Bravo Models.
 Check spark plugs, wires, distributor cap and ignitiontiming. Check and adjust idle speed.
 Clean flame arrestor and crankcase ventilation hoses.Replace PCV valve. Inspect both system for loose, damaged or corroded fasteners. Inspect condition and tension of belts. seawater section of closed cooling system. Clean, inspect and test pressure cap. & Replace coolant. & Derive regine coupler every 50 hours if operated at idle for prolonged periods of time. MAINTENANCESERVICE MANUAL NUMBER 25 90-861328-1 NOVEMBER 1999 Page 1B-5 Engine and Tune-Up Specifications MCM (Sterndrive) ModelMCM 4.3LALPHA /BRAVO MCM 4.3LHALPHA /BRAVO MCM 4.3LEFI ALPHA /BRAVO Propshaft Horsepower(SAV1 Rating) 190 205 (190)2 2101 (188)2 Propshaft Kilowatts (SAV1 Rating) 142 153 (142)2 1571 (146)2 Number of Cylinders V-6 Displacement 262 cid (4.3 l) Bore / Stroke - in. (mm) 4.0 x 3.48 (101.6 x 88.4) Compression Ratio 9.4:1 9.4:1 Compression Pressure Minimum 100 psi (690 kPa)7 Idle rpm In Neutral3 650 rpm5 600 rpm5 Maximum rpm (at WOT)3 4400-4800 rpm Oil Pressure (at 2000 rpm) Minimum 30 psi (207 kPa) Minimum Oil Pressure (at Idle) Minimum 4 psi (28 kPa) Fuel Pressure (1800 rpm) 3-7 psi (21-48 kPa) 30 psi ( kPa) Electrical System 12 V Negative (-) Ground Alternator Rating 55 or 65 amp 8 Minimum Battery Requirements 375 cca / 475 mca / 90 Ah Firing Order 1-6-5-4-3-2 Spark Plug TypeAC -MR43LTS Champion - RS12YCNGK - BPR6EFS Spark Plug Gap .045 in. (1.1 mm) Timing (at idle rpm)4 10° BTDC 8° BTDC Preliminary Idle Mixture 1 1/4 Turns DNA Thermostat 160° F (71° C) 1 Power Rated in Accordance with NMMA (National Marine Manufacturers' Association) rating procedures. 2 Power Rated in Accordance with SAV1 rating procedures. This rating procedure is used to certify that the engine complies with "Stage 1" Bodensee and Swiss Regulations. Horsepower differences in test rpm, allowable test tolerances, and/or installation of special kit components.3 Measured using an accurate service tachometer with engine at normal operating temperature.4 Timing must be set using a special procedure as outlined in the appropriate section of this manual. Timing can-not be properly set using the conventional method.5 A special procedure must be followed to adjust idle rpm.

Consult your Authorized Mercury MerCruiser Dealerbefore attempting this procedure.6 Idle speed on EFI models is not adjustable.7 Minimum recorded compression in any one cylinder should not be less than 70 percent of the highest recordedcylinder.8 Serial Number Break for 65 Amp alternator: OL619083 and above. MAINTENANCE SERVICE MANUAL NUMBER 25 Page 1B-6 90-861328-1 NOVEMBER 1999 Fluid Capacities NOTICE Unit Of Measurement: U.S. Quarts (Liters)All capacities are approximate fluid measures. Sterndrive Engines Model All Models Crankcase Oil (With Filter) 1 4-1/2 (4.3) Seawater Cooling System 2 15 (14.1) Closed Cooling System 20 (19) 1 Always use dipstick to determine exact quantity of oil or fluid required.2 Seawater Cooling System capacity information is for winterization use only.

Sterndrives NOTICE Unit Of Measurement: U.S. Fluid Ounces (Milliliters)All capacities are approximate fluid measures.

Model ALPHA ONE Drive Unit Oil Capacity (With Gear Lube Monitor) 64 (1892) Model BRAVO TWO BRAVO THREE Drive Unit Oil Capacity (With Gear Lube Monitor) 88 (2603) 104 (3076) 96 (2839) MAINTENANCESERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1B-7 20-Hour Break-In Period IMPORTANT: The first 20 hours of operation is the engine break-in period.

Correctbreak-in is essential to obtain minimum oil consumption and maximum engine per-formance. 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 condi-tions 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. During next 10 hours. normal operating temperature. After Break-in Period To help extend the life of your Mercury Mercruiser power package, the following recommen-dations should be considered:• Use a propeller that allows the engine to operate at or near the top of the maximum rpm range (refer to "Specifications" section) when at full throttle with a normal boat

load. • Operation at 3/4 throttle setting or lower is recommended. Refrain from prolonged op-eration, an Authorized Mercury MerCruiser Dealer should be contacted to discuss and/or perform various scheduled maintenance items. If you arein 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, whicheveroccurs first. MAINTENANCE SERVICE MANUAL NUMBER 25 Page 1B-8 90-861328--1 NOVEMBER 1999 CA261 Specifications Fuel RecommendationsIMPORTANT: Use of improper gasoline can damage your engine seriously.

Enginedamage resulting from use of engine, anddamage caused thereby will not be covered under the limited warranty. FUEL RATINGS Mercury 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. Premiumgasoline [92 (R+M)/2 Octane] is also acceptable. DO NOT use 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 are Alcohol (Ethanol) or Ether (MTBE or ETBE).

If Ethanol is the "oxygen-ate" that is used in the gasolines Containing Alcohol." These "Reformulated Gasolines" are acceptable for use in your Mercruiserengine. VAPOR LOCKING Fuels containing alcohol and winter grade fuels will aggravate vapor lock problems. A vaporlock condition can be identified by the following problems:• Engine starts and, upon advancing throttle, shuts off and will not restart. • If engine does restart, it shuts off when advancing throttle. • Engine is difficult to restart after operating the boat and then leaving the boat and then leaving the boat and then leaving the starts and, upon advancing throttle. ited to:• air temperature • fuel tank location • fuel supply system • engine coolant temperature and vacuum of fuel to engine compartment air temperature and vacuum of fuel to engine compartment air temperature and vacuum of fuel to engine compartment air temperature and vacuum of fuel to engine contact and vacuum of fuel to engine compartment air temperature and vacuum of fuel to engine co

NOVEMBER 1999 Page 1B-9 CA618 GASOLINES CONTAINING ALCOHOL If the gasoline in your area contains either "methanol" (methyl alcohol), you should be aware of certain adverse effects that can occur. These adverseeffects are more severe with "methanol." Increasing the percentage of alcohol in the fuel canalso worsen these adverse effects. Some of these adverse effects are caused because the alcohol in the gasoline can absorb moisture from the gasoline in the fuel system components on your Mercury not know what percentage your boat's fuel system will withstand. Contact your boat manufacturer for specific recommendations on the boatsfuel system components (fuel tanks, fuel lines and fittings).

Be aware that gasolinescontaining alcohol may cause increased: • Corrosion of metal parts. • Deterioration of rubber or plastic parts. • Fuel permeation through rubber fuel lines. • Starting and operating difficulties. WARNINGFIRE 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. Carefulperiodic inspection of entire fuel system is mandatory, particularly after storage.

Allfuel components including fuel tanks, whether plastic metal or fiberglass, fuellines, fittings, fuel filters and carburetors/fuel injection components should be in-spected for leakage, softening, hardening, swelling or corrosion. Any sign of leak-age or deterioration requires replacement before further engine operation. Because of possible adverse effects of alcohol in gasoline, it is recommended that only alco-hol-free gasoline be used where possible. If only fuel containing alcohol is available, or ifthe presence of alcohol is available, or ifthe presence of alcohol is available. storage of gasoline in the fuel tank for long periods should be avoided.

Longperiods of storage, common to boats, create unique problems. In cars alcohol-blendfuels normally are consumed before they can absorb enough for phase separation to take place. Inaddition, internal corrosion may take place during storage if alcohol has washed pro-tective oil films from internal components. MAINTENANCE SERVICE MANUAL NUMBER 25 Page 1B-10 90-861328--1 NOVEMBER 1999 Test For Alcohol Content In Gasoline. Use any small transparent bottle or tube that can be capped and is, or can be, provided with graduations or a mark at about 1/3 full. A pencil mark on a piece of adhesivetape may be used. PROCEDURE 1. Fill the container, Theproportions of fuel to water are not critical, but there should be 2 to 3 times as much fuelas water. 3. Shake container vigorously and allow it to sit upright for 3 to 5 minutes.

If the volume of water appears to have increased, alcohol is present. If you are not sure, there is noneed for concern. If the dividing line between water and fuel becomes cloudy, use themiddle of the cloudy band.

Power Steering Fluid Use Ouicksilver Power Trim and Steering Fluid or automatic transmission Fluid (ATF)Dexron III. Coolant for Closed Cooling System at any time. We recommend that the coolant section of closed cooling system be filled with ExtendedLife Ethylene Glycol 5/100 Antifreeze/Coolant mixed 50/50 with purified water. In areaswhere the possibility of freezing does not exist, it is permissible to use a solution of rust inhi-bitor and water (mixed to manufacturer's recommendations). If any non-compatible coolant is added to this coolant, coolant must be changed every 2 years or 400 hours, whichever occurs first. All coolants other than Extended Life 5/100Ethylene Glycol Antifreeze/Coolant must be changed every 2 years or 400 hours, whichever occurs first. Mercury MerCruiser V-8 engines can use any type of permanent antifreeze or any brandantifreeze solution that meets GM specification 1825M. MAINTENANCESERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1B-11 CA693 Crankcase Oil To help obtain optimum engine performance and to provide maximum protection, westrongly 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 goodgrade, straight weight, detergent automotive oil of correct viscosity, with an APIclassification of SH,CF/CF-2, may be used. In those areas where Quicksilver 4-Cycle 25W-40 Marine Engine Oil or a recommendedstraight weight oil are not available, a multiviscosity 20W-40 (SH, CF/CF-2) or, as a secondbut 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 Quicksil-ver 25W-40 or a good quality 20W-40 or 20W-50), synthetic oils, low quality oils or oilsthat contain solid additives are specifically not recommended. The chart below is a guide to crankcase oil selection. The oil filter should always be changed with oil. 70534 Quicksilver 4-Cycle Marine Engine Oil SAE 20W SAE 30W SAE 40W 32° F0° C 50° F10° C AIR TEMPERATURE Overfilled crankcases (oil level being too high ) can cause a fluctuation or drop in oil pressureand rocker arm "clatter" on Mercury MerCruiser engines. The over-full condition results inthe engine crankshaft splashing and agitating the oil, causing it to foam (become aerated). The aerated oil causes the hydraulic valve lifters to "bleed down." This, in turn, results inrocker arm "clatter" and loss of engine performance, due to the valves not opening properly. Care must be taken when checking engine oil level. Oil level must be maintained between the following steps are done before checking the oil level. Boat "at rest" in the water, or • If boat is on a trailer, raise or lower bow until the boat is setting at the approximate anglethat it would be if setting "at rest" in the water.

• Allow sufficient time for oil to drain into the crankcase if engine has just been run or oilhas just been added. MAINTENANCE SERVICE MANUAL NUMBER 25 Page 1B-12 90-861328--1 NOVEMBER 1999 Checking Engine Oil Level / FillingIMPORTANT: ENGINE CRANKCASE OIL MUST BE CHECKED AT INTERVALSSPECIFIED IN "MAINTENANCE SCHEDULE" CHART. It is normal for an engine to use certain amount of oil in the process of lubrication and cooling of the engine. The amount of oil consumption is greatly dependent upon engine and allow boat to come to a rest. 2. Allow oil to drain back into oil pan - approximately 5 minutes. 3. Remove dipstick. 4. Wipe clean and reinstall.

Push dipstick all the way into dipstick tube. 5. Remove dipstick and note the oil level. 6. Oil level must be between the FULL or OP RANGE and ADD marks. 7. If oil level is below ADD mark, proceed to Steps 8.

and 9. 8. Remove oil filler cap from valve rocker arm cover.

9. Add required amount of oil to bring level up to, but not over, the FULL mark on dipstick. Changing Oil and Filter 1. Start engine and run until it reaches normal operation, as it flows more freely, carrying away more impurities. 2. Stop engine. 3. Remove drain plug from oil pan or from oil drain hose. IMPORTANT: If engine is factory equipped with Quick Drain Oil Hose, pull tetherthrough bilge drain before removing drain plug is not accessible because of boat construction, oil may be removed through dipstick tube, using a Quicksilver Crankcase Oil Pump (See Ouicksilver AccessoryGuide.) 4

After oil has drained completely, reinstall drain plug (if removed) and tighten securely. 5. Remove and discard oil filter and its sealing ring. 6. Coat sealing ring on new filter with engine oil and install.

Tighten filter securely (followingfilter manufacturer's instructions). Do not overtighten. 7.

Fill crankcase with oil. See "Specifications" for type of oil and quantity. 8. Check dipstick to ensure oil level is up to, but not over, FULL or OP RANGE mark ondipstick. 9. Start engine and check for leaks. MAINTENANCESERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1B-13 Changing Water Separating Fuel Filter WARNINGBE careful when changing water separating fuel filter. Gasoline is extremelyflammable and highly explosive under certain conditions. Be sure ignition key isOFF. Do not smoke or allow spark or open flame in area when changing fuel filter. Wipe up any spilled fuel immediately. CAUTIONThe electric fuel pump and factory installed 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, if equipped, from around the waterseparating fuel filter and brackets outer edges. MAINTENANCE SERVICE MANUAL NUMBER 25 Page 1B-14 90-861328-1 NOVEMBER 1999 2. Remove water separating fuel filter and sealing ring from mounting bracket and discard.

70573 b a a - Fuel Filterb - Sealing Ring 3. Coat sealing ring on new filter with motor oil. 4. Thread filter wrench. 5. Start and run engine. 6. Check filter connection for gasoline leaks. If leaks exist, recheck filter installation.

7. Install cover pieces around fuel filter. Be certain top part of cover latches to lower part. MAINTENANCESERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1B-15 Power Steering SystemChecking Fluid Level ENGINE WARM 1. Stop engine. Position drive unit so that it is straight back. 2. Remove fill cap / dipstick from power steering pump and note fluid level. 74908 a b a - Fill Cap / Dipstickb - Power Steering Pump 3. Level should be between the FULL HOT mark and ADD mark, but fluid is still visible in pump reservoir, add required amount of Quicksilver Power Trim and Steering Fluid or automatic transmission fluid (ATF) Dex-ron III through fill cap opening, to bring level up to FULL HOT mark on dipstick. DO NOTOVERFILL.

5. If fluid is not visible in reservoir, a leak exists in the power steering system. Find causeand correct. Engine Cold1. With engine stopped, position drive unit so that it is straight back.

2. Remove fill cap / dipstick from power steering pump and note fluid level. 3. Level should be between FULL COLD mark and bottom of dipstick, but fluid is still visible in pump reservoir, add required amount of Quicksilver Power Trim and Steering Fluid or automatic Dexron III transmis-sion fluid (ATF), through fill cap opening, to bring level up to FULL COLD mark on dip-stick. DO NOT OVERFILL. If fluid is not visible in reservoir, a leak exists in the power steering system. Find cause and correct. MAINTENANCE SERVICE MANUAL NUMBER 25 Page 1B-16 90-861328--1 NOVEMBER 1999 Filling and BleedingIMPORTANT: Power steering system must be filled exactly as explained in the follow-ing to be sure that all air is bled from the system.

All air must be removed, or fluid inpump may foam during operation and be discharged from pump reservoir. Foamyfluid also may cause power steering pump. 3. Add Quicksilver Power Trim and Steering Fluid or Dexron III automatic transmissionfluid (ATF), as required, to bring level up to FULL COLD mark on dipstick. IMPORTANT: Use only Quicksilver Power Trim and Steering Fluid or Dexron III automatic transmission fluid (ATF), as required, to bring level up to FULL COLD mark on dipstick. of travel in each direction several times. 5. Recheck fluid level and add fluid, if necessary. 6. Install vented fill cap. Tighten securely. CAUTIONDO NOT operate engine without water being supplied to seawater pickup pump, orpump impeller may be damaged and subsequent overheating damage to enginemay result. 7. Start engine and run at fast idle (1000-1500 rpm) until engine reaches normal operatingtemperature.

During this time, turn steering wheel back and forth to end of travel in eachdirection several times. 8. Position drive unit so that it is straight back and stop engine. 9. Remove fill cap from pump. 10. Allow any foam in pump reservoir to disperse. 11. Check fluid level and add fluid, as required, to bring level up to FULL HOT mark on dip-stick. DO NOT OVERFILL 12. Reinstall fill cap. Tighten securely. IMPORTANT: Drive unit must be positioned straight back and power steering fluidmust be hot to accurately check fluid level. 13. If fluid is still foamy (in Step 5.), repeat Steps 7. through 12. until fluid does not foam and level remains constant. MAINTENANCESERVICE MANUAL NUMBER 25 90-861328-1 NOVEMBER 1999 Page 1B-17 Closed Cooling System Checking Coolant Level CAUTIONAllow engine to cool down before removing pressure cap.

Sudden loss of pressure could cause hot coolant to boil and discharge violently. After engine has cooled, turn cap 1/4 turn to allow any pressure to escape slowly, then push down and turncap all the way off. 1. Coolant level in heat exchanger should be full (to bottom of filler neck). IMPORTANT: When reinstalling pressure cap, be sure to tighten it until it contacts onfiller neck. 2. Coolant level should be between the ADD and FULL marks on coolant recovery reservoir WAINTENANCE SERVICE MANUAL NUMBER 25 Page 1B-18 90-861328--1 NOVEMBER 1999 Flushing SystemIf engine is operated in salty, polluted or mineral-laden water, flush seawater cooling system (preferably after each use) to reduce corrosion and prevent the accumulation of deposits in the system. Thoroughly flush the seawater cooling system prior to storage. NOTE: For additional protection against freezing and rust to the exhaust manifolds and other components, a 50-50 mixture of antifreeze and water can be run through the engineduring Power Package Layup. 1. Install flushing attachment b - Hose WARNINGWhen flushing, be certain the area around propeller is clear, and no one is standingnearby. To avoid possible injury, remove propeller. CAUTIONDo not run engine above 1500 rpm when flushing. Suction created by seawater pick-up pump may collapse flushing hose, causing engine to overheat. 2. Open water tap enough to cool the engine, about • of its maximum capacity. Adjust asrequired so that the engine does not overheat. 3. With drive in neutral gear, start engine and advance the throttle until the engine temperature gaugeon dash. Do not run the engine above 1500 rpm or engine overheating may occur. 4. Run engine for 10 minutes or until the discharge water is clear. 5. Slowly return the throttle to the idle position and turn engine off. IMPORTANT: DO NOT rapidly advance or return throttle as this can cause water in-gestion. MAINTENANCESERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1B-19 BOAT IN WATER 1. Raise drive unit to full UP / OUT position.

2. Install flushing attachment over water pickup holes in gear housing as shown. 3. Attach a water to full DOWN / IN position. CAUTIONDo not run engine above 1500 rpm when flushing. Suction created by seawater pick-up pump may collapse flushing hose, causing engine to overheat.

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

5. Partially open water tap (approximately 1/2 maximum capacity). DO NOT use full waterpressure. 6.

Place remote control in neutral, idle speed position, and start engine. 7. Operate engine at idle speed in neutral for 10 minutes, then stop engine. 8. Shut off water tap. 9. Raise drive unit to full UP / OUT position. 10. Remove water hose and flushing attachment. MAINTENANCE SERVICE MANUAL NUMBER 25 Page 1B-20 90-861328--1 NOVEMBER 1999 Lubrication Throttle Cable1. Lubricate pivot points and guide contact surfaces with SAE 30W motor oil. 74941 b a a a b 71359 2 Barrel Carbureted Models - Pivot Points b - Guide Contact surfaces with SAE 30W motor oil. 72016 b b a a a Typical Shift Cablea - Pivot Pointsb - Guide Contact Surface MAINTENANCESERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1B-21 Engine Coupler / U-Joint Shaft Splines are greased with Quicksilver Engine Coupler Spline Grease, 92-816391A4; universal joints are greased with Ouicksilver 2-4-C MarineLubricant. NOTE: Refer to Mercury MerCruiser Sterndrive Service Manual for sterndrive unit removaland installation, if necessary. IMPORTANT: Sterndrive Unit does not have to be removed to grease coupler. 1.

Lubricate engine coupler splines through grease fitting on coupler by applying approxi-mately 8-10 pumps of grease from a typical hand-operated grease from a typical Bravo Drive Coupler Typical Bravo Drive Coupler Typical Bravo Drive Coupler that is similar to the Alpha Coupler. a - Grease Fittingb - Quicksilver Engine Coupler Spline Grease 72531 a a Typical Bravo Drivea - Quicksilver Engine Coupler Spline Grease MAINTENANCE SERVICE MANUAL NUMBER 25 Page 1B-22 90-861328--1 NOVEMBER 1999 Sterndrive Drive Shaft Extension Models 72018 a a 72028 a a Transom End Engine Enda - Grease Fitting Cleaning Flame Arrestor WARNINGAvoid 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 allowsources of spark or open flame in area when cleaning flame arrestor and crankcaseventilation hoses. WARNINGAvoid gasoline is extremely flammable and highly explo-sive under certain conditions. NEVER use gasoline is extremely flammable and highly explo-sive under certain conditions. MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1B-23 Top Mounted Flame Arrestor1. Remove flame arrestor cover. 2. Remove crankcase ventilation hose from fitting on side of flame arrestor housing. 3. Remove flame arrestor.

76501 a a - Flame Arrestor 4. Clean flame arrestor in solvent. Blow dry with compressed air. 5. Clean crankcase ventilation hose for cracks or deterioration and replace if necessary. 7. Reinstall flame arrestor and crankcase ventilation hose. 8. Reinstall flame arrestor cover. Serpentine Drive Belt Component Location WARNINGAvoid possible serious injury. Make sure engine is shut off and ignition key isremoved before inspecting belt. NOTE: Some models will have components arranged in a different order. All configurations are not shown. Checking, replacing and adjustment procedures are the same. MAINTENANCE SERVICE MANUAL NUMBER 25 Page 1B-24 90-861328--1 NOVEMBER 1999 Serpentine Belt Routing S/N 0L619083 and Below Alpha With Closed Cooling Bravo With Power Steering Alpha With Closed Cooling Bravo With Closed Cooling Bravo With Power Steering Alpha With Closed Cooling Bravo With Power Steering Steering and Power Steering MAINTENANCESERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1B-25 Serpentine Belt Routing (Continued) S/N 0L619084 and Above 7650276503 Alpha With Power Steering Bravo With Power Steering Bravo Without Power Steering Bravo Without Power Steering Bravo Without Power Steering MAINTENANCE SERVICE MANUAL NUMBER 25 Page 1B-26 90-861328--1 NOVEMBER 1999 Inspection1. Inspect drive belt for the following: • Excessive wear • Cracks (across the belt width) may be acceptable. • Fraving • Glazed surfaces 75130 ba a - Frayingb - Cracks Replacing and/or Adjusting Tension REMOVAL 1. Loosen 5/8 in. locking nut on adjustment stud. 2. Turn adjustment stud and loosen belt. 3. Remove drive belt. INSTALLATION AND ADJUSTMENT 4.

Install drive belt on pulleys. 5. Adjust tension by loosening 5/8 in. locking nut on adjustment stud. Leave wrench onadjustment stud. NOTE: Belt deflection is 1/4 in. (6 mm) deflection with moderatethumb pressure. 6. Use 5/16 in. socket and tighten adjusting stud until the correct deflection of the belt isobtained at location specified above. MAINTENANCESERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1B-27 7. While holding adjustment stud at the correct belt tension, tighten 5/8 in. locking nut. 8. Run engine for a short period of time and recheck belt adjustment. 74908 a b a - 5/8 in. Locking Nutb - 5/16 in. Adjusting Stud Ignition Timing Thunderbolt V Models1. Connect timing light to number 1 spark plug wire. 2. Connect a jumper wire from the ignition tim-ing lead to a good ground. This has to be done before the ignition key is turned ONto lock the ignition module into Base Timing Mode. 3. Before starting the engine, connect jumper wire from timing lead is located towards the front of the engine near the distributor, as equipped for your model. 4. Start engine and run at 1300 rpm until it reaches normal operating temperature.

5. Disconnect throttle cable from the carburetor. 6. With engine at idle rpm, adjust the carburetor idle rpm, check the ignition timing. If incorrect, rotate thedistributor until timing is correct. Torque clamping screw to 18 lb-ft (25 Nm).

8. Adjust the idle mixture screw. Inward is LEAN, outward is RICH. 9. Recheck ignition timing. 10. Stop engine. Remove timing light, jumper wire has to be removed or the ignition module will staylocked in the Base Timing Mode and it will not be able to advance the ignition timingcorrectly when the engine rpm is increased. 11. Adjust and reinstall throttle cable. Open and close remote control throttle lever. Ensurethat the carburetor throttle lever is contacting the idle rpm adjusting screw every time. 12.

Restart the engine, increase rom to 1300 then return to idle position slowly and shut theengine off. Ensure that the carburetor throttle lever is contacting the idle rom screw, 13. Shut engine off. MAINTENANCE SERVICE MANUAL NUMBER 25 Page 1B-28 90-861328-1 NOVEMBER 1999 EFI1.

Connect timing light to number 1 spark plug wire. 2. Start engine and run at 1300 rpm until it reaches normal operating temperature. 3. Stop engine and connect the scan tool or timing tool to the DLC connector on the EFIwiring harness. 4. Start engine, allow rpm to stabilize. NOTE: MEFI-1 models only, manually adjust remote control throttle lever to get 1200 enginerpm.

NOTE: MEFI-3 models only, ECM will automatically adjust engine rpm to approximately 1200 rpm when put in the service mode on a scan tool or when using the timing is correct, rotate the distributor until timing is correct. Torqueclamping screw to 18 lb-ft (25 Nm). 6. Recheck ignition timing. 7. Disconnect scan tool or timing tool from DLC connector. 8. If required, return remote control throttle lever to idle position and shut off engine. 9.

Restart engine, increase rpm to 1300 then return to idle position slowly.

Ensure that engine returns to idle rpm. Readjust throttle cable, if required. 10. Shut engine off. MAINTENANCESERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1B-29 Cold Weather or Extended Storage Precautions WARNINGAlways disconnect battery cables from battery BEFORE working on fuel system to prevent fire or explosion. WARNINGBE CAREFUL while working on fuel system; gasoline is extremely flammable and highly explosive under certain conditions. Be sure that ignition key is OFF. DO NOTsmoke or allow sources of spark and/or open flames in the area. Wipe up any spilledfuel immediately. WARNINGAvoid Fire or Explosion: To prevent a potential fire hazard, be sure that engine com-partment is well ventilated and that there are no gasoline vapors present duringstarting or fogging of engine. WARNINGAvoid Fire or Explosion: Fuel injection system is pressurized during operation. Allow engine to cool down before attempting to remove the water separating fuel filter in the following procedure. Also, hold a clean shoptowel over the water separating fuel filter when removing it to help avoid fuel spray-ing on the engine. CAUTIONIf boat is in the water separating fuel filter when removing it to help avoid fuel spray-ing on the engine. restarted, to prevent water from flowing back into cooling system and/orboat. As a precautionary measure attach a tag to the ignition switch or steeringwheel of the boat with the warning that the seacock must be opened or the waterinlet hose reconnected prior to starting engine. CAUTIONDO NOT operate engine without water flowing through seawater pickup pump, aspump impeller may be damaged and subsequent overheating damage to engine without water flowing through seawater pickup pump, aspump impeller may be damaged and subsequent overheating damage to engine without water flowing through seawater pickup pump, aspump impeller may be damaged and subsequent overheating damage to engine without water flowing through seawater pickup pump, aspump impeller may be damaged and subsequent overheating damage to engine without water flowing through seawater pickup pump, aspump impeller may be damaged and subsequent overheating damage to engine without water flowing through seawater pickup pump, aspump impeller may be damaged and subsequent overheating damage to engine without water flowing through seawater pickup pump, aspump impeller may be damaged and subsequent overheating damage to engine without water flowing through seawater pickup pump, aspump impeller may be damaged and subsequent overheating damage to engine without water flowing through seawater pickup pump, aspump impeller may be damaged and subsequent overheating damage to engine without water flowing through seawater pickup pump. Closed Cooling section must bekept filled with a solution of ethylene glycol antifreeze tomanufacturer's recommended proportions to protect engine to lowest temperatureto which it will be exposed). DO NOT USE PROPYLENE GLYCOL antifreeze in closedcooling section. Seawater section, however, must be drained completely. CAUTIONA discharged battery can be damaged by freezing. MAINTENANCE SERVICE MANUAL NUMBER 25 Page 1B-30 90-861328--1 NOVEMBER 1999 CAUTIONSeawater section of cooling system MUST BE COMPLETELY drained for winterstorage, or immediately after cold weather use, if the possibility of freezing temper-atures exists. Failure to comply may result in trapped water causing freeze and/orcorrosion damage to engine. WARNINGWhen running engine with boat out of water, be certain that area in vicinity of propeller is clear and that no person is standing nearby. As a precautionary measure, it is recommended that the propeller be removed. CAUTIONDO NOT run engine above 1500 rpm, as suction created by seawater pickup pumpmay collapse water supply hose and cause engine to overheat. WARNINGBe sure that engine to ensure the following information to ensure complete draining of cool-ing system. • Engine must be as level as possible. • A wire should be repeatedly inserted into all drain holes to ensure there are noobstructions in passages. IMPORTANT: To prevent threads in manifolds, elbows and cylinder blocks from rust-ing during storage, reinstall drain plugs. NOTE: If possible, place a container under drains and hoses to prevent water from draininginto boat. MAINTENANCESERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1B-31 Power Package Layup NOTICE Refer to "Precautions" in this section BEFORE proceeding. IMPORTANT: Mercury Mercruiser strongly recommends that this service be per-formed by an Authorized Mercury MerCruiser Dealer.

Damage caused by freezing ISNOT covered by the MerCruiser Limited Warranty. 1. Fill fuel tank(s) with fresh gasoline that does not contain alcohol in fuel containing alcohol in fuel tanks (if fuelwithout alcohol is not available): Fuel tanks should be drained as low as possible andQuicksilver Gasoline Stabilizer for Marine Engines added to any fuel remaining in thetank. Refer to "Fuel Requirements" for additional information. NOTE: If desired, a portable fuel tank can be used to perform the remainder of the powerpackage layup 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 withQuicksilver Gasoline Stabilizer to circulate through fuel system. 4. Shut off engine. 5. Change oil and oil filter. 6.

Flush cooling system. Refer to "Flushing Cooling System" procedure. 7. Close the fuel shutoff valve, if equipped. If no fuel shutoff valve is present, a suitablemethod must be employed to STOP the flow of fuel shutoff valve is present, a suitablemethod must be employed to STOP the flow of fuel shutoff valve is present. 1999 8. Prepare EFI fuel system for extended storage as follows: a. Allow engine to cool down. b. Remove the water separating fuel filter.

c. Pour out a small amount of fuel into a suitable container, then add approximately 2fluid ounces (60 ml) of Quicksilver 2-Cycle Outboard Oil to fuel filter. e. Start and operate engine at idle speed until the water separating fuel filter and fuelinjection system are empty and engine stops. f.

Remove and discard water separating fuel filter. g. Install new filter. 75533a a - Water Separating Fuel Filter 9. Prepare carbureted fuel system for extended storage as follows: a. Remove flame arrestor assembly and start engine. b. While operating fuel filter. g. Install new filter. 75533a a - Water Separating Fuel Filter 9. Prepare carbureted fuel system for extended storage as follows: a. Remove flame arrestor assembly and start engine. b. While operating fuel filter. g. Install new filter. 75533a a - Water Separating Fuel Filter 9. Prepare carbureted fuel system for extended storage as follows: a. Remove flame arrestor assembly and start engine. b. While operating fuel filter. g. Install new filter. 75533a a - Water Separating Fuel Filter 9. Prepare carbureted fuel system for extended storage as follows: a. Remove flame arrestor assembly and start engine. b. While operating fuel filter. g. Install new filter. 75533a a - Water Separating Fuel Filter 9. Prepare carbureted fuel system for extended storage as follows: a. Remove flame arrestor assembly and start engine. b. While operating fuel filter. g. Install new filter. 75533a a - Water Separating Fuel Filter 9. Prepare carbureted fuel system for extended storage as follows: a. Remove flame arrestor assembly and start engine. b. While operating fuel filter. g. Install new filter. The filter 9. Prepare carbureted fuel system for extended storage as follows: a. Remove flame arrestor assembly and start engine. b. While operating fuel filter. The filter 9. Prepare carbureted fuel system for extended storage as follows: a. Remove flame arrestor assembly and start engine. b. While operating fuel filter. The filter 9. Prepare carbureted fuel system for extended storage as follows: a. Remove flame arrestor as f chambers by squirting approximately 8 ounces (227grams) of Quicksilver Storage Seal or SAE 20W engine oil into carburetor bores. c. 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. 10.

Turn ignition key to OFF position. 11. Refer to "Flushing Cooling System" and appropriately remove water supply to the sea-water pickup pump. 12. Clean flame arrestor and crankcase ventilation hoses and reinstall. 13. Lubricate all items listed in "Draining". Instructions" section. 15. On Models with Closed Cooling System: Test coolant to ensure that it will withstandthe lowest temperature expected during storage. 16. Service batteries per manufacturer's instructions. 17. Clean outside of engine and repaint any areas required with Quicksilver Primer and Spray Paint. After paint has dried, spray Quicksilver Corrosion and Rust PreventiveType II or wipe down with Quicksilver Storage Seal or SAE 20W engine oil. 18. For additional protection against freezing and rust to the exhaust manifolds and other components, a 50-50 mixture of antifreeze and water can be run through the engineduring Power Package Layup. MAINTENANCESERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1B-33 Draining Instructions DRAINING SEAWATER (RAW-WATER) COOLED MODELS NOTICE Refer to "Precautions" in this section BEFORE proceeding. IMPORTANT: Engine must be as level as possible to ensure complete draining of cooling system. 1. Remove drain plugs from bottom of port and starboard manifold fittings. 2. Remove drain plugs (port and starboard) from cylinder block or cylinder block Y-fitting. CAUTIONAvoid product damage.

Do not disturb the Y-fitting when removing the drain plug. There is an ignition control "Knock Sensor" in the upper hole of the fitting. This sen-sor must not be loosened or removed. It is tightened to a critical specification at the factory. 74073 a b cd e Starboard Side Shown (Port Similar)a - Exhaust Elbow Drain Plugb - Cylinder Block Drain Plugc - Y-Fitting (Fuel Injected Only)d - Cylinder Block Drain Plug (Fuel Injected Only)e - Knock Sensor MAINTENANCE SERVICE MANUAL NUMBER 25 Page 1B-34 90-861328--1 NOVEMBER 1999 3. Repeatedly clean out drain holes using a stiff piece of wire. Do this until entire system is drained. NOTE: It may be necessary to lift, bend or lower hoses to allow water to drain completelywhen hoses are disconnected. 4. Remove the engine water circulating pump hose or drain plug, as equipped. 72587 a 76038b a - Hose, Water Circulating pump hose or drain plug, as equipped. 75081a75018a Some Carbureted Models Fuel Injected Modelsa - Drain Plug 6. Remove seawater pump inlet hose as shown.

75533a b a - Seawater Inlet Hoseb - Hose To Cooler 7.

Crank engine over slightly with starter motor to purge any water trapped in seawaterpickup pump. DO NOT ALLOW ENGINE TO START. MAINTENANCESERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1B-35 8. After seawater section of cooling system has been drained completely: a. Install all drain plugs and tighten securely b. Reconnect hoses and tighten all hose clamps securely.

c. If NOT equipped with seacock: Seawater inlet hose must remain disconnected and plugged until engine is to be restarted. IMPORTANT: Mercury MerCruiser recommends that propylene glycol antifreeze(nontoxic and biodegradable) be used in seawater section of the cooling system forcold weather or extended storage. Make sure that the propylene glycol antifreezecontains a rust inhibitor and is recommended for use in marine engines.

Be certainto follow the propylene glycol manufacturer's recommendations. 9. For additional assurance against freezing and corrosion in the internal water passages: a.

Remove the thermostat cover and thermostat. b.

Fill the engine seawater cooling system with a mixture of antifreeze and tap watermixed to manufacturer's recommendation to protect engine to the lowest tempera-ture to which it will be exposed during cold weather or extended storage. c. Using a new gasket, reinstall thermostat and cover. Tighten cover bolts to 30 lb-ft(41 Nm). NOTE: Hoses shown removed for visual clarity.

Do not remove hoses

74493 a b c de a - Housingb - Gasketc - Thermostatd - Spacere - Fill Here MAINTENANCE SERVICE MANUAL NUMBER 25 Page 1B-36 90-861328--1 NOVEMBER 1999 DRAINING SEAWATER SECTION OF CLOSED COOLED (COOLANT) MODELS NOTICE Refer to "Precautions" in this section BEFORE proceeding. IMPORTANT: Drain seawater section of closed cooling system only. IMPORTANT: Engine must be as level as possible to ensure complete draining of cooling system. 1. Remove drain plug from the water tube or Cool Fuel System cooler, as equipped. 75081aa 75018 Some Carbureted Models Fuel Injected Modelsa - Drain Plug NOTE: It may be necessary to lift, bend or lower hoses to allow water to drain completelywhen hoses are disconnected. MAINTENANCESERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1B-37 3. Remove seawater pump inlet hose. 75533 a b a - Seawater Inlet Hoseb - Hose To Cooler 4. Remove end caps, sealing washers and gaskets from the heat exchanger. 5. Repeatedly clean out drain holes using a stiff piece of wire. Do this until entire systemis drained. 6. After seawater section of cooling system has been drained completely: a. Install all drain plugs and tighten all hose clamps securely. b. Reconnect hoses and tighten securely. b. Reconnect hoses and tighten all hose clamps securely. c. Apply Quicksilver Perfect Seal to both sides of new end plate gaskets, d. Assemble new gaskets, new sealing washers and end plates onto heat exchanger.Torque end plate screws to 36-72 lb-in. (4-8 Nm). e. If NOT equipped with seacock: Seawater inlet hose must remain disconnected and plugged until engine is to be restarted. MAINTENANCE SERVICE MANUAL NUMBER 25 Page 1B-38 90-861328--1 NOVEMBER 1999 Draining Sterndrive NOTICE Predelivery Preparation Instructions Must Be Performed Before Delivering Boat ToThe Product Owner. 1. On Bravo Drive Equipped Models: Insert a small wire (repeatedly) to make sure that speedometer pitot tube, anode cavity Vent Holec - Anode Cavity Drain Passaged - Gear Housing Water Drain Hole (One Each - Port and Starboard)e - Gear Housing Cavity Vent Holef - Gear Housing Cavity Vent Hole 2. On Alpha Drive Equipped Models: Insert a small wire (repeatedly) to make sure that speedometer pitot tube, trim tab cavity vent hole and trim tab cavity drain passage areunobstructed and drained. 71216 a d b c e f a - Speedometer Pitot Tubeb - Trim Tab Cavity Vent Holec - Trim Tab Cavity Vent Hole - Gear Housing Cavity Vent Hole - Gear Housing Cavity Vent Hole - Trim Tab Cavity Vent Hole - Trim Tab Cavity Vent Hole - Trim Tab Cavity Vent Hole - Gear Housing Cavity Vent Hole - Trim Tab Cavity Vent Hole - Trim Tab Cavity Vent Hole - Gear Housing Cavity Vent Hole - Recommissioning NOTICE Refer to "Precautions" in this section BEFORE proceeding, 1. Ensure that all cooling system hoses are connected and tight, 2. Ensure all petcocks and drain plugs are installed and tight, 3. Inspect serpentine drive belt for completion "Annually" and "Every100 hours or Annually" in maintenance schedule, except items which were performed at time of engine layup. 5.

For sterndrive unit recommissioning, refer to appropriate Sterndrive Service Manual.

CAUTIONWhen installing battery (in next step), be sure to connect positive battery cable topositive (+) terminal and negative (-) battery terminal. If battery cables are reversed, damage to electrical system WILL result.

6. Install fully charged battery. Clean battery cable clamps and terminals to help retardcorrosion. CAUTIONDO NOT operate engine without cooling water pickuppump or water pump impeller will be damaged and subsequent overheatingdamage to engine and closely observe instrumentation to ensure that all systems are func-tioning properly. 8. Carefully inspect entire engine for fuel, oil, water and exhaust leaks. 9. Check steering system, shift and throttle controls for properly. 8. Carefully inspect entire engine for fuel, oil, water and exhaust leaks. 9. Check steering system, shift and throttle controls for properly. 8. Carefully inspect entire engine for fuel, oil, water and exhaust leaks. 9. Check steering system, shift and throttle controls for properly. 8. Carefully inspect entire engine for fuel, oil, water and exhaust leaks. 9. Check steering system, shift and throttle controls for properly. 8. Carefully inspect entire engine for fuel, oil, water and exhaust leaks. 9. Check steering system, shift and throttle controls for properly. 8. Carefully inspect entire engine for fuel, oil, water and exhaust leaks. 9. Check steering system, shift and throttle controls for properly. 8. Carefully inspect entire engine for fuel, oil, water and exhaust leaks. 9. Check steering system, shift and throttle controls for properly. 8. Carefully inspect entire engine for fuel, oil, water and exhaust leaks. 9. Check steering system, shift and throttle controls for properly. 8. Carefully inspect entire engine for fuel, oil, water and exhaust leaks. 9. Check steering system, shift and throttle controls for properly. 8. Carefully inspect entire engine for fuel, oil, water and exhaust leaks. 9. Check steering system, shift and throttle controls for properly. 8. Carefully inspect entire engine for fuel, oil, water and exhaust leaks. 9. Check steering system, shift and throttle controls for properly. 8. Carefully inspect entire engine for fuel, oil, water and exhaust leaks. 9. Check steering system, shift and throttle controls for properly. 8. Check steering system, shift and throttle controls for properly. 8. Check steering system, shift and throttle controls for properly. 8. Check steering system, shift and throttle controls for properly. 8. Check steering system, shift and throttle controls for properly. 8. Chec TROUBLESHOOTINGSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1C-1 IMPORTANT INFORMATIONSection 1C - Troubleshooting Table of Contents Precautions 1C-2...

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..... TROUBLESHOOTING SERVICE MANUAL NUMBER 25 Page 1C-2 90-861328--1 NOVEMBER 1999 Precautions WARNINGAlways disconnect battery BEFORE working on fuel system toprevent fire or explosion. Improper installation of brass fittings or plugs intofuel pump or fuel filter base can crack casting and/or cause a fuel leak. Followspecific procedures given in this manual for all fuel line connections. WARNINGWhen running engine with boat out of water, be certain that area in vicinity ofpropeller is clear and that no person is standing nearby. As a precautionarymeasure, it is recommended that the propeller be removed. WARNINGBE CAREFUL while working on fuel system; gasoline is extremely flammable and highly explosive under certain conditions. Be sure that ignition key is OFF. DO NOTsmoke or allow sources of spark and/or open flames in the area. Wipe up any spilledfuel immediately. WARNINGAvoid Fire or Explosion: Fuel injection system is pressurized during operation. Usecare when removing water separating fuel filter.

Fuel could spray on hot engine causing fire or explosion. Allow engine to cool down before attempting fuel filter in the following procedure. Also, hold a clean shoptowel over the water separating fuel filter when removing it to help avoid fuel spray-ing on the engine. ventilated and that no gasoline vapors are present to prevent the possibility of a FIRE or EXPLOSION. WARNINGDO NOT leave helm unattended while performing idle speed adjustment. CAUTIONDO NOT operate engine without water flowing through seawater pickup pump, aspump impeller may be damaged and subsequent overheating damage to engine orsterndrive unit may result. CAUTIONDO NOT run engine above 1500 rpm, as suction created by seawater pickup pumpmay collapse water supply hose and cause engine to overheat. TROUBLESHOOTINGSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1C-3 Used Spark Plug Analysis Use the following illustrations for determining serviceability of spark plug. Spark plug suitable for additional service, using the followingprocedures: 1. Remove any oil deposits with solvent and dry plugs thoroughly. 2. Open electrode gap wide enough to permit cleaning and filing. 3. Remove combustion deposits from firing end of spark plug with a plug cleaner. Blow offwith compressed air to remove abrasives. 4. File electrode surfaces to restore clean, sharp edges. Again remove filings withcompressed air. 5. Reset gap to specifications by bending only side electrode with proper tool. Normal ConditionFew deposits are present and probably will be light tan or gray in color. This plug shows that plug heat range is compatible with engine, and engine is electrically and mechanically ingood running condition. With proper plug servicing (clean, file and re-gap), this plug can bereinstalled with good results. 72420 Chipped Insulator Chipped insulator careless plug re-gapping. Under certain conditions, severe detonation also can split insulator firing ends. Replace spark plug. 72420 TROUBLESHOOTING SERVICE MANUAL NUMBER 25 Page 1C-4 90-861328--1 NOVEMBER 1999 Wet Fouling (Oil Deposits)Plug becomes shorted by excessive oil entering combustion chamber, usually in engine withmany hours of operation. Worn piston rings, cylinder walls, valve guides or valve stem sealsare causes of oil entering combustion chamber.

## engines may wet foul plugs beforenormal oil control is achieved with proper break-in procedures.

Such fouled plugsmay be serviced (clean, file and re-gap) and reinstalled. 72420 Cold FoulingDry, black deposits indicate rich fuel mixture or weak ignition. Clogged flame arrestor, flooding carburetor, sticky choke or bad ignitionleads. After correcting cause, service (clean, file and re-gap) plugs and reinstall. 72421 OverheatingInsulator is dull white or gray and appears blistered. Electrodes are eroded and there is anabsence of deposits. Check that correct plug heat range is being used. Also check forover-advanced ignition timing, cooling system malfunction, lean fuel/air mixtures, leakingintake manifold or sticking valves.

Replace spark plugs.

72421 TROUBLESHOOTINGSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1C-5 High Speed GlazingInsulator has yellowish, varnish-like color, indicating that temperatures suddenly have risen, usually during hard, fast acceleration under heavy load. Normal deposits do not get achance to blow off. Instead, they melt and form a conductive coating. Replace plugs. If condition recurs, use colder heat range plug and service plugs more frequently. 72421 Scavenger DepositsPowdery white or yellow deposits are built up on shell, insulator and electrodes. This isnormal appearance with certain branded fuels. Accumulation on ground electrodes and shell areas may be unusually heavy, but may be easily chipped off. Plugs may be serviced (clean, file and re-gap) and reinstalled. 72422 Pre-Ignition DamagePre-ignition DamagePre-ignition damage is caused by ground electrode meltsfirst, followed by ground electrode. Normally, insulators are white but may be dirty if plug hasbeen misfiring. Check for correct plug heat range, advanced ignition timing, lean fuelmixture, incorrect fuel used, malfunctioning cooling system, leaking intake manifold or lackof lubrication. Replace spark plugs. 72422 TROUBLESHOOTING SERVICE MANUAL NUMBER 25 Page 1C-6 90-861328--1 NOVEMBER 1999 Reversed Coil PolarityConcave erosion of ground electrode is an indication of reversed polarity. Center electrodewill show only normal wear.

Engine will misfire and idle rough. To correct, reverse primarycoil leads. Replace spark plugs. 72422 Splashed Deposits potted deposits, which sometimes occur after along period of misfiring. When normal combustion temperatures are restored, uponinstallation of new plugs, deposits loosen from top of piston and head and are thrown againsthot insulator. Plugs may be serviced (clean, file and re-gap) and reinstalled. 72423 Mechanical DamageMechanical damage to spark plug firing end is caused by foreign object in combustionchamber.

Because of valve overlap, small objects can travel from one cylinder to another. Check all cylinders, intake manifold and exhaust material to prevent further damage.

Re-place spark plugs. 72423 IMPORTANT: When working on engine, spark plug holes and carburetor throatshould be kept covered to prevent foreign objects from entering combustionchamber. TROUBLESHOOTINGSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1C-7 Poor Boat Performance and/or Poor Maneuverability Symptom Cause A. Improper drive unit trim angle B. Improper weight distribution C. Boat is underpowered Bow too lowD. Permanent or power hook in boat bottom (marine growth) A. Improper drive unit trim angle B. Propeller pitch too great C. Dirty boat bottom (marine growth) D. Poor running engineBow too high E. Improper weight distribution F. Rocker in boat bottom G. False bottom full of water H. Improperly adjusted anode (afterplanes) A. Drive unit installed too high on transom B. Dirty or rough boat bottom C. Damaged propeller; pitch too small; diameter too small Propeller ventilating D. Keel located too close to propeller ortoo deep in the water E. Water pickup or through hull fittingslocated too close to propeller F. Hook in boat bottom G. Propeller F. Hook in boat bottom G. Propeller plugged up with weeds TROUBLESHOOTING SERVICE MANUAL NUMBER 25 Page 1C-8 90-861328--1 NOVEMBER 1999 Improper Full Throttle Engine RPM RPM Too High Cause Special Information Propeller Damaged; pitch too low; diameter toosmall; propeller hub slipping. Boat Water pickup or through hull fittingsmounted too close to propeller (ventilation); keel located too close to propeller (ventilation); keel located too close to propeller and/or too deep in the water (ventilation). Drive installed too high ontransom; wrong gear ratio. Operation Engine coupler slippingUnit trimmed out too far. RPM Too Low Cause Special Information Propeller Damaged; pitch too great; diameter toogreat. Boat Dirty or damaged bottom; false bottom full ofwater. Drive installed too low on transom; wrong gear ratio. Operation Unit trimmed in too far. TROUBLESHOOTINGSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1C-9 Engine Cranks Over But Will Not Start Or Starts Hard Important Information1. First, determine which engine system is causing the problem. To make an engine run, basic components - fuel, spark (ignition), and compression - are required.

If all threecomponents are present, the engine should run. If any one of the three are missing, weak, or arriving at the wrong time the engine will not run. 2. Check ignition system operation. Remove coil wire from tower on distributor cap. Holdcoil wire near ground and check for spark while cranking engine over. Repeat procedure with spark plug wires. If there is spark at the spark plugsand make sure they are correct type and heat range, and not fouled or burned. 3. Run a compression check on engine is mechanically OK. Thunderbolt V Ignition (No Spark) Cause Special Information Moisture on ignition components Distributor cap or spark plug wires arcing Battery, electrical connections, damaged wiring Ignition switch Shift interrupter switch (Alpha One ModelsOnly) Shorted tachometer Disconnect tachometer Disconnect tachometer and try again Ignition timing Spark plugs Fouled, burned, cracked porcelain Spark plug wires Faulty insulation, broken wires Cracked or dirty distributor cap Faulty ignition components Check components Engine synchronizer (if equipped) hookedup series on purple ignition wire (dualengines only) Synchronizers must be hooked up directlycoil terminal (parallel chute) TROUBLESHOOTING SERVICE MANUAL NUMBER 25 Page 1C-10 90-861328-1 NOVEMBER 1999 Testing Thunderbolt V Ignition System Ensure that tachometer GRY lead is not shorted toEnsure that tachometer GRY lead is not shorted toground (-) at the tachometer or within the harness. No Spark Check all terminal connections at distributor, ignition module and ignition coil.Battery OK? Distributor clamping screw tight?

No SparkCheck With key in RUN position, check for 12 volts at engine and instrumentWith key in RUN position, check for 12 volts at positive (+) terminal on ignition coil.0 Volts wiring har-ness, batterycables, key switch. Unplug WHT/RED bullet connector from distributor.0 Volts Check for 12 volts on lead coming from module. 12 Volts Reconnect WHT/RED bullet connectors. Remove high-tension lead from distributor to coil. Insert a spark gap tester from coil tower to ground. Discon-nect WHT/GRN lead that comes from module, Spark at coil.tion sensor in distributor.against ground (-). No spark at coil. Substitute a new ignition coil. Repeat above Spark at Install newSubstitute a new ignition coil.

Repeat abovetest. Spark atcoil. Install newignition coil. No spark at coil. Replace ignition module. IMPORTANT: The WHT/GRN lead must be touched against ground (-) 2-3 times persecond to simulate a running engine. Repeat this test several times to ensure that spark is present.

TROUBLESHOOTINGSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1C-11 Fuel System Rich Cause Special Information Clogged flame arrestor Excessive fuel pump pressure regulator defective Fuel System Rich Cause Special Information Clogged flame arrestor Excessive fuel pump pressure regulator defective Fuel System Rich Cause Special Information Clogged flame arrestor Excessive fuel pump pressure regulator defective Fuel System Rich Cause Special Information Clogged flame arrestor Excessive fuel pump pressure regulator defective Fuel System Rich Cause Special Information Clogged flame arrestor Excessive fuel pump pressure regulator defective Fuel System Rich Cause Special Information Clogged flame arrestor Excessive fuel pump pressure regulator defective Fuel System Rich Cause Special Information Clogged flame arrestor Excessive fuel pump pressure regulator defective Fuel System Rich Cause Special Information Clogged flame arrestor Excessive fuel pump pressure regulator defective Fuel System Rich Cause Special Information Clogged flame arrestor Excessive fuel pump pressure regulator defective Fuel System Rich Cause Special Information Clogged flame arrestor Excessive fuel Pump pressure Fu Engine will not start after warm engineshut down Miscellaneous Cause Special Information Low grade or stale fuel Water in fuel TROUBLESHOOTING SERVICE MANUAL NUMBER 1999 Engine Will Not Crank Over Cause Special Information Remote control lever not in neutral posi-tion Battery charge low; damaged wiring; looseelectrical connections Circuit breaker tripped Blown fuse Ignition switch Slave solenoid Faulty neutral start safety switch Open circuit Starter motor Mechanical engine malfunction Charging System Inoperative Cause Special Information Loose or broken serpentine belt Engine rpm too low on initial start Rev engine to 1500 rpm Loose or corroded electrical connections Faulty battery gauge Best way to test is to replace gauge Battery will not accept charge Low electrolyte or failed battery Faulty alternator or regulator Refer to SECTION 4C for complete "Charging System" diagnosis procedures TROUBLESHOOTINGSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1C-13 Noisy Alternator Cause Special Information Loose mounting bolts Drive belt Worn, frayed, loose drive pulley Worn or dirty bearings Faulty key switch Test, as outlined in SECTION 4D Faulty gauge Test, as outlined in SECTION 4D Faulty sender Test, as outlined in SECTION 4D Radio Noise Cause Special Information A "popping" noise that will increase withengine rpm. Noise will stop as soon as en-gine is turned off. Ignition System - wrong spark plugs;cracked distributor cap; cracked coil tower;leaking spark plug wires; moisture onignition components "High pitched whine" in the radio Alternator - poor brush contact on the sliprings A "hissing or crackling" noise when instru-ments are jarred with ignition on Instrumentation - loose connections, orantennae wire routed too close to instru-ments Varying unexplained noises Accessories - bilge pump, bilge blower; fish finder, depth locator; cabin heatermotor, etc. Disconnect one at a time untilnoise disappears. TROUBLESHOOTING SERVICE MANUAL NUMBER 25 Page 1C-14 90-861328--1 NOVEMBER 1999 Poor Fuel Economy Cause Special Information Fuel leaks Operator habits Prolonged idling; slow acceleration; failureto cut back on throttle once boat is onplane; boat overloaded; uneven weightdistribution Engine laboringBent, damaged, or wrong propeller. Watertest boat for proper quere fuel Crankcase ventilation system not working Engine running too cold or too hot Plugged or restricted exhaust Engine Low compression Engine Runs Poorly at Idle Symptoms Cause Engine surges Low top speed or lack of power Refer to "Fuel Injection System Trouble-Poor cold engine operation Refer to "Fuel Injection System Trouble-shooting," SECTION 5H Engine stalls Hard starting Refer to "Engine Starts Hard" TROUBLESHOOTINGSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1C-15 Engine Runs Poorly At High RPM Cause Special Information Also refer to "Poor Boat Performance" Crankcase overfilled with oil Check oil level with boat at rest in thewater. Antisiphon valve (if equipped) Restricting fuel supply Plugged fuel tank vent Fuel supply Refer to "Fuel Injection SystemTroubleshooting," SECTION 5H Ignition timing Low grade of fuel or water in the fuel Spark plugs Fouled, burned, cracked porcelain, incorrect heat range Spark plug wires Poor insulation, broken wires Distributor cap or rotor Dirty or cracked Coil Distributor Excessive play in shaft Engine overheating Refer to "Engine Overheats" Low compression Worn valves, rings, cylinders, etc. Restricted exhaust TROUBLESHOOTING SERVICE MANUAL NUMBER 25 Page 1C-16 90-861328--1 NOVEMBER 1999 Engine Acceleration Is Poor Cause Special Instructions Also refer to "Poor Boat Performance" Idle mixture screws Incorrect ignition timing Incorrect distributor or amplifier advancecurve Refer to SECTION 4B Cracked or dirty distributor cap or rotor Vacuum leak Intake manifold Spark plugs Fouled, burned; wrong heat range; cracked porcelain Low compression Troubleshooting with Vacuum Gauge Reading Cause Steady reading between 15-21 inches atidle rpm Normal Extremely low reading, but steady at idlerpm Vacuum leak; incorrect timing; underpowered boat; faulty boat bottom Fluctuates between high and low at idlerpm Blown head gasket between two adjacentcylinders Fluctuates 4 or 5 inches very slowly at idlerpm Spark plug gap too narrow, valves aresticking Fluctuates rapidly at idle, steadies as rpmis increased Valve guides are worn Continuously fluctuates between low andnormal reading at regular intervals at idlerpm Burned or leaking valve TROUBLESHOOTINGSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1C-17 Engine Noise Important InformationNo definite rule or test will positively determine source of engine noise; therefore, use thefollowing information only as a general guide to engine noise is timed with engine speed or one-half enginespeed. Noises timed with engine speed are related to crankshaft, rods, pistons, pistonpins and flywheel. Noises timed to one-half engine speed are valve train related.

The use of a stethoscope can aid in locating a noise source. However, because noisewill travel to other metal parts not involved in the problem, caution must be exercised. 3. If you believe noise is confined to one particular cylinder, ground spark plug leads, oneat a time. If noise lessens noticeably or disappears, it is isolated to that particular cylinder. 4. Try to isolate the noise to location in engine: front to back, top to bottom. This can helpdetermine which components are at fault. 5. Sometimes noises can be caused by moving parts coming in contact with othercomponents. Examples are: flywheel or coupler; exhaust flappers rattling against exhaust pipe; crankshaft striking (pan, pan baffle, or dipstick tube); rocker arm strikingvalve cover; and loose flywheel cover. In many cases if this is found to be the problem, a complete engine teardown is not necessary.

6. When noise is isolated to a certain area and component, removal and inspection will berequired. Refer to proper sections of service. 7. If noise cannot be distinguished between engine and drive unit, remove drive from boat. Run a water supply directly to engine. Run engine without the drive to determine if noiseis still there. Valve Cover Area Location Possible Causes Rocker arm striking valve cover area, timed to one-half engine Rocker arm out of adjustment speed, noise could be confined to onecylinder or may be found in any multitude of cylinders Bent push rod Collapsed lifter TROUBLESHOOTING SERVICE MANUAL NUMBER 25 Page 1C-18 90-861328--1 NOVEMBER 1999 Cylinder area, may be confined to one Bent connecting rod cylinder area, may be confined to one Bent connecting rod installed wrong Cylinder area, may be confined to one Bent connecting rod cylinder area, may be confined to one Piston pin Cylinder worn Camshaft Area Location Possible Causes Crankshaft timing sprocket Camshaft area, front of engine, timed to Timing chainCamshaft area, front of engine, timed to Timing chainCamshaft area, front of engine speed Valve Lifter Cam Bearings Fuel Pump Camshaft area, center of engine, timed to Timing chainCamshaft area, front of engine speed Valve Lifter Cam Bearings Fuel Pump Camshaft area, front of engine speed Valve Lifter Cam Bearings Fuel Pump Camshaft area, front of engine speed Valve Lifter Cam Bearings Fuel Pump Camshaft area, front of engine speed Valve Lifter Cam Bearings Fuel Pump Camshaft area, front of engine speed Valve Lifter Cam Bearings Fuel Pump Camshaft area, front of engine speed Valve Lifter Cam Bearings Fuel Pump Camshaft area, front of engine speed Valve Lifter Cam Bearings Fuel Pump Camshaft area, front of engine speed Valve Lifter Cam Bearings Fuel Pump Camshaft area, front of engine speed Valve Lifter Cam Bearings Fuel Pump Camshaft area, front of engine speed Valve Lifter Cam Bearings Fuel Pump Camshaft area, front of engine speed Valve Lifter Cam Bearings Fuel Pump Camshaft area, front of engine speed Valve Lifter Cam Bearings Fuel Pump Camshaft area, front of engine speed Valve Lifter Cam Bearings Fuel Pump Camshaft area, front of engine speed Valve Lifter Cam Bearings Fuel Pump Cam Bearin bearing Distributor gear Camshaft area, rear of engine, timed toone half engine speed Valve lifterone half engine speed Valve liftersto one half engine speed Valve liftersto one half engine, timed toone half engine speed Valve lifterone half engine speed Valve liftersto one half engine speed Valve lifterone half engine speed Valve liftersto one half engine speed Valve lif NOVEMBER 1999 Page 1C-19 Crankshaft area, front of engine, timed to engine speed Main bearing Rod bearing Crankshaft area, front of engine, timed to engine speed Rod bearing Loose flywheel cover Loose couplerCrankshaft area, rear of engine, timed to Loose flywheelengine speed Main bearings to engine speed Rod bearing Rod bearing Rod bearing Loss of oil pressureCrankshaft area, throughout engine, timed Main bearings to engine speed Rod bearing STROUBLESHOOTING SERVICE MANUAL NUMBER 25 Page 1C-20 90-861328--1 NOVEMBER 1999 Miscellaneous Noise Possible Cause Advanced timing Low octane fuelEngine spark knock Engine running hot Carbon deposits in engine Vacuum leak Whistle Dry or tight bearing in an accessory Leaking high tension lead Sparks jumping Cracked coil tower Cracked distributor cap Serpentine drive belt slipping Squeaks or squeals Dry or tight bearing in an accessory Parts rubbing together Rattling in exhaust shutters TROUBLESHOOTINGSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1C-21 Oil Pressure Miscellaneous Cause Special Information Measuring oil pressureUse a good automotive oil pressure testgauge. Do not rely on the oil pressure gauge fluctuation, drop in oil pres-sure, and hydraulic valve lifter noise athigh rpm Oil level in crankcase below ADD markLow oil pressure gaugefluctuation; internal engine is not up tooperating temperature. As the airtemperature warms up and engine isrunning at normal opening temperature, it is normal for oil pressure to drop. Low engine oils, lowoil pressure readings at idle do not "clatter" (at idle), there is a sufficient volume of oil to lubricate allinternal moving parts properly. The reasonfor the drop in oil pressure is that engineent causes an expansion of the internal tolerances in the engine and, also, the oilwill get thin somewhat from heat. Low engine oil pressure at idle after run-ning at a high rpm Refer to the two preceding steps Boats with dual engines. Low engine oil pressure at idle after run-ning at a high rpm Refer to the two preceding steps. different oilpressure readings between the two engines, as long as both engines fall Boats with dual stations. Differences in oilpressure can be attributed to differences in Pressure Cause Special Information Low oil level in crankcase Defective oil pressure gauge and/orsender Verify with an automotive test gauge. Refer to SECTION 4D for instrumenttesting.

Thin or diluted oil Oil broken down; contains water or gas; wrong viscosity; engine running too hot ortoo cold; excessive idling in cold water(condensation) Oil pump, air leakon suction side of oil pump relief valve stuck open; pickup tuberestricted; worn parts in oil pump; air leakon suction side of oil pump relief valve stuck open; pickup tuberestricted; worn parts in oil pump; air leakon suction side of oil pump relief valve stuck open; pickup tuberestricted; worn parts in oil pump; air leakon suction side of oil pump relief valve stuck open; pickup tuberestricted; worn parts in oil pump; air leakon suction side of oil pump; air cracked orporous cylinder block Excessive bearings, main bearings, main bearings, main bearings, rodbearings, rodbearings, main bearings, rodbearings, rodbearings, rodbearings, main bearings, rodbearings, rodbearings, rodbearings, main bearings, rodbearings, rodbea TROUBLESHOOTINGSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1C-23 Excessive Oil Consumption Cause Special Information Normal consumption. One quart of oil consumption Cause Special Information Normal Caus whitepaper on bilge floor, locate oil leak(s) Oil too thin Oil diluted or wrong viscosity Oil level too high Drain holes in cylinder head plugged Oil will flood valve guides Defective piston ringsGlazed, scuffed, worn, stuck, improperlyinstalled; ring grooves worn; improperbreak-in; wrong end gap Defective cylindersOut of round, scored, tapered, glazed; excessive bearing clearance; cracked piston to cylinder clearance; tapered, glazed; excessive bearing clearance; tapered, glazed; excessive bearing; tapered, glazed; excessive bearing; tapered, glazed; excessive bearing; tapered, glazed; excessive; tapered; Important InformationIMPORTANT: First determine location of water in engine. This information can helpdetermine where the water came from and how it got into the engine. The three mostcommon problems are water in crankcase oil or water in crankcase oil and on top of pistons. After locating water remove all the water from the engine by removing all spark plugs and pumping cylinders out by cranking engine over. Change oil and filter.

Replace spark plugs. Start engine and see if problem can be duplicated. If problem can be duplicated, there is a mechanical problem. If the problem that exists only under certain environmental conditions. If water is contained to cylinder(s) only, it is usually entering through the intake system, exhaust system, or head gasket.

If the water is contained to crankcase only, it is usually caused by a cracked or porous block, a flooded bilge or condensation. If the water is located in both the cylinders, or complete submersion. Checking for rust in the intake manifold or exhaust manifolds is a good idea. Rust in theseareas will give clues if the water entered these areas. TROUBLESHOOTINGSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1C-25 Water on Top of Pistons Cause Special Information Operator shut engine off at high rpm Engine "diesels" or tries to run backwards Poor fuel, high idle rpm timing set toohigh Rain water running into flame arrestor Hatch cover Spark plug misfiring Improper combustion causes moisture in the cylinder head bolts Blown cylinder head gasket Check for warped cylinder block, and intake manifold Water in Crankcase Oil Cause Special Information Water in boat bilgeBoat has been submerged or bilge waterwas high enough to run in through dipsticktube Water seeping past piston rings or valves Refer to "Water in Engine" ("On Top of Pis-tons") Engine running cold Defective thermostat, missing thermostat NUMBER 25 Page 1C-26 90-861328--1 NOVEMBER 1999 Engine Overheats Mechanical Cause Special Information Engine rpm below specifications at wide-open-throttle (engine laboring) Damaged or wrong propeller; growth onboat bottom; false bottom full of water Wrong ignition timing Timing too far advanced or retarded Sticking distributor advance weights Spark plug wires crossed (wrong firingorder) Lean fuel mixture Wrong heat range spark plugs Exhaust restriction Valve timing off Jumped timi low rpm, but will overheat atspeeds above 3000 rpm. Engines that are seawater cooled:Using a clear plastic hose, look for airbubbles between thermostat housing and manifold(s). If airbubbles are present at a higher rpm, it is agood indication there is a blown headgasket. Insufficient lubrication to moving parts of engine Defective oil pump, plugged oil passage, low oil level TROUBLESHOOTINGSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1C-27 Engine Overheating or the temperature gauge or sender is faulty.IMPORTANT: Best way to test gauge or sender is to replace them. Loose or broken drive belt Seawater pump inlet(models with belt driven seawater pumponly) Pump will suck air. Pump may fail to primeor will force air bubbles into cooling system. Seawater pickup clogged Obstruction on boat bottom causing waterturbulence Obstruction will be in front of seawaterpickup, causing air bubbles to be forcedinto cooling system Defective thermostat Exhaust elbow water outlet holes plugged Insufficient seawater pump operation Worn pump impeller Obstruction in cooling system such ascasting flash, sand, rust, salt, etc. Refer to water flow diagram for enginetype being serviced Engine Contents -Mechanical" IMPORTANT: In addition to previous checks, make the following checks if engine equipped with closed cooling. Low coolant level Antifreeze not mixed properlyAntifreeze should be mixed 50/50 ormaximum 60/40 (60% antifreeze, 40% water) Heat exchanger cores plugged Water hoses reversed at the water distribution block Refer to water flow diagram in SECTION 6 TROUBLESHOOTING SERVICE MANUAL NUMBER 25 Page 1C-28 90-861328--1 NOVEMBER 1999 Insufficient Water Flow from Belt Driven Seawater Pickup Pump Cause Special Information Drive belt Loose, worn or broken Seawater Pickup and seawater pump inlet Pump will suck air, pump may fail to primeor will force air bubbles into coolingsystem Seawater pump TROUBLESHOOTINGSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1C-29 Power Steering Poor, Erratic or No Assist Cause Special Information Drive belt Worn, broken or out of adjustment Low fluid level Air in systemAir leak in lines, pump or air frominstallation.

Refer to SECTION 9A forbleeding procedure. Leaking hoses Refer to SECTION 9A for bleeding procedure. Steering cables and/or steering helmCable or helm partially frozen from rust orcorrosion; cable over-lubricated; impropercable installation. Binding in sterndrive unit Refer to appropriate Sterndrive ServiceManual Restriction in hydraulic hoses Causes a loss of pressure Control valve not positioned properly, notbalanced properly, or the mounting nut isloose Mounting screw loose fitting spool TROUBLESHOOTING SERVICE MANUAL NUMBER 25 Page 1C-30 90-861328--1 NOVEMBER 1999 Noisy Pump or air frominstallation Faulty pump Use stethoscope to listen for noise inpump Restricted fluid passages Kinks or debris in hoses or debris inpassages Stop nut adjusted improperly Refer to appropriate Sterndrive ServiceManual Fluid Leaks Cause Special Information Loose hose connections Refer to appropriate Sterndrive ServiceManual Fluid Leaks Cause Special Information Loose hose connections Refer to appropriate Sterndrive ServiceManual Fluid Leaks Cause Special Information Loose hose connections Refer to appropriate Sterndrive ServiceManual Fluid Leaks Cause Special Information Loose hose connections Refer to appropriate Sterndrive ServiceManual Fluid Leaks Cause Special Information Loose hose connections Refer to appropriate Sterndrive ServiceManual Fluid Leaks Cause Special Information Loose hose connections Refer to appropriate Sterndrive ServiceManual Fluid Leaks Cause Special Information Loose hose connections Refer to appropriate Sterndrive ServiceManual Fluid Leaks Cause Special Information Loose hose connections Refer to appropriate Sterndrive ServiceManual Fluid Leaks pump System overfilled; fluid contains water; fluid contains air Cylinder piston rod seal Faulty seals in o-rings in pump Cracked or porous metal parts TROUBLESHOOTING SERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 1C-31 THIS PAGE IS INTENTIONALLY BLANK TROUBLESHOOTING SERVICE MANUAL NUMBER 25 Page 1C-32 90-861328--1 NOVEMBER 1999 THIS PAGE IS INTENTIONALLY BLANK 2A MCM MODELSSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 2A-1 REMOVAL AND INSTALLATIONSection 2A - MCM Models Table of Contents Torgue Specifications 2A-2...

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..... Mercathode Connections 2A-12...... Shift Cable Installation 2A-12...... Power Steering Connections 2A-12..... Fuel Supply Connections 2A-13...... Throttle Cable Installation and Adjustment 2A-14.

MCM MODELS SERVICE MANUAL NUMBER 25 Page 2A-2 90-861328--1 NOVEMBER 1999 Torque Specifications Fastener Location lb-in. lb-ft Nm Cable Barrel Spread Cotter KeyDrive Unit Shift Cable End Guide See Note Hose Clamps Securely Rear Engine Mounts 35-40 47-54 Power Steering Fluid Hose Fitting 23 31 Remote Control Shift Cable Barrel SecurelyRemote Control ShiftCables Cable End Guide See Note NOTE: Tighten, then loosen nut 1/2 turn. Tools Description Part Number Engine Coupler Spline Grease 91-816391A4 Quicksilver Liquid Neoprene 92-27511-2 Loctite 592 Pipe Sealant With Teflon Obtain Locally MCM MODELSSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 2A-3 Removal. Refer to Sterndrive service Manual. 1. Disconnect battery cables from battery. 2. Remove instrument harness connector plug from engine harness receptacle afterloosening clamp. WARNINGBe careful when working on fuel system Gasoline is extremely flammable and highly explosive under certain conditions. Do not smoke or allow spark or openflame in area. Wipe up any spilled fuel intent, loosen fuel line to prevent fuel in tank from leaking into bilge. 4. Disconnect throttle cable from carburetor or throttle body and retain locknuts and hard-ware. 5. Disconnect trim sender bullet connectors from transom assembly from engine harness. NOTE: After wires are disconnected be sure to loosen them from transom assembly from engine harness wires from shift cut-out switch harness, 7. Disconnect MerCathode wires from MerCathode controller if mounted on engine, ifequipped. 8. Disconnect exhaust elbow hoses (bellows). 10. Remove both shift cables from shift plate. Retain locknuts and hardware. 11. Disconnect exhaust elbow hoses (bellows). 10. Remove both shift cables from shift plate. Retain locknuts and hardware. 11. Disconnect exhaust elbow hoses (bellows). 10. Remove both shift cables from shift plate. Retain locknuts and hardware. 11. Disconnect exhaust elbow hoses (bellows). 10. Remove both shift cables from shift plate. Retain locknuts and hardware. 11. Disconnect exhaust elbow hoses (bellows). 10. Remove both shift cables from shift plate. Retain locknuts and hardware. 11. Disconnect exhaust elbow hoses (bellows). 10. Remove both shift cables from shift plate. Retain locknuts and hardware. 11. Disconnect exhaust elbow hoses (bellows). 10. Remove both shift cables from shift plate. Retain locknuts and hardware. 11. Disconnect exhaust elbow hoses (bellows). 10. Remove both shift cables from shift plate. Retain locknuts and hardware. 11. Disconnect exhaust elbow hoses (bellows). 10. Remove both shift cables from shift plate. Retain locknuts and hardware. 11. Disconnect exhaust elbow hoses (bellows). 10. Remove both shift cables from shift plate. Retain locknuts and hardware. 11. Disconnect exhaust elbow hoses (bellows). 10. Remove both shift cables from shift plate. Retain locknuts and hardware. 11. Disconnect exhaust elbow hoses (bellows). 10. Remove both shift plate. Retain locknuts and hardware. 11. Disconnect exhaust elbow hoses (bellows). 10. Remove both shift plate. Retain locknuts and hardware. 11. Disconnect exhaust elbow hoses (bellows). 10. Remove both shift plate. Retain locknuts and hardware. 11. Disconnect exhaust elbow hoses (bellows). 10. Remove both shift plate. Retain locknuts and hardware. 11. Disconnect exhaust elbow hoses (bellows). 10. Remove both shift plate. Retain locknuts elbow hoses (bellows). 10. Remove both shift plate. Retain locknuts elbow hoses (belbow hoses) Disconnect and plug fluid hoses from power steering control valve on transom. MCM MODELS SERVICE MANUAL NUMBER 25 Page 2A-4 90-861328--1 NOVEMBER 1999 CAUTIONCenter lifting eye (located on top of thermostat housing) is used for enginealignment only. DO NOT use to lift entire engine. CAUTIONDO NOT allow lifting sling to hook or compress engine components or damage willoccur. 13. Support engine with suitable sling through lifting eyes on engine and remove front andrear engine with suitable sling through lifting eyes on engine. DO NOT hit power steering control valve. MCM MODELSSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 2A-5 Installation and Alignment 1. Inspect fiber washers onto inner transom plate inside fiber washer. 3. Ensure that rear engine mount locknuts are in position. 4. Lubricate exhaust bellows with soap and water to ease installation. 5. Lubricate engine coupler splines with Quicksilver Engine Coupler Spline Grease. 72023d c b a a - Double Wound Lockwasherb - Fiber Wound Lockwa CAUTIONCenter lifting eye (located on top of thermostat housing) is used for engine and adjust so that engine is level whensuspended. 7. Lift engine into position (in boat), using an overhead hoist. 8. Align rear engine mounts with inner transom plate mounts while simultaneously aligningexhaust tubes with exhaust pipe hoses (bellows). MCM MODELS SERVICE MANUAL NUMBER 25 Page 2A-6 90-861328--1 NOVEMBER 1999 IMPORTANT: Engine attaching hardware must be installed in sequence shown. 9. Install both rear engine mounting Bolts and hardware as shown. Torque to 37 lb-ft (50Nm). 72535 ab d e f g h c a - Rear Engine Mounte - Double Wound Lockwasherf - Fiber Washer (Cemented in Place)g - Inner Transom Plate Mountsh - Locknut (Hidden In This View) CAUTIONWhen lowering engine into position DO NOT set engine on shift cable. Shift cableouter casing can be crushed causing difficult or improper shifting. 10. Set engine down on stringers and relieve hoist tension. Disconnect sling from enginelifting eyes and switch sling to center lifting Eyeb - Engine Lifting Eyes MCM MODELSSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 2A-7 CAUTIONDO NOT use an alignment tool from another manufacturer. Alignment tools other than Ouicksilver Alignment Tool 91-805475A1, may cause improper alignment and damage to gimbal bearing, engine coupler, or alignment tool: I DO NOT attempt to force alignment tool! DO NOT raise or lower engine with alignment tool inserted (or partially inserted)in gimbal bearing or engine coupler. CAUTIONAvoid damage to exhaust system. On engine swith single piece manifolds, stresscan be placed on the lower exhaust pipe if front of engine is raised too high whileperforming engine alignment procedure. 72536 a bc d e Engine Mounta - Nut and Lockwasherb - Adjustment Nutc - Turn Adjustment Nut in This Direction (Counterclockwise)d - Slotted Hole Toward Front of Enginee - Tab Washer MCM MODELS SERVICE MANUAL NUMBER 25 Page 2A-8 90-861328--1 NOVEMBER 1999 11. Align engine as follows: a. Attempt to insert solid end of Quicksilver Alignment Tool through gimbal bearing and out of engine coupler splines. If it will not insert easily proceed to following. b. While observing the above precautions, CAREFULLY raise and lower front of engine coupler splines. If it will not insert easily proceed to following. b. While observing the above precautions, CAREFULLY raise and lower front of engine coupler splines. Alignment Tool (91-805475A1)b - Insert This End of Alignment Tool through Gimbal Housing Assembly 72585 a b c a - Alignment Tool (91-80547A1)b - Gimbal Bearingc - Engine mount adjustment nuts an equal amount indirection required to align engine. c. Adjust front engine mounts until they rest on boat stringers. d. Relieve hoist tension entirely and fasten both front mounts to boat stringer usingappropriate hardware (lag bolts or through-bolts, etc.). e. Recheck alignment with alignment tool. Tool must enter coupler splines freely. If not, readjust front mounts. f. When alignment is correct, tighten locknut or nut with lockwasher on each mountsecurely. MCM MODELSSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 2A-9 g. Bend tab washer down against flat on adjusting nut. 72536 a bc d e a - Locknutb - Adjustment Nut In This Direction (Counterclockwise) To Raise Front Of Engined - Slotted Hole To Front Of Enginee - Tab Washer h. Remove alignment tool if not already removed. 12. Tighten all exhaust system hose clamps on each con-nection): a. On Engines with Thru-Prop Exhaust: 72537 b a a Thru Prop Exhaust Showna - Hose Clamps b - Exhaust Tube - Long Tube, Port Side - Short Tube, Starboard Side MCM MODELS SERVICE MANUAL NUMBER 25 Page 2A-10 90-861328--1 NOVEMBER 1999 Engine ConnectionsIMPORTANT: When routing all wire harnesses and hoses, be sure they are routed and secured to avoid coming in contact with hot spots on engine and avoid contact withmoving parts. 1. Connect seawater hose to water tube at gimbal housing with hose clampc - Seawater Inlet 72614 b aa b c Alpha Modelsa - Water Inlet Tubeb - Hose Clampc - Seawater Inlet 72614 b aa b c Alpha Modelsa - Water NUMBER 25 90-861328--1 NOVEMBER 1999 Page 2A-11 Electrical Connect instrument harness to engine harness in engine harness to engine harness) - BLK (From Engine Harness) -(From Transom)d - BLK (From Transom Assembly) IMPORTANT: Do not attach any accessory ground (-) wires to transom plate groundpoint. Accessory ground wires should only be attached to ground stud on engine. 3. Connect any grounding wires or accessories that may have been disconnected. MCM MODELS SERVICE MANUAL NUMBER 25 Page 2A-12 90-861328--1 NOVEMBER 1999 Mercathode controller assembly. Apply a thin coat of Quicksilver Liquid Neoprene to all connections. 22232a b c d a - ORG Wire - From Electrode on Transom Assembly IMPORTANT: Adjust shift cables as outlined in appropriate Sterndrive ServiceManual. Shift Cable Installation 1. Refer to appropriate Sterndrive Service Manual and install and adjust drive unit and remote control shift cables, using hardware retained. Power Steering System as outlined in SECTION 1B - "Maintenance" or refer to appropriate SterndriveService Manual. 1. Connect power steering fluid hoses to control valve (large fitting first). CAUTIONRoute hoses exactly as shown below. This will help avoid stress on the hose fittings and will help avoid stress on the hose fittings. 2. Torgue both fittings to 23 lb-ft (31 Nm). 73786 MCM MODELSSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 2A-13 3. Connect battery cable (usually RED) to POSITIVE (+) battery terminal. Tighten clamp securely. Then, connectNEGATIVE (-) battery cable (usually BLK) to NEGATIVE (-) battery terminal. Tightenclamp securely. NOTE: Spray terminals with a battery connection sealant to help retard corrosion. Fuel Supply Connections WARNINGAvoid gasoline fire or explosion. Improper installation of brass fittings or plugs intofuel pump or fuel filter base can crack casting and/or cause a fuel leak. • Apply #592 Loctite Pipe Sealant with Teflon to threads of brass fitting or plug.DO NOT USE TEFLON TAPE. • Thread brass fitting or plug an additional 1-3/4 to 2-1/4 turns using a wrench. DO NOTOVER TIGHTEN. • Install fuel line. To prevent over tightening, hold brass fitting with suitablewrench and tighten fuel line connectors securely. Check for fuel leaks. WARNINGBe careful when working on fuel system. Gasoline is extremely flammable and highly explosive under certain conditions. Do not smoke or allow spark or openflame in area. Wipe up any spilled fuel immediately. 1. Connect fuel line from fuel tank(s) to engine. Tighten connections securely. 2. Check for leaks. MCM MODELS SERVICE MANUAL NUMBER 25 Page 2A-14 90-861328-1 NOVEMBER 1999 Throttle Cable Installation and Adjustment1. Connect throttle cable using hardware retained and adjust as follows: CARBURETED ENGINES 72013ab cd d b MerCarb 2 Barrel Carburetora - Cable End Guideb - Attaching Hardwarec - Cable Barreld - Anchor Studs 72014 a b c d d b b Weber 4 Barrel Carburetora - Cable End Guideb - Attaching Hardwarec - Cable Barreld - Anchor Studs 72014 a b c d d b b Weber 4 Barrel Carburetora - Cable End Guideb - Attaching Hardwarec - Cable End Guideb - Attaching Hardware retained and adjust as follows: CARBURETED ENGINES 72013ab cd d b MerCarb 2 Barrel Carburetora - Cable End Guideb - Attaching Hardwarec - Cab Attaching Hardware (DO NOT Overtighten)c - Cable Barreld - Anchor Studs 1. Place remote control handle(s) in neutral, idle position. IMPORTANT: Be sure that cable is routed in such a way as to avoid sharp bends and/or contact with moving parts. DO NOT fasten any items to throttle cable. Outer cablemust be free to move when cable is actuated. 2. Install cable end guide on throttle lever, then push cable barrel lightly toward throttlelever end. (This will place a slight preload on cable to avoid slack in cable when movingremote control lever.) Adjust barrel on throttle cable end quide nut until it con-tracts and then loosen 1/2 turn. Tighten cable barrel securely. DO NOT OVERTIGHTEN, as cable must pivot freely. MCM MODELSSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 2A-15 4. Place remote control throttle lever in the wide-open-throttle (WOT) position. Ensure thatthrottle shutters (valves) are completely open and throttle shutters throttle lever in the wide-open-throttle (WOT) position. Return remote control throttle lever to idle position and check to ensure that throttle levercontacts idle speed adjustment screw. 74104 ab Weber 4 Barrel Carburetor Body Casting 70392 b a Weber 4 Barrel Carburetor Idle Positiona - Throttle Leverb - Idle Speed Adjustment Screw MCM MODELS SERVICE MANUAL NUMBER 25 Page 2A-16 90-861328--1 NOVEMBER 1999 EFI ENGINES 1. Install cable end guide on throttle lever, then push cable barrel end lightly toward throttlelever end. (This will place a slight preload on shift cable to avoid slack in cable whenmoving remote control lever). Adjust barrel on throttle cable to align with hole in anchorplate. 2. Secure throttle cable with hardware as shown and tighten securely. Tighten locknut untilit contacts, then loosen one-half turn. 3. Place remote control throttle level in the wide open the wide open throttle level in the wide open throttle level in throttle lever to idle position. 75867 c d b a a - Cable End Guideb - Flat Washer and Locknutc - Cable Barreld - Flat Washer and Locknut MCM MODELSSERVICE MANUAL NUMBER 25 Page 2A-18 90-861328--1 NOVEMBER 1999 Page 2A-17 THIS PAGE IS INTENTIONALLY BLANK MCM MODELSSERVICE MANUAL NUMBER 25 Page 2A-18 90-861328--1 NOVEMBER 1999 THIS PAGE IS INTENTIONALLY BLANK 3A 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-1 ENGINESection 3A - 262 cid (4.3L) Engines Table of ContentsTorque Specifications 3A-2....

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262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-2 90-861328-1 NOVEMBER 1999 Torque Specifications 262 cid (4.3L) Engines Description lb-in. lb-ft Nm Alternator Brace to Alternator Brace to Alternator Brace to Engine 30 41 Alternator Brace to Alternator Brace to Alternator Brace to Engine 30 41 Alternator Brace to Alternator Brace to Alternator Brace to Engine 30 41 Alternator Brace to Retaining Stud 120 14 Balance Shaft Driven Gear Bolt(Torque Plus 35°) 15 20 Balance Shaft Thrust Plate 120 14 Camshaft Sprocket 20 27 Camshaft Thrust Plate 106 12 Carburetor 132 15 Connecting Rod Cap Nuts(Torque Plus 70°) 20 27 Coupler/Flywheel 35 48 Crankcase Front Cover 124 14 Crankshaft Pulley Bolt (Cast Aluminum) 40 54 Cylinder Head Bolts - First Sequence Angle Torque Second Sequence 22 30 Angle Torque Second Sequence Short Bolt 55 Degrees Short Bolt 75 Degrees Distributor Hold Down 25 34 Exhaust Manifold 20 27 Flywheel 75 100 Flywheel Housing to Block 30 41 Flywheel Housing Cover 80 9 Front Mount Bracket 30 41 Fuel Filter Bracket Bolt 25 25 Fuel Pump Inlet Fitting (Small DiameterSee Note) 96 10.8 Fuel Pump Inlet Fitting ( NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-3 Torque Specifications 262 cid (4.3L) Engines (continued) Description lb-in lb-ft Nm Main Bearing Cap 75 100 Oil Pan Screw (1/4-20) 80 9 Oil Pan Nuts (5/16-20) 165 19 Oil Pump 65 68 Oil Pump Cover 80 9 Power Steering Pump Brace to Block 30 41 Power Steering Pump Bracket 30 41 Rear Crankshaft Oil Seal RetainerScrews and Nuts 133 15 Rear Mount (MCM) 40 54 Rocker Arm Nuts 22 30 Roller Lifter Restrictor Plate 12 16 Seawater Pump Bracket (if equipped) 30 41 Spark Plugs 15 20 Starter Motor 50 68 Thermostat Housing 30 41 Torsional Damper 40 54 Water Circulating Pump 30 41 Water Temperature Sender 20 27 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 1999 Lubricants / Sealants / Adhesives Description Part Number Quicksilver RTV Sealer 92-91601-809820 Quicksilver RTV Sealer 92-91601-80 1 Ouicksilver Perfect Seal 92-34227--1 Ouicksilver Needle Bearing Assembly Lubricant 92-825265A1 General Motors Cam and Lifter Prelube or Equivalent Obtain Locally Tools Mercury Marine Special Tools (see note) Description Part Number Torque Angle Gauge (Degree Wheel Torquing) TA 360 NOTE: Snap-On Tools can be ordered from your nearest Snap-On branch sales office ordistributor. 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-5 Kent-Moore Special Tools 29784 Little Mack Roseville, MI 48066(800) 345-2233 Description Part Number Valve Spring Compressor J5892 Valve Spring Compressor J8062 Valve Spring Compressor J8062 Valve Spring Tester J8056 Valve Guide Reamer J5830-2 Carbon Remover Brush J8089 Piston Pin Remover Kit J24086-B Piston Ring Groove Cleaner J3936-03 Piston Ring Compressor J8037 Connecting Rod Bolt Guide Set (3/8-24) J5239 Oil Pump Suction Pipe Installer J23822-A Crankshaft Bearing Remover and Installer J23523-E Crankshaft Gear and Sprocket Puller J5825-A Crankshaft Gear and Sprocket Installer J5590 Air Adaptor J23590 Main Bearing Remover/Installer J33834 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-6 90-861328--1 NOVEMBER 1999 Specifications 262 CID / 4.3L Engine Specifications NOTICE Unit Of Measurement: Inches (Millimeters) Displacement 262 cid (4.3 L) Bore 4.00 (101.6) Stroke 3.48 (88.39) Compression Ratio 9.2:1 Heads Cast Iron Camshaft Steel CYLINDER BORE Diameter 4.0007-4.0017 (101.6178-1016431) Production .0005 (0.0127) Maximum Out-of-Round Service .002 (0.05) Maximum Thrust Side .001 (0.02) Over Production PISTON Production .0007-.002 (0.017 - 0.05) Clearance Service .002 (0.06) Maximum TagerProduction .0005 (0.0127) Maximum TagerProduction .0005 (0.0127) Maximum Thrust Side .001 (0.02) Maximum TagerProduction .0005 (0.0127) Maximum TagerProduction CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328-1 NOVEMBER 1999 Page 3A-7 262 CID / 4.3L Engine Specifications NOTICE Unit Of Measurement: Inches (Millimeters) PISTON RING Top .02-.06 (0.508-1.524)Groove Side Production 2nd .04-.08 (1.016-2.032)Clearance Service .004 (0.10) MaximumCompression Top .010-.016 (0.25-.016) (0.25 0.40) GapProduction 2nd .018-.026 (0.46-0.66) Maximum Service .02-.08 (0.50-2.03) Maximum Groove Side Production .02-.07 (0.508-0.177) Groove Side Production .015-.050 (0.381-1.27) GapService .009-.065 (0.23-1.65) Maximum PISTON PIN Diameter .9267-.9271 (23.545-23.548) Production .015-.050 (0.381-1.27) GapService .009-.065 (0.23-1.65) Maximum OilProduction .015-.050 (0.381-1.27) GapService .009-.065 (0.23-1.65) Maximum PISTON PIN Diameter .9267-.9271 (23.545-23.548) Production .015-.050 (0.381-1.27) GapService .009-.065 (0.23-1.65) Maximum PISTON PIN Diameter .9267-.9271 (23.545-23.548) Production .015-.050 (0.381-1.27) GapService .009-.065 (0.23-1.65) Maximum PISTON PIN Diameter .9267-.9271 (23.545-23.548) Production .015-.050 (0.381-1.27) GapService .009-.065 (0.23-1.65) Maximum PISTON PIN Diameter .9267-.9271 (23.545-23.548) Production .015-.050 (0.381-1.27) GapService .009-.065 (0.23-1.65) Maximum PISTON PIN Diameter .9267-.9271 (23.545-23.548) Production .015-.050 (0.381-1.27) GapService .009-.065 (0.23-1.65) Maximum PISTON PIN Diameter .9267-.9271 (23.545-23.548) Production .015-.050 (0.381-1.27) GapService .009-.065 (0.23-1.65) Maximum PISTON PIN Diameter .9267-.9271 (23.545-23.548) Production .015-.050 (0.381-1.27) GapService .009-.065 (0.23-1.65) Maximum PISTON PIN Diameter .9267-.9271 (23.545-23.548) Production .015-.050 (0.381-1.27) GapService .015-.050 (0.381-1.27) .0002-.0007 (0.0051-0.0177)Clearance in Piston Service .001 (0.02) Maximum Fit in Rod .0008-.0016 (0.021-0.040) Interference 262 CID (4.3L Engine Specifications CRANKSHAFT NOTICE Unit Of Measurement: Inches (Millimeters) No. 1 2.4488-2.4495 (62.199-62.217) Diameter No. 2, 3 2.4485-2.4494 (62.191-62.215) No. 4 2.4479-2.4489 (62.179-62.203) Main Journal Production .0002 (0.007) MaximumOut-of-Round Service .001 (0.02) Maximum No. 1 .0008-.0020 (0.0203-0.0508) Main BearingProduction No. 2, 3, 4 .0011-.0023 (0.0279-0.0584) Main BearingClearance No. 1 .001-.002 (0.03-0.05) Service No. 2, 3, 4 .001-.002 (0.25-0.06) Crankshaft End Play .002-.008 (0.05-0.20) Crankshaft End Play .002-.008 ( Out-of- Production .0002 (0.007) Maximum Rod Side Clearance .001.003 (0.02-0.07) Maximum Rod Side Clearance .001.003 (0.02-0.0 Engine Specifications NOTICE Unit Of Measurement: Inches (Millimeters) VALVE SYSTEM Lifter Hydraulic Roller Rocker Arm Ratio 1.50:1 Intake & Exhaust) 46° Seat Runout (Intake & Exhaust) 46° Seat Runout (Intake & Exhaust) Valve Lift Exhaust) 46° Seat Runout (Intake & Exhaust) Valve Lift Exhaust) 46° Seat Runout (Intake & Exhaust) Valve Lift Exhaust) Valve Lift Exhaust) 46° Seat Runout (Intake & Exhaust) Valve Lift Exhaust) Valve Lift Exhaust) 46° Seat Runout (Intake & Exhaust) Valve Lift Exhaust) Valve Lift Exhaust) 46° Seat Runout (Intake & Exhaust) Valve Lift .002 (0.05) Maximum Intake .035-.060 (0.89-1.52) Seat Width Exhaust .002 (0.279-0.069) StemClearance Intake .001 (0.025) Maximum Intake StemProduction Exhaust .002 (0.51) Maximum Intake .001 (0.025) Maximum Intake .001 (0.0279-0.069) StemClearance Intake .001 (0.025) Maximum Intake .001 (0.025) Maximum Intake .001 (0.0279-0.069) StemClearance Intake .001 (0.025) Maximum Intake .001 (0.0279-0.069) StemClearance Intake .001 (0.025) Maximum Intake . 2.03 (51.6) ValveValve Closed 76-84 Lb. (338-374 N) at 1.7 in (43.16 mm)Spring Pressure ValveOpen 187-203 Lb. (832-903 N) at 1.27 in (42.9-43.43) 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-10 90-861328-1 NOVEMBER 1999 262 CID / 4.3L Engine Specifications NOTICE Unit Of Measurement: Inches (Millimeters) CAMSHAFT AND DRIVE ±Intake .286-.290 (7.26-7.36) Lobe Lift ±. 002(0.051) Exhaust .292-.296 (7.42-7.52) Journal Diameter 1.8682-1.8692 (47.452-47.478) Journal Diameter 1.8682-1.8692 (47.478-478) Journal Diameter 1.8682-1.8692 (47.478-478) Journal Diameter 1.8682-1.8692 (47.478-478) Journal Diameter 1.8692 (47.478-478) .001-.009 (0..0254-0.2286) Timing Chain Deflection .375 (9.5) from taut position [total .75 (19)] FLYWHEEL Runout .008 (0.203) Maximum BALANCE SHAFT Front Bearing Journal 2.1648-2.1654 (55.985-55.001) Rear Bearing Journal 1.4994-1.500 (38.084-38.100) Rear Bearing InsideDiameter Assembled Production 1.5014-1.503 (37.525-37.575) Rear Bearing Outside Diameter Production 1.875-1.876 (46.825-46.850) Rear Bearing Journal Clearance .001-.0036 (.025-.091) 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328-1 NOVEMBER 1999 Page 3A-11 General Some of the repairs in this section must be completed with engine removal depends upon type of repair standfor major repairs. When engine removal is not required, make certain that battery cables are disconnected at the battery prior to performing any on-board engine repair procedure. Lubricate all moving parts (during reassembly) with engine oil. Apply Quicksilver PerfectSeal on threads of and under heads of cylinder head bolts and on threads of all cylinder blockexternal bolts, screws and studs.

Engine IdentificationThe Mercury MerCruiser Model can be determined by looking at the last two letters of theengine serial number and/or model decals are missing, the engine code letters mayhelp in determining the engine models. 72873 a a - Location of GM Engine Code (Front Starboard Side, Near Cylinder HeadMating Surface) MCM (Sterndrive) Code Rotation 4.3L LJ 4.3LH LK LH 4.3L EFI LK 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-12 90-861328--1 NOVEMBER 1999 Cylinder Head Identification 72875 4.3 a - Left Hand Rotation (CCW) - All Sterndrive Engines Crankshaft end thrustis controlled by flanges on the No. 4 bearing. A torsional damper on the forward end of thecrankshaft serves to help dampen any engine torsional vibration.

Piston and Connecting RodsPiston pins are offset slightly toward the thrust side of the pistons to provide a gradualchange in thrust pressure against the cylinder wall as the piston travels its path. Pins havea floating fit in the piston and a press fit in the connecting rod (to hold them in place). Connecting rods are made of forged steel and are connected to the crankshaft throughinsert type bearings.

Camshaft and DriveCamshafts are generally cast iron. However, engines with roller lifters have steel camshafts. All camshafts are driven at 1/2 crankshaft speed by a timing chain and sprockets, and aresupported by four main bearings, which are pressed into the block.

A helical gear on the aft end of the camshaft drives the distributor and oil pump. Balance ShaftThe balance shaft is located in the engine block valley directly above and parallel to the camshaft. The balance shaft extends the entire length of the engine and is supported oneach end by a bearing. It is also driven by the camshaft through a helical gear set. The function of the balance shaft is to equalize the dynamic forces inherent in particular engine designs, thus minimizing engine vibration.

262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328-1 NOVEMBER 1999 Page 3A-13 Cylinder HeadThe cylinder heads are made of cast iron and have individual intake and exhaust ports foreach cylinder. Stainless steel or graphite composition head gaskets are used to retard corrosion.

Valve TrainThe valves and valve springs are of a heavy-duty design to withstand the high enginespeeds encountered. Valve tips have been hardened to extend valve life. Exhaust valverotators are used to help extend valve life. Exhaust valverotators are used to help extend valve life. Exhaust valverotators are used to help extend valve life. Exhaust valverotators are used to help extend valve life. Exhaust valverotators are used to help extend valve life. Exhaust valverotators are used to help extend valve life. Exhaust valverotators are used to help extend valve life. Exhaust valverotators are used to help extend valve life. Exhaust valverotators are used to help extend valve life. Exhaust valverotators are used to help extend valve life. Exhaust valverotators are used to help extend valve lifters also serve to removeany clearance (lash) from the valve train to keep all parts in constant contact. The roller lifters are restrained from rotating by two retainers (restrictors) located in thevalley. The valve lifters also are used to lubricate the valve train bearing surfaces. Intake ManifoldThe manifold is of the single level design for efficient fuel distribution. All passages are ofapproximately equal length to assure more even fuel-air mixture to the cylinders. Lubrication SystemThe engine lubrication system is of the force-feed type in which oil is supplied under fullpressure to the crankshaft, connecting rods, camshaft bearings and valve lifters, and issupplied under controlled volume to the push rods and rocker arms.

All other moving parts are lubricated by gravity flow or splash. A positive displacement gear-type oil pump is mounted on the rear main bearing cap and is driven by an extension shaft from the distributor (which is driven by the camshaft). Oil from the bottom of the pump in the rear of the oil pan is drawn into the oil pump through an oilpickup screen and pipe assembly. If the screen should become clogged, a relief valve in the screen will open and continue toallow oil to be drawn into the system. Once the oil reaches the pump, the pump forces theoil through the lubrication system. A spring-loaded relief valve in the pump limits themaximum pump output pressure. After leaving the pump, the pressurized oil flows through a full-flow oil filter. On engines withan engine oil cooler, the oil also flows through the cooler should they become restricted. Some of the oil, after leaving the oil cooler and/or filter, is routed to the No. 4 crankshaft mainbearing. The remainder of the oil gallery, which is located directlyabove the camshaft bearingbore. Some of the oil also flows introve the valve lifter oil gallery, which is an annular groove in each camshaft bearingbore. Some of the oil assages to an annular grooves in the block and allow oil to flow in-between the bearings and the camshaft bearings have holes which align and the camshaft bearings have holes which align and flows in-between the bearings and the camshaft main bearings is forced through a hole in the upperhalf of each bearing and flows in-between the bearings and the camshaft main bearings and flows in-between the bearings and the crankshaft main bearings and flows in-between the bearings and flows in-between the bearings and the crankshaft main bearings and flows in-between the bearings and flows in-between the bearings and flows in-between the connecting rod bearings and flows in-between the camshaft bearings and flows in-between the bearings and flows in-between t

Oil which is forced out theends of the connecting rod bearings and crankshaft main bearings is splashed onto the camshaft, cylinder walls, pistons and piston pins, keeping them lubricated. Oil which isforced out the front end of the No. 1 crankshaft main bearing also assists in lubricating the camshaft drive. Oil which reaches the valve lifter oil galleries is forced into each hydraulic valve lifter throughholes in the side of the lifter. From here, the oil is forced through the metering valve in eachof the lifters (which controls the volume of oil flow) and then up through the push rods to therocker arms. A hole in each rocker arm push rod seat allows the oil to pass through therocker arm and lubricate the valve train bearing surfaces. After lubricating the valve train, oil drains back to the oil pan through oil return holes in the cylinder head and block.

The distributor shaft and gear also is lubricated by the oil flowing through the right valve lifteroil gallery. Bearing Failures 70436 a Tapered Journala - Overlay Gone From Entire Surface 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-15 Bearing Failures (Continued) 70436a Lack Of Oil a - Overlay Worn Off 70436a Radius Ridea - Worn Area 70436 a Improper Seatinga - Bright Or Polished Sections 70436a Fatigue Failures - Craters or Pockets 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-16 90-861328--1 NOVEMBER 1999 Piston Failures NOTE: Engine failure due to pre ignition or detonation are beyond the control of MercuryMerCruiser. No warranty will apply to failures that occur under these conditions. Pre-IgnitionPre-ignition, caused by combustion chamber hot spots. Control of the start of ignition is lost, as combustion pressure rises too early, causing power loss andrough running. The upward motion on the piston is opposed by the pressure rise. This canresult in extensive damage to the internal parts from the high increase in combustionchamber temperature.

<sup>7</sup>2424 Pre-Ignition Damage <sup>7</sup>2314 a b c d Combustion Differencesa - Ignited By Hot Depositsb - Regular Ignition Sparkc - Ignites Remaining Fueld - Flame Front Collide 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-17 PRE-IGNITION CAUSES 1.

Hot spots in the combustion chamber from glowing deposits (due in turn to the use of improper oils and/or fuels). 2. Overheated spark plug electrodes (improper heat range or defective plug). 3. Any other protuberance in the combustion chamber, such as an overhanging piece of gasket, an improperly seated valve or any other inadequately cooled section of materialwhich can serve as a source. DetonationDetonation, commonly called "fuel knock," "spark knock" or "carbon knock," is abnormalcombustion of the fuel which causes the fuel to explode violently. The explosion, in turn, causes overheating or damage to the spark plugs, pistons, valves and, in severe cases, results in pre-ignition. Use of low octane gasoline is one of the most common causes of detonation. Even with highoctane gasoline, detonation could occur if engine maintenance is neglected. 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-18 90-861328--1 NOVEMBER 1999 OTHER CAUSES OF DETONATION IMPORTANT: Use of improper fuels will cause engine damage and poor performance. 1. Over-advanced ignition timing.

2. Lean fuel mixture at or near full throttle (could be caused by carburetor or leaking intakemanifold). 3. Cross-firing spark plugs. 4. Excess accumulation of deposits on piston and/or combustion chamber (results inhigher compression ratio). 5. Inadequate cooling of engine by deterioration of cooling system. 72425 Detonation Damage 72315 a b c d Combustion Descriptiona - Spark Occursb - Combustion Beginsc - Combustion Continuesd - Detonation Occurs 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-19 Engine Mounts 72316 Front Mount 72318 Rear Mount/Flywheel Housing IMPORTANT: Press rear mount out with press. 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 Page 3A-20 90-861328--1 NOVEMBER 1999 Rocker Arm Cover RemovalIt may be necessary to remove exhaust manifold before removing rocker arm cover.

(Referto Section 7B) 1. Disconnect crankcase ventilation hoses. 2. Remove any items that interfere with the removal of rocker arm covers. IMPORTANT: DO NOT pry rocker arm cover, may be loosened by bumping end of rockercover from the rear with palm of hand or a rubber mallet.

3. Remove rocker arm cover. Installation1.

Clean sealing surfaces on cylinder head and rocker arm cover with degreaser. 2. Place new rocker arm cover gasket in position in rocker arm cover. 75853a a - Rocker Arm Cover Gasket 3. Install rocker arm cover. 75853a a - Rocker Arm Cover Gasket 3. Install rocker arm cover. 75853a a - Rocker Arm Cover Gasket 3. Install rocker arm cover. 75853a a - Rocker Arm Cover Gasket 3. Install rocker arm cover. 75853a a - Rocker Arm Cover Gasket 3. Install rocker arm cover. 75853a a - Rocker Arm Cover Gasket 3. Install rocker arm cover. 75853a a - Rocker Arm Cover Gasket 3. Install rocker arm cover. 75853a a - Rocker Arm Cover Gasket 3. Install rocker arm cover. 75853a a - Rocker Arm Cover Gasket 3. Install rocker arm cover. 75853a a - Rocker Arm Cover Gasket 3. Install rocker arm cover. 75853a a - Rocker Arm Cover Gasket 3. Install rocker arm cover. 75853a a - Rocker Arm Cover Gasket 3. Install rocker arm cover. 75853a a - Rocker Arm Cover Gasket 3. Install rocker arm cover. 75853a a - Rocker Arm Cover Gasket 3. Install rocker arm cover. 75853a a - Rocker Arm Cover Gasket 3. Install rocker arm cover. 75853a a - Rocker Arm Cover Gasket 3. Install rocker arm covers. 6. Connect crankcase ventilation hoses to rocker arm covers. 7. Start engine and check for oil leaks. 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328-1 NOVEMBER 1999 Page 3A-21 Intake Manifold Removal. 1. Disconnect connect hoses from thermostat housing. 75847 3. Disconnect electrical leads interfering with removal. 4. Disconnect crankcase ventilation hoses from rocker arm covers. 5.

Disconnect throttle cable from carburetor or throttle body. 75867 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-22 90-861328--1 NOVEMBER 1999 6. Remove fuel line running between fuel pump and carburetor or throttle body. 76404 a a a - Fuel Line 7.

Remove distributor cap and mark position of rotor on distributor housing. Also, markposition of distributor housing on intake manifold. 8. Remove distributor. IMPORTANT: Do not crank engine over after distributor has been removed. 9. Remove other ignition components. 10. Remove oil sending unit. 11. Disconnect any other miscellaneous items that will prevent removal of manifold. IMPORTANT: It may be necessary to pry intake manifold away from cylinder headsand block, in next step. Use extreme care to prevent damage to sealing surfaces.

12. Remove intake manifold bolts, then remove intake manifold and carburetor assembly. NOTE: If intake manifold requires replacement, transfer all remaining parts to new manifold. 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-23 Cleaning and Inspection1. Clean gasket material from all mating surfaces. 75853 IMPORTANT: When cleaning cylinder head mating surface, do not allow gasketmaterial to enter engine crankcase or cylinder head ports. 2. Inspect manifold for cracks or scratches.

Machined surfaces must be clean and free ofall marks and deep scratches or leaks may result. 3.

Check intake passages for varnish buildup and other foreign material. Clean asnecessary. 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-24 90-861328--1 NOVEMBER 1999 InstallationIMPORTANT: When installing intake manifold gaskets, in next step, observe thefollowing: • Be sure to install gasket with marked side up. Both gaskets are identical. • On engines with 2 barrel carburetor, remove metal insert from manifold gasket tobe used on starboard (right) cylinder head to provide clearance for heat pipe onintake manifold. • All Mercury MerCruiser V-6 GM engines that have "automatic" carburetor chokesmust use an intake gasket that has an opening for the exhaust crossover port inthe intake manifold.

Without this opening the "automatic" carburetor choke willnot operate properly.

The choke will remain ON longer causing rough engine op-eration and wasted fuel. 71850 a a - Exhaust Crossover Port Opening 1. Apply Quicksilver Perfect Seal to intake manifold gaskets especially around coolantpassages (both sides). 2. Place gaskets on cylinder heads. 71850 a b a a - Coolant Passagesb - Gaskets 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-25 3. Apply a 3/16 in. (5 mm) wide bead of Quicksilver RTV Sealer to engine block as shown.Extend sealer 1/2 in. (13 mm) up on intake gaskets. IMPORTANT: DO NOT get Quicksilver RTV Sealer into oil sending unit hole at rear ofengine. 71850 a a - RTV Sealer (Typical Both Ends) 71851 b b - Oil Sending Unit Hole 4. Carefully install manifold assembly and torque bolts to 35 lb-ft (48 Nm) in sequence asshown. 72878 1 23 4 8 6 5 7 a Intake Manifold Torque Sequencea - Front 5. Connect all electrical leads. 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-26 90-861328--1 NOVEMBER 1999 6. Connect hoses to thermostat housing. 75847 7. Install fuel line to carburetor and fuel pump.

76404 a a - Fuel Line 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328-1 NOVEMBER 1999 Page 3A-27 8. Connect crankcase ventilation hoses to rocker arm covers. 9. Install distributor. Position rotor and housing to align with marks made during removal, then install distributor cap. 10. Install other ignition components and reconnect wires. 11. Coat threads of oil pressure sending unit with Quicksilver Perfect Seal and install. 12. Connect any other items which were disconnected from manifold during removal. 13. Start engine. 14. Adjust ignition timing and carboretor. Ts. Check hose connections, gaskets and seals for leaks. 16. Inspect fuel line connections for fuel leaks. Rocker Arm/Push Rod RemovalNOTE: When servicing only one cylinder's rocker arm submits are norvers. 78653 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-28 90-861328-1 NOVEMBER 1999 2. Remove rocker arm assemblies and push rods. 75674 IMPORTANT: Place rocker arm assemblies and push rods. 75674 IMPORTANT: Place rocker arm sand rocker arm assemblies and push rods. 75674 IMPORTANT: When install ing rocker arms and rocker arm balls, coat bearingsurfaces of rocker arms and rocker arm balls, coat bearingsurfaces of rocker arms and rocker arm balls with engine oil. 1. Install push rods in a rack for reassemblyin their original locations. Be sure push rods seat in lifter socket. 2. Install rocker arms, rocker arms and rocker arm nuts in their original locations. 3. Torque rocker arms unts rocker arm nuts are torqued to specification. 260 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 90-861328-1 NOVEMBER 1999 Page 3A-29 Hydraulic Roller and recover and severing Payes 2. Push Rod Seat 1. Install rocker arms, ore extremely simple in design.Normally, readjustments are not necessary and servicing requires only that care and cleanlines be exercised in the handling of parts. 72031 **0 0 0 0 0 0 1** Push Rod Seat 1. Hoter Manuface and Payes 1. Push Rod Seat 1. Hoter Bay Valve 1 Planger5 - Check Ball 6. Check Ball 6. Check Ball 6. Check

Another method is to place a finger on face of valve spring retainer. If lifter is not functioning properly, a distinct shock will be felt when valve returns to its seat. General types of valve lifter noise are as follows: 1. Hard rapping noise - usually caused by plunger becoming tight in bore of lifter body so that return spring cannot push plunger back up to working position. Probable causesare: a. Excessive varnish or carbon deposit, causing abnormal stickiness. b. Galling or "pickup" between plunger and bore of lifter body. 2.

Moderate rapping noise - probable causes are: a. Excessively high leakdown rate. b. Leaky check valve seat. c. Improper adjustment. 3. General noise throughout valve train - this will, in most cases, be a definite indication insufficient oil supply or improper adjustment. 4. Intermittent clicking - probable causes are: a. A microscopic piece of dirt momentarily caught between ball seat and check valveball. b. In rare cases, ball itself may be out of round or have a flat spot. c. Improper adjustment. In most cases, where noise exists in one or more lifters, all lifter units should be removed, disassembled, cleaned in solvent, reassembled and reinstalled in engine. If dirt, corrosion, carbon, etc., is shown to exist in one unit, it more likely exists in all the units; thus it wouldonly be a matter of time before all lifters caused trouble. 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-31 Removal1. Remove rocker arm covers. 75853 2. Remove intake manifold. IMPORTANT: Keep valve push rod and hydraulic lifter from each valve together as amatched set and mark or store them so they can be reinstalled in the same locationlater. 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-32 90-861328--1 NOVEMBER 1999 3. Remove rocker arm assemblies and push rods. 75670 a b a - Rocker Arm Assemblyb - Push Rods NOTE: Engines with roller lifters have additional valve train components shown below. 72329 b a a - Lifter Restrictor Retainerb - Fasteners 72340 a b a - Roller Lifter 4.

### Remove lifter restrictors and lifters.

262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-33 5. Remove fasteners from lifter retainers (restrictors) and remove retainers. Do not disturbilifters at this time. 71852 a b a - Lifter Retainer (Restrictor) - Fasteners 6. Make matching marks on all retainers and lifters as to location and orientation in bores, to allow reassembly in exact position on camshaft lobes (so that the roller's bearing androller will roll in the same direction on the same lobe, if reused). 7. Remove valve lifters. 76586 b 71853 a b b c a - Roller Lifter (s)c - Matching Marks 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-34 90-861328--1 NOVEMBER 1999 Cleaning and Inspection1. Thoroughly clean all parts in cleaning solvent and inspect them carefully. 2. If any parts are damaged or worn, entire lifter body wall is scuffed or worn, inspect cylinder block lifter bore. 4. If roller is worn or damaged, inspect camshaft lobe. 5. If push rod seat is scuffed or worn, inspect push rod. InstallationIMPORTANT: It is recommended that the engine oil be changed and a new oil filter beinstalled whenever servicing valve lifters, coat the roller with engine oil. If new lifters a new camshaft have been installed, an additive containing EP lube (such asGeneral Motors Cam and Lifter Prelube or equivalent) should be poured overcamshaft lobes before installing lifters. IMPORTANT: Before installing lifters if a new camshaft has been installed. 1. Align matching marks made prior to disassembly, and install hydraulic valve lifters and components.

Torque roller lifter retainer (restrictor) plate fasteners to 12 lb-ft (16 Nm). 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-35 NOTE: Components shown removed in left drawing for visual clarity 71853 a b b c 76586 b a - Roller Lifter Retainerb - Roller Lifter(s)c - Matching Marks 71852 b a a - Lifter Retainer (Restrictor) b - Fasteners 2. Install intake manifold. 3. Install push rods.

Ensure push rods seat in lifter socket. 4. Install rocker arms and rocker arm nuts. Torque nuts to 22 lb-ft (30 Nm). 5.

Install rocker arm cover. Torque fasteners to 106 lb-in. (12 Nm). 6.

Start engine and check for leaks. 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-36 90-861328--1 NOVEMBER 1999 Valve Stem Oil Seal / Valve Spring Replacement Removal - Head Installed1. Remove rocker arm cover. 75853 2. Remove spark plug of affected cylinder. 3.

Remove rocker arm assembly. 75670 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-37 4. Install air line adaptor tool (J-23590) in spark plug hole and apply compressed air to holdvalves in place. 76572 NOTE: If compressed air is not available, piston may be brought up to TDC and used to keepvalves from falling out of valve guides. IMPORTANT: Do not turn crankshaft while valve springs, retainers and locks are removed or valves will fall into cylinder. 5. Using valve spring compressor as shown, compress valve spring and remove valvelocks. 72881 a b a - Valve Spring Compressor (J-5892)b - Rocker Arm Nut 6. Slowly release valve spring compressor. Remove cap, retainer or rotator, and valvespring. IMPORTANT: Keep air pressure in cylinder valve springs, caps and valve locks are removed or valves will fall into cylinder. 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-38 90-861328--1 NOVEMBER 1999 7. Remove seals from valve stems and valve guide. 72330 a a - Intake Valve Guide Seal Valve Assembly (Exploded View) 75843 a bc d e f gh a - Valve Locksb - Retainerc - Rotatord - Cape - Outer Springf - Valve Stem Oil Sealg - Intake Valve 1. Lubricate valve guides and valve stems with engine oil. 2. Install each valve in the port from which it was removed or to which it was fitted. 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-39 Installation - Head Installed1. Install valve guide seal (intake valve only) over valve stem and push down until seated against head. 2. Set valve spring (with damper installed) and cap in place. 3. Place retainer on intake valve and/or rotator on exhaust valve.

76573 4. While compressing valve spring with valve spring compressor, install oil seal in lowergroove of valve stem, making sure seal is not twisted. A light coating of oil will help pre-vent twisting. 5. Install valve locks (Quicksilver Needle Bearing Assembly Lubricant may be used to holdthem in place) and slowly release tool, making sure locks seat properly in upper groovesof valve stem. 72881 a b a - Valve Spring Compressor (J-5892)b - Rocker Arm Nut 6. Install push rods and rocker arm assemblies. 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-40 90-861328--1 NOVEMBER 1999 7. Torque rocker arm nuts to 22 lb-ft (30 Nm). 76569 8. Install rocker arm cover. Torque to 106 lb-in. (12 Nm).

9. Install spark plug torque to 15 lb-ft (20 Nm). Cylinder Head Removal1. Drain engine cooling system. 2. Remove exhaust manifolds. 75052 a One Piece Exhaust Manifold 3. Remove intake manifold. 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328-1 NOVEMBER 1999 Page 3A-41 4. Remove rocker arm covers. 75853 5. Remove rocker arm assemblies and push rods (keep in order for reassembly in their original locations). 75670 6. Remove any components attached to front or rear of cylinder head.

7. Remove spark plugs. 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-42 90-861328--1 NOVEMBER 1999 8. Remove head bolts. 76589 CAUTIONThe head gasket may be holding cylinder head to block.

Use care when prying offcylinder heads. DO NOT damage gasket surfaces. DO NOT drop cylinder heads. 9. Place cylinder heads. 9. Place cylinder heads. 2. Inspect sealing surfaces for deep nicks and scratches. 3. Inspect for corrosion around cooling passages. 4. Clean head bolt threads and engine block bolt hole threads, making sure no dirt, old oilor coolant remain. 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-43 Installation CAUTIONWhen using ribbed stainless steel head gaskets, apply a thin coating of QuicksilverPerfect Seal to both sides of gasket. Too much sealer may hold gasket away fromhead or block causing leakage. DO NOT use sealer on graphite composition headgaskets. 1. Place head gasket in position over dowel pins. 76588 2. Carefully set cylinder heads in two steps. First Pass Short Bolt Medium Bolts with Quicksilver Perfect Seal and install finger-tight. 76589 4. Torque cylinder heads in two steps. First pass, torque all bolts to 22 lb-ft (30 Nm). Second pass is an angle torque sequence as follows: First PassShort Bolt Medium BoltLong Bolt 2 2 lb-ft (30 Nm) Short Bolt + 55 Degrees Second Pass Medium Bolt + 65 Degrees (Angle Torque)Long Bolt + 75 Degrees 72883 a Cylinder Head Torque Sequencea - Front 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-45 5. Install push rods, rocker arm assemblies and lifter restrictors in their original positions. 7656876.

Torque rocker arm nuts to 22 lb-ft (30 Nm). 7. Install intake manifold. 8. Install rocker arm covers.

75853 9. Install exhaust manifolds. 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-46 90-861328--1 NOVEMBER 1999 10. Install any components removed from front or rear of cylinder heads. 12. Follow procedures below for your model.

Refer to SECTION 6A or 6B of this manual. Seawater Cooled Models: Provide for adequate water supply to seawater pickup (seeSection 6A). Closed Cooled Models: Refill closed cooling section 6B), and provide ade-quate water supply to seawater pickup. CAUTIONEnsure that cooling water supply is available before starting the engine. 13.

Start engine.

14. Set timing. 15. Set idle speed. 16. Check for leaks. 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-47 Cylinder Head and Valve Conditioning Disassembly1.

Using value spring compressor, compress value spring and remove value locks. Slowly release tool. 72884 a a - Value Spring Compressor (J-8062) 2. Remove all value components. 3. Remove values from cylinder head and place in a rack, in order, for reassembly in theiroriginal locations. Cleaning1. Clean push rods and rocker arm assemblies. 2. Clean carbon from values using a wire wheel. 3. Clean gasket material from cylinder head mating surfaces. 4.

Clean all carbon from combustion chambers and valve ports using carbon removerbrush. 72334 a a - Carbon Remover Brush (J-8089) 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-48 90-861328--1 NOVEMBER 1999 5. Thoroughly clean valve guides with valve guide cleaner.

72335 a a - Valve Guide Cleaner (J-8101) Inspection1. Inspect cylinder heads for cracks in exhaust ports, water jackets, and combustion chambers (especially around spark plug holes and valve seats). Replace heads if anycracks are found. 2. Inspect cylinder head gasket surface for burrs, nicks, erosion or other damage. Also, check flatness of cylinder head gasket surface, using a machinist's straight edge andfeeler gauges as shown.

Take measurements diagonally across head (both ways) and straight down center head. Refer to "Specifications." 72885 a b a - Straight Edgeb - Feeler Gauge IMPORTANT: Cylinder head-to-block gasket surface should be resurfaced if warpedmore than specified. When head resurfacing is required, cylinder head-to-intakemanifold gasket surface on head must be milled to provide proper alignmentbetween intake manifold and head. 3. Inspect valves for burned heads, cracked faces or damaged stems. 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-49 IMPORTANT: Excessive valve stem to bore clearance will cause excessive oilconsumption and possible valve breakage. Insufficient clearance will result in noisyand sticky valves. 4. Measure valve stem clearance as follows: a. Attach a dial indicator to cylinder head, positioning it against the valve stem and close to the valve guide. b. Holding valve head off seat about 1/16 in. (2 mm), move valve stem back and forthin direction shown. Compare stem clearance with specifications.

c. If clearance exceeds specifications, it will be necessary to ream valve guides foroversized valves, as outlined under "Valve Guide Bore RepairIMPORTANT: Be sure to measure valve stem diameter of both the intake and exhaustvalve, as valve stem diameter may or may not be the same for both valves. If .015 in. oversize valves are required, ream valve guide bores for oversize valves, asfollows: 1. Measure valve stem diameter of old valve being replaced and select proper size valveguide reamer from chart below. Standard Valve Stem Diameter Reamer Required for .015 in. Oversize Valve .341 in. J-5830-2 2. Ream valve guide bores, as shown. 72886 3. Remove the sharp corner created by reamer at top of valve guide. 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-50 90-861328-1 NOVEMBER 1999 Valve Springs - Checking TensionUsing valve spring tester, as shown, check valve spring tester, as shown, check valve spring tester, as shown, check valve spring tester to "Specifications." IMPORTANT: Springs should be replaced if not within 10 lbs. (44 N) of specifiedtension. 72308 a b a - Valve Spring Tester (J-8056)b - Torque Wrench Valve Seat RepairValve seat reconditioning is very important, since seating of valves must be perfect forengine to deliver maximum power and performance. Another important factor is valve head cooling. Good contact between each valve and itsseat in head is important to ensure that heat in valve head will be properly dispersed. Several different types of equipment are available for reseating valve seats. Equipment are availables for seating valve seats. Solo68 ab c d Typical "3-Angle" Valve Seat a - Top Angle (30°)b - Seat Angle (46°)c - Bottom Angle (60°)d - Seat Width 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 09-861328--1 NOVEMBER 1999 Page 3A-51 Poy-208-2ensuring concentricity. 7238 Measuring Valve Seat Concentricity Valve GrindingValves that are pitted must be reflaced to the proper centering of pilot in valve guide, ensuring concentricity. 72338 Measuring Valve Seat RepairValve seat

(0.8 mm) after grinding, replace the valve. Several different types of equipment are available for refacing valves. The recommendation of the manufacturer of the equipment being used should be carefully followed to attainproper results. 50695 a b a - 1/3 [.341 in] (8.16 mm)b - 1/32 [.031 in] (0.79 mm) Min 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-52 90-861328-1 NOVEMBER 1999 Reassembly1. Lubricate valve guides and valve stems with engine oil. 2. Install each valve in the port from which it was removed or to which it was fitted. 3. Install valve guide seal (intake valve only) over valve stem and push down until seated against head. 4. Install quad ring over exhaust valve stem until it touches cylinder head with valve closed. IMPORTANT: The exhaust valve guide seals have been removed. They are replaced with a quad ring as shown below. If repairing heads with seals, replace them with thequad ring upon reassembly. 75307a b a - Quad Ringb - Valve Seal 5. Set valve spring (with damper installed) and cap in place. 6. Place retainer on intake valve and/or rotator on exhaust valve. 7. While compressing valve spring compressor, install oil seal in lowergroove of valve stem, making sure seal is not twisted. A light coating of oil will helpprevent twisting. 72884 a a - Valve Spring Compressor (J-8062) 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328-1 NOVEMBER 1999 Page 3A-53 8. Install valve locks (Quicksilver Needle Bearing Assembly lube may be used to hold themin place) and slowly release tool, making sure locks seat properly in upper grooves of valve stem. 76573 ab e 75843 a bc d e f gh a - Valve Locksb - Retainer - Rotatord - Cape - Valve Stem Oil Sealf - Outer Spring - Intake Valve h - Exhaust Valve 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-54 90-861328-1 NOVEMBER 1999 9.

Check installed height of valve springs using a narrow, thin scale. Measure from springseat to top of valve spring, as shown. If measurement exceeds specified height, installa valve spring shim and recheck.

DO NOT shim valve springs to give an installed heightless than the minimum specified. 05037 72339 b a a - Valve Spring Installed Heightb - Cut Away Scale (Grind Out This Portion) 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-55 Dipstick Specifications All Engines 75851 FULL ADD 23-11/16 27-

7/16 1-1/16 13/16 ADD OP. RANGE 34-13/16 (884) 27-1/2 (699) 1-1/8 (29) 76497 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 90-801328-1 NOVEMBER 1999 Fage 3A-56 90-801328-1 NOVEMBER 1999 Fage

Remove dipstick and tube. 3. Remove oil pan.

Installation1. Clean sealing surfaces of engine block and oil pan. 2. Apply a small amount of Quicksilver RTV Sealer to joints of rear seal retainer and jointsof front cover. IMPORTANT: Quicksilver RTV Sealer sets up in about 15 minutes. Be sure tocomplete assembly promptly. 72888 b a a - Joints of Rear Seal Retainerb - Joints of Front Cover 3. Install oil pan gasket in position.

NOTE: A one-piece oil pan gasket may be reused if it is still pliable and is not cracked, tornor otherwise damaged. 72889 a a - Oil Pan Gasket 4. Install oil pan. Starting from the center and working outward in each direction, torquenuts and bolts to 18 lb-ft (25 Nm). 5. Install dipstick tube and dipstick. 6. Fill crankcase with required quantity of oil of specified viscosity. Refer to SECTION 1B- "Maintenance." 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-57 Oil Pump Assembly1 - Extension Shaft2 - Shaft Coupling3 - Pump Body4 - Drive Gear and Shaft5 - Idler Gear6 - Pickup Screen and Pipe7 - Pump Cover8 - Pressure Regulator Valve9 - Pressure Regulator Spring 10 - Plug11 - Retaining Pin12 - Screws The oil pump consists of two gears and a pressure regulator valve enclosed in a two-piecehousing. Oil pump is driven by distributor shaft which is driven by distributor shaft. Removal1. Remove oil pan. 2.

Remove gasket carefully, the one-piece gasket for the oil pan may be reused if still pli-able and not cracked, torn or damaged. 72889a b a - Oil Pumpb - Pickup Screen and Pipe 3. Remove oil pump. 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-58 90-861328--1 NOVEMBER 1999 Disassembly1.

Remove pump cover. IMPORTANT: Mark gear teeth for reassembly with same teeth indexing. 2. Remove idler gear and drive gear from pump body. 3. Remove retaining pin, spring, and pressure regulator valve from pump cover. IMPORTANT: Do not remove pickup screen and pipe assembly, unless replacement is necessary. Loss of press fit condition could result in an air leak and loss of oilpressure. IMPORTANT: Do not disturb pickup screen and pipe assembly requires replacement, mount pump in a soft-jawedvise and extract pipe from pump. Cleaning and Inspection1. Wash all parts in cleaning solvent and dry with compressed air. 2. Inspect pump body and cover for cracks or excessive wear.

3. Inspect pump gears for damage and excessive wear. 4.

Check for loose drive gear shaft in pump body. 5. Inspect inside of pump cover for wear that would permit oil to leak past ends of gears. 6.

Inspect pickup screen and pipe assembly for damage to screen and pipe. 7. Check pressure regulator valve for fit. IMPORTANT: Pump gears orbody are damaged or worn, replacement of entire oil pump assembly is necessary. Reassembly CAUTIONBe careful of twisting, shearing or collapsing pipe while installing in pump. Pickupscreen must be parallel to oil pan bottom when oil pump is installed. If pickup screen and pipe assembly was removed, mount pump in a soft-jawed vise, applyQuicksilver Perfect Seal to end of new pipe and, using oil pump suction pipe installer(J-21882), tap the pipe in place with a hammer. IMPORTANT: Oil internal parts liberally before installation. 1. Install pressure regulator valve and related parts.

2. Install drive gear in pump body. 3. Install idler gear in pump body with smooth side of gear toward pump cover opening. Align marks made in disassembly. 4. Fill gear cavity with engine oil. 5.

Install pump cover and torque attaching bolts to 106 lb-in. (12 Nm). 6. Turn extension shaft by hand to check for smooth operation. 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-59 Installation1. Install pump, with extension shaft, to rear main bearing, aligning extension shaft with distributor drive shaft. 2.

Tighten oil pump bolt to 65 lb-ft (88 Nm). 72889a b a - Oil Pumpb - Pickup Screen and Pipe 3. Install oil pan.

The one-piece oil pan gasket may be reused if still pliable and not dam-aged. Torsional Damper Removal 1. Remove drive belt. 2. Remove drive belt. 2. Remove drive pulley, then remove torsional damper retaining bolt. IMPORTANT: Do not use a universal claw type puller to remove torsional damper (innext step) as outside ring of torsional damper is bonded in rubber to the hub and useof claw type puller may break the bond. 3. Remove torsional damper remover and installer. 72890 a a - Torsional Damper Remover and Installer (J-23523-E) 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-60 90-861328--1 NOVEMBER 1999 InstallationIMPORTANT: The inertia weight section of torsional damper is assembled to the hubwith a rubber type material. The installation procedure (with proper tool) must befollowed or movement of the inertia weight on the hub will destroy the tuning of thetorsional damper.

1. Replace key in crankshaft if it is damaged. 2. Coat seal surface of torsional damper with engine oil. 3.

Install torsional damper on crankshaft, using torsional damper remover and installer asfollows: b. Install appropriate end of threaded rod in crankshaft at least 1/2 in. (13 mm) toprevent damage to threads. c. Install plate, thrust bearing, washer and nut on rod. d. Install torsional damper on crankshaft by turning nut until it contracts. 72346 a a - Torsional Damper Remover and Installer (J-23523-E) b.

Remove tool from crankshaft. c. To prevent oil leakage, apply Quicksilver RTV sealant to torsional damper keyway. d.

Install torsional damper bolt. Torque to 74 lb-ft (100 Nm). 4. Install drive pulley(s). Torque bolts to 35 lb-ft (48 Nm).

5. Install and adjust drive belt. 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-61 Crankcase Front Cover Oil Seal Oil Seal Replacement (Without Removing Front Cover) REMOVAL 1. Remove torsional damper.

2. Pry seal out of cover from the front with a large screwdriver, being careful not to distortfront cover or damage crankshaft. INSTALLATION IMPORTANT: Correct rotation oil seal must be used to prevent oil leak. 73123 b a Front Seal WITHOUT Helical Groovesa - Can Be Used on Any Rotation Engineb - Seal Lip Toward Inside of Engine 73124 c ab Front Seals WITH Helical Groovesa - MCM (LH) Rotation Enginesb - Seal Lip Toward Inside of Engine 73124 c ab Front Seals WITH Helical Groovesa - MCM (LH) Rotation Enginesb - Seal Lip Toward Inside of Engine 73124 c ab Front Seals WITH Helical Groovesa - MCM (LH) Rotation Enginesb - Seal Lip Toward Inside of Engine - Rotation of Crankshaft as Viewed from Front End Looking Toward Flywheel End 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-62 90-861328--1 NOVEMBER 1999 1. Apply Quicksilver Perfect Seal to seal retainer mating surface and apply grease to seallips. 2. Install new seal with open end of seal inward, using crankcase front cover seal installer.Drive seal in until it just contracts. Do not use excessive force. 72347a a - Crankcase Front Cover Seal Installer (J-35468) 3. Reinstall torsional damper. Crankcase Front Cover Removal1. Remove engine from boat if necessary to gain access to cover.

2. Remove torsional damper and oil pan. 3. Remove water circulating pump. IMPORTANT: Crankcase front cover is not reusable per G.M. Specification. It must bereplaced if removed. 4.

Remove crankcase front cover. 76577 5. Drive oil seal out of front cover (from the rear) using a punch. 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 1999 Page 3A-63 Cleaning and Inspection 1. Clean old gasket material and sealer from mating surface on cylinder block. 2.

Surfaces must be clean and flat or oil leakage may result. InstallationIMPORTANT: Crankcase front cover is not reusable per G.M. Specification. It must bereplaced if removed. 1. Install oil seal in cover with lip of seal toward inside of engine, using crankcase frontcover seal installer. To prevent distortion support cover around seal area with anappropriate tool as shown.

72348 b a a - Crankcase Front Cover Seal Installer (J-35468)b - Support 2. Coat both sides of front cover gasket with Quicksilver Perfect Seal and place in positionon engine. 3. Install front cover, making sure holes in cover align with dowel pins in block. Torque frontcover attaching screws to 100 lb-in. (11 Nm). 76577 4. Install oil pan and torsional damper. 5. Install water circulating pump.

6. Install engine in boat. 7. Fill crankcase with engine oil. 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-64 90-861328--1 NOVEMBER 1999 8. Follow procedures in SECTION 6A or 6B of this manual: Seawater Cooled Models: Provide for adequate water supply to seawater pickup (Refer to SECTION 6A). Closed Cooled Models: Refill closed cooling section (Refer to SECTION 6B), and provideadequate water supply to seawater pickup. CAUTIONEnsure that cooling water supply is available before starting the engine. 9.

Start engine and check for water and oil leaks. Flywheel Removal1. Remove engine from boat. Refer to SECTION 2 - "Removal and Installation". 2. Refer to "Flywheel Housing" description in this section and remove flywheel housing andrelated parts. 3. Remove coupler. 4. Remove flywheel.

72349 Alpha One Coupler 72350 Bravo Coupler Inspection1. Inspect splines in coupler for wear. 2. Check flywheel ring gear for worn and missing teeth. 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-65 Installation1. Clean mating surfaces of flywheel and crankshaft. Remove any burrs. Mating surfaces must be clean bare metal. 2. Aligning dowel hole in flywheel with dowel in crankshaft, install flywheel. Torque boltsto 75 lb-ft (100 Nm). 3. Check flywheel runout as follows: a. Attach a dial indicator to engine block. b. Take readings around outer edge of flywheel. Push in on flywheel as far as it will goto remove crankshaft end play. c. Maximum runout - .008 in. (0.203 mm). 72353 a a - .008 In. (0.203 mm) Max Runout IMPORTANT: Insert three rubber bumpers in Alpha coupler before installation onflywheel. 72354 a a - Rubber Bumper 4. Install drive coupler. Torque bolts to 35 lb-ft (48 Nm). 5. Install flywheel housing and related parts. Torque bolts to 30 lb-ft (41 Nm). 6. Install flywheel housing cover. Torque bolts to 80 lb-in. (9 Nm). 7. Refer to SECTION 2 "Removal and Installation" and install engine.

262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-66 90-861328--1 NOVEMBER 1999 Rear Main Oil Seal The rear crankshaft oil seal can be replaced without removing the oil pan or rear mainbearing cap from engine. RemovalRemove seal by using a screwdriver to pry it out of retainer as shown. 72355 c a b a - Rear Sealb - Seal Retainerc - Slots (Three) 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-67 Cleaning and InspectionClean crankshaft/seal running surface and seal retainer. IMPORTANT: Correct rotation oil seal must be used to prevent oil leak. 73126 b a Rear Seal WITHOUT Helical Groovesa - Can Be Used On Any Rotation Engineb - Seal Lip Toward Inside Of Engine 73127 c b a Rear Seal WITH Helical Groovesa - MCM (LH) Rotation Enginesb - Seal Lip Toward Installation1. Apply Quicksilver Perfect Seal to seal retainer mating surface. Apply grease to seal lips. 2. Install seal using rear main seal installer. (J-26817-A) 72356a a - Rear Main Oil Seal Retainer Removal1.

Remove oil pan. 2. Remove oil seal retainer fasteners. 3. Remove oil seal retainer. 72464a b a a - Fastenersb - Oil Seal Retainer Cleaning and Inspection 1. Clean gasket material from mating surfaces. 2. Inspect oil seal retainer for cracks or scored surface. 3. Inspect oil seal for worn, dry or torn rubber. Replace if necessary, refer to "Rear MainOil

Seal." 4

Inspect alignment pin for damage; replace if necessary. Installation1. Coat seal lips with clean 30W motor oil. 2. Install gasket and oil seal retainer with rear main seal.

3. Coat threads of oil seal retainer fasteners with Loctite Pipe Sealant with Teflon. 4. Install fasteners and torque to 133 lb-in.(15 Nm).

5. Install oil pan fasteners. Torque engine oil pan nuts and bolts 18 lb-ft (25 Nm). NOTE: A one-piece oil pan gasket may be reused if it is still pliable and is not damaged. 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-69 Main Bearings IMPORTANT: Before removing main bearing caps or connecting rod caps, mark themfor reassembly in their original locations. Main bearings are of the precision insert type and do not use shims for adjustment. Ifclearances are found to be excessive, a new bearing, both upper and lower halves, will berequired. Service bearings are available in standard size and .001 in., .010 in. and .020 in.undersize. Selective fitting of both rod and main bearing inserts is necessary in production in order toobtain close tolerances. For this reason you may find one half of a standard insert with onehalf of a .001 in. undersize insert which will decrease the clearance .0005 in. from using afull standard bearing. IMPORTANT: If crankshaft has an undersize journal and a new bearing is required, journal must be reconditioned to accept a .010 or .020 in. undersize bearings are not available for service. InspectionIn general, the lower half is suitable for use, it canbe assumed that the upper half is also satisfactory. If the lower half is suitable for use, it canbe assumed that upper half is also satisfactory and total be replaced of the boat and upside down so crankshaft will rest on the upper bearing and journal. To ensure the proper seating of the crankshaft, all bearing cap bolts should be at theirspecified torque. In addition, before to checking fit of bearings, the surface of the crankshaft journal and bearing should be wiped clear of oil. 1. With the oil pan and oil pump removed, remove bearing cap to be inspected.

2. Place a piece of gauging plastic the full width of the bearing (parallel to the crankshaft) on the journal as shown. 72357 a b a - Gauging Plasticb - Journal 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-70 90-861328--1 NOVEMBER 1999 3. Install the bearing cap and evenly torque the retaining bolts to specifications. Bearingcap MUST be torqued to specification in order to assure proper reading. Variations intorque affect the compression of the plastic gauge. IMPORTANT: Do not rotate the crankshaft while the gauging plastic is between thebearing and journal. 4. Remove bearing cap.

The flattened gauging plastic will be found adhering to either thebearing cap or journal. 5. On the edge of the gauging plastic envelope there is a graduated scale correlated inhousandhs of an inch. Without removing the gauging plastic, measure its compressed Gauging plastic envelope. 72358 a b a - Compressed Gauging Plasticb - Graduated Scale NOTE: Normally main bearing journal will result inrapid bearing giournals wear evenly and are not out of round. However, if a bearing is being fitted to an out-of-round journal (.001 in. max.), be sure to ft to themaximum diameter of the journal: If the bearing orjournal. Be sure to measure the journal with a micrometer if the flattened gauging plastic tapers toward the middle or ends, there is a difference is not within specifications, replace both upper and/over inserts as a unit. 7. A standard, or .001 in., undersize bearing may produce the proper clearance. If the learning is fitted to the ext undersize bearing or journal will result inrapid bearing, recheck clearance. 8. Proceed to the next bearing. After all bearings have been checked, rotate the crankshaft to see that there is no excessive drag. When checking No. 1 main bearing, lossenaccessory drive belts to prevent tapered reading with plastic gauge. 262 CID (4.31) ENGINESSERVICE MANUAL NUMBER 25 90-861328-1 NOVEMBER 1999 Page 3A-71 9. Measure crankshaft to the extreme front position. Measure at the front end of the rear main bearing with a feeler gauge as shown[Specifications - .002-.006 (0.06-0.15)], 72360 a - Force Crankshaft to Extreme Forward Position ReplacementNOTE: Main bearing caps. 265 CID (4.31) ENGINESSERVICE MANUAL NUMBER 25 90-861328-1 NOVEMBER 1999 Page 3A-71 9. Measure crankshaft to Extreme form and bearing site at the rear main bearing with a feeler gauge as shown[Specifications - .002-.006 (0.06-0.15)], 72360 a - Force Crankshaft to Extreme Forward Position ReplacementNOTE: Main bearing source of new, correct size, main bearing suprestices of new, correct size, main bearing suprestices of new, c

6. Install main bearing cap with arrows pointing toward front of engine. 7. Torque all main bearing caps, EXCEPT THE REAR MAIN CAP, to 75 lb-ft (102 Nm); then tap end of crankshaft, firstrearward then forward with a lead hammer. This will line up rear main bearing and crankshaft thrust surfaces. Torque rear main bearing cap to 75 lb-ft (102 Nm). 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-74 90-861328--1 NOVEMBER 1999 Connecting rod bearings are of the precision insert type and do not use shims foradjustment. DO NOT FILE RODS OR ROD CAPS. If clearances are found to be excessive, a new bearing will be required. Service bearings are available in standard size and .001 in.and .002 in. undersize for use with new and used standard size crankshafts, and in .010 in.and .020 in. undersize for use with reconditioned crankshafts. On removing a connecting rod cap, it is possible to find a .010 in. undersize bearing. Theseare used in manufacturing for selective fitting. Inspection and ReplacementIMPORTANT: Before you remove the connecting rod cap, mark the side of the rod and cap. 1.

With oil pan and oil pump removed, remove the connecting rod cap and bearing. 2. Inspect the bearing for evidence of wear and damage. Do not reinstall a worn ordamaged bearing shells and crankpin clean of oil. 4. Measure the crankpin for out-of-round or taper with a micrometer. If not withinspecifications, replace or recondition the crankpint clean of oil. 4. Measure the crankpin for out-of-round or taper with a micrometer. If not withinspecifications, replace or recondition the crankpint to determinenew bearing size required. 5. If within specifications, measure new or used bearing clearances with gauging plasticor its equivalent. If a bearing is being fitted to an out-of-round crankpin, be sure to fit to the maximum diameter of the crankpin is out of round .001 in., interference between the bearing and crankpinwill result in rapid bearing failure. a. Place a piece of gauging plastic, the length of the bearing (parallel to the crankpin or bearing sould occurif placed elsewhere.) 72361 a a - Gauging Plastic b.

Install the bearing in the connecting rod and cap. c. Install the bearing cap and evenly torque nuts to 45 lb-ft (61 Nm). IMPORTANT: Do not turn the crankshaft with the gauging plastic installed. 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328-1 NOVEMBER 1999 Page 3A-75 d. Remove the bearing cap and using the scale on the gauging plastic envelope, measure the gauging plastic width at the widest point as shown. 72358 a b 6. If the clearance exceeds specifications, select a new, correct size bearing and measure the clearance.

NOTE: Be sure to check what size bearing is being removed in order to determine properreplacement size bearing. If clearance cannot be brought within specifications, the crankpinwill have to be ground undersize.

If the crankpin is already at maximum undersize, replacecrankshaft. 7. Coat the bearing surface with oil, install the rod cap and torque nuts to 45 lb-ft (61 Nm). 8. When all connecting rod bearings have been installed, tap each rod lightly (parallel tothe crankpin) to make sure they have clearance. 9. Measure all connecting rod side clearances between connecting rod caps as shown[Specifications - .006-.014 (0.152-0.356)]. 72891 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-76 90-861328--1 NOVEMBER 1999 Connecting Rod/Piston Assembly Removal1. Remove oil pan and dipstick tube. 2. Remove oil pump. 76571 3. Remove distributor and intake manifold. 4. Remove cylinder heads. 76576 5. Use a ridge reamer to remove any ridge and/or deposits from upper end of cylinder bore. IMPORTANT: Before ridge and/or deposits are removed, turn crankshaft until piston is at top of stroke, thenremove cloth and cuttings. 6. Mark connecting rod sad bearing caps (left bank 1, 3 and 5; right bank 2, 4 and 6 fromfront to rear on same side as piston thrust). 7. Remove connecting rod and piston assembly out of top of cylinder block. 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-77 NOTE: It will be necessary to turn crankshaft slightly to disconnect and remove some connecting rod and piston assemblies. 72892 a - Connecting Rod Bolt Guide (3/8-24) [J-5239] Disassemble piston from connecting rod using piston pin remover. 72893 a b c d e a - Piston from connecting rods in cleaning solvent and dry with compressed air. 2. Check for twisted and bent rods and inspect for nicks and cracks. Replace damagedconnecting rods.

PISTONS NOTE: Cylinder bore and taper must be within specifications before pistons can beconsidered for re-use.

1. Clean varnish from piston skirts with a cleaning solvent. DO NOT WIRE BRUSH ANYPART OF PISTON. Clean ring grooves with a groove cleaner and make sure oil ringholes are clean. 2. Inspect piston for damaged ring lands, skirts and pin bosses, wavy or worn ring lands, scuffed or damaged skirts and eroded areas at top of piston. 3. Inspect grooves for nicks and burrs that might cause rings to hang up. 4. Measure piston skirt and check clearance as outlined under "Piston Selection." 5. Slip outer surface of a new top and second compression ring rino respective piston ring ring entirely around the groove to make sure that ring does not bind. Ifring groove causes binding, remove by dressing with a fine cut file. If a distorted ringcauses binding, recheck with another ring. 72894 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-79 6. Proper clearance on piston ring in its groove is nacke sure d. See "Specifications." 72895 PISTON PINS 1. Piston pin clearance is designed to maintain adeguate clearance under all engineoperating conditions. Because of the soft of warnish and scuffing when measured. See "Specifications." 72895 PISTON PINS 1. Piston pin bores and piston pins mustbe free of varnish and scuffing when measured. Measure piston pin bore with a dial bore gauge or inside micrometer. If clearance is in excessof the .001 in. (0.02 mm) wear limit, replace piston and piston pin assembly. 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-80 90-861328-1 NOVEMBER 1999 Reassembly PISTONS AND PISTON PINS IMPORTANT: When reassembling pistons and connecting rods, se ware that: • Piston and pin are machine fitted to each other and must remain together as amatched set. Do not intermix pistons and pins. • If original pistons and/or connecting rods are being used, be sure to assemble piston for damaged ring lands, scuffed or damaged set. 7286 a a - Notch 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 90-861328-1 NOVEMBER 1999 Page 3A-811. Assemble piston to connecting rod searce under al

If a new connecting rod has been installed, mark connecting rod and cap (on side of rodand cap with slots for connecting rod bearing tangs) with cylinder number in which it willbe installed. PISTON RINGS All compression rings are marked on upper side of ring. When installing compression rings, make sure that marked side is toward top of piston. Oil control rings are a three-piece type, consisting of two rings and a spacer. 1. Select rings comparable in size to cylinder bore and piston size. 2. Slip compression ring in cylinder bore about 1/4in. (6 mm) (below ring travel). Be sure that ring is square with cylinder wall. 3. Measure gap between ends of ring is below specifications, remove ring and try another for fit. 5. Fit each compression ring to cylinder in which it is going to be used. 6. Clean and inspect pistons. 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-82 90-861328--1 NOVEMBER 1999 7. Install piston rings as follows: a. Install oil ring spacer in groove and insert anti-rotation tang in oil hole. b. Hold spacer ends together and install lower steel oil ring rail with gap properly located. c. Install upper steel oil ring rail with gap properly located.

Flex the oil ring assembly to make sure ring is not binding. If ring groove is causingbinding, remove with a fine cut file. If a distorted ring is causing binding, use a newring. IMPORTANT: Use piston ring expander (91-24697) for compression ring installation. e. Install lower compression ring with marked side up, using ring expander. InstallationIMPORTANT: Cylinder bores must be clean before piston installation. Clean with hot water and detergent wash. Aftercleaning, swab bores several times with light engine oil and clean cloth, then wipewith a clean dry cloth. 1. Lubricate connecting rod bearings and install in rods and rod caps. 2. Lightly coat pistons, rings and cylinder walls with light engine oil. 3. With bearing caps removed, install connecting rod bolt guide (3/8-24) (J-5239) on con-necting rod bolts. IMPORTANT: Be sure ring gaps are properly positioned as shown. 72373 a b b c d e f g Ring Gap Locationa - Oil Ring Spacer Gap (Tang In Hole Or Slot Within Arc)b - Oil Ring Gaps - Port Sidef - Engine Frontg - Starboard Side 4. Install each connecting rod and piston assembly in its respective bore. Install withconnecting rod bearings toward outside of cylinder block. Use piston ring compressor to compressor for which they werefitted, and used pistons to install pistoninto bore. Hold ring compressor firmly against cylinder block until all piston rings at rong of each addition. Be sure to install new pistons in same cylinders for which they were removed. Each connecting rod and bearing cap should be marked, beginning at front of engine (1,3 and 5 in left bank and 2, 4 and 6 in the were fitted, and used pistons in same cylinder from which they were removed. Each connecting rod and bearing cap should be marked, beginning at front of engine (1,3 and 5 in left bank and 2, 4 and 6 in the form which they were removed. Each connecting rod and bearing cap should be marked, beginning at front of engine (1,3 and 5 in left bank and 2, 4 and 6 in the bank and 2, 4 and 6 in the bas and 2, 4 and 6 in the bas and 2, 4 and 6

MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-83 IMPORTANT: Be sure to install new pistons in same cylinder from which they were removed. Eachconnecting rod and bearing cap should be marked, beginning at front of engine (1,3 and 5 in left bank and 2, 4 and 6 in right bank). Numbers on connecting rod andbearing cap must be on same side when installed in cylinder bore. If a connecting rod should be fitted and connecting rod should be numbered to correspond with new cylindernumber. 72552 a - Piston Ring Compressor (J-8037) 5. Remove connecting rod bolt guide. 6. Install bearing caps and torque nuts to 20 lb-ft (27 Nm), then tighten nuts an additional70 degrees angular torque using a Torque Angle Gauge. 7. Check connecting rod side clearance. NOTE: If bearing replacement is required, refer to "Connecting Rod Bearings." 8. Install dipstick and oil pan.

b. Install cylinder heads. c. Install intake manifold. d. Install distributor. 9. Fill crankcase with oil. Refer to SECTION 1 - "Maintenance." 10. Torque rocker arm nuts to 22 lb-ft (30 Nm). 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-84 90-861328--1 NOVEMBER 1999 Crankshaft Removal1. Remove engine from boat. 2. Drain crankcase oil. 3. Remove starter.

76489 a b a - Starterb - Mounting Bolts 4. Remove flywheel housing. 5. Remove drive coupler and flywheel. 76490 a b a - Flywheelb - Bolts 6. Remove water pump. 8. Remove crankshaft pulley and torsional damper. 9. Remove spark plugs. 10. Remove oil pan and dipstick tube. 11.

Remove oil pump. 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-85 12. Timing chain cover. 76491 a a - Timing chain cover.

18. Remove main bearing caps and carefully lift crankshaft out of cylinder block.

262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-86 90-861328--1 NOVEMBER 1999 19. If new main and/or connecting rod bearings are to be installed, remove main bearing inserts from cylinder block and bearing caps, and/or connecting rod bearing inserts from connecting rod and caps. Install new bearings following procedures outlined. 76582 76581 76579 Cleaning and Inspection1. Wash crankshaft in solvent and dry with compressed air. 2. Measure main bearing journals and crankpin dimensions with a micrometer forout-of-round, taper or undersize.

Refer to "Specifications." 3. Check crankshaft for runout (by supporting at front and rear main bearings journals inV-blocks) and check at front and rear intermediate journals with a dial indicator. Referto "Specifications." 4. Replace or recondition crankshaft if not within specifications. 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-87 Installation1. If a new crankshaft is being installed, remove timing sprocket from old crankshaft and reinstall on new crankshaft as outlined.

IMPORTANT: Be sure that all bearings and crankshaft journals are clean. 2. Install main bearings in engine block as follows.

72359 ab c Main Bearing Insertsa - Lower Bearing Insert (Install in Cap)b - Upper Bearing Insert (Install in Block)c - Oil Groove 3. Carefully lower crankshaft into place. Be careful not to damage bearing surface. 4.

Check clearance of each main bearing. If bearing clearances are satisfactory, apply en-gine oil to journals and bearings. 5. Install main bearings "when tightening rear main bearing cap. 6. Check crankshaft end play. 7. Install rear main seal retainer and seal. Torque fasteners to 133 lb-in. (15 Nm). 8. Check clearance for each connecting rod bearing. If bearing clearances are satisfactory, apply engine oil to journals and bearings.

9. Install rod caps and torque nuts to 45 lb-ft (61 Nm). 10. Reverse Steps 3 - 13 in Removal. 11. Install new oil filter. 12.

Fill crankcase with oil. 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-88 90-861328--1 NOVEMBER 1999 Timing Chain and Sprocket Removal1.

Remove torsional damper, oil pan and crankcase front cover. 2. Turn crankshaft until timing marks on crankshaft sprockets are inalignment. 72899 b a a - Timing Marks Alignedb - Locating Pin 3. Remove camshaft sprocket and timing chain. (If sprocket does not come off easily, alight tap on the lower edge of the sprocket using a plastic mallet, should dislodge it.) 4. Remove crankshaft sprocket if removed. CAUTIONWhen timing marks are aligned in this procedure, the No. 4 cylinder is oncompression (TDC); therefore, if the distributor is to be installed, the rotor MUSTBE positioned at the No. 4 post on the distributor cap. 2. Install timing chain on camshaft sprocket vertical with chain hangingdown. Align marks on camshaft and crankshaft sprockets. IMPORTANT: Do not attempt to drive sprocket on camshaft, as welsh plug at rear ofengine can be dislodged. 3. Install sprocket nor camshaft sprocket provide to 18 lb-ft (24 Nm). 4. Lubricate timing chain. 3. Using crankshaft gear and sprocket procket procket procket procket provide and sprocket procket procket procket installer, as shown, install sprocket on camshaft. 72377 a a - Crankshaft Gear and Sprocket Installer (J-5590) 2. Install timing chain. 3. Install crankcase cover and torsional damper. Checking Timing Chain and sprockets installed, check timing chain and sprockets installed, check timing chain and sprocket installed are crankshaft gear and sprocket installed, check timing chain and sprocket installed, check timing chain and sprocket installed are cranks

Rotate camshaft in the opposite direction to slacken the chain, then force chain out withfingers and again measure the distance between reference point and timing chain. 4. The deflection is the difference between these two measurements. If the deflectionexceeds 3/4 in. (19 mm), timing chain should be replaced. 72899 a a - Reference Point 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-90 90-861328--1 NOVEMBER 1999 Balance Shaft / Gears Removal1. Remove manifold.

IMPORTANT: Crankcase front cover is not reusable per G.M. Specification. It must bereplaced if removed. 2. Remove crankcase front cover. 76577 3. Remove timing chain. 4. Insert hard wood wedge between gear teeth and remove TORX bolt retaining balanceshaft driven gear. Remove gear. 72900 b c a a - Wedgeb - Driven Gear - Drive Gear 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-91 5. Unscrew stud and remove balance shaft drive gear on camshaft as shown. 72901 b a a - Studb - Drive Gear 6. Remove two TORX bolts retaining balance shaft thrust plate. IMPORTANT: Care should be taken in next step as damage to cylinder block and/orbalance shaft could result. 7.

Insert pry bar in aft section between balance shaft and cylinder block. Gently apply for-ward pressure and remove balance shaft. 72902 a b c a - Pry Barb - Balance Shaft rear bearing, place a cloth in valley to prevent anydebris from entering the crankcase. 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-92 90-861328--1 NOVEMBER 1999 8. Balance shaft rear bearing can be replaced using balance shaft removal and installertool in conjunction with bearing puller. 72903 a b a - Balance Shaft Removal and Installation Toolb - Bearing Puller Cleaning and Inspection1. Wash balance shaft in solvent and blow dry with compressed air. 2. Inspect rear bearing for wear or damage. See "Specifications." NOTE: Front bearing is not serviceable and may be replaced only with the balance shaft or excessive side to side play. Also checkfor scored bearings or roughness while rotating. 4. Inspect front cylinder block bore for scoring or evidence of bearing spinning in bore. 5. Inspect gears for chips or excessive wear on teeth. 6. Inspect balance shaft remover and installed on the bearing. This will assureproper depth setting of rear bearing when installed. 1. Use balance shaft remover and installer tool along with GM shim to insert bearings with engine oil and install balance shaft. 3. Using a soft face mallet, tap shaft until front bearing retaining ring seats against cylinder Block. 72904 a b a - Retaining Ringb - Cylinder Block 4. Install thrust plate and two TORX bolts. Torque to 120 lb-in.

### (14 Nm). 5.

Install driven gear on balance shaft. 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-94 90-861328--1 NOVEMBER 1999 6. Align marks on drive and driven gear and install drive gear on camshaft. 72905 a a - Alignment Marks 7. Install bolts to retain camshaft sprocket and torque to 20 lb-ft (27 Nm). 8. Apply thread adhesive to threads of balance shaft bolt and install. 9. Insert hard wood wedge between gear teeth and torque driven gear retaining bolt to 15lb-ft (20 Nm), then tighten bolt an additional 35 degrees angular torque using a TorqueAngle Gauge. 72906 a b a - Wedgeb - Driven Gear 10. Install timing chain. 11. Install crankcase front cover. 12. Install manifold. 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-95 Camshaft Measuring Lobe LiftNOTE: Procedure is similar to checking valve timing. If improper valve operation isindicated, measure lift of each push rod in consecutive order and record readings. 1.

Remove valve mechanism. 2. Position indicator with ball socket adaptor tool on push rod. Ensuer that push rod is inlifter socket. 72907 a a - Ball Socket Adaptor Tool (J-8520-1) 3. Rotate crankshaft torsional damper slowly in direction of engine rotation until lifter is onheel of cam lobe. At this point, push rod will be in its lowest position. 4. Set dial indicator on zero, then rotate balancer slowly (or attach an auxiliary starterswitch and "bump" engine over) until push rod is in fully raised position. 5. Compare total lift, recorded from dial indicator, with "Specifications." 6. Continue to rotate engine until indicator reads zero. This will be a check on accuracy oforiginal indicator reading. 7.

If camshaft readings for all lobes are within specifications, remove dial indicatorassembly. 8. Install rocker arm and push rod. Torque nuts to 20 lb-ft (27 Nm). 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-96 90-861328--1 NOVEMBER 1999 Removal1. Remove valve lifters. 76585 IMPORTANT: Crankcase front cover is not reusable per G.M. Specification. It must bereplaced if removed. 2. Remove crankcase front cover.

76577 3. Remove camshaft as follows: a. Remove timing chain, sprocket and camshaft thrust plate. 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-97 b. Install two 5/16-18 x 5 in. bolts in camshaft bolt holes and carefully remove camshaftas shown. 72908 InspectionMeasure camshaft bearing journals with a micrometer for out-of-round condition. If journalsexceed .001 in. (0.025 mm) out-of-round, camshaft should be replaced. Also check camshaft for alignment with V-blocks and dial indicator which indicates exactamount camshaft is out of true. If out more than .002 in.

(0.05 mm) (dial indicator reading)camshaft should be replaced. 72909 Checking Camshaft Alignment Installation1.

Install camshaft as follows: a. Install two 5/16-18 x 5 in. bolts in camshaft bolt holes, then lubricate camshaft jour-nals with engine oil and install camshaft. DO NOT damage bearings.

h

Lubricate camshaft lobes with General Motors Cam and Lifter Prelube or equivalent. c. Install timing chain. 2. Install trankcase front cover and valve lifters. 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-98 90-861328--1 NOVEMBER 1999 Camshaft Bearings RemovalCamshaft bearings can be replaced while engine is disassembled for overhaul or without complete disassembly. To replace bearings without complete disassembly, removecamshaft and crankshaft, leaving cylinder heads attached and pistons in place. Before removing crankshaft, fasten connecting rods against sides of engine so that they will notinterfere while replacing camshaft bearings. 1. With camshaft and crankshaft removed, drive camshaft rear plug from cylinder block. NOTE: This procedure is based on removal of bearings from center of engine first, thus requiring a minimum amount of turns to remove all bearings. 2. Using camshaft bearing remover and installer set (J-6098-01) (with nut and thrustwasher installed to end of threads), position pilot in front camshaft bearing and installpuller screw through pilot. 3. Install tool with shoulder toward bearing. Ensure a sufficient amount of threads areengaged. 4. Using two wrenches, hold puller screw while turning nut. When bearing has been pulledfrom bore, remove tool and bearing from puller screw. 5. Remove remaining bearings (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-99 6. Assemble driver on driver handle and remove front and rear camshaft bearings bydriving toward center of cylinder block. 72870 a b c a - Driverb - Driver Handlec - Bearing block with solvent and blow out with compressedair.

Be sure grooves and drilled oil passages are clean. InstallationFront and rear bearings must be installed last as pilot will not fit into bearing bores if bearings are not the same. Be sure to install bearings inproper locations (Indicated by bearing manufacturer) and to position bearings asfollows (directional references are in reference to engine in its normal operatingposition): • Front bearing must be positioned so that oil holes are equal distance from 60'clock position in the block. Intermediate and center bearings must be positioned so that oil holes are at the 5 o'clock position (toward left side of block andat a position pilot in frontcamshaft bearing bore and insert screw through pilot. b. Index center camshaft bearing, then position appropriate size remover and installer tool and thread puller screw and turn nut until bearing has been pulled intoposition. Remove the remover and installer tool and check to ensure that oil hole(s) in bearing are positioned correctly. It will be necessary to position pilot in rear camshaft bearings in same manner being sure to install rearing bore to i

262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-100 90-861328--1 NOVEMBER 1999 2. Installing front and rear bearings: a. Install appropriate size remover and installer tool on drive handle. b. Index front bearing (as explained in "Important" above), and drive it into position withtool. Check position of oil hole(s) in bearing to ensure bearing is positioned correctly. c. Install rear bearing in same manner, being sure to index bearing correctly. 3. Install a new camshaft rear plug. IMPORTANT: Plug must be installed flush to 1/32 in. (0.8 mm) deep and must beparallel with rear surface of cylinder block. 4. Install crankshaft and camshaft. Cylinder Block Cleaning and Inspection1. Remove all engine components. 2. Wash cylinder block thoroughly in cleaning solvent and clean all gasket surfaces. 3. Remove expansion plugs.

NOTE: These plugs may be removed with a sharp punch or they may be drilled and priedout, 5. Clean and inspect water passages in cylinder block for cracks in cylinder walls, water jacket valve lifter bores and mainbearing webs. 262 CD (4,31): ENGNBUCE MANUAL NUMBER 25 90-661328–1 NOVEMBER 1999 Page 3A-102 Page 3A-102

262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-103 PISTON SELECTION 1. Check used piston to cylinder bore diameter with a telescope gauge 2-1/2 in. (64 mm) from topof cylinder bore as shown. 72386 b. Measure piston diameter at skirt across center line of piston pin as shown. 72911 c. Subtract piston diameter from cylinder bore diameter to determine piston-to-boreclearance.

Determine if piston-to-bore clearance is in acceptable "Specifications" range. 2. If used piston is not satisfactory, determine if a new piston can be selected to fit cylinderbore within acceptable range. 3.

If cylinder bore must be reconditioned, measure new piston diameter (across centerline of piston pin), then hone cylinder bore to correct clearance (preferable range). 4. Mark piston to identify cylinder for which it was fitted. 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-104 90-861328--1 NOVEMBER 1999 Oil Filter By-Pass Valve Inspection and/or ReplacementOil by-pass valve should be inspected whenever engine is disassembled for major repairor whenever inadequate oil filtration is suspected. 1.

Remove oil filter from cylinder block and remove by-pass valve. 2. Clean by-pass valve in solvent and blow dry with compressed air. 3. Inspect fiber valve fits tightly against itsseat on the seal. Push valve down and release it. Valve should return freely to its seat. If valve operation is questionable, by-pass valve should be replaced.

72912 a Typical By-Pass Valvea - Fiber Valve 4. Wipe out valve chamber in cylinder block to remove any foreign material.

Install by-pass valve and cylinder block adaptor to engine block. 6. Lubricate oil filter rubber seal and install hand-tight only. 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-105 Remote Oil Filter Inspection and/or Replacement1. Remove nut from back side of power steering pump bracket. 75010 a Typicala - Nut 2.

The outer oil line on the oil filter housing must be removed in order to install the bracket. 75010 a - Remove This Line NOTE: Oil lines must be routed under the return line to the power steering pump. Ensurethat the oil lines do not rub or chafe on the exhaust manifold or engine mount. 262 CID (4.3L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-106 90-861328--1 NOVEMBER 1999 3. Place bracket over the stud and install nut. Torque nut to 12 lb-ft (16 Nm). 75010 a b c a - Bracketb - Nutc - Power Steering Beturn Line 4. Install bracket screw from the front side of power steering bracket. 75011 a a - Bracket Screw 5. Install previously removed oil line into oil filter housing. Torque fitting 20 to lb-ft (27 Nm). 6. Lightly lubricate seal on oil filter with engine oil. Install oil filter on oil filter adapter. Handtighten only. 7. Route oil lines past engine mount. Use hose clip over screw and reinstall screw. 262 CID (4.3L) ENGINESSERVICE MANUAL NUMBER 25 90-861328--1 NOVEMBER 1999 Page 3A-107 8. Place the seal in adapter and lightly lubricate with engine oil. Position adaptor over en-gine block and install the bushing in the block. Torque bushing to 40 ft-lb (50 Nm). 75175 a b c d a - Engine Block To Adapter Sealb - Adapter - Quad Ringd - Bushing 9. Install oil lines in adapter and orientate as shown. Torque fittings to 20 lb-ft (27 Nm). 75163 a a - Oil Lines 10.

Check oil level and fill if necessary. 11. Start engine and check for oil leaks. 262 CID (4.3.L) ENGINES SERVICE MANUAL NUMBER 25 Page 3A-109 THIS PAGE IS INTENTIONALLY BLANK 262 CID (4.3.L) ENGINESSERVICE MANUAL NUMBER 25 Page 3A-109 THIS PAGE IS INTENTIONALLY BLANK My son's 2012 Hurricane boat outdrive was repaired by a shop in November 2016. The Mercruiser 4.3 MPI was running great when the outdrive broke. The boat was taken for the winter in another city. The boat was taken to bis lakehouse on July 4 2017 and would not start. Also, he noticed the alarm "beep" did not occur upon switching flui dinto air intake, but only it will not start the electric fuel pump (s) are not geneting fluid into the fuel rais. We cannot the the upper, or would cause the boat was taken to the fuel pumps, nor do we have suggestions on what are the likely suspects to look for that would prevent the fuel pump from getting power, or would cause the diagnostics to not run before startup? Which service manual do you recommend for us to get that will be the best, most detailed one for this Mercruiser system. Thanks for any help you may have to offer! This sort of sounds like either your fuel pump relay system is bad. On top of the engine should be 2 (or 3) relays, try switching them around and see if the symptoms change any....Also try tapping on the relays in case they are slightly stuck internally form sitting. Next to the relays and ECM area should be a little fuse box with a black cover over the top of the fuse. Remove the black cover and check your 3 fuses. Last edited: Jul 30, 2017 Thank you, Fun Times! Your input sure gives some things to check! And the wiring diagram is great, too. Thanks so much! It will likely be next weekend before I can get back up to the lakehouse to check these out - but I'll post back here with what we found out.... So having an issue with my 4.3 Mercruiser also. This sound just like what I have going on too. No power to the fuel pump. Switched relays no difference, checked fuses, all good. When I turn th