service bulletin

STERN DRIVES/INBOARD ENGINES

NUMBER: 79-9
DATE: 4/25/79

CIRCULATE TO:
SERVICE MANAGER
PARTS MANAGER
MECHANICS

A. Rochester Quadrajet Carburetor Idle Mixture Screw
B. MCM 470 Voltage Regulator
C. MCM 470 Dual Station Water Temperature Sender
D. V-8 Engine Timing Chain/Sprocket Replacement

A. ROCHESTER QUADRAJET CARBURETOR IDLE MIXTURE SCREW

(Attach Bulletin Reference Sticker to PP 4B-28, 4B-34 and 9A-7 of Your Service Manual.)

Rochester Quadrajet carburetors now incorporate a new style idle mixture screw with a "double D" head. (Figure 1) A special ¼" drive socket (C-91-86197) is available for adjusting this screw.

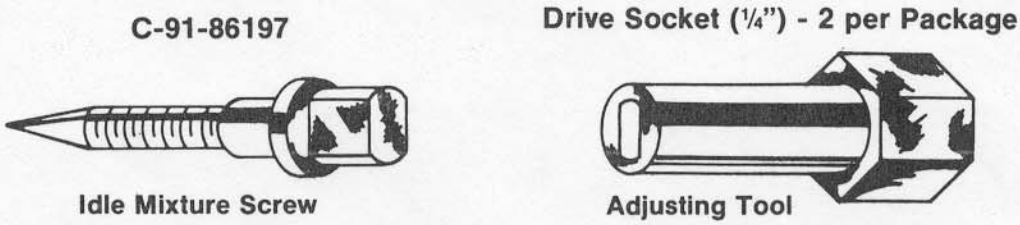


Figure 1. Idle Mixture Screw and Adjusting Tool

B. MCM 470 VOLTAGE REGULATOR

(Attach Bulletin Reference Sticker to P. 3C-7 of Your Service Manual.)

MerCruiser 470 Engines, Serial No. 5120656 and above, are equipped with new voltage regulator B-86255A2. The new voltage regulator permits the use of battery isolator with the MerCruiser 470 charging system and will backfit 470 Engines starting with Serial No. 4625580. Voltage regulator B-77305A2 (originally used on 470 Engines, Serial No. 4625580-thru-5120655) is superseded by the new regulator for service replacement.

C. MCM 470 DUAL STATION WATER TEMPERATURE SENDER

(Attach Bulletin Reference Sticker to Section 3D Index Page in Your Service Manual.)

MerCruiser 470 Engines, which are installed in boats equipped with dual station instrumentation, must use dual station water temperature sending units (B-79157). If a single station sending unit is used, incorrect temperature gauge readings will result. The dual station water temperature sender can be identified easily by the designation "334-L" stamped on one of the hex flats.

D. V-8 ENGINE TIMING CHAIN/SPROCKET REPLACEMENT

(Attach Bulletin Reference Sticker to P. 5C-25 of Your Service Manual.) + 280

MCM 250 (Serial No. 4768000 and above), 255 (Serial No. 4175800 and above), 898, 228, 260 and MIE [standard rotation (left hand) only], 255 (Serial No. 4178300 and above), 198 and 228 are equipped with link type timing chains and sprockets that have nylon teeth. If any of these components require replacement, a new timing chain assembly (B-35378A1) must be used. The timing chain assembly consists of a new roller type timing chain (B-35378), an all-metal crankshaft sprocket (B-43-48338) and an all-metal camshaft sprocket (B-43-35338). The original components cannot be used in any combination with the replacement components. Component pieces of the replacement timing chain assembly are available.

service bulletin

STERN DRIVES/INBOARD ENGINES

NUMBER: 80-6
DATE: 3/12/80

CIRCULATE TO:
SERVICE MANAGER
PARTS MANAGER
MECHANICS

A. MCM 470 Cylinder Head Gasket
B. MCM 470 Heat Exchanger Mounting Bracket
C. Temperature Gauge Resistor B-82-88645A3 for MCM 470/485 and MIE 470 Engines
D. Alternator Rotor Remover
E. MCM 470 Power Steering Pump Installation
F. MerCruiser Inboard Transmission Fluid
G. MIE 228/255/330 Cylinder Block Replacement
H. MerCruiser Crankcase Oil Recommendations
I. Condenser B-392-6324 Shorting Problem

A. MCM 470 CYLINDER HEAD GASKET

(Attach Bulletin Reference Sticker to P. 5D-4 of Your Service Manual.)

A new, "heavy-duty" cylinder head gasket (B-27-92166) with improved service life now can be ordered as a service replacement part for MCM 470 engines.

B-27-92166 Cylinder Head Gasket

B. MCM 470 HEAT EXCHANGER MOUNTING BRACKET

(Attach Bulletin Reference Sticker to P. 7D-38 of Your Service Manual.)

A new heat exchanger mounting bracket (B-86296A1) has been released for MCM 470 engines. It incorporates rubber vibration isolation mounts, which are designed to absorb engine vibration, and thereby improves heat exchanger life. The new mounting bracket assembly can be used to replace mounting bracket B-77226 on MCM 470 engines with Serial No. 4625580 and above.

The new style mount should be installed in applications in which recurring heat exchanger internal leaking problems have been experienced. In addition to the B-86296A1 mounting bracket assembly, 3 flat washers (C-12-27025) and 3 locknuts (C-11-49253) are required to replace the 3 lockwashers and 3 nuts used with the old style mounting bracket. Torque new nuts to 60 in. lbs. (69kg-cm).

B-86296A1 Heat Exchanger Mounting Bracket

C. TEMPERATURE GAUGE RESISTOR B-82-88645A3 for MCM 470/485 and MIE 470 ENGINES

(Attach Bulletin Reference Sticker to P. 3D-1 of Your Service Manual.)

MerCruiser 470/485 Stern Drive Engines and 470 Inboard Engines are equipped with 160°F thermostats. Normal cooling system operating temperature with this thermostat installed is approximately 160°F - 185°F.

Quicksilver Temperature Gauges are color-coded yellow, green and red. The division point between green and red represents 180°F. Because of this, and because of gauge and sender tolerances, the gauge sometimes will read slightly into the red, even though the engine is not overheating. To eliminate this condition, a Temperature Gauge Resistor (B-82-88645A3), which will adjust the reading back into the green zone, can be installed. The resistor attaches directly to the "Send" terminal on the gauge. Order from your Factory Branch or Distributor.

B-82-88645A3 Temperature Gauge Resistor 10 Ohm 1 Watt

D. ALTERNATOR ROTOR REMOVER

(Attach Bulletin Reference Sticker to P. 5D-1 of Your Service Manual.)

A new Alternator Rotor Remover (J-6978-E) is available for the MCM 470/485 and MIE 470 models from Kent-Moore Tools, Inc., 28635 Mound Road, Warren, Michigan 48089. The new

(OVER)

tool replaces J-6978-04 and has a longer screw to permit removal of the alternator rotor without using a spacer between the screw and crankshaft.

The longer screw (J-22214-4) also is available separately and can be ordered to update tool J-6978-04. Order directly from Kent-Moore Tools, Inc.

J-6978-E Alternator Rotor Remover

E. MCM 470 POWER STEERING PUMP INSTALLATION

(Attach Bulletin Reference Sticker to P. 2A-9 of Your Service Manual.)

When installing Power Steering Kit B-76742A1 or B-76742A3 on MCM 470 Engines, BE SURE to torque the screws, which attach the pump mounting bracket to the cylinder head, to 25 ft. lbs. (3.4mkg). The torque also MUST BE rechecked after 20 hours of operation.

F. MERCRUISER INBOARD TRANSMISSION FLUID

(Attach Bulletin Reference Sticker to Section 9A Index Page of Your Service Manual.)

Inquiries have been received concerning the color of the transmission fluid in MIE transmissions. The transmission fluid appears green rather than the normal red shade of automatic transmission fluid. This is caused by dye that is added to the transmission fluid during final testing at the factory. The dye enables the tester to detect any transmission fluid leaks with the use of a "black light".

Transmission fluid recommendations have not changed. Use only Automatic Transmission Fluid Type A-Suffix A, Ford Type F or Dexron. (If one kind is already in the transmission, the same kind or one of the other two may be added.)

G. MIE 228/255/330 CYLINDER BLOCK REPLACEMENT

(Attach Bulletin Reference Sticker to P. 5C-1 of Your Service Manual.)

The subject blocks have been changed in the area of the remote oil filter adaptor. Prior to the change, the remote oil filter adaptor was secured to the block with one ½"-13 screw. New blocks are designed for remote oil filter adaptors which are secured with two 5/16"-18 screws. The remote oil filter adaptors are not interchangeable; therefore, when replacing an older style block with a later style block, Remote Oil Filter Adaptor Kit B-86029A1 also must be installed. The kit includes a new adaptor and all necessary attaching parts.

When replacing a cylinder block on a MIE 228/255/330 model, BE SURE to check the block to determine if the remote oil filter adaptor kit is required.

H. MERCRUISER CRANKCASE OIL RECOMMENDATIONS

(Attach Bulletin Reference Sticker to P. 1C-3 of Your Service Manual.)

A single-viscosity, petroleum-based oil, that meets A.P.I. (American Petroleum Institute) classification "SE", is recommended for use in all MerCruiser Engines. Viscosity should be selected from the following chart:

Prevailing Daytime Temperature During Which Oil Will Remain in Crankcase	Recommended Viscosity	Oil and Oil Filter Change Intervals
0°F (-18°C) to 32°F (0°C)	SAE 20W	50 Hours of Operation or 30 Days, Whichever Occurs First
32°F (0°C) to 90°F (32°C)	SAE 30	100 Hours of Operation or 60 Days, Whichever Occurs First
90°F (32°C) and Above	SAE 40	

Multi-viscosity oils (synthetic-based as well as petroleum-based) ARE NOT RECOMMENDED for use in MerCruiser Engines. Multi-viscosity oils are satisfactory for automotive engines which operate at lower continuous duty RPM settings than do marine engines. Under continuous duty high output operating conditions encountered in marine applications, a permanent loss of viscosity may result if multi-viscosity oils are used. This, of course, can lead to dangerously low oil pressure.

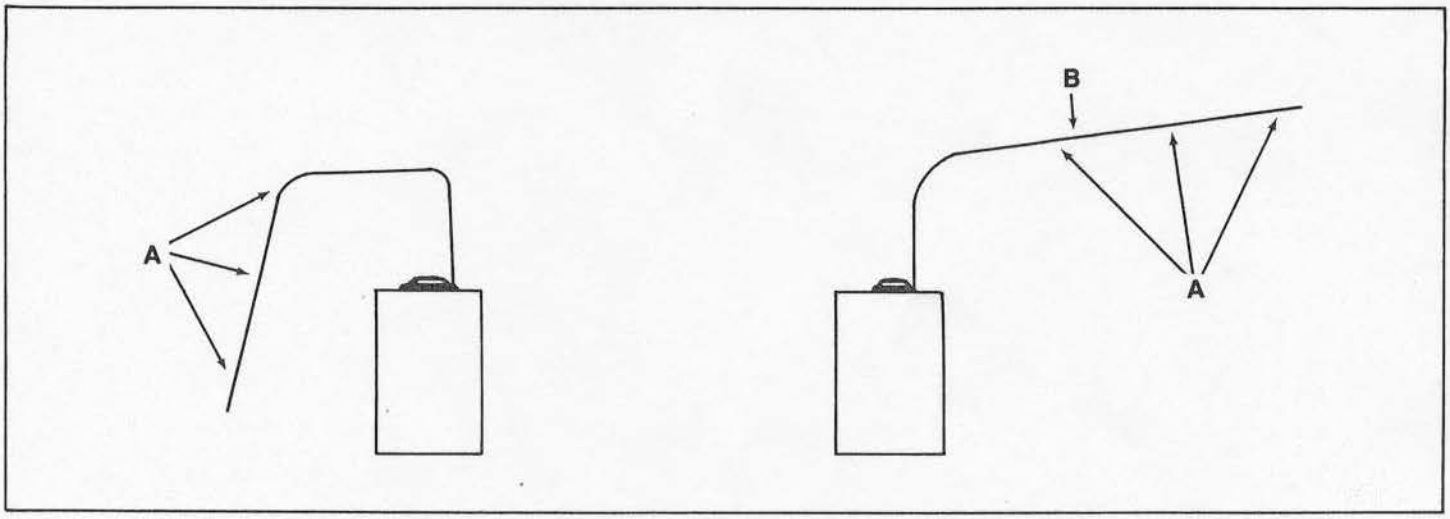
Oils, which contain "solid" additives, such as colloidal graphite and molybdenum disulfide, ARE NOT RECOMMENDED for MerCruiser Engines. When used in high RPM applications, such as marine engines, these "solid" additives can centrifuge out. This then can reduce or eliminate crankpin bearing radial clearance and can plug crankshaft oil passages.

Any failure, that is caused by the use of multi-viscosity oils or oils containing "solid" additives, will not be covered by MerCruiser warranty.

I. CONDENSER (B-392-6324) SHORTING PROBLEM

(Attach Bulletin Reference Sticker to P. 3B-3 of Your Service Manual.)

Condenser B-392-6324 (Figure 1) is used in Prestolite distributors on MCM 888, MCM 233 and MIE 233. The condenser has a copper strap with 3 mounting holes. When installing a replacement condenser, it is necessary to bend the strap in the opposite direction (180°) and to cut the strap off at the hole next to the condenser. (Figure 2) If this procedure is not followed, the copper strap will short out to the distributor housing.



a - Mounting Holes in Copper Strap
b - Location to Cut Off Copper Strap

Figure 1. Condenser

Figure 2. Strap Bent 180°

service bulletin

mercruiser
STERN DRIVES/INBOARD ENGINES

NUMBER: 80-12
DATE: 9/19/80

CIRCULATE TO:
SERVICE MANAGER
PARTS MANAGER
MECHANICS

A. MCM 470/485 and MIE 470 Voltage Regulator Damage
B. MCM 470/485 and MIE 470 Water Cooled Voltage Regulator Testing
C. Early MCM 470 Charging System (with Air Cooled Voltage Regulator) Testing

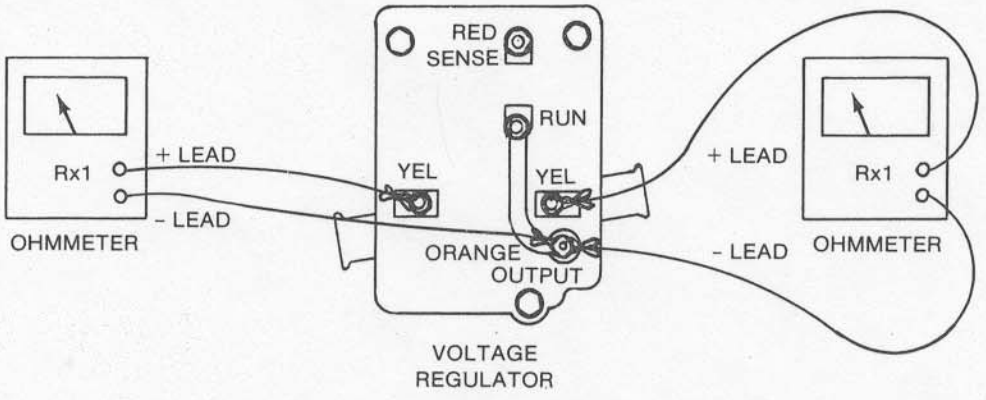
A. MCM 470/485 and MIE 470 VOLTAGE REGULATOR DAMAGE

Excessive resistance in the ammeter circuit can cause voltage regulator damage on MerCruiser 470/485 engines. To prevent this possibility, a Voltage Regulator Kit (B-86255A3), which eliminates the ammeter circuit, has been released. The kit includes a voltage regulator, jumper wire, battery meter and installation instructions. Install this kit on any MerCruiser 470 (Serial No. 4625580 and above) or 485 engine (originally equipped with an ammeter) with which recurring voltage regulator failures have been experienced.

B. MCM 470/485 and MIE 470 WATER COOLED VOLTAGE REGULATOR TESTING

Disconnect both battery cables from battery and remove regulator from engine.

Check regulator diodes (Figure 1) by connecting positive (+) ohmmeter lead to one stator terminal (yellow) and negative (-) ohmmeter lead to output (orange) terminal. Meter MUST show conduction. Reverse ohmmeter leads. Meter MUST NOT show conduction. Repeat test for other stator (yellow) terminal.



NOTE: Positive lead of ohmmeter shows conduction with a diode, as shown below.

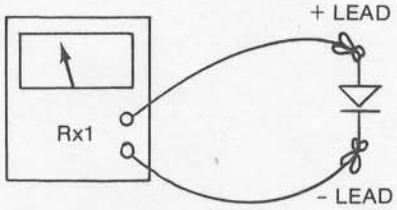


Figure 1. Checking Regulator Diodes

Check voltage regulation point using a D.C. variable voltage supply and ohmmeter (Figure 2). Connect voltage supply positive (+) lead to sense (red) terminal. Connect jumper wire from sense (red) terminal to output (orange) terminal. Connect voltage supply negative (-) lead to ground on regulator case. Turn on voltage supply to 16-18 volts. Connect ohmmeter positive (+) lead to ground on regulator case and ohmmeter negative (-) lead to one stator (yellow) terminal. Ohmmeter MUST NOT show conduction. If meter shows conduction, momentarily disconnect and reconnect it. If meter still shows conduction, voltage regulator is bad (regulation point too high) and must be replaced. If meter did not show conduction, slowly reduce voltage supply setting while observing ohmmeter. Meter MUST go into conduction at some voltage between 15 volts and 13.5 volts. If meter does not show conduction when supply voltage is reduced to between 15 volts and 13.5 volts, voltage regulator is bad (regulation point too low) and must be replaced. Repeat test for other stator (yellow) terminal.

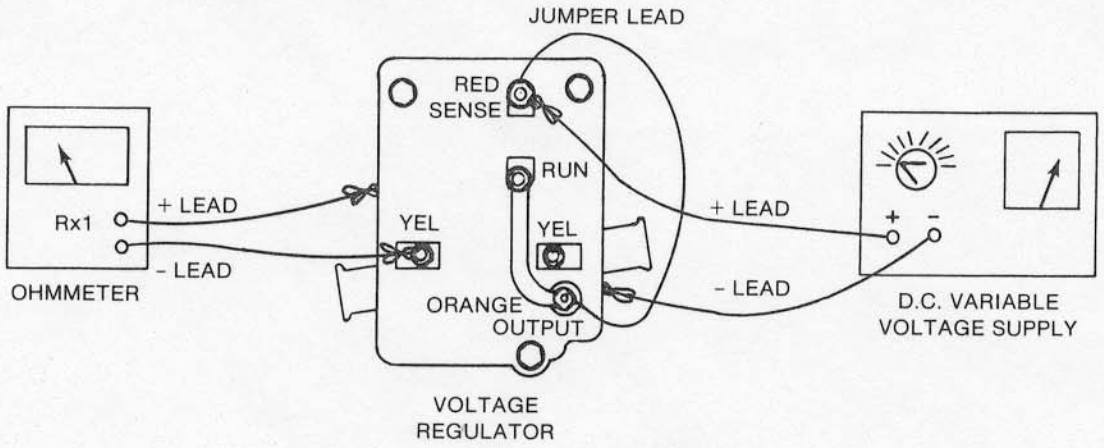


Figure 2. Checking Voltage Regulator Point - Water Cooled Regulator

C. EARLY MCM 470 CHARGING SYSTEM (with AIR COOLED VOLTAGE REGULATOR) TESTING

1. Make the following corrections in your MerCruiser Service Manual - Section 3 (Electrical), Part C, Page 29:
   a. STATOR TESTING, Step 4:
   Systems with 4 stator wires: Connect ohmmeter between 2 white/black wires. Meter should read 2.6 ohms.
   b. REGULATOR TESTING, Step 1:
   With regulator leads disconnected, continuity should not exist between regulator leads or between white lead and metal base. Continuity should exist between red lead and metal base in one direction of polarity only. Reversing meter leads should result in no continuity between red lead and metal base.
2. Check voltage regulation point using a D.C. variable voltage supply and ohmmeter (Figure 3). Connect voltage supply positive (+) lead to regulator red lead and voltage supply negative (-) lead to ground on regulator case. Connect ohmmeter postive (+) lead to regulator white lead and ohmmeter negative (-) lead to ground on regulator case. Slowly increase voltage while observing ohmmeter. Meter must show conduction when voltage reaches 14.5 volts (± 0.5v). If meter shows conduction before voltage reaches 14 volts, regulation point is too low and voltage regulator must be replaced. If meter does not show conduction until voltage exceeds 15 volts, regulation point is too high and voltage regulator must be replaced.

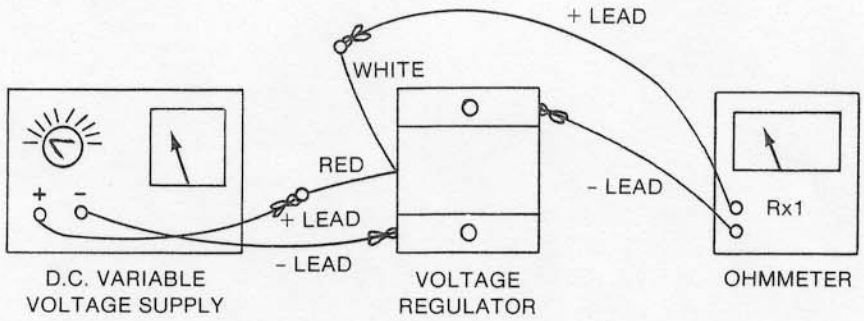


Figure 3. Checking Voltage Regulation Point - Air Cooled Regulator

service bulletin

mercruiser
STERN DRIVES/INBOARD ENGINES

NUMBER: 81-24
DATE: 10/5/81

A. Loose Coupling/Flywheel on MerCruiser Stern Drive Engines - MCM 120 - 260
B. Exhaust Manifold Stud Breakage - MCM 120 Engine
C. Shift Cable Travel Dimensions for MerCruiser 120 thru 260 Stern Drives

CIRCULATE TO:
SERVICE MANAGER
PARTS MANAGER
MECHANICS

A. LOOSE COUPLING/FLYWHEEL ON MERCRUISER STERN DRIVE ENGINES - MCM 120-260

If an above model engine has a "rattling" or "knocking" noise in it, inspect the coupling/flywheel attaching nuts for proper torque. This noise usually occurs at idle RPM or as engine RPM is decreased quickly. If, for any reason, an engine has been removed from the boat for service work, check the torque of the coupling/flywheel attaching nuts. Following is a list of models and serial numbers that may be affected.

MCM 120 S.N. 5554835 to 6028974
MCM 140 S.N. 5567940 to 6044881
MCM 165 S.N. 5568540 to 5860349
MCM 470 S.N. 5545960 to 6028369
MCM 485 S.N. 5685395 to 6040096
MCM 898 S.N. 5610748 to 6021586
MCM 228 S.N. 5610848 to 6028141
MCM 260 S.N. 5610948 to 6034474

If a loose coupling/flywheel is found to be the cause of the noise as described above, use the following procedure to repair.

1. Remove all coupling/flywheel attaching nuts.
2. Remove washers, coupling and flywheel.
3. Inspect mating surfaces between crankshaft-flywheel and flywheel-coupling for damage
   - If coupling surface is damaged or mounting holes are elongated, replace coupling.
   - If flywheel mounting holes are elongated, replace flywheel. If mounting surfaces are damaged, have surfaces refaced at a machine shop. A maximum of .020" (.508mm) can be removed. If damage is so severe to mounting surface that it cannot be resurfaced, replace flywheel.
   - If crankshaft mounting surface is damaged, have surface refaced. A maximum of .020" (.508mm) can be removed. If damage is so severe to mounting surface that it cannot be resurfaced, replace crankshaft.

NOTE: When having mounting surfaces refaced, make sure surface is perpendicular to crankshaft. Remove only enough material to remove transferred metal. The removal of all pit marks is not necessary.

4. Inspect coupler mounting studs for damage and tightness. If damaged or loose, replace and use Loctite 'A' on threads before installing into crankshaft.
5. Place flywheel, coupling and washers onto crankshaft studs.

NOTE: MCM 470/485 only. Replace small O.D. washers with larger O.D. washers, Part No. B-12-45176.

6. Use suitable flywheel holding tool and torque coupling/flywheel attaching nuts to 60 lbs. ft. (81.3 N.m).

B. EXHAUST MANIFOLD STUD BREAKAGE - MCM 120 Engine

Broken exhaust manifold studs on the above model engine has been reported to our service department. The causes for this type of failure centers around two problems:

1. Manifold stud(s) not properly tightened into cylinder head and;
2. Loss of torque on nuts securing exhaust manifold to cylinder head.

To minimize the chance of stud breakage it is recommended that you retorque all manifold attaching nuts to 23 lbs. ft. (33.2N.m) before delivery or at the 20-hour checkup. On engines that have a "3rd" lifting ring installed on the rear manifold stud, remove this lifting ring and discard. Use Loctite "A" and tighten stud securely into cylinder head, torque attaching nut to proper tightness.

On engines that have stud breakage, use the following procedure:

1. Remove manifold from cylinder head.
2. Remove all manifold stud(s) from cylinder head.
3. Clean gasket surfaces on cylinder head and manifold.
4. Check cylinder head and manifold mating surfaces for warpage. Resurface if necessary.
5. Install ALL NEW STUDS into cylinder head. Apply Loctite "A" to stud threads before installing.
6. Use new gasket and install manifold to cylinder head.
7. Use NEW manifold attaching nuts and torque to 23 lbs. ft. (33.2 N.m).
8. Use suitable flush device and start engine up. Allow engine to get up to operating temperature and check for all leaks.
9. Shut engine off and allow it to cool.
10. Retorque manifold attaching nuts to 23 lbs. ft. (33.2 N.m).

B-11-49910	**Nut, Manifold 6 required per engine**
B-16-49915	**Stud, Manifold 4 required per engine**
B-16-60799	**Stud, Manifold 2 required per engine**
B-27-52546	**Gasket, Manifold 1 required per engine**

C. SHIFT CABLE TRAVEL DIMENSIONS FOR MERCRUISER 120 thru 260 STERN DRIVES

Following are the MINIMUM cable travels needed to properly shift the MerCruiser 120 thru 260 stern drives. This information will aid you when troubleshooting shift problems. If minimum shift control cable travel is not achieved, problem is in shift control and/or shift control cable. Dimensions are from full forward to full reverse position measured at connecting points located on shift plate. See Figures 1 and 2.

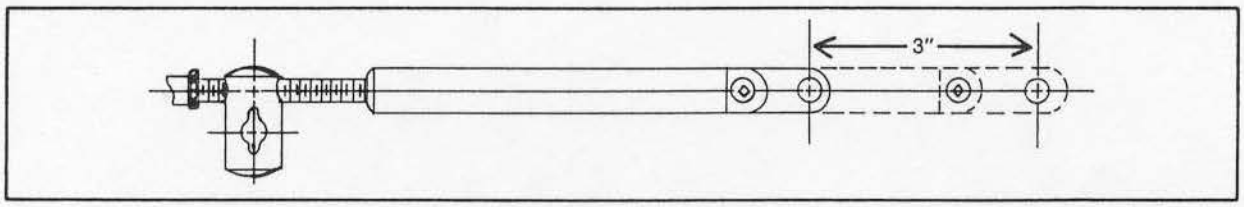


Figure 1. MINIMUM Shift Control Cable Travel (3 inches)

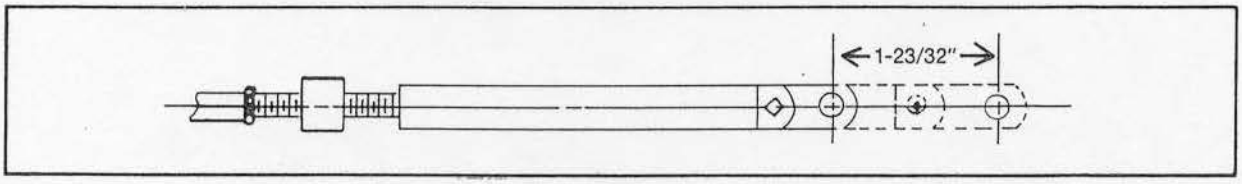


Figure 2. MINIMUM Drive Unit Shift Cable Travel (1-23/32 inches)

MerCruiser
STERN DRIVES/INBOARD ENGINES

service bulletin

NUMBER: 81-29
DATE: 11/3/81

CIRCULATE TO:
SERVICE MANAGER
PARTS MANAGER
MECHANICS

A. Replacement Drive Plate For Mercury Transmission Used on TR or TRS Drive Units - Ford and G.M. Small Block V-8 Engines
B. .010" U.S. Center Main and Main Bearing Assemblies MCM/MIE 470 and MCM 485 Engines
C. Installation of Connecting Rod Bearings - MCM/MIE 470 and MCM 485 Engines

A. REPLACEMENT DRIVE PLATE FOR MERCURY TRANSMISSION USED ON TR OR TRS DRIVE UNITS - Ford and G.M. Small Block V-8 Engines

The Drive Plate (Part No. 62819) that was used on the MerCruiser TR or TRS packages using Ford engines is no longer available. A new drive plate (Part No. 98147) can be used as a service replacement for the MerCruiser TR or TRS packages using either Ford or "Small Block" G.M. engines.

98147 Drive Plate Will Be Replacement Part For Models of Engines Listed Below	
Ford (Replaces 62819)	**G.M. (Replaces 70637)**
MCM 225 TR	MCM 228 TR
MCM 255 TR	MCM 255 TR
MCM 255 TRS	MCM 280 TRS

B. .010" U.S. CENTER MAIN and MAIN BEARING ASSEMBLIES - MCM/MIE 470 and MCM 485 Engines

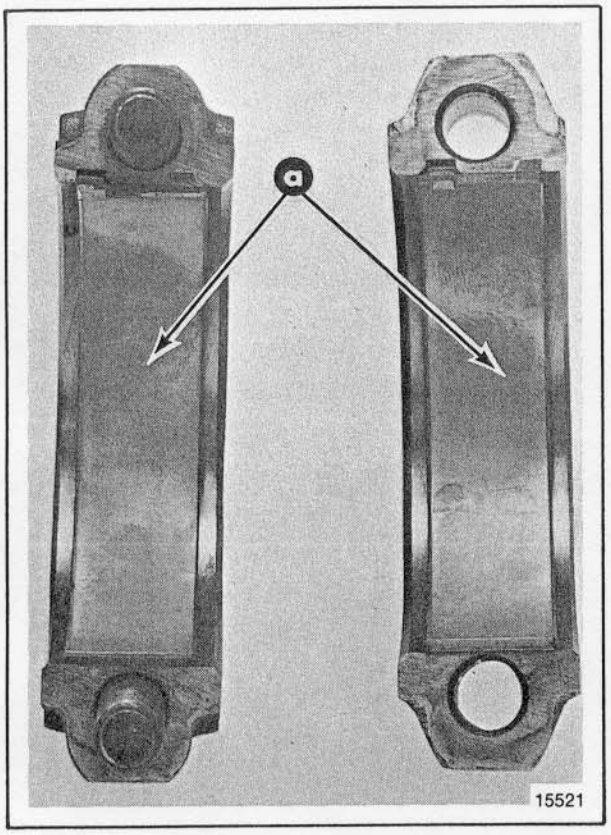
In the past only standard, .002" U.S. and .020" U.S. Center Main and Main Bearing Assemblies were available for the crankshaft of the above model engines. Because of numerous requests from the field, .010" U.S. bearing assemblies will now be available. Part numbers are listed below.

.010" U.S. Main Bearing Assembly	**74313A4**
.010" U.S. Center Main Bearing Assembly	**74314A4**

NOTE: U.S. is abbreviation for "undersize".

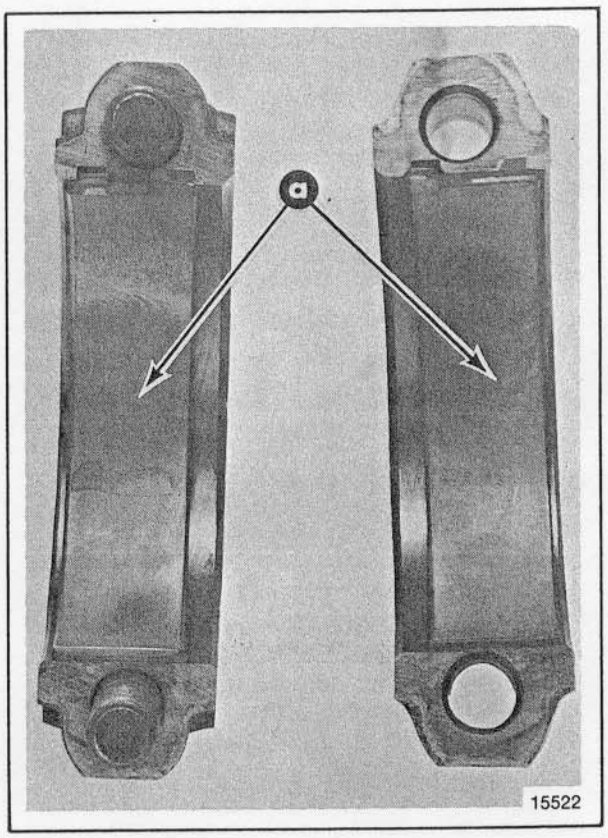
C. INSTALLATION OF CONNECTING ROD BEARINGS - MCM/MIE 470 and MCM 485 Engines

During the installation of connecting rod bearings into the connecting rods, make sure bearing halves are installed correctly. Improper installation of these bearings can cause premature failures.



a - Centered in Connect Rod

Figure 1. Correct Bearing Installation



a - Not Centered in Connect Rod

Figure 2. Incorrect Bearing Installation

mercruiser
service bulletin
STERN DRIVES/INBOARD ENGINES
NUMBER: 81-30
DATE: 11/25/81

Procedure for Replacing Cylinder Head Gasket; Checking Valve Clearance; Torquing Cylinder Head Bolts and Torquing Rocker Arm Bolts - MCM/MIE 470, MCM 485.

CIRCULATE TO:
SERVICE MANAGER
PARTS MANAGER
MECHANICS

DISASSEMBLY

1. Drain seawater and closed cooling section of engine cooling system.
2. Remove any component that would interfere with the removal of the cylinder head.
3. Remove rocker arm cover and gasket. Keep old gasket for use later.

IMPORTANT: Place rocker arms, rocker arm fulcrums and push rods in a rack or container so that all pieces from each valve can be kept together. If this is not done, damage could occur to valve train components upon reassembly.

4. Remove rocker arm attaching bolts, rocker arms, fulcrums and push rods.
5. Remove cylinder head bolts. Remove cylinder head and gasket. Discard gasket.

CLEANING and INSPECTION

- Clean all gasket surfaces on cylinder head, cylinder block, intake and exhaust manifolds.
- Clean sealer from cylinder head bolts, using a wire brush or suitable solvent.

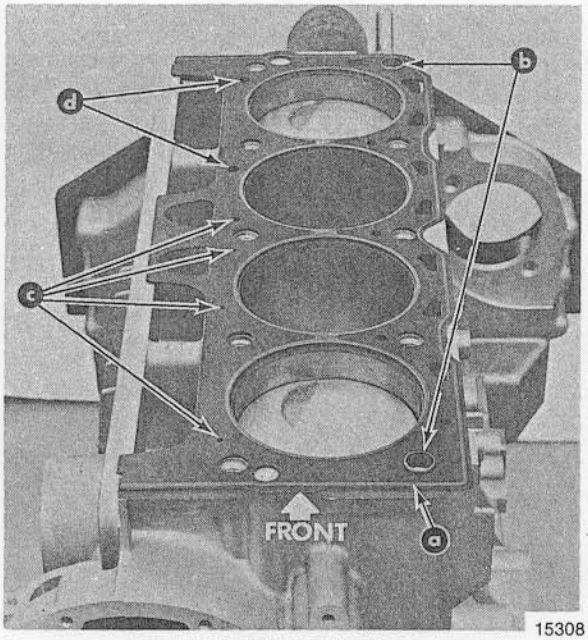
IMPORTANT: Cylinder head bolt holes (located in cylinder block) must be free of water and oil to prevent cylinder block failure from hydraulic pressure buildup while torquing cylinder head bolts.

- Clean threaded cylinder head bolt holes in cylinder block.
- Clean both cylinder head and cylinder block. Be sure all oil, grease, water and anti-freeze is removed.
- Inspect cylinder head/cylinder block for warpage.

REASSEMBLY

IMPORTANT: DO NOT use any gasket cement or sealer on Head Gasket, Cylinder Head or Cylinder Block.

1. Position new cylinder head gasket on cylinder block with the word FRONT (stamped on gasket) toward front of engine and facing DOWN toward cylinder block (Figure 1). Make sure alignment dowel pins ("b" Figure 1) are through correct holes in head gasket.
2. Place cylinder head on gasket. Make sure alignment dowel pins ("b" in Figure 1 in cylinder block) go into holes in cylinder head.
3. Coat underside of cylinder head bolt heads and threads of cylinder head bolts with Perfect Seal and install. DO NOT tighten bolts at this time.



a - Cylinder Head Gasket
b - Alignment Dowel Pins
c - Small Water Passage Holes
d - Large Water Passage Holes

Figure 1. Cylinder Head Gasket Installation

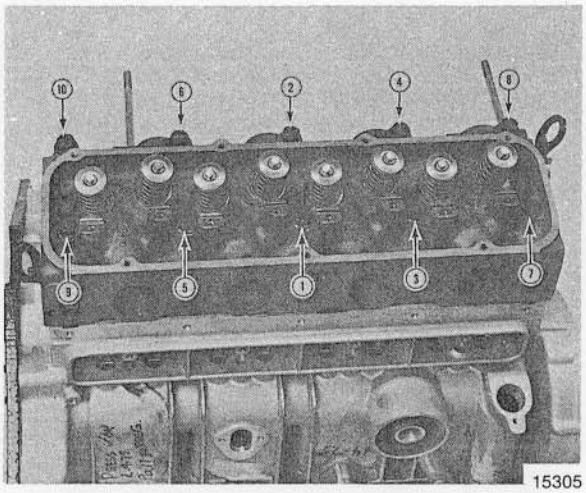


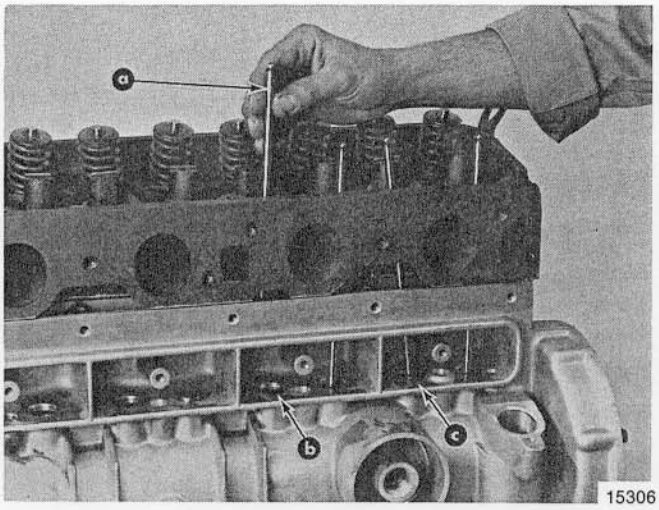
Figure 2. Cylinder Head Bolt Torquing Sequence

IMPORTANT: Failure to properly torque cylinder head bolts can cause cylinder head gasket failure.

4. Follow torquing sequence shown in Figure 2. Torque cylinder head bolts in three steps:
   - 55 lbs. ft. (74.6 N.m)
   - 90 lbs. ft. (122.0 N.m)
   - 130 lbs. ft. (176.3 N.m)

IMPORTANT: To prevent bending a push rod, and to avoid a false torque reading, it is very important that rocker arms, rocker arm fulcrums and push rods be reinstalled in EXACTLY the same place they were removed from. Follow steps below.

5. Install each push rod into lifter it was removed from. Be sure push rod end seats INTO lifter socket. (Figure 3)



a - Push Rod
b - Lifter (Note Socket)
c - Push Rod Installed into Lifter Socket

Figure 3. Installing Push Rod (Side Cover Removed for Visibility

6. Install each rocker arm fulcrum, rocker arm and rocker arm attaching bolt into the position it was removed from. DO NOT tighten rocker arm attaching bolts at this time.

TORQUING ROCKER ARM BOLTS

IMPORTANT: Torquing of rocker arm attaching bolt must be done with valve in closed position. Failure to do this can result in bent push rod.

1. Set #1 piston at TDC (firing) and torque the following rocker arm attaching bolts to 20 lbs. ft. (27.1 N.m). (Figure 4)
   - #1 - Intake and Exhaust
   - #2 - Intake
   - #3 - Exhaust
   - #4 - Intake

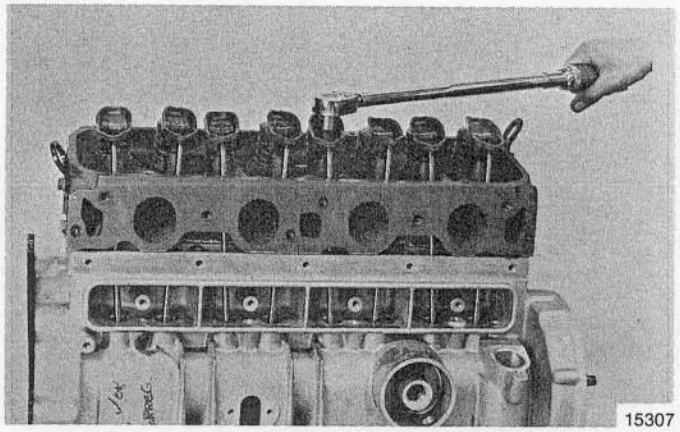


Figure 4. Torquing Rocker Arm Attaching Bolts

2. Rotate the crankshaft 360° (1 complete revolution) and torque the following rocker arm attaching bolts to 20 lbs. ft. (27.1 N.m).
   - #2 - Exhaust
   - #3 - Intake
   - #4 - Exhaust

CHECKING VALVE CLEARANCE

IMPORTANT: Valve clearance is not adjustable. If clearance is not correct, it will be necessary to change the push rod to one of the correct length so that proper clearance can be achieved. Read the following instructions COMPLETELY BEFORE checking clearance.

T71P-6513-A

Valve Lifter Collapsing Tool - ~~T711P-6513A~~
Available From: Owatonna Tools, Inc.
2013 Fourth Street N.W.
Industrial Park Warehouse
Owatonna, MN 55060

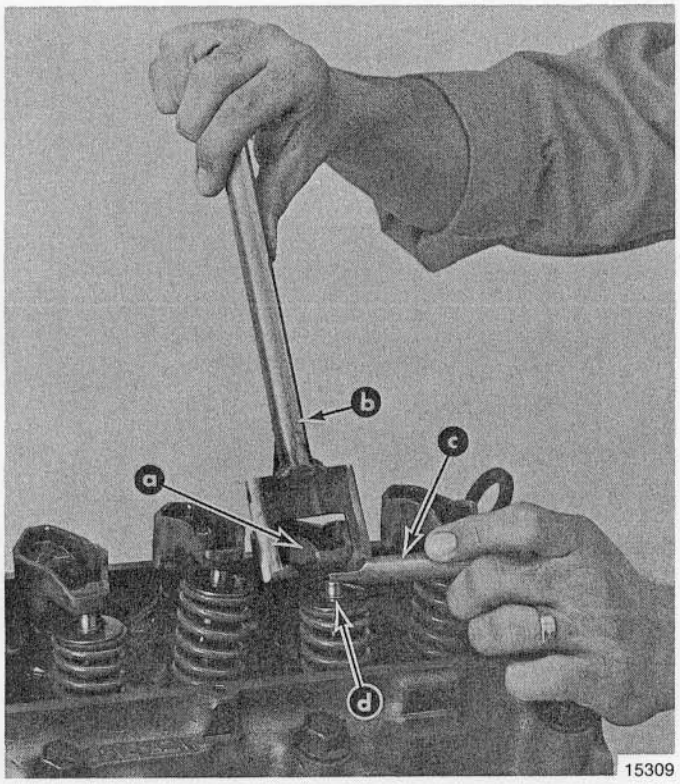
1. With #1 piston at TDC (firing), check clearance of following valves:
   - #1 - Intake and Exhaust
   - #2 - Intake
   - #3 - Exhaust
   - #4 - Intake

   a. Install valve lifter collapsing tool as shown in Figure 5. Firmly push on handle until lifter is completely collapsed.

CAUTION: Excess pressure on valve lifter collapsing tool may bend push rod.

b. The correct clearance (distance between end of valve stem and face of rocker arm) is .075" - .175" (1.905 - 4.445mm).

c. Using feeler gauge, drill rod or appropriate tool, check clearance between rocker arm face and valve stem end (Figure 5).
If clearance is less than .075" (1.905mm), install a shorter push rod than was originally in engine.
If clearance is more than .175" (4.445mm), install a longer push rod. Select correct push rod from chart.



a - Rocker Arm
b - Valve Lifter Collapsing Tool
c - Tool to Measure Clearance
d - Valve Stem

Figure 5. Checking Valve Clearance

MERCRUISER 470 TYPE ENGINE PUSH RODS LENGTHS

Mercury Marine Part Number	Lengths	Color Code
67502-3	8.595" - 8.625" (217.313 - 219.075mm)	Red ~~None~~
67502-4	8.655" - 8.685" (219.837 - 220.599mm)	Blue
67502-5	8.625" - 8.655" (219.075 - 219.837mm)	None
67502-6	8.685" - 8.715" (220.599 - 221.361mm)	Yellow

2. Rotate crankshaft 360° (1 complete revolution) and check clearance of following valves:
   - #2 - Exhaust
   - #3 - Intake
   - #4 - Exhaust

   After installing new push rod, recheck valve clearance to be sure it is within specifications.

REASSEMBLY - CONTINUED

1. Install rocker arm cover using old gasket.

CAUTION: Cylinder head bolts MUST be retorqued after engine has been brought to normal operating temperature. Failure to do this can cause head gasket failure.

2. Reinstall all components that were removed during disassembly.
3. Fill closed cooling system following instructions in "Operation and Maintenance Manual".

RETORQUE CYLINDER HEAD BOLTS

CAUTION: Cylinder head bolts MUST be retorqued after engine has been brought to normal operating temperature. Failure to do this can result in head gasket failure.

1. Supply water to water intake holes in gear housing and start engine. After normal operating temperature has been reached, shut engine off.
2. Remove rocker arm cover and gasket. Discard gasket.
3. Torque cylinder head bolts to 130 lbs. ft. (176.3 N.m) following tightening sequence shown in Figure 3.
4. Install rocker arm cover with new gasket and torque bolts to 90 lbs. in. (10.2 N.m).
5. Run engine and carefully inspect for leaks.

Correction: Figure # 2

mercruiser
STERN DRIVES/INBOARD ENGINES

service bulletin

NUMBER: 81-33
DATE: 12/16/81

A. Gasohol in MerCruiser Engines
B. Approach Angle to Valve Seat in Cylinder Head - MCM/MIE 470 and MCM 485 Engines

CIRCULATE TO:
SERVICE MANAGER
PARTS MANAGER
MECHANICS

A. GASOHOL IN MERCRUISER ENGINES

While gasohol (10% ethyl alcohol in lead-free gasoline) and other alcohol/gasoline blends used abroad are giving good service in cars, special precautions must be taken for use in MerCruiser-powered boats.

While Mercury Marine does not recommend gasohol for MerCruiser engines, it can be used. Tests to date reveal that it has no major effect on the rubber and neoprene fuel system parts.

Fuels containing alcohol have a tendency to absorb moisture slowly from the air. At first this moisture will remain in solution, but once the water content of the fuel has built up to somewhere around 1%, it will separate out, bringing the alcohol with it. This alcohol-water mixture settles at the bottom of the fuel tank and MerCruiser engines will not run on it. Before the engine can be restarted, it is necessary to remove the separated layer, flush out the fuel system with clean fuel and usually, remove and dry the spark plugs.

In cars, fuels containing alcohol normally are burnt before they can absorb enough moisture to cause trouble, but boats often sit idle long enough for separation to take place.

When operating a MerCruiser engine on gasohol, storage of gasohol in the fuel tank for periods of more than a few days must be avoided in a high humidity climate.

In such conditions, either drain the fuel tank and idle the engine until the carburetor runs dry, or run the tank nearly empty and refill with fresh fuel prior to the next use. If changing to straight gasoline, the engine then should be run long enough to purge the gasohol from the carburetor before shutting down.

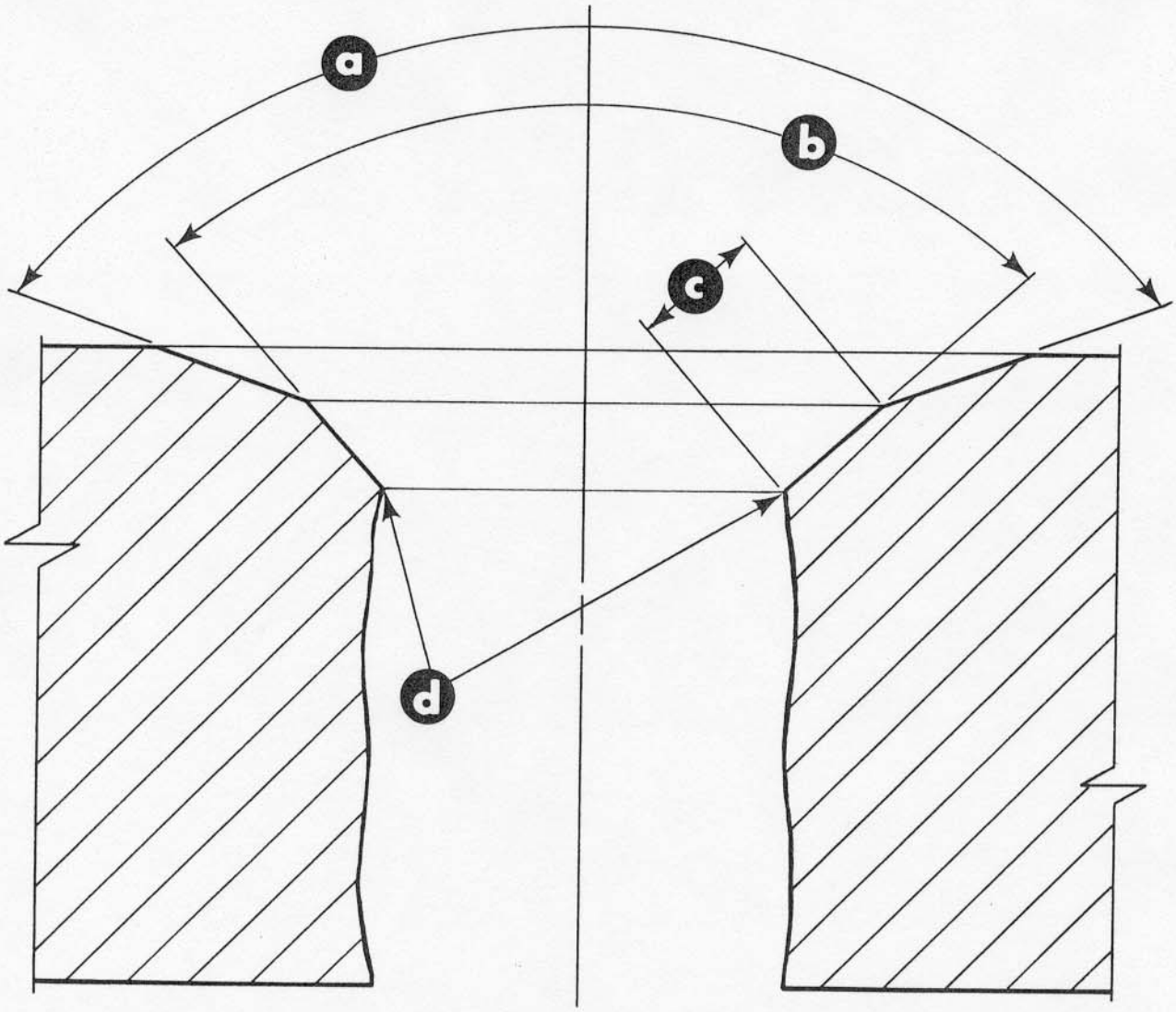
The use of gasohol in MerCruiser four-cycle engines, that can run on lead-free fuel, is satisfactory, as it is in most automobiles, except for the risk of separation when fuel is stored in the tanks. Those MerCruiser engines, that were built in 1974 and prior years, however, required leaded gasoline. When gasohol is used in these (prior to 1975) engines, a minimum of one tank-full of leaded gasoline must be used after each four tank-fulls of gasohol.

B. APPROACH ANGLE TO VALVE SEAT IN CYLINDER HEAD - MCM/MIE 470 and MCM 485 ENGINES

After valve seat in cylinder head has been refaced, recheck seat width. If seat width exceeds maximum limit, remove enough stock from top edge and/or bottom edge of seat to reduce width to specifications. Refer to the following chart for correct angles to be used on the different surfaces.

(OVER)

Model		Seat Width	Seat Angle	Top Edge (Approach Angle)	Bottom Edge
470	Intake	.060" - .080"	45°	20°	60°
	Exhaust			30°	
485	Intake	.060" - .080"	30°	15°	60°
	Exhaust		45°	30°	



a - Top Edge "Approach Angle"
b - Seat Angle
c - Seat Width
d - Bottom Edge

Figure 1. Valve Seat in Cylinder Head

mercruiser
STERN DRIVES/INBOARD ENGINES

service bulletin

NUMBER: 81-35
DATE: 12/22/81

A. Use of Permanent Type Anti-Freeze Solutions in Mercury Marine Engines - MCM/MIE 470 and MCM 485 Models

B. Thermostat Operation in Mercury Marine Engines - MCM/MIE 470 and MCM 485 Models

CIRCULATE TO:
SERVICE MANAGER
PARTS MANAGER
MECHANICS

A. USE OF PERMANENT TYPE ANTI-FREEZE SOLUTIONS IN MERCURY MARINE ENGINES - MCM/MIE 470 and MCM 485 Models

It has been found that most permanent type anti-freeze solutions may become corrosive to aluminum after about 3 years of use OR if exhaust gases have entered into the cooling system from a blown head gasket. This corrosion is not sufficient enough to cause significant damage to the engine block, but loose particles that are generated can travel to the heat exchanger. These loose particles may plug up the coolant side of the heat exchanger.

NOTE: The coolant (anti-freeze) flows AROUND THE OUTSIDE of the cooling tubes while seawater flows THRU THE INSIDE of the cooling tubes in the heat exchanger.

The automotive companies are experiencing the same problem in products with aluminum parts that come in contact with the current permanent type anti-freeze. Because of this, automotive companies will be recommending a different type of anti-freeze solution for aluminum engines/radiators in the near future. This later type anti-freeze solution is not compatible with the present permanent type anti-freeze. The two types must not be mixed.

As soon as this new type anti-freeze solution is readily available, we will notify the field. At present, Mercury Marine is not using the new anti-freeze solution in new MCM/MIE 470 and 485 engines. Because of this, it is strongly recommended that:

- The coolant be completely drained and flushed from the closed cooling system at least every two (2) years.
- The coolant be completely drained and flushed from the closed cooling system whenever exhaust gases have entered into the system.
- The complete system be refilled with a 50/50 mixture of water and fresh permanent type anti-freeze.

NOTE: DO NOT operate system on straight water. System MUST USE a 50/50 mixture of permanent type anti-freeze and water.

B. THERMOSTAT OPERATION IN MERCURY MARINE ENGINES - MCM/MIE 470 and MCM 485 Models

The thermostat in a MCM/MIE 470 or MCM 485 engine determines which direction the coolant flow should take. If the thermostat is closed, the coolant bypasses the heat exchanger. When the thermostat is open, the coolant flows thru the heat exchanger to be cooled. The cooling system on these model engines MUST NOT BE OPERATED WITHOUT A THERMOSTAT installed. Without a thermostat, the engine WILL OVERHEAT.

service bulletin

mercruiser
STERN DRIVES/INBOARD ENGINES

NUMBER: 82-3
DATE: 5/11/82

A. Exhaust Elbows Used On Early Production MerCruiser MIE 340 Engine
B. Exhaust Elbows Used On Later Production MerCruiser MIE 230/260/340 Engines
C. Permanent Type Anti-Freeze Solutions that are Approved for Use in MerCruiser 4 Cylinder 224 CID Engines (MCM/MIE 470 and MCM 485 Models)

CIRCULATE TO:
SERVICE MANAGER
PARTS MANAGER
MECHANICS

A. EXHAUST ELBOWS USED ON EARLY PRODUCTION MERCRUISER MIE 340 ENGINE

The early production runs of the above model engine used a 0° or 15° exhaust elbow without a stainless steel tube in the exhaust outlet. Under certain operating conditions and/or with certain exhaust collector systems, water can be drawn back into the engine during idle speed.

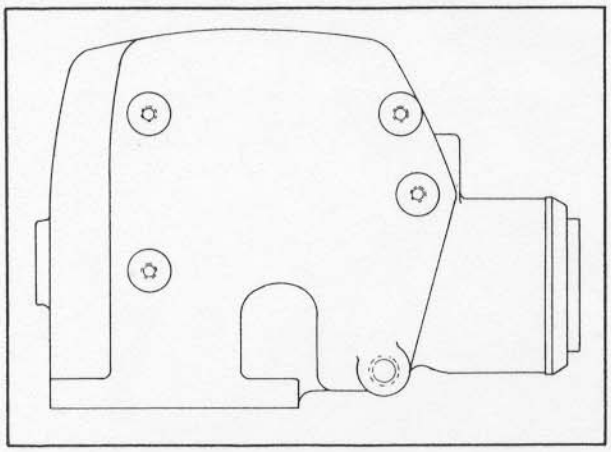
Because of this possibility, inspect all MIE 340 engines below Serial No. 6040783. Look at casting number on each exhaust elbow to ascertain if elbow is of early production type.

	Without S.S. Tube	With S.S. Tube
0°	97554	98501
15°	95755	98503

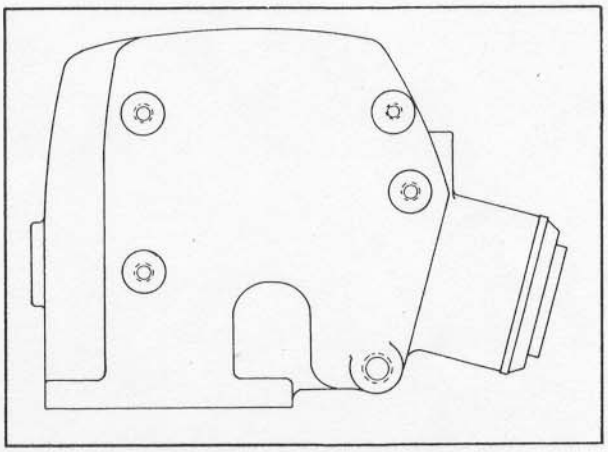
Replace all elbows, without the stainless steel tube, on the above model engines. Order the following below for each engine:

2	98502A2	0° Exhaust Elbow
	OR	
2	98504A3	15° Exhaust Elbow
2	27-87105	Elbow Gasket

B. EXHAUST ELBOWS USED ON LATER PRODUCTION MERCRUISER MIE 230/260/340 ENGINES



98502A2 0° Exhaust Elbow. Standard On Engines Equipped with In-Line Transmissions



98504A3 15° Exhaust Elbow. Standard On Engines Equipped with V-Drive Transmissions. Optional On Engines Equipped with In-Line Transmissions

C. PERMANENT TYPE ANTI-FREEZE SOLUTIONS THAT ARE APPROVED FOR USE IN MERCRUISER 4 CYLINDER 224 CID ENGINES (MCM/MIE 470 and MCM 485 MODELS)

Listed below are the current brands of permanent type anti-freeze solutions that are approved for use in aluminum component MerCruiser engines.

NOTE: Use this information in conjunction with Service Bulletin 81-35 (12/22/81).

PRESTONE II
PEAK (Produced after January, 1981)
or any brand anti-freeze solution that meets G.M. specification 1825M.

DO NOT MIX the new anti-freeze solution with the old solution or it will cause small particles to form in the coolant. These small particles can settle in the heat exchanger and restrict coolant flow.

- Drain and flush the old anti-freeze solution from the closed cooling system.
- Re-fill closed cooling system with a 50/50 mixture of water and one of the approved brands of permanent type anti-freeze solutions listed above.

  NOTE: In tropical areas, a good brand of rust inhibitor mixed with water can be used instead of a 50/50 mixture of anti-freeze and water. This supersedes the information in Service Bulletin 81-35 that states that the engines must use a mixture of anti-freeze and water.

Production has started using the new type anti-freeze solution. The starting serial number is listed below.

MCM 470/485	**6073100 and above**

mercruiser
STERN DRIVES/INBOARD ENGINES

service bulletin

NUMBER: 82-5
DATE: 6/01/82

TROUBLESHOOTING THE COOLING SYSTEM ON MERCRUISER 4 CYLINDER 224 CID ENGINES (MCM/MIE 470, MCM 485 and MCM 488)

CIRCULATE TO:
SERVICE MANAGER
PARTS MANAGER
MECHANICS

The following is a general guide to troubleshoot/repair the closed cooling system used on MerCruiser 4 Cylinder 224 CID Engines (470/485/488).

There are several configurations of this cooling system, but the operation is essentially identical. Basically, the system is composed of two separate sub-systems; the seawater circuit and the closed cooling circuit. (Figures 2, 3 and 4) The seawater circuit is similar in function to the fan used in an automobile. The closed cooling circuit is similar in function to the rest of the cooling system in an automobile.

The seawater circuit has one prime cause of trouble: reduced water flow (similar to reduced air flow in an automobile). The most common causes of reduced seawater flow:

- Bad seawater pump impeller
- Kinked or loose hoses
- Impeller blade or debris in drive/transom assembly water passages
- Blockage in heat exchanger (seawater circuit)
- Blocked exhaust elbow
- Improperly repaired heat exchanger
- Hose fitting in exhaust elbow installed too deep

The closed cooling circuit can have trouble from three different causes: 1) loss of coolant, 2) reduced coolant flow and 3) aeration of coolant.

The most common causes of the three different problems in the closed cooling circuit are as follows:

Loss of Coolant

- Loose hoses
- Damaged filler cap
- Leaking heat exchanger
- Cracked or warped cylinder head
- Improperly installed gaskets between exhaust manifold and exhaust elbow
- Cracked manifold
- Worn seals on circulating pump
- Cylinder block porosity

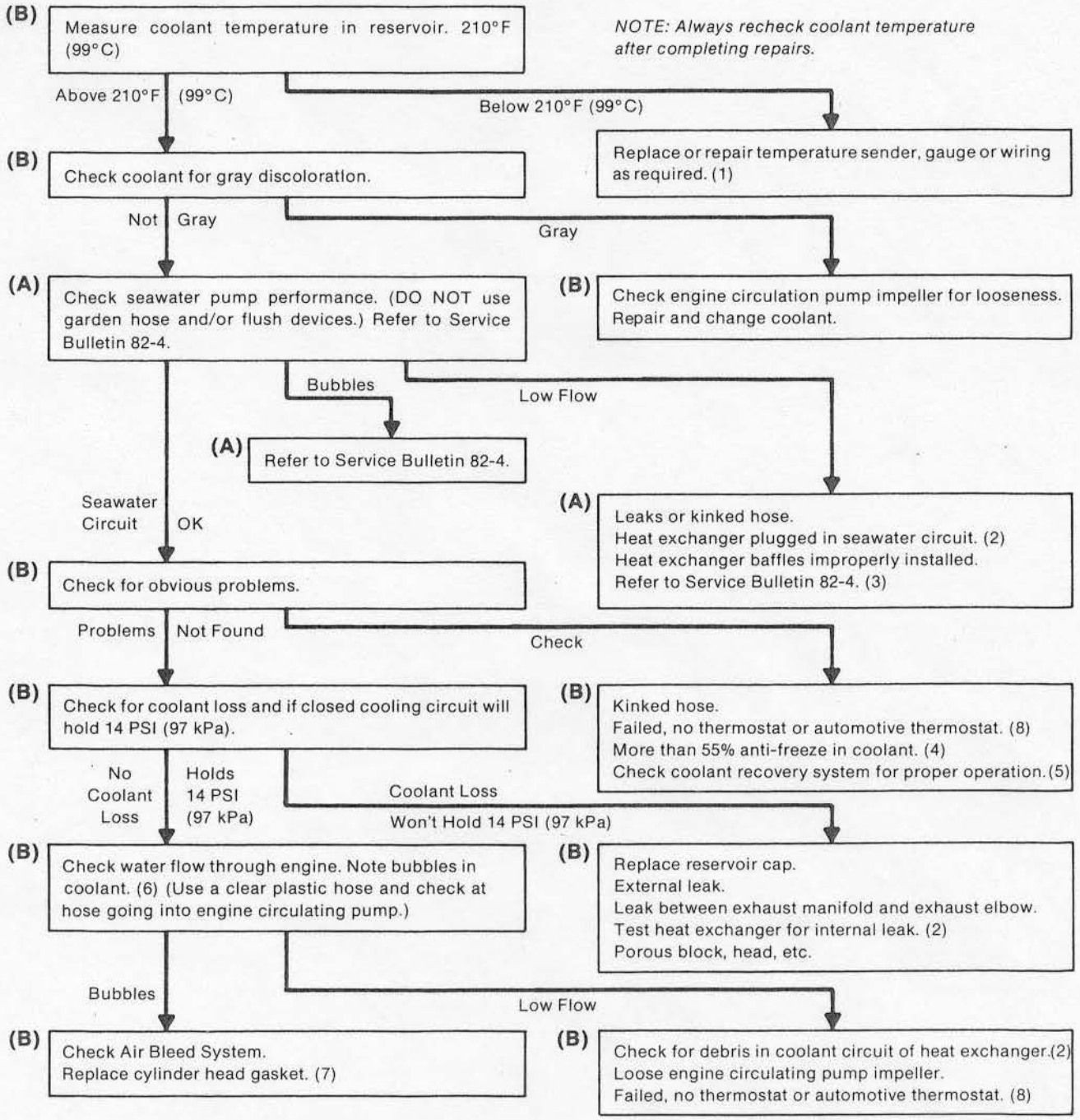
Reduced flow

- Thermostat failure or automotive thermostat being used
- Aeration
- Blockage in heat exchanger (closed cooling circuit)
- Loose circulating pump impeller
- Collapsing hoses

Aeration

- Improper filling
- Leaking cylinder head gasket

Although the cause of trouble can occur individually, two or three of them usually show up together. All result in an increase in engine temperature. In the following Chart, (A) refers to the seawater circuit and (B) refers to the closed cooling circuit.



NOTE 1: Normal operating engine temperature taken at the water temperature sender with a direct reading gauge is 165° F (74° C) to 200° F (93° C) at W.O.T. Dual station boats must use a dual station water temperature sender.

NOTE 2: Refer to "Testing" Heat Exchanger.

NOTE 3: MIE seawater pump flows 30-32 Gal/Min. at 4200 RPM.

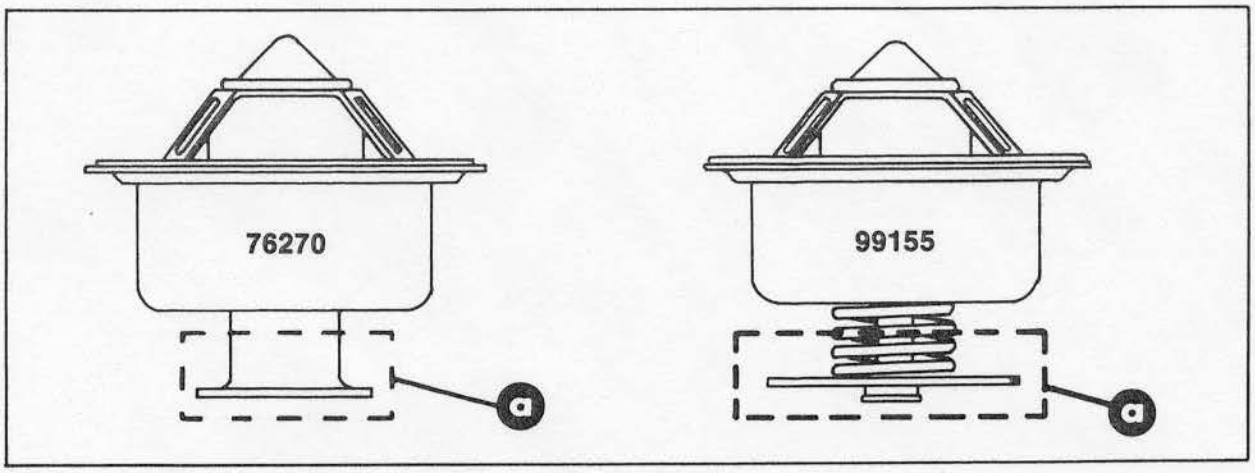
NOTE 4: % of anti-freeze in coolant can be checked with anti-freeze tester.

NOTE 5: Refer to "Coolant Recovery and Air Bleed Systems Operation".

NOTE 6: Run in lake for this test.
Note coolant color in clear plastic hose and reservoir before starting engine. Coolant is dark in color. Start engine and run at 3500 RPM.
Normal: *Coolant is dark in color (near the color before starting engine) with some air bubbles.*
Abnormal: *Coolant becomes very light in color because of many bubbles.*

NOTE 7: Refer to "Testing for Cylinder Head Gasket Leak".

NOTE 8: Automotive thermostats CANNOT BE USED in these engines because they DO NOT direct the coolant flow to the heat exchanger when thermostat is open. (Figure 1)



a - Umbrella Must Be On Thermostat

Figure 1. Thermostat

FILLING CLOSED COOLING SYSTEM

After draining closed cooling system, refill system with anti-freeze solution as recommended in Service Bulletin 82-3. Start engine and run at fast idle (1000-1500 RPM) (with water running to seawater pump). Fill until coolant level in reservoir remains "full". Normally, there will be air trapped in the coolant. Normal operation will remove the "trapped" air shortly after the thermostat opens. The coolant level must be rechecked in the reservoir after the thermostat has opened.

COOLANT RECOVERY AND AIR BLEED SYSTEMS OPERATION

Coolant Recovery System: This system keeps the reservoir full. Normal coolant overflow into recovery bottle is approximately ½ pint during warm-up. The coolant recovery system draws coolant back into the reservoir from the recovery bottle as the engine cools. As long as there is coolant in the recovery bottle, the reservoir should remain completely full. If not, there's a vacuum leak, usually at the hose leaving the reservoir, or the gasket under the recovery filler cap. The gasket seals against the outer rim of the filler neck.

Air Bleed System: This system is designed to reduce or remove aeration which occurs during filling, or slight head gasket leakage. The system operates by producing a small flow through the reservoir which allows coolant/air bubbles to separate and vent the air bubbles off while passing through the reservoir. For the system to operate properly, the small hose and fittings going from the reservoir to the exhaust (or intake manifold) must not be plugged.

TESTING FOR CYLINDER HEAD GASKET LEAK

A leaking head gasket will cause combustion gas to be forced into the cooling system. The mixture of coolant and tiny air bubbles is a poor heat conductor; and will overheat an engine quickly. Compression tests or cooling system pressure check normally will not detect the leak because the test pressure is far below the combustion pressures which cause the leak. An effective test is as follows:

NOTE: Run boat in lake for this test. It is best to run the engine at or above cruising speed during this test. Usually a failed head gasket will not cause the engine to overheat below cruising speed.

1. Install a clear plastic hose between the reservoir and coolant recovery bottle. Use a 2-3 ft. (61-91cm) long hose for this test.
2. Route this hose so a "U" is formed.
3. Put enough coolant into hose to fill the center 4 or 5 inches (10-13cm) of the "U".
4. Observe the "U" while the engine is running.
   a. During idle and warm-up: some coolant and/or air will leave the reservoir.

b. During cruising speed (2500-3500 RPM): coolant and/or air leaving the reservoir should stop after approximately 5 minutes running at a given RPM. A leaking head gasket will produce air bubbling through the "U", going to the coolant recovery bottle. The frequency and size of the bubbles will depend on the size of the leak.

c. At higher speeds (4000+ RPM): Normal operation is the same as described in "b" above. A failed head gasket will cause the bubbles to come faster and may be accompanied by violent, intermittent bursts of coolant leaving the reservoir.

It is important not to confuse normal warm-up expansion with a failed head gasket. Normal warm-up produces an intermittent flow of coolant which will stop within approximately 5 minutes at a given RPM. A head gasket leak will not stop - the one thing that marks a failed head gasket is the continued passage of air, that may be accompanied by violent, intermittent bursts of coolant leaving the reservoir. If coolant continues to flow (not in violent, intermittent bursts) from the reservoir at cruising speed, something else besides the head gasket is causing the engine to overheat.

TESTING HEAT EXCHANGER

For Internal Leak: An internal leak will cause coolant to go into the seawater circuit when pressure is put on the closed cooling circuit.

a. Remove a seawater hose from the exchanger. DO NOT DRAIN the exchanger.

b. Pressurize the closed cooling circuit to 14-20 PSI (97-138kPa) with a radiator tester.

c. If seawater begins to overflow from the nipple (from which hose was removed in "a"), there is a leak.

For Blockage:

NOTE: Seawater flows THROUGH the tubes in the exchanger. Closed cooling coolant flow AROUND the tubes.

a. Remove end caps and inspect for any blockage in the seawater circuit (broken impeller blades, weeds, etc.).

b. Remove closed cooling circuit hoses and inspect the tubes just inside the nipples. Because the complete exchanger cannot be inspected, the heat exchanger should be replaced if blockage is suspected.

HEAT EXCHANGER REPAIR

a. Freezing the seawater circuit usually forces the end castings out of the shell. These castings can be cleaned, re-inserted properly and soldered in place by a radiator shop. Refer to Figures 5, 6, 7 or 8 for proper placement of end castings.

IMPORTANT: The end castings directs the seawater flow through the heat exchanger in Stern Drive (MCM) Engines. If they aren't installed correctly, the water takes a short cut and two-thirds (or more) of the exchanger is not used.

- **Stern Drive (MCM) Engines with a 3" (8cm) Dia. Heat Exchanger: Seawater passes through exchanger three (3) times before leaving.**
- **Stern Drive (MCM) Engines with a 4" (10cm) Dia. Heat Exchanger: Seawater passes through exchanger five (5) times before leaving.**
- **Inboard (MIE) Model Engines: Seawater passes through exchanger once before leaving.**

b. Internal leaks can be repaired by soldering shut the ends of the leaking tube. This is only a temporary fix because usually another tube will start leaking after a short period of time and this also causes a reduction in cooling capacity. DO NOT close more than 3 tubes.

c. Nipples and drains that have been broken off the heat exchanger can be re-attached by brazing. Care must be taken not to melt other joints during repair.

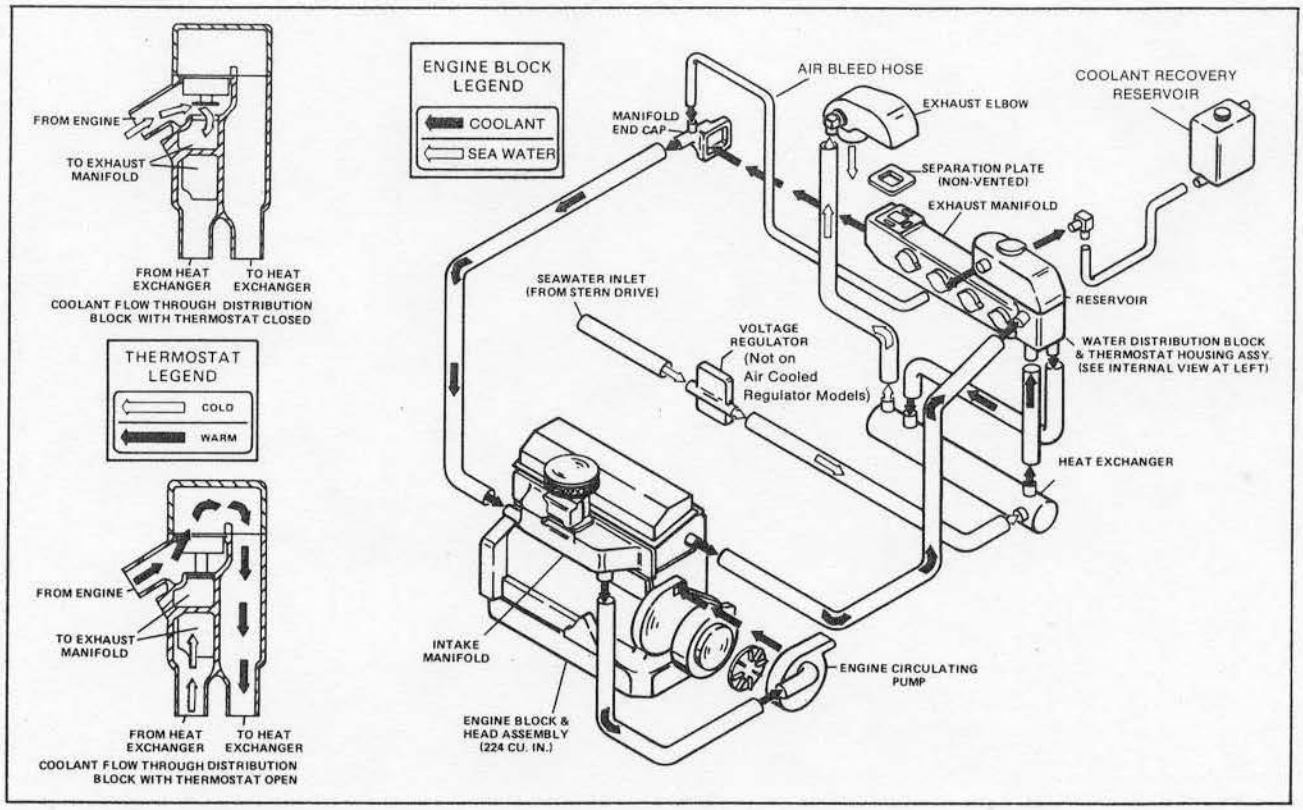


Figure 2. MCM 470 Water Flow Circuits [With 3" (8cm) Dia. Heat Exchanger]

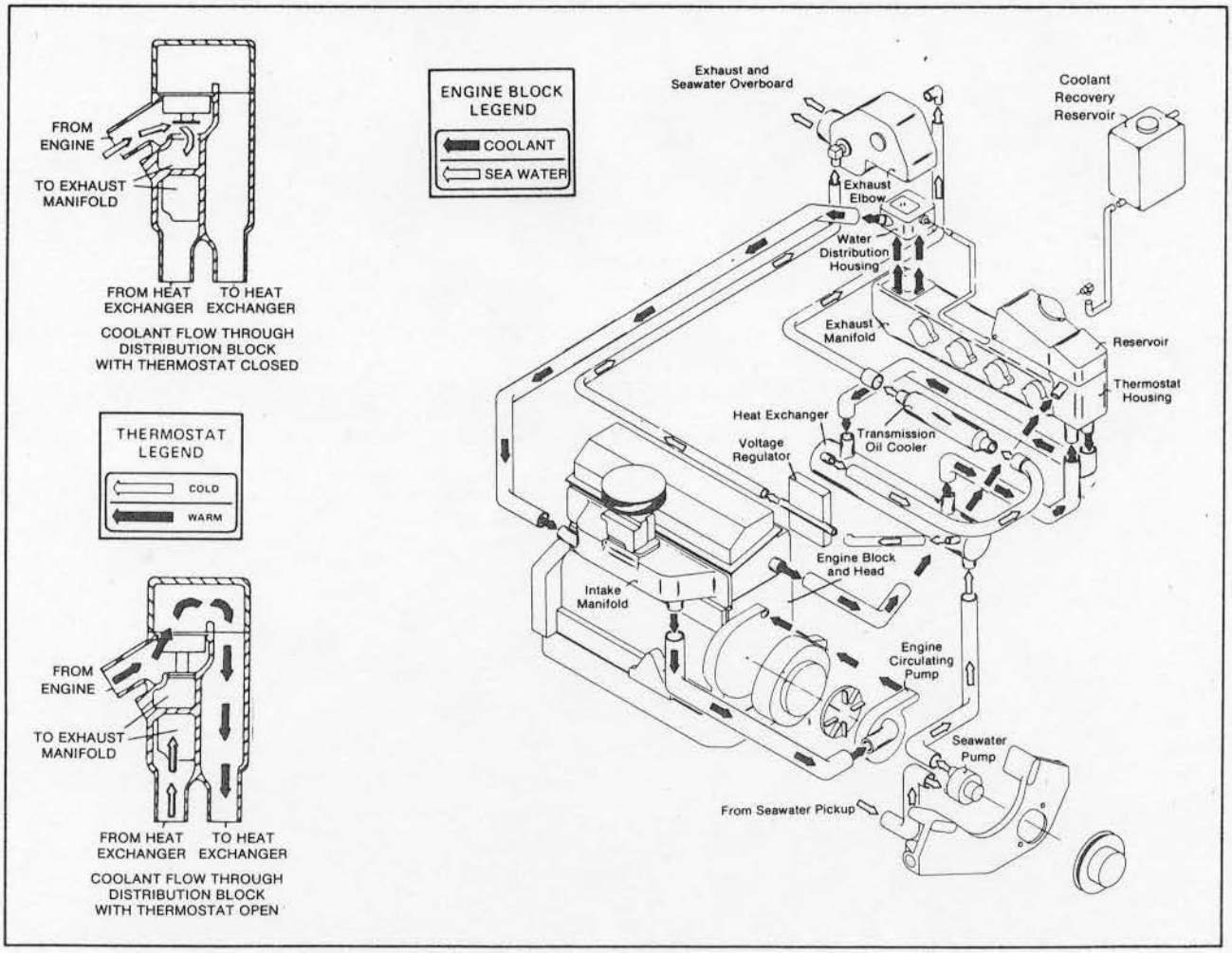


Figure 3. MIE 470 Water Flow Circuits

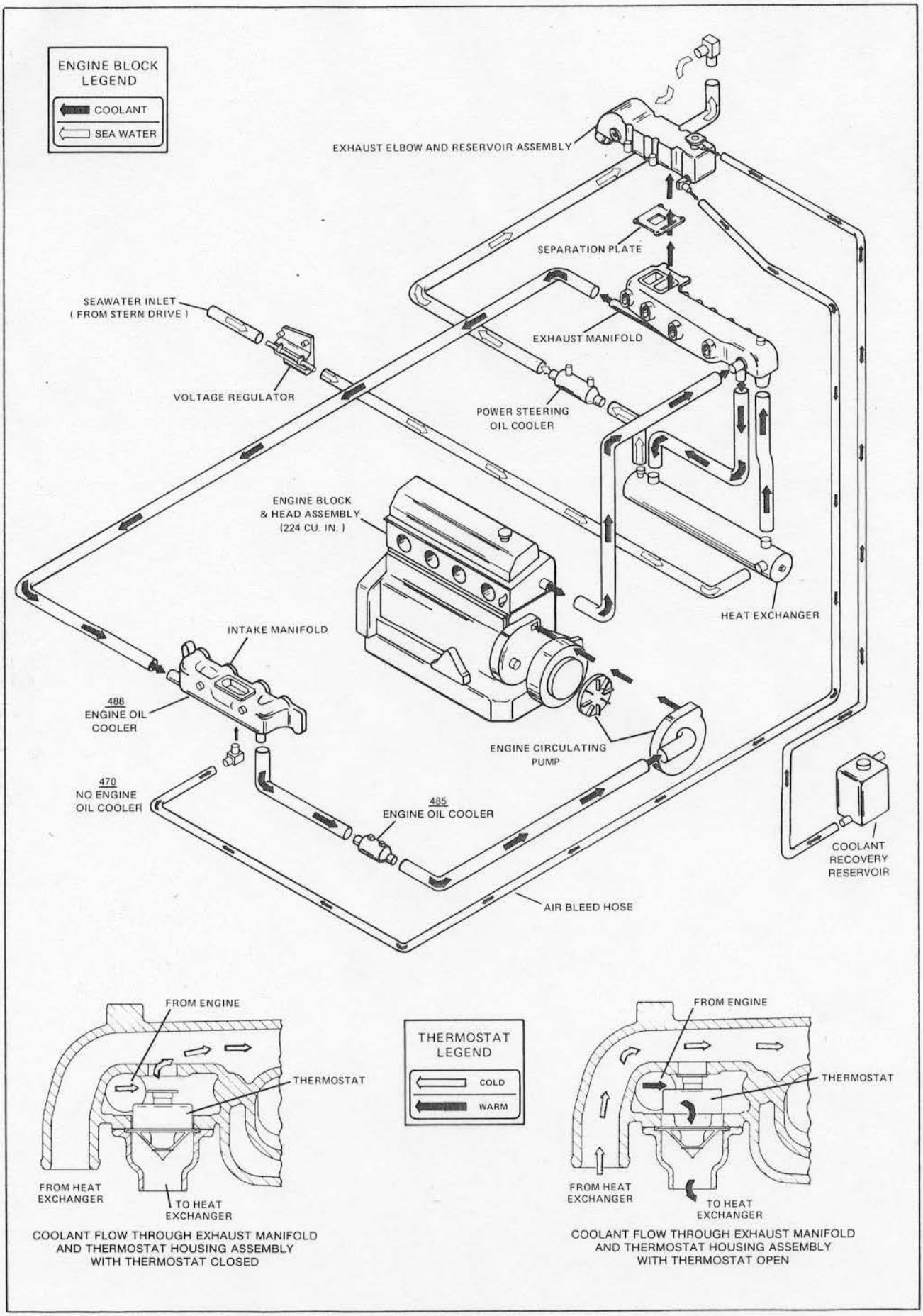
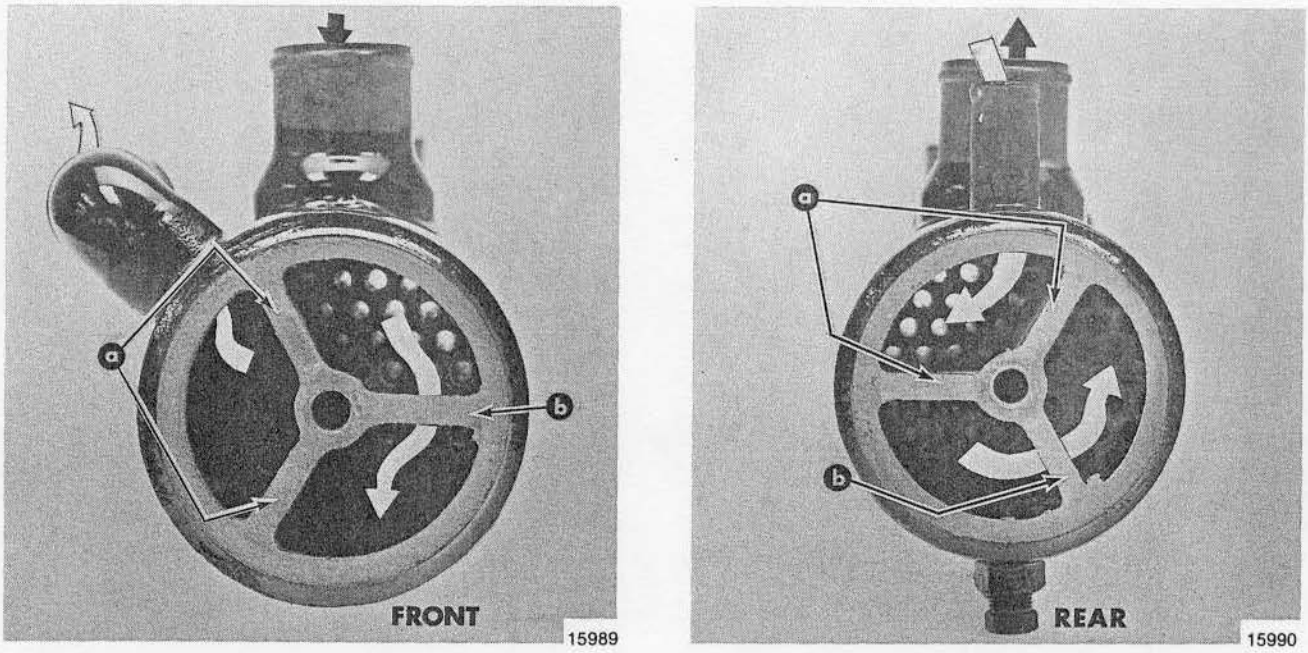


Figure 4. MCM 485 [3" (8cm) Dia. Heat Exchanger] and MCM 470/488 [4" (10cm) Dia. Heat Exchanger] Water Flow Circuits

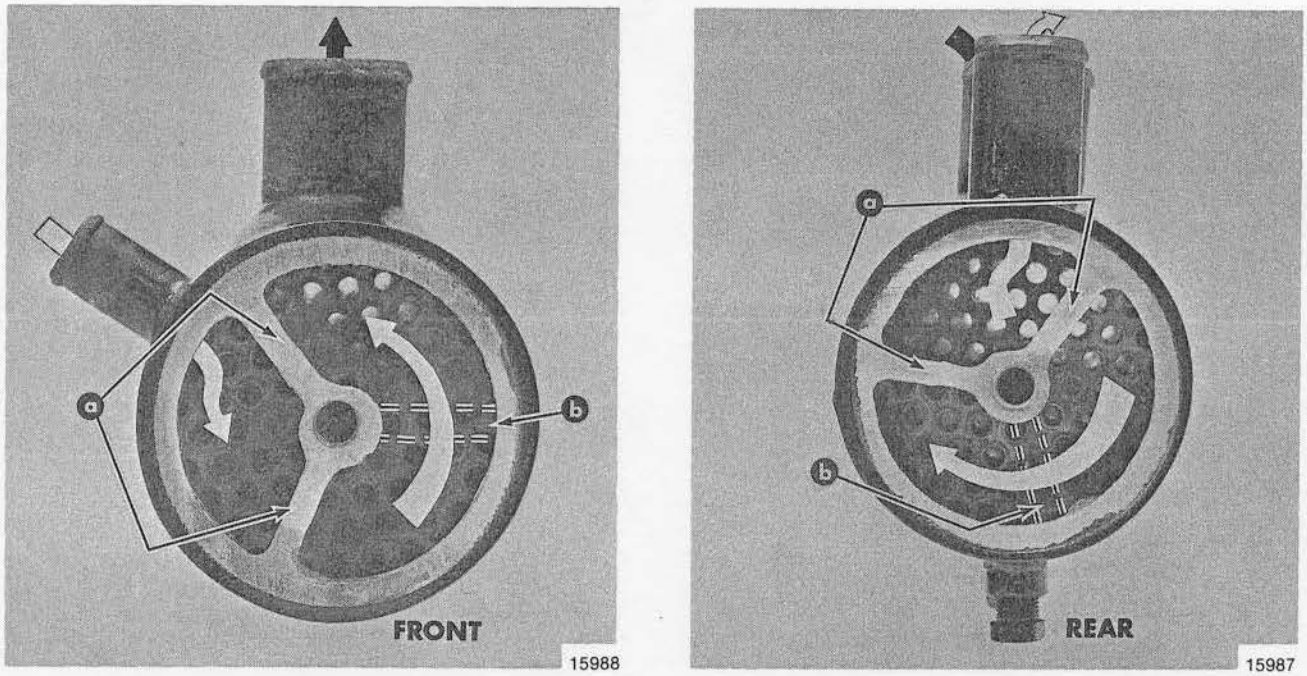


Closed Cooling Coolant Flow

Seawater Flow

a - Solid Ribs
b - Open Rib

Figure 5. 75959 End Casting Placement [MCM 470 3" (8cm) Dia.]

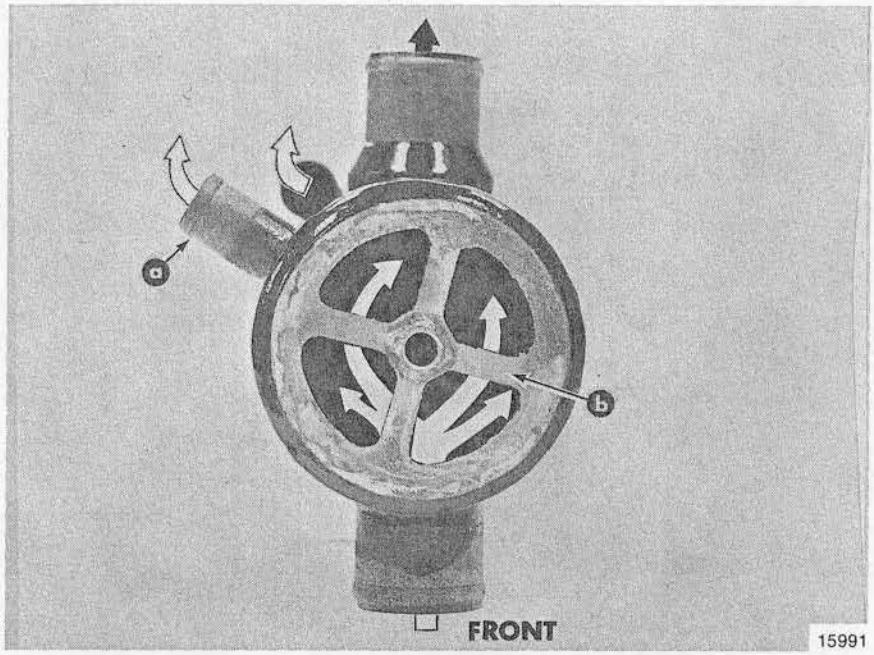


Closed Cooling Coolant Flow

Seawater Flow

a - Solid Ribs
b - Open Rib (If Exchanger Has 3rd Rib At Each End)

Figure 6. 77319 End Casting Placement [MCM 470/485 3" (8cm) Dia.]

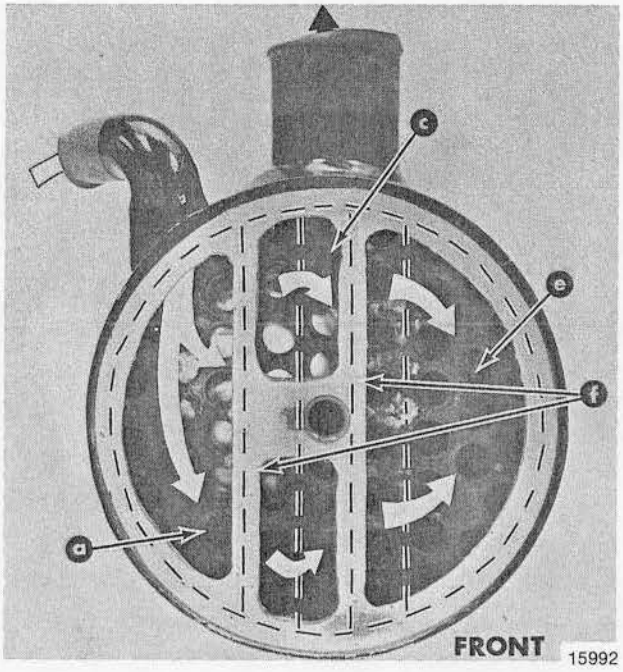


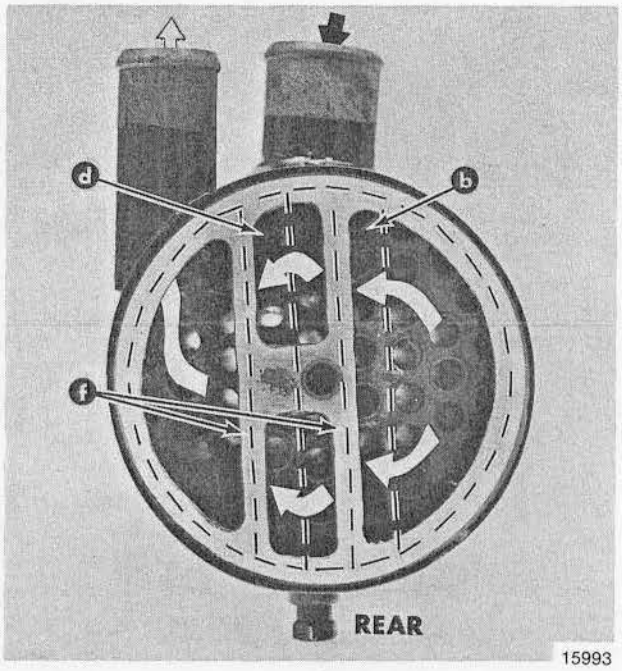
Closed Cooling Coolant Flow

Seawater Flow

a - Small Amount of Seawater to Cool Voltage Regulator
b - All 4 Ribs Are Open

Figure 7. 78165 End Casting Placement [MIE 470 3" (8cm) Dia.]





Closed Cooling Coolant Flow

Seawater Flow

a - 17 Tube Flow To Rear
b - 8 Tube Flow To Front
c - 9 Tube Flow To Rear
d - 8 Tube Flow To Front
e - 17 Tube Flow To Rear
f - The Two Ribs On Each End Are Solid

Figure 8. 98643 End Casting Placement [MCM 470/488 4" (10cm) Dia.]

merCruiser
STERN DRIVES & INBOARDS

service bulletin

NUMBER: 83-1

CIRCULATE TO:
SERVICE MANAGER ☐
PARTS MANAGER ☐
MECHANICS ☐
"Place in a Service Bulletin Binder"

A. **Use of SAE 30W Oil for Engine Break-In - All Models**
B. **Battery Requirements for MerCruiser Engines - All Models**
C. **Replacement Ignition Resistance Wire - All Models**

A. USE OF SAE 30W OIL FOR ENGINE BREAK-IN - ALL MODELS

SAE 30W Quicksilver 4-Cycle Marine Engine Oil is now being used in the crankcase of all MerCruiser Engines for break-in. If Quicksilver 4-Cycle Marine Engine Oil is not available, use any good grade, detergent SAE 30W "SE" or "SF" oil. DO NOT USE Quicksilver Engine Oil Supplement with SAE 30W oil during the break-in period. After the break-in period, Engine Oil Supplement can be used. Listed below are the starting serial numbers:

MCM 120	6255466
MCM 140	6256955
MCM 470	6257008
MCM 488	6299270
MCM 898	6260100
MCM 228	6259640
MCM 260	6250990
MCM 330	6301823

MIE 230, 260 and 340 - no serial numbers available. Engines produced after August, 1982 had SAE 30W oil in the crankcase.

B. BATTERY REQUIREMENTS FOR MERCRUISER ENGINES - ALL MODELS

To obtain adequate cranking power for the 4 cycle MerCruiser engine, select a battery with a "Cold Cranking Amperage" of no less than:

- 2 amperes per cu. in. displacement for 4 cylinder engines
- 1½ amperes per cu. in. displacement for 6 cylinder engines
- 1 ampere per cu. in. displacement for 8 cylinder engines

If auxiliary equipment such as bilge pumps, radio, T.V. or other electrical accessories are going to be used, without the engine running, the "Reserve Capacity" rating (along with the "Cold Cranking Amperage" rating) should be taken into consideration.

The "Reserve Capacity" rating indicates the amount of time a fully charged new battery at 80°F (27°C) will deliver 25 amperes to a load before being exhausted. At the end of this time period, the battery will probably not be able to crank the engine until being recharged. The "Reserve Capacity" rating was developed by the automotive industry in order to give some indication of the length of time that the automobile headlights can be left on before the battery is exhausted. This rating replaces the obsolete "Ampere Hour" rating which was based on a discharge rate over a 20 hour period.

"Deep Cycle" batteries may not be suitable when used as a "Cranking" battery on MerCruiser engines. These batteries are normally constructed to withstand "deep cycle" use (charge and discharge at moderate current levels). If a "Deep Cycle" battery does not have a "Cold Cranking Amperage" rating, DO NOT use it as a cranking battery.

Listed below are the minimum "Cold Cranking Amperage" battery ratings to be use on MerCruiser engines.

BATTERY COLD CRANKING AMPERAGE			
305	**350**	**375**	**450**
MCM 120 MCM 898 MCM 228 MIE 228 MIE 230	MCM 185 MCM 260 MIE 255 MIE 260	MCM 140 MCM 165	MCM 470 MIE 470 MCM 485 MCM 488 MCM 330 MIE 330 MIE 340 MCM 370

C. REPLACEMENT IGNITION RESISTANCE WIRE - ALL MODELS

In the past, if the ignition resistor wire had to be replaced, the complete engine wiring harness had to be changed. A replacement ignition resistance wire is now available. To install the replacement wire, follow the instructions that come in the kit.

Resistance Cable **84-94227A2**

mercruiser
STERN DRIVES & INBOARDS

service bulletin

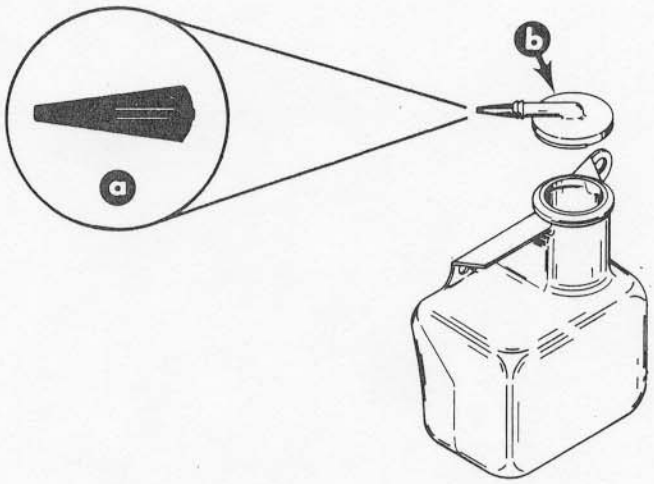
NUMBER: 83-3

A. Plug in Coolant Recovery Bottle Cap Air Vent - MCM 470/488
B. Metric Power Steering Pump Mounting Studs - All Models
C. Metric Power Steering Pump Pressure Hose "O" Ring - All Models
D. Quicksilver Insulating Compound Used on Ignition Coil Tower - All Engines Equipped with Thunderbolt IV (HEI) Ignition Systems

CIRCULATE TO:
SERVICE MANAGER ☐
PARTS MANAGER ☐
MECHANICS ☐
"Place in a Service Bulletin Binder"

A. PLUG IN COOLANT RECOVERY BOTTLE CAP AIR VENT - MCM 470/488

Early production runs of the above model engines had this "plug" in the air vent of the Coolant Recovery Bottle Cap. If this plug is not removed, engine may overheat. Remove and discard "plug" from all the above model engines before running engine. Later production engines do not have this "plug" installed.



a - Plug
b - Recovery Bottle Cap

Figure 1. Remove and Discard Plug

B. METRIC POWER STEERING PUMP MOUNTING STUDS - ALL MODELS

Listed below, are the metric mounting studs that are used on metric power steering pump.

MCM 120/140	**16-41877**
All V-8's	**16-41877**
MCM 470/485/488	**16-41878**

C. METRIC POWER STEERING PUMP PRESSURE HOSE "O" RING - ALL MODELS

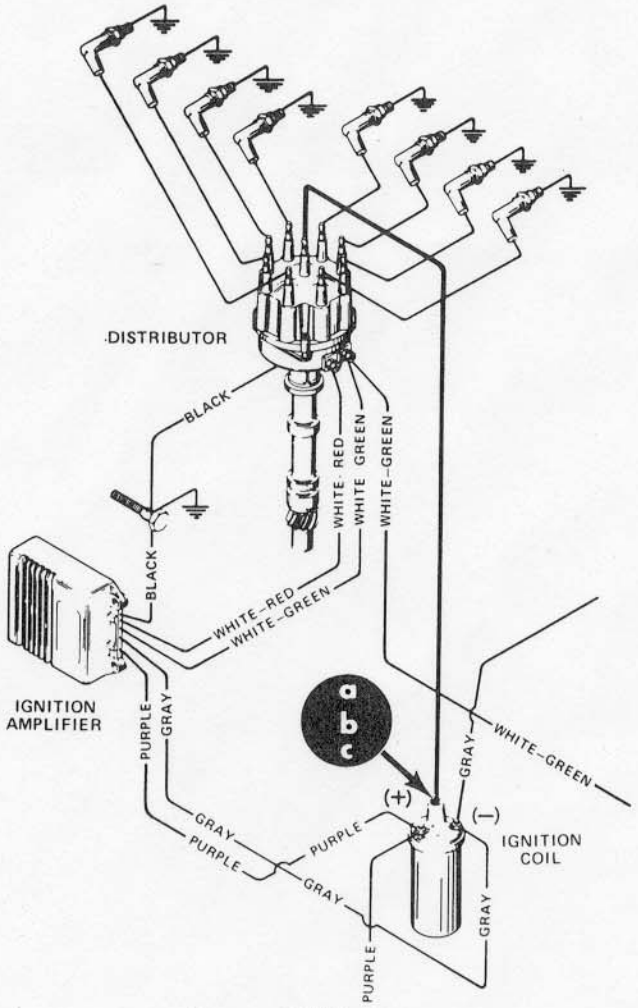
The "O" Ring used to seal the Metric Power Steering Pump Pressure Hose connection is listed below.

"O" Ring	**25-89879**

D. QUICKSILVER INSULATING COMPOUND USED ON IGNITION COIL TOWER - ALL ENGINES EQUIPPED WITH THUNDERBOLT IV (HEI) IGNITION SYSTEMS

Production is using Insulating Compound on all Thunderbolt IV (HEI) ignition coil towers. We recommend that whenever an engine (with Thunderbolt IV Ignition System) is serviced, apply approximately 1/2 oz. of Insulating Compound inside the nipple of the coil high tension lead. Force nipple into coil tower and wipe off excess. (Figure 2) This Insulating Compound will help "waterproof" this area of the ignition system.

Quicksilver Insulating Compound 92-41669-1



a - Remove Coil Wire/Boot
b - Apply 1/2 Oz. of 92-41669-1
c - Reinstall Coil Wire/Boot

Figure 2. Applying Quicksilver Insulating Compound

merCruiser
STERN DRIVES & INBOARDS

service bulletin

NUMBER: 83-6

CIRCULATE TO:
SERVICE MANAGER ☐
PARTS MANAGER ☐
MECHANICS ☐
"Place in a Service Bulletin Binder"

DUAL BATTERY CHARGING SYSTEMS USING A BATTERY ISOLATOR

Battery Isolators allow the addition of an auxiliary (second) battery to the MerCruiser electrical system. The auxiliary battery is primarily used as a power source for various accessories installed on the boat. The Battery Isolator will allow the alternator to charge both the cranking and auxiliary batteries at the same time while preventing accessories, connected to the auxiliary battery, from drawing power from the cranking battery.

MerCruiser engines that meet the following requirements can use a Battery Isolator.

MCM/MIE 470/MCM 485/488

1. Engines equipped with 86255A2 or 99502A9 Water Cooled Voltage Regulator.
2. MCM/MIE 470 (Serial No. 4625580 thru 5120655) with 77305A2 Water Cooled Voltage Regulator, must have a new 99502A8 Regulator installed.

ALL OTHER MODELS

1. All engines equipped with a 3-wire belt driven alternator.
2. We recommend 1-wire Delco alternators be replaced with a 3-wire belt driven alternator (78403A2) before installing a Battery Isolator.

⚠CAUTION

Follow Battery Isolator manufacturer's instructions for wire gauge. Battery Isolator installation must conform to BIA Low Voltage Wiring Standard No. 125-79.

Printed in U.S.A.

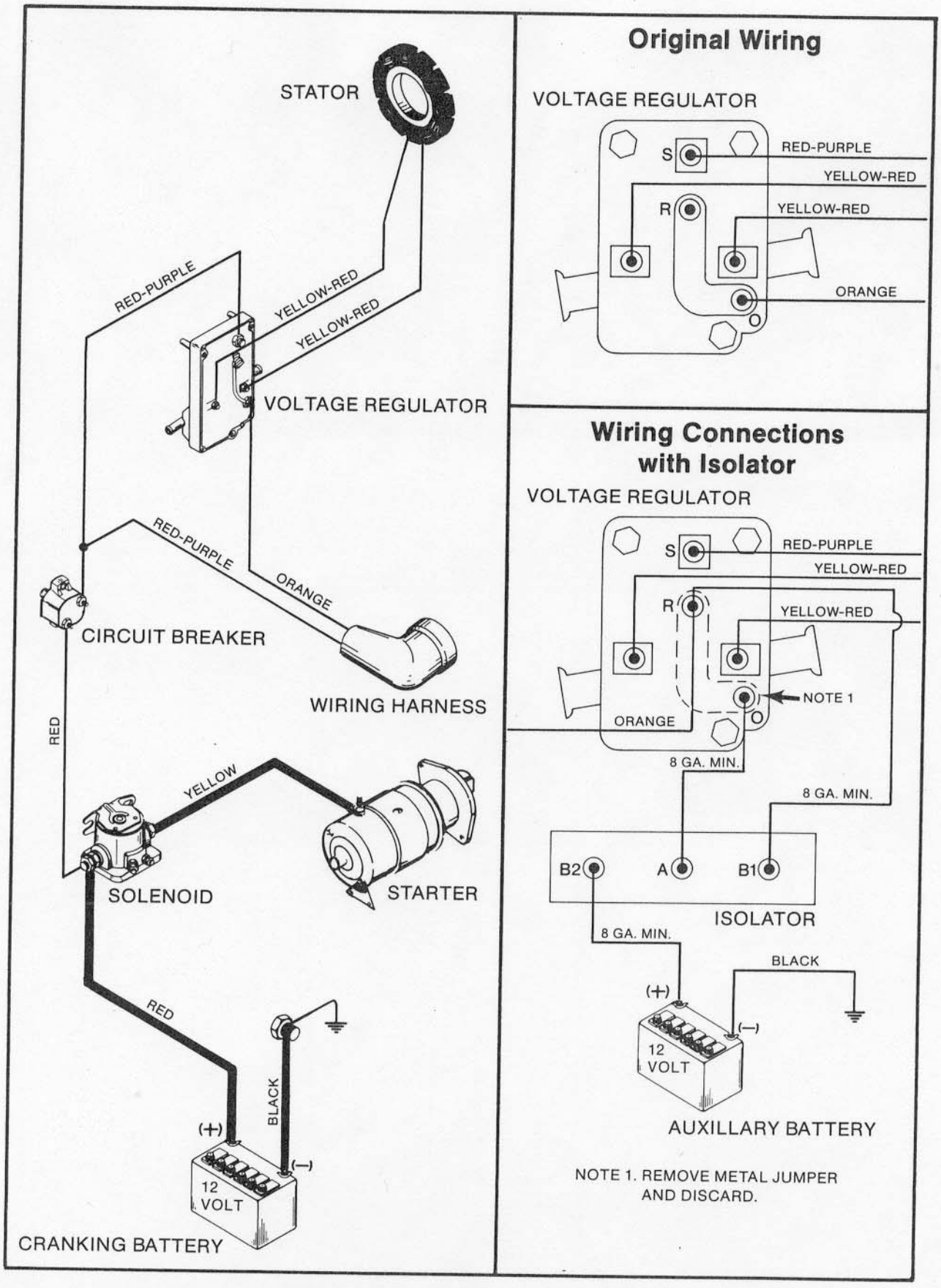


Figure 1. 470/485 with Ammeter Gauge (Prestolite Starter Motor)

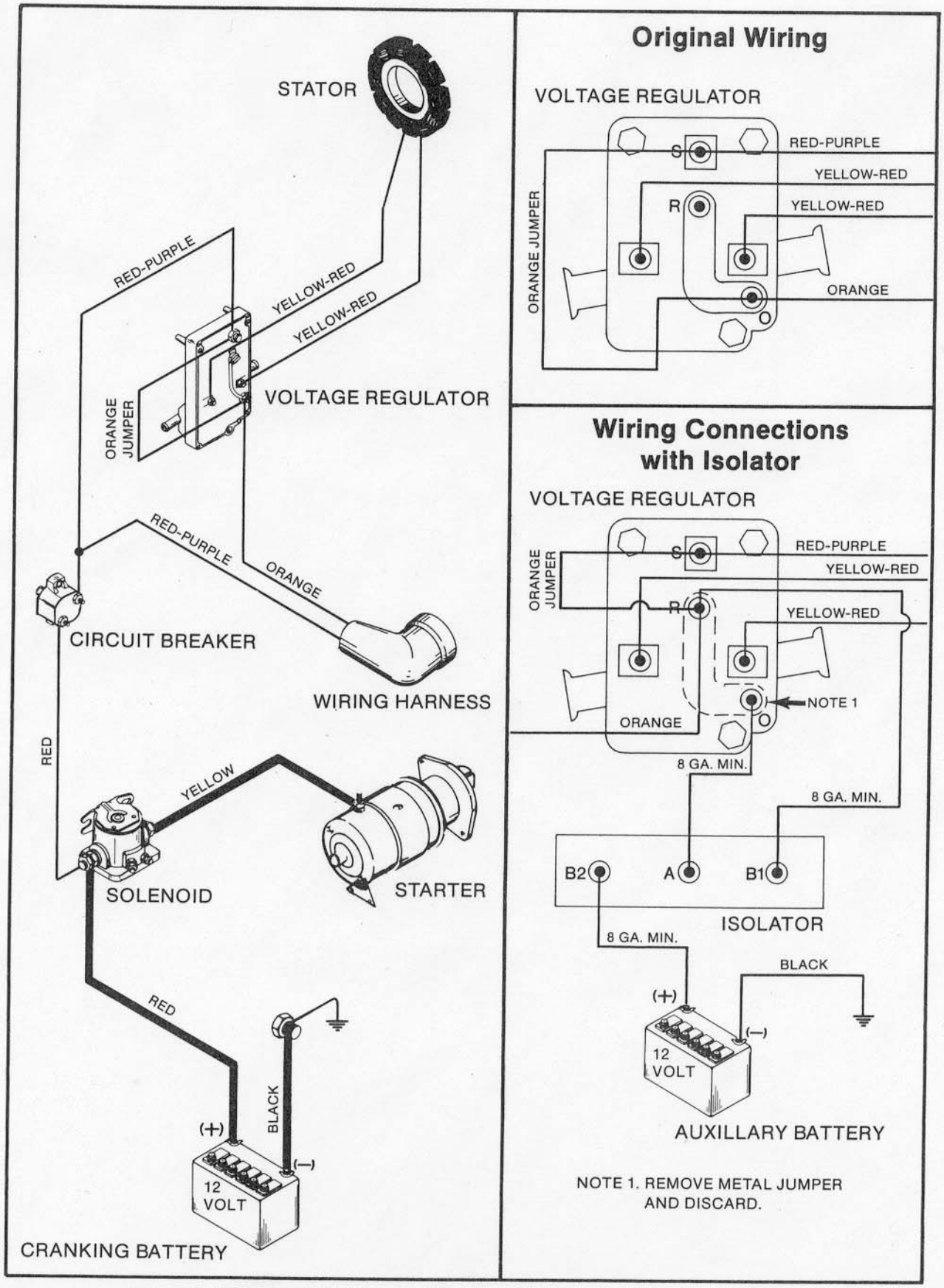


Figure 2. 470/485 with Voltmeter Gauge and Ammeter By-Pass Jumper Wire (Prestolite Starter Motor)

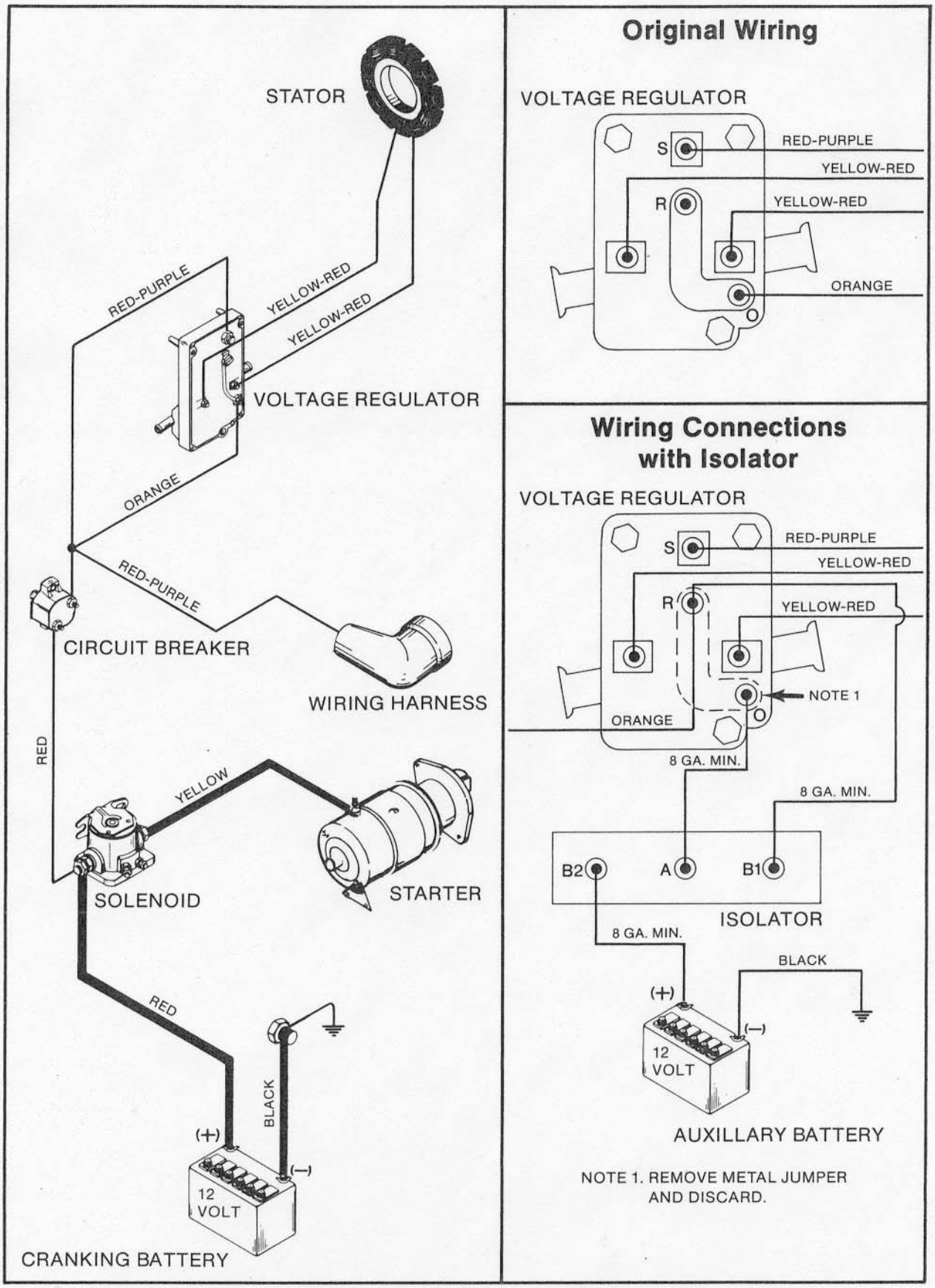


Figure 3. 470/485 with Engine Wiring Harness Wired for Voltmeter (Prestolite Starter Motor)

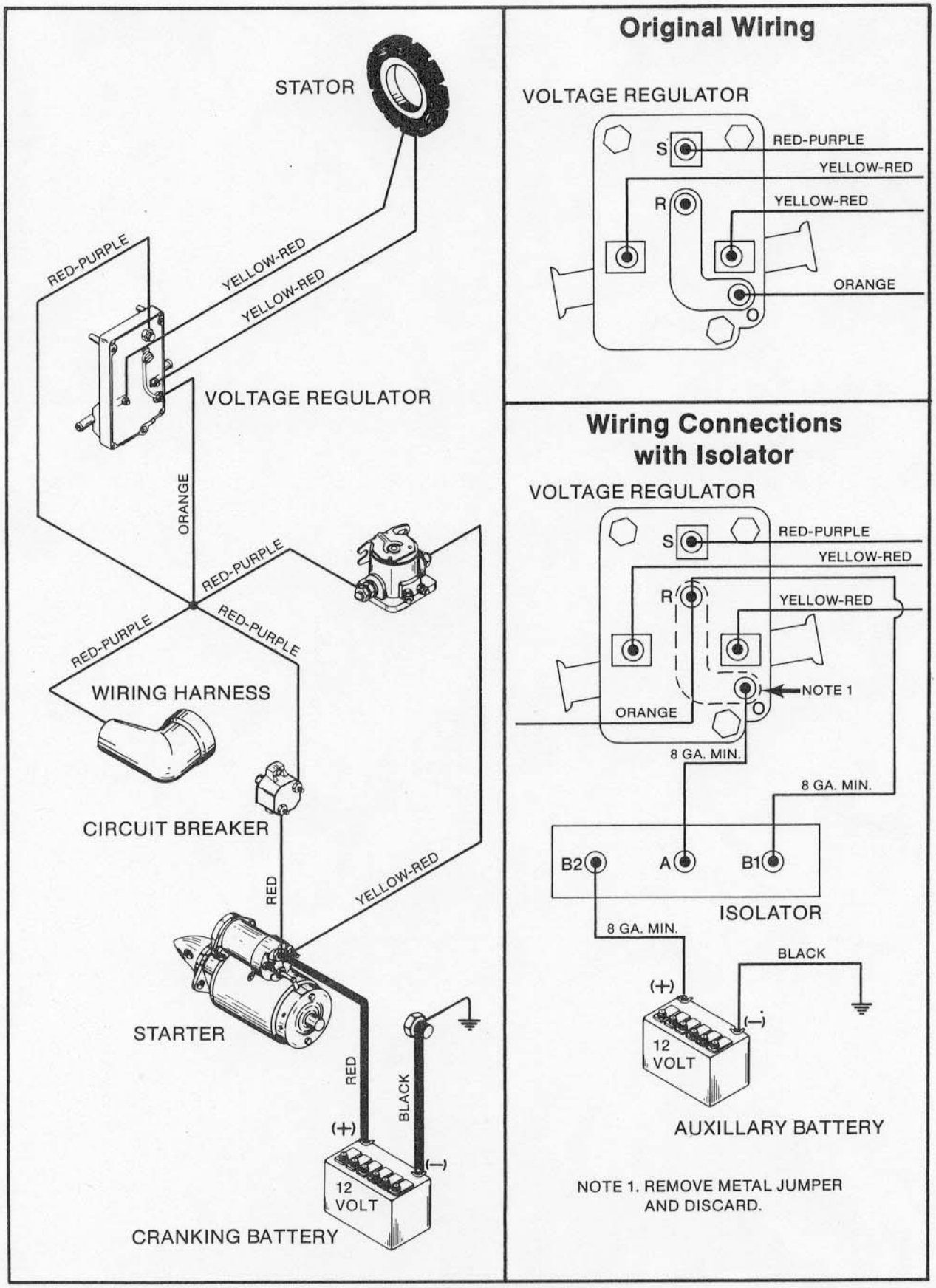


Figure 4. 470/488 with Engine Wiring Harness Wired for Voltmeter (Delco Remy Starter Motor)

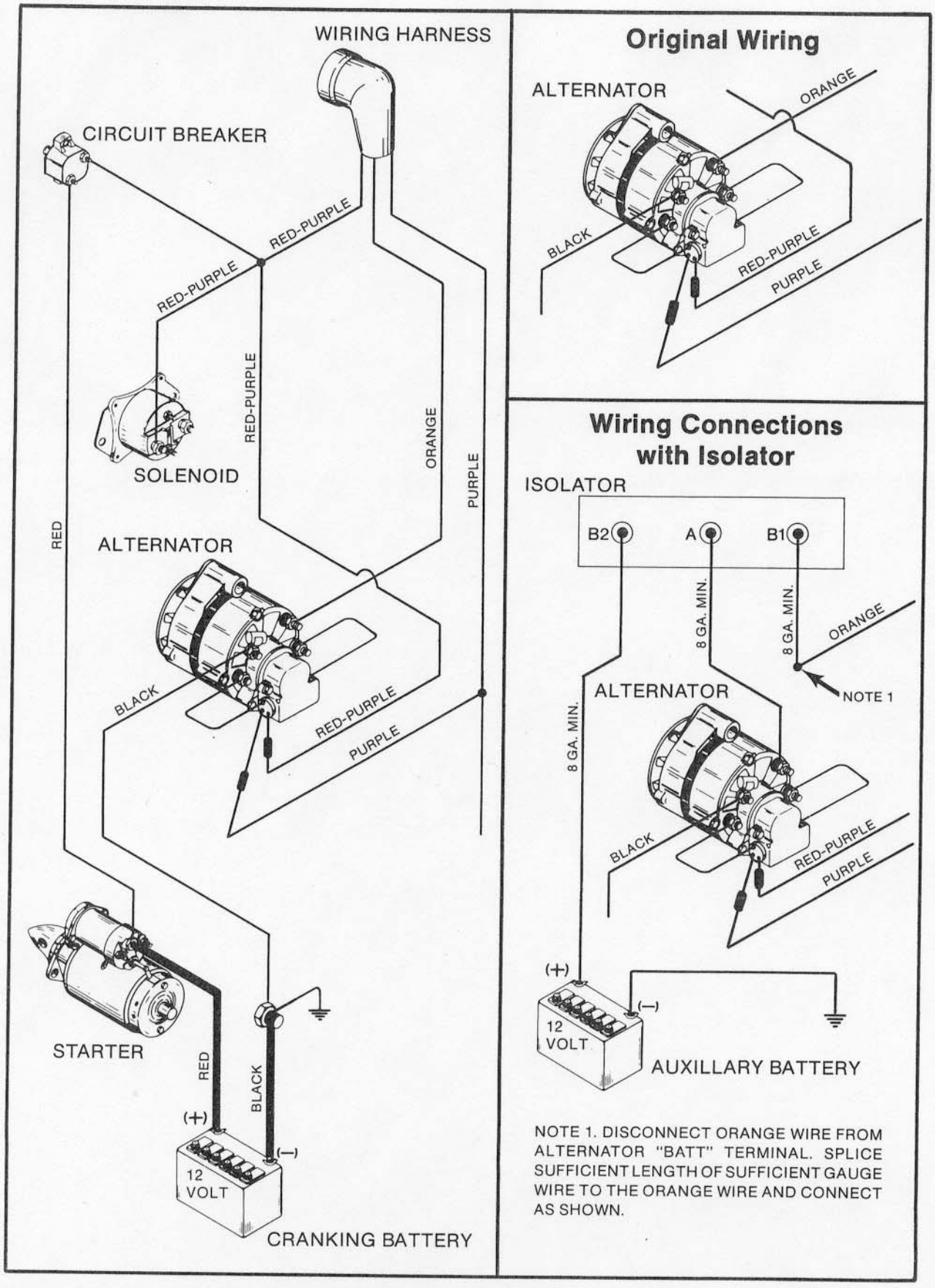


Figure 5. 3-Wire Belt Driven Alternator with Ammeter Circuit (Typical Wiring Shown)

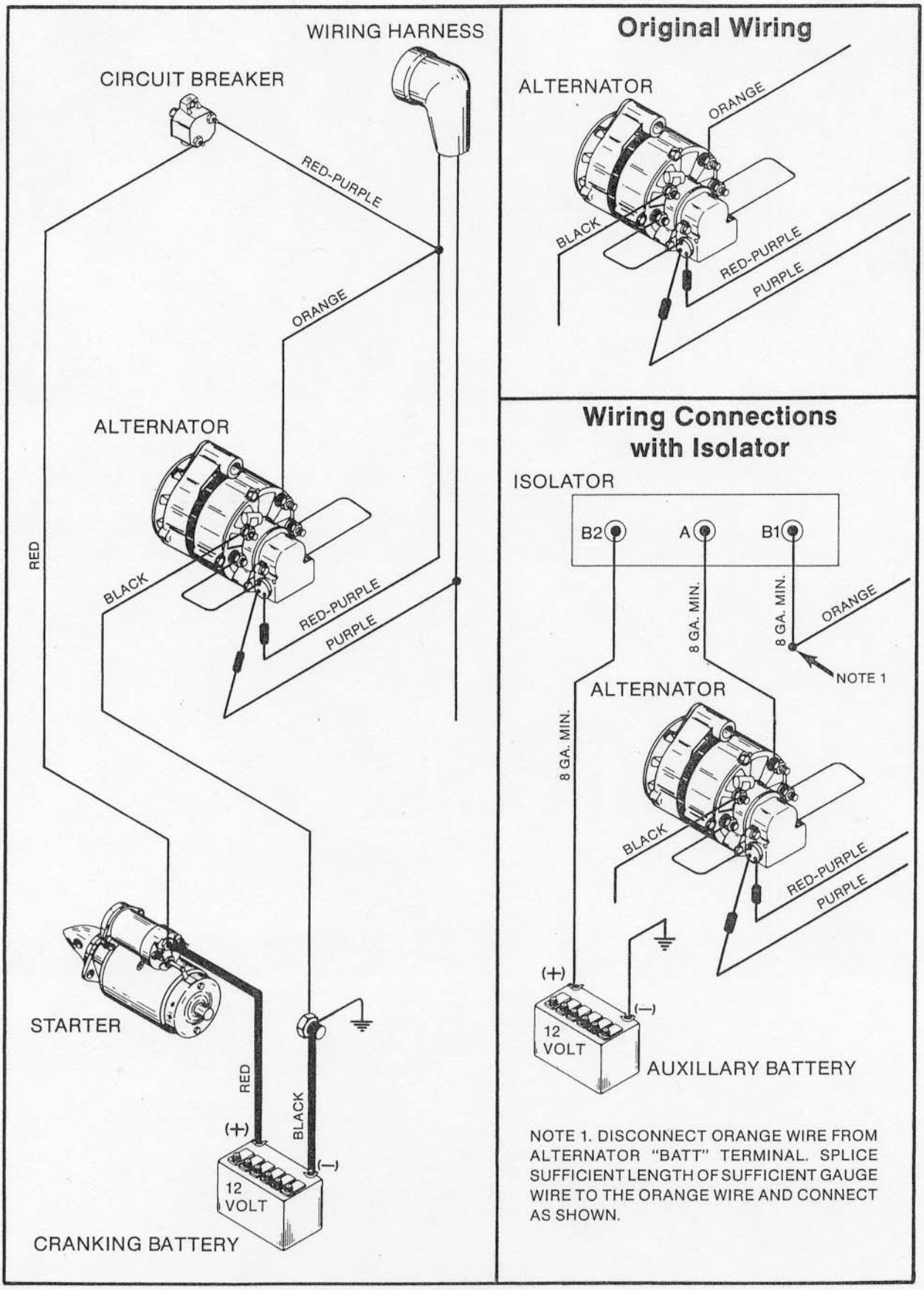


Figure 6. 3-Wire Belt Driven Alternator with Voltmeter Circuit (Typical Wiring Shown)

mercruiser STERN DRIVES & INBOARDS

service bulletin

NUMBER: 83-8

A. Troubleshooting the Charging System - MCM/MIE 470, MCM 485/488

CIRCULATE TO:
SERVICE MANAGER ☐
PARTS MANAGER ☐
MECHANICS ☐
"Place in a Service Bulletin Binder"

A. TROUBLESHOOTING THE CHARGING SYSTEM - MCM/MIE 470, MCM 485/488

⚠WARNING

When performing the following procedure, be sure to observe the following:

Be sure that engine compartment is well ventilated and that no gasoline vapors are present, to avoid the possibility of a fire.

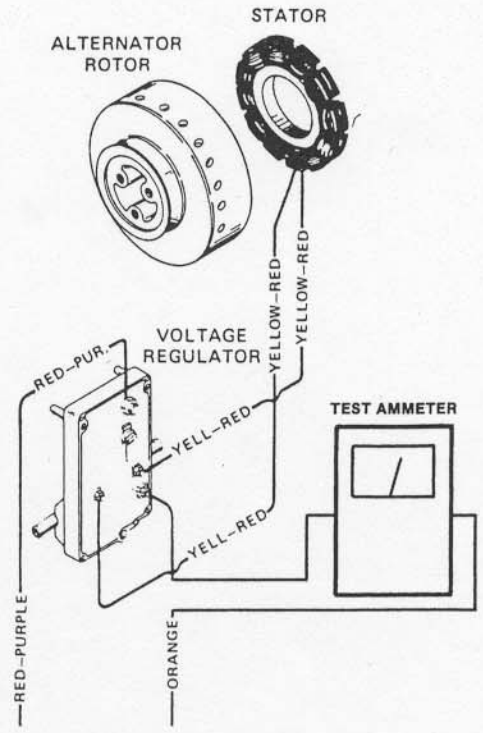
Before connecting or disconnecting any electrical connection, battery cables MUST BE REMOVED from battery to prevent possible personal injury or damage to equipment.

- The charging system may be connected to one or more batteries during these tests, however, these batteries must not be connected to any other charging source.
- Check that all connections are tight prior to starting tests. Insure that the battery posts and terminals are clean and making good contact. Verify with test equipment that wiring harnesses are not at fault.
- Examine the pins and sockets of the engine harness connector for burned, loose or dirty connections. Using a knife blade, spred the slot (in the male pins of this connector) slightly to insure good contact.
- Make sure alternator rotor is magnetized.

- Temporarily install ammeter in series with the orange output lead from the regulator. This meter is required only for these tests, following:

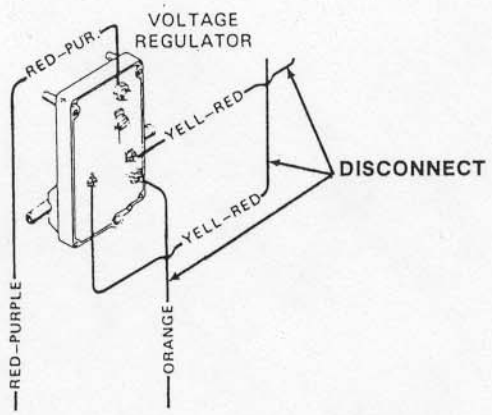
CONSTANT HIGH OUTPUT

1. Remove one yellow-red wire from its regulator terminal and tape back temporarily. Run engine at 1000 RPM. Any output current indicates a stator short to ground.
2. Reconnect the yellow-red lead and repeat test with the other yellow-red lead.
3. If there is no output with either yellow-red lead in the above test, the regulator is bad.



NO OUTPUT

1. Remove the 2 yellow and the orange leads from the regulator.
2. Check the resistance between the regulator case and either yellow/red stud. A near zero reading from either stud to the case - replace regulator.



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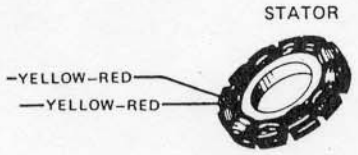
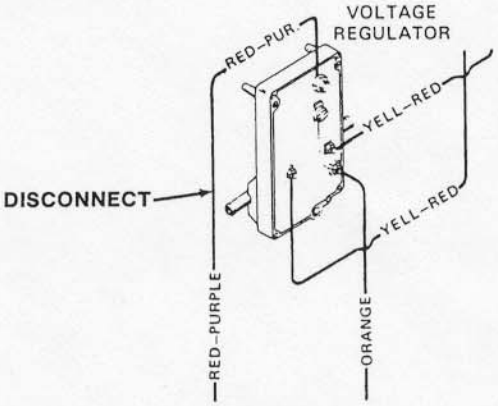
3. Check the resistance between the yellow/red leads. Resistance greater than 1 ohm - replace the stator.



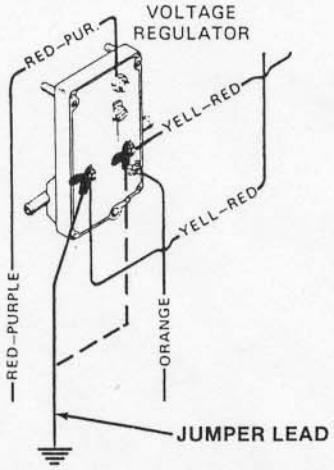
If Steps 2 and 3 tests show both parts to be good, proceed.

4. With all leads on the regulator, except the sense lead, run the engine at 1000 RPM and observe ammeter. Any charging current indicates a low voltage set point - replace regulator.



If there isn't any output, proceed;

5. With all leads reconnected, use a jumper lead (with "alligator clips" at both ends). Clip one end of jumper lead to ground and the other end of the lead to one yellow-red terminal (on regultor). Run the engine at 1000 RPM and observe ammeter. Repeat this same test with the other yellow-red terminal. Both of these tests shold indicate an output of at least 10 amps. If output is less - replace regulator.



mercruiser
STERN DRIVES & INBOARDS

service bulletin

NUMBER: 83-11

CIRCULATE TO:
SERVICE MANAGER ☐
PARTS MANAGER ☐
MECHANICS ☐
"Place in a Service Bulletin Binder"

A. VOLTAGE REGULATOR DAMAGE - MCM/MIE 470 and MCM 485/488

Excessive resistance in the Ammeter Circuit can cause Voltage Regulator damage on MerCruiser 470/485/488 engines. To prevent this possibility, engine wiring harnesses had the Ammeter Circuit eliminated. On these engines, a Voltmeter has to be used. The starting serial numbers for the engines equipped with the Voltmeter Circuit are listed below:

MIE 470	**All had ammeter circuit**
MCM 470	**5847335 and above**
MCM 484	**5813434 and above**
MCM 488	**All engines**

If recurring Voltage Regulator failures are experienced on engines equipped with an Ammeter Circuit, order Voltage Regulator Kit (99502A8). This kit contains the necessary parts and instruction sheet to convert to a Voltmeter Circuit. The Voltmeter gauge in the dash would have to be purchased separately.

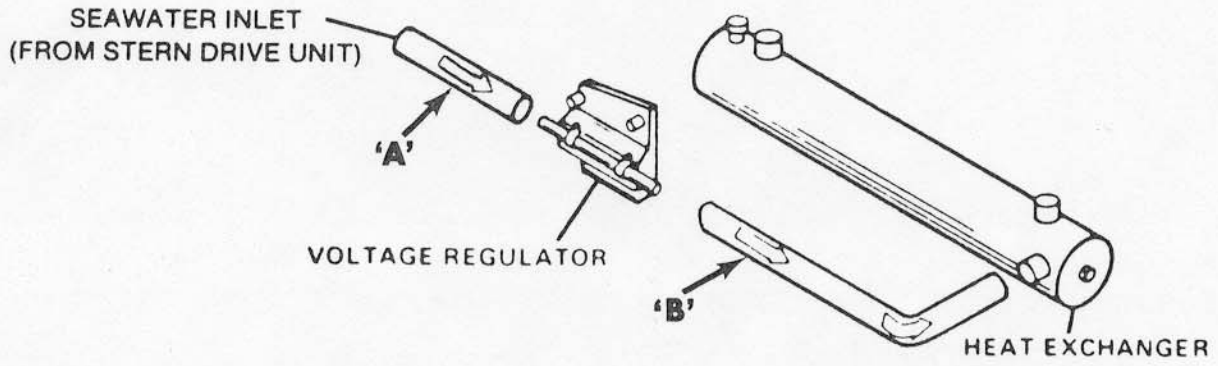
Voltage Regulator Kit 99502A8

B. PROCEDURE FOR FILLING CLOSED COOLING SYSTEM. (TO REMOVE TRAPPED AIR) - ALL MODELS

1. Make sure front of engine is slightly higher than rear of engine.
2. Fill closed cooling section with coolant until level remains at bottom of fill neck.
3. Leave fill cap off. Start engine and run at 1500-1800 RPM. Add coolant as necessary to keep level at fill neck.
4. Run engine at 1500-1800 RPM until engine is at operating temperature AND thermostat has opened.
5. Shut engine off. Add coolant until it is even with the filler neck. Fill coolant recovery bottle to approximately half full.
6. Install cap and water test at higher RPM.
7. Let engine cool down, remove cap and add coolant if necessary.

C. WATER COOLED VOLTAGE REGULATOR WATER HOSE REPLACEMENT - MCM/MIE 470, MCM 485/488

Voltage Regulators 86255A2 and A3 had a 5/8" dia. water tube. These two regulators supersede to 99502A8. The 99502A8 regulator has a 3/4" dia. water tube. This kit has the necessary water hoses to connect the 3/4" dia. regulator to the 5/8" dia. heat exchanger and gimbal housing water inlet tube. Chart below shows the replacement hose part numbers for the various heat exchanger/ regulator/water inlet tube combinations.

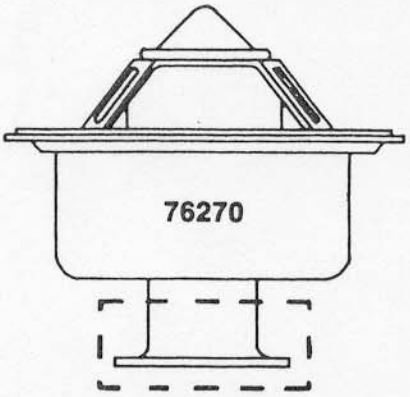


HOSE 'A'		
Water Inlet Tube O.D.	**Regulator Tube O.D.**	**Hose Part Number**
5/8" (15.9mm)	5/8" (15.9mm)	32-47642
5/8" (15.9mm)	3/4" (19mm)	32-99519

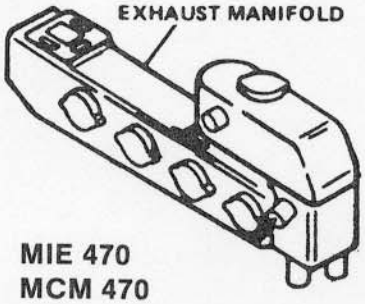
HOSE 'B'		
Regulator Tube O.D.	**Heat Exchanger Tube O.D.**	**Hose Part Number**
5/8" (15.9mm)	5/8" (15.9mm)	32-88132
5/8" (15.9mm)	3/4" (19mm)	32-41497
3/4" (19mm)	5/8" (15.9mm)	32-99521
3/4" (19mm)	3/4" (19mm)	32-99520

D. THERMOSTATS - MCM/MIE 470, MCM 485/488

Because there is a difference in operation and design of the two thermostats offered, care must be taken when ordering replacement part. Refer to chart below for correct thermostat usage.

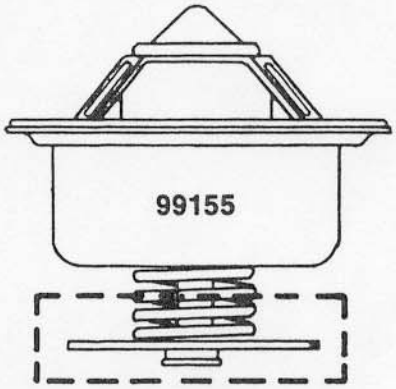


Use In This Type Manifold

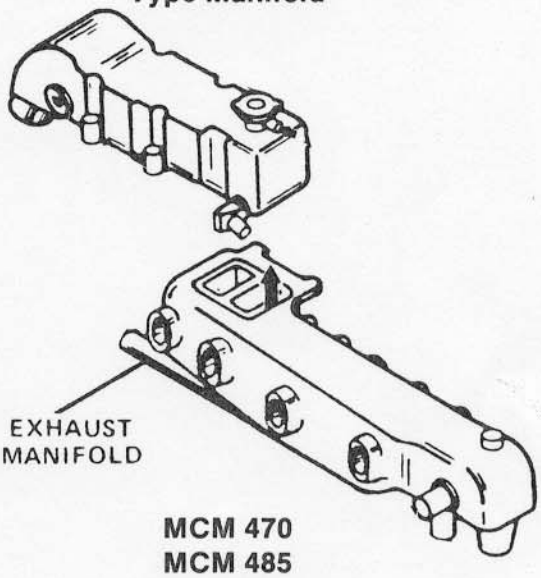


MIE 470
MCM 470

EXCEPTION: MCM 470 Models that have Heavy Duty Closed Cooling (4" dia. Heat Exchanger) Kit installed on engine. Thermostat housing (in kit) was machined to accept 99155 thermostat.



Use In This Type Manifold



MCM 470
MCM 485
MCM 488

E. ELECTRICAL/IGNITION TROUBLESHOOTING - ALL MODELS

Many times, valuable man hours are wasted in troubleshooting an electrical/ignition problem only to find that a loose or corroded connection is at fault.

When servicing a MerCruiser, for any reason, make it a routine service practice to check ALL electrical connections (ignition components, charging system, battery terminals, power trim, etc.). Make certain that ALL connections are clean and tight and insulated with Quicksilver Liquid Neoprene (92-25711-1), where necessary.

F. MAIN BEARING AND ROD BEARING CLEARANCE - MCM/MIE 470, MCM 485/488

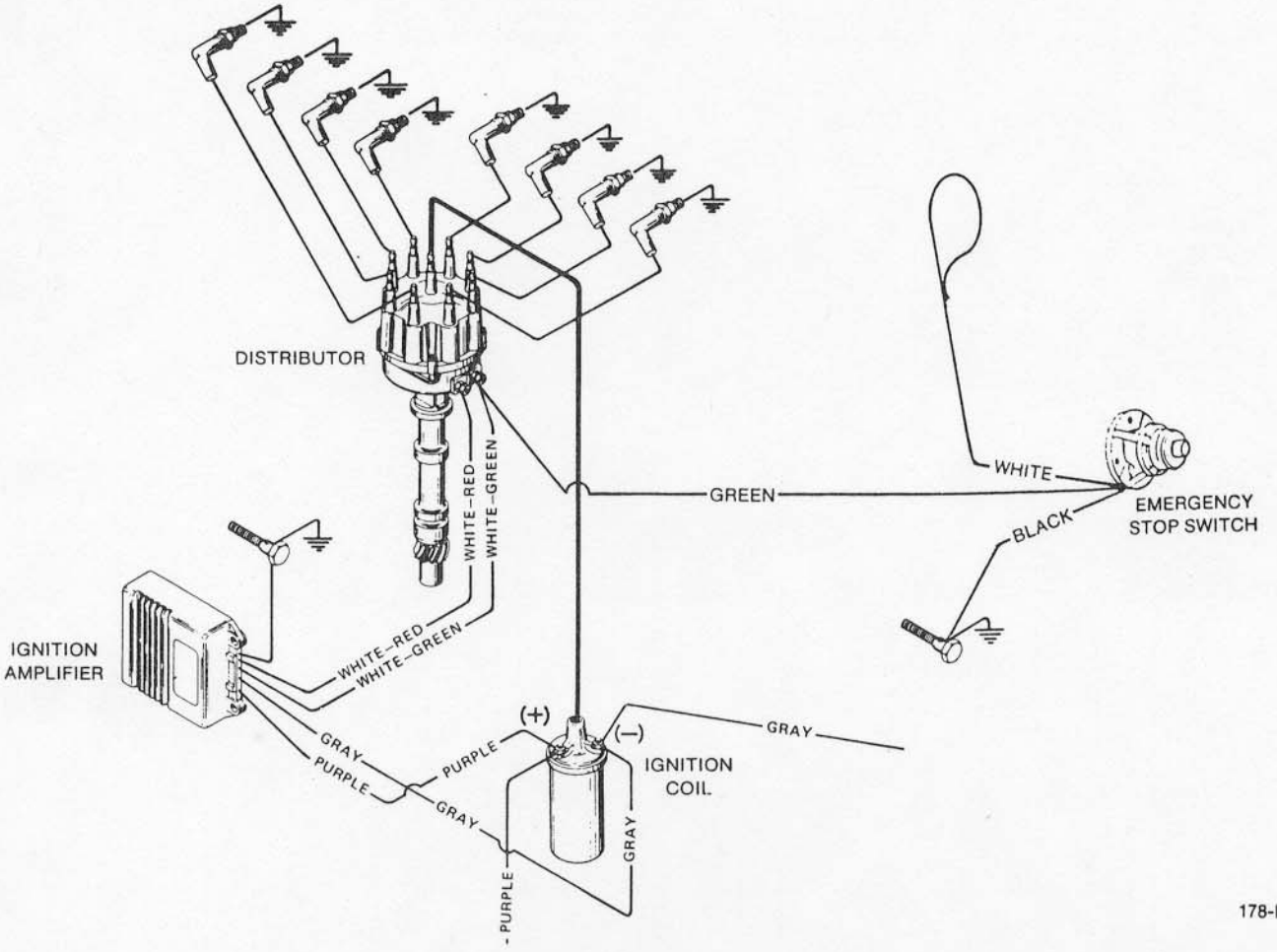
Change specifications in MerCruiser Service Manual (90-71707), page 8B-1 and 8B-2 as follows:

Main Bearing Clearance	Production	.0009-.0031 (.0228-.0787mm)
	Service	.001-.003 (.0254-.0762mm)

Rod Bearing Clearance	Production	.0009-.0031 (.0228-.0787mm)
	Service	.001-.003 (.0254-.0762mm)

G. EMERGENCY STOP SWITCH (65503A2) WIRE CONNECTION - THUNDERBOLT IV (HEI) IGNITION SYSTEMS

1. Tape white stop switch harness lead to harness and insulate with at least two layers of electrical tape.
2. Connect green stop switch harness lead to distributor terminal which has white-green lead already connected to it.
3. Connect black stop switch harness lead to convenient engine ground.
4. Coat connections with Liquid Neoprene.



mercruiser STERN DRIVES & INBOARDS

service bulletin

NUMBER: 83-5

CIRCULATE TO:
SERVICE MANAGER ☐
PARTS MANAGER ☐
MECHANICS ☐
"Place in a Service Bulletin Binder"

A. MCM 470 (S/N 6218037 and above), MCM 488 Tune-Up Specifications
B. MCM 470 (S/N 6218037 and above), MCM 488 Electrical Specifications
C. MCM 470 (S/N 6218037 and above), MCM 488 Carburetor Specifications
D. MCM 488 Internal Engine Specifications Camshaft

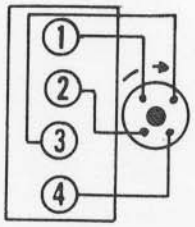
A. MCM 470 (S/N 6218037 and above), MCM 488 TUNE-UP SPECIFICATIONS

Model	470	488
Horsepower (Kilowatts)	170 (127kw)	188 (140kw)
Cu. In. Displacement	224 (3.7 liters)	
No. of Cyls.	4	
Bore	4.36" (11.07cm)	
Stroke	3.75" (9.53cm)	
Compression Ratio	8.8:1	
Compression Pressure	150 psi (1035 kPa)	
Point Gap	.022" (.56mm)	
Point Dwell	28° - 34°	
Point Spring Tension	19 - 23 oz. (538 - 652 g)	
Spark Plug Type	Champion RBL9Y or AC-R42TS	
Plug Gap	.035" (.89mm)	
Timing @ Idle RPM	8° BTDC	
Max. RPM @ W.O.T.	3800-4200	4400-4800
Idle RPM (In Gear)	650-700	
Firing Order	1-3-4-2	
Fuel Pump Pressure	3-6 psi (21 - 41 kPa)	
Electrical System	12-Volt Neg. Ground	

Model	470	488
Battery Rating	Min. 450 Amps - Cold Cranking Amperage	
Oil Pressure @ 2000 RPM	30 - 60 psi (207 - 414 kPa)	
Oil Pan Capacity w/Filter (*Approx.)	*5.5 Qts. (5.2 liters)	*6.5 Qts. (6.1 liters)
Alternator Rating	39 Amp @ 4200 RPM	
Closed Cooling System Capacity (Approx.)	11 Qts. (10.4 liters)	
Closed System Cap Pressure	14 psi (97 kPa)	
Thermostat	160°F (71°C)	
Stern Drive Unit Oil Capacity (Approx.)	32 Oz. (.95 liter)	
Stern Drive Unit Gear Ratio	1.84:1 1.65:1 (Optional)	

* *Approximately.*
ALWAYS use dipstick to determine exact quantity of oil required.

FRONT



Firing Order
1-3-4-2

Left-Hand Rotation Engine Firing Order

B. MCM 470 (S/N 6218037 and above), MCM 488 ELECTRICAL SPECIFICATIONS

IGNITION SPECIFICATIONS

Engine Model	470/488
Resistor Wire (Ohms)	1.8 - 2
Spark Plug Type Spark Plug Gap Point Dwell Point Spring Tension Timing	Refer to "Tune-Up Specifications"
Condenser	18 - .25 MFD

Engine Model	470/488
Coil	Coil Part No. 32193A2
Coil Primary Resistance (Ohms) Minimum	1.1
Coil Primary Resistance (Ohms) Maximum	1.5
Coil Secondary Resistance (Ohms)	9,500-15,000

STARTER MOTOR SPECIFICATIONS

Identification Number	No Load Test					Brush Spring Tension
	Volts	Min. Amps	Max. Amps	Min. RPM	Max. RPM	
50-97499A2 (Delco-Remy) 1998404	10.6	60	100	5300	10,600	56 - 105 Oz. (1588 - 2976 g)

ALTERNATOR SPECIFICATIONS

Identification Number	Ground	Rotation	Field Current		Output (Hot)
			Amps	Volts	
398-6231A6	Negative	Same as Engine	N.A.	N.A.	39 @ 4200 RPM
			Permanent Magnet		

C. MCM 470 (S/N 6218037 and above), MCM 488 CARBURETOR SPECIFICATIONS

All Measurements are ± 1/64" (0.4mm)

Model	470	488
Make (Model)	Rochester (2GV)	Rochester (4MV)
Part No. Mercury/Rochester	1376-5990/ 17057132	1347-8460/ 17081299
Float Level	11/16" (17.5mm) (NOTE 1)	1/4" (6.4mm) (NOTE 2)
Float Drop (NOTE 3)	1-3/4" (44.5mm) (NOTE 1)	N.A.
Pump Rod	1-5/32" (29.4mm)	N.A.
Pump Rod Hole Location	N.A.	Inner
Accelerator Pump (NOTE 4)	N.A.	23/64" (9.1mm)
Air Valve Dash Pot (Air Valve Rod)	N.A.	.025" (.64mm)
Vacuum Break	N.A.	.190" [3/16" (4.8mm)]
Air Valve Spring Wind Up	N.A.	1/4 Turn (40 - 50 g)
Choke Setting	Index Marks Aligned	

Model	470	488
Choke Unloader	.080" [5/64" (2.0mm)]	N.A.
Main Jet	.066" (16.8mm)	
Power Valve	.052" (13.2mm)	N.A.
Metering Rod (Primary)	N.A.	.036" (9.1mm)
Metering Rod (Secondary)	N.A.	D.E.
Idle Mixture Screw, Pre-liminary Setting	1-1/4 Turns	2 - 3 Turns

NOTES:

1) *Fuel Inlet Needle Is Spring Loaded. Before Checking Float Level, Raise Float and Allow It to Fall By Its Own. DO NOT FORCE FLOAT DOWNWARD BY HAND. Check and Adjust Float Level Using Existing Procedure.*
2) *Fuel Inlet Needle Is Spring Loaded. Float Lever Must Just Touch Inlet Needle Ball.* ***DO NOT PUSH DOWN*** *(Compress Spring)* ***ON BALL.***
3) *Float Drop Measured From Air Horn (With Gasket In Place) to Bottom - Most Part of Float. THIS IS DIFFERENT THAN OLD METHOD.*
4) *Accelerator Pump Measurement Taken From Flame Arrestor Mounting Surface to Pump Stem With Throttle Plates Fully Closed. THIS IS DIFFERENT THAN PREVIOUS METHOD.*

D. MCM 488 INTERNAL ENGINE SPECIFICATIONS

Camshaft

Lobe Lift (Max.)	Intake .287" (7.3mm) Exhaust .299" (7.6mm)
Color Code	Blue Paint (Near Dist. Gear)

Valves and Springs

Valve Clearance (with Lifter Collapsed)			.110" - .210" (2.794 - 5.334mm)
Valve Diameter			Intake 2.090" (53.1mm) Exhaust 1.661" (42.2mm)
Valve Face Angle			Intake 44° Exhaust 44°
Valve Spring (External Damper-Green Stripe)	Free Length		2.18 [2-3/16" (55.37mm)]
	Pressure Lbs. @ In. (NOTE 1)	Closed @ 1.86" (47.24mm)	90-100 Lbs. (40.8 - 45.3 kg)
		Open @ 1.36" (34.54mm)	255 - 275 (115.6 - 124.7 kg)
	Installed Height		1.86" [1-55/64" (47.2mm)]

NOTE 1: Test spring pressure with damper assembled.

Cylinder Head

Valve Seat Angle	Intake 45° Exhaust 45°
Valve Seat Width	Intake .060" - .080" Exhaust (1.5 - 2.0 mm)
Valve Seat Approach Angle	Intake 20° Exhaust 30°
Valve Seat Bottom Edge	Intake 60° Exhaust 60°

The rest of the internal engine specifications are the same as the 470/485

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service bulletin

NUMBER: 85-33

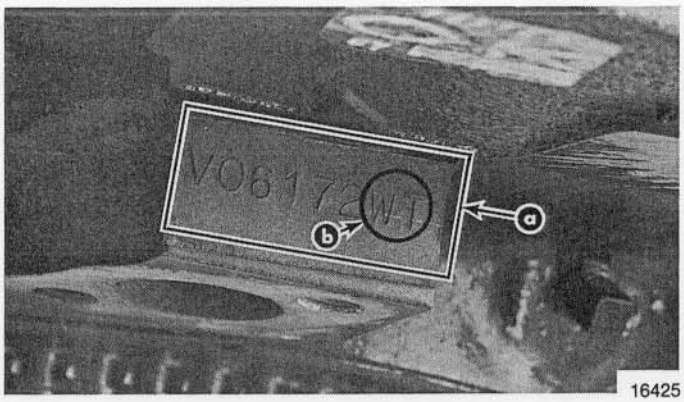
NOTICE
This bulletin supercedes bulletin 83-7.

CIRCULATE TO:
SERVICE MANAGER ☐
PARTS MANAGER ☐
MECHANICS ☐
"Place in a Service Bulletin Binder"

A. MerCruiser Engine Identification - G.M. Engine Models (1974 and Newer)
B. Cylinder Head Identification Marks - G.M. Small Block V-8 Engines (1980 and Newer)
C. Mercury 4 Cylinder 224 CID Engine Identification - 470/485/488/170/190

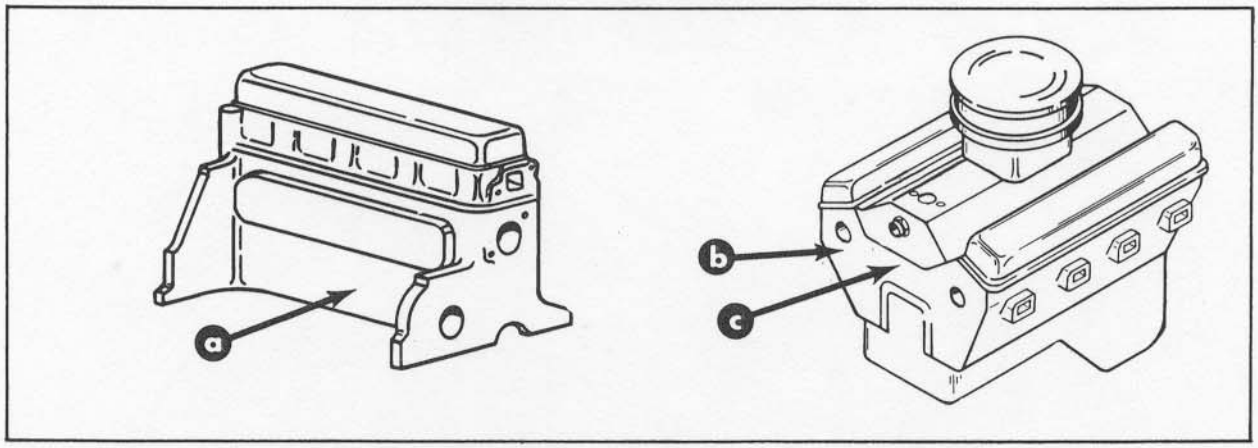
A. MERCRUISER ENGINE IDENTIFICATION - G.M. ENGINE MODELS (1974 and NEWER)

The MerCruiser Model can be determined by looking at the LAST TWO LETTERS of the engine code stamped into the cylinder block. (Figure 1) This code number is stamped on all MerCruiser Power Packages and replacement partial engines but not replacement cylinder block assemblies.



a - Engine Code (V06172WT)
b - Last Two Letters (WT)

Figure 1. G.M. Engine Code



a - 4 and 6 Cylinder-In-Line (Near Distributor)
b - V-6 and Small Block V-8 (Front, Starboard Side, Near Cylinder Head Mating Surface)
c - Large Block V-8 (Front of Engine Just Above Timing Gear/Chain Cover)

Figure 2. G.M. Engine Code Location

If the engine serial number, and/or model decals are missing, the engine code letters may help in determining the engine model. Following is a list of G.M. engines and their respective code letters.

MCM Stern Drive Engines (All Are L.H. Rotation)

120 - NB	898/200 - MN/MX or PY	330 - XS
140 - RA	228/230 - MJ/MY or PZ	330 (B-W) - XY
165 - SD	250 - WS or WT	370/400/
185 (229 CI) - JK	255 - WH or WN	440/460 - XF
185 (262 CI) - KW	260 - WT or AN	475 Turbo
205 (262 CI) - KR	280/300 - WK	

MIE Inboard Engines (Either Rotation)

L.H. (Standard) Rotation		R.H. (Opposite) Rotation	
198 - MR	260 - WN or AB	198 - MS	260 - WR or AR
228 - MA	330 - XN or XY	228 - MB	330 - XR or XZ
230 - MA or PA	340 - XY or XYY	230 - MB or PB	340 - XZ or XZZ
255 - WH or WN	350 - XB	255 - WJ or WR	350 - XC

B. CYLINDER HEAD IDENTIFICATION MARKS - G.M. SMALL BLOCK V-8 ENGINES (1980 and Newer)

The identification mark is lcoated on both ends of the cylinder head.

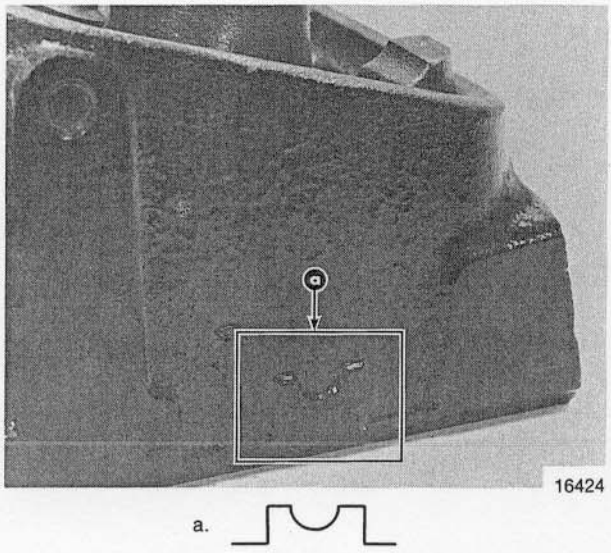


Figure 3. 305 CID Engines (898, 228, 230)

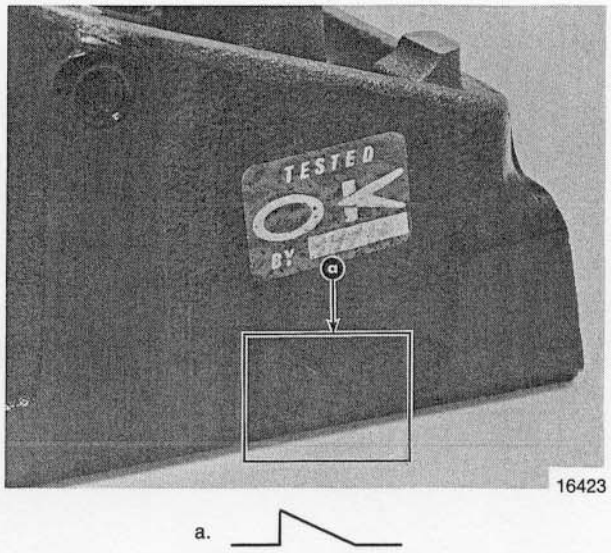
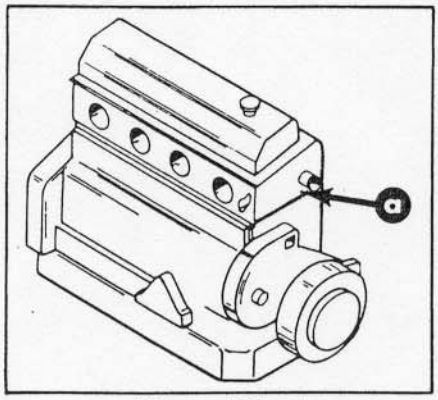


Figure 4. 350 CID Engines (255, 260)

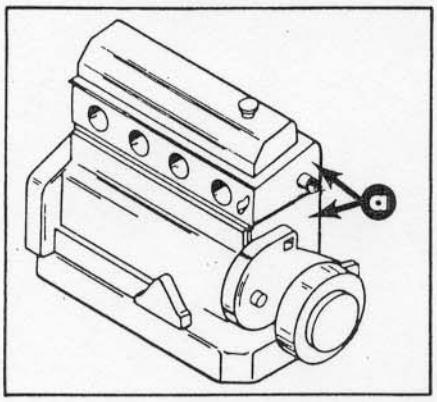
C. MERCURY 4 CYLINDER 224 CID ENGINE IDENTIFICATION - 470/485/488/170/190

If the engine serial number and/or model decals are missing, the following will help in determining what model it is. Look for stamped code number in cylinder head. Also look at valve spring for color code.



a - "Stamped" Number

Figure 5. Location of Stamped Number



a - "X" Stamped on Both the Cylinder Head and Cylinder Block

Figure 6. Location of Identification

MCM/MIE 470 (L.H.) (Figure 5)	- Stamped "0" or no stamp at all in cylinder head. Single coil valve springs with orange stripe.
MIE 470 (R.H.) (Figure 5)	- Same as above plus 1/4" thick ring between cylinder block and distributor.
MCM 485 (Figure 5)	- Stamped "5" in cylinder head. Valve springs have internal dampener and Red/Green or Blue/White stripes.
MCM 488 (Figure 5)	- Stamped "8" in cylinder head. Valve springs have external dampener around spring and Green stripe.
MCM 170/190 (Figure 6)	- Stamped "X" on both cylinder head and block. Same valve spring as 488 except dampener has anti-rotation tab

NOTE: Refer To MerCruiser Service Bulletin 84-26 for replacement partial engines and cylinder heads used on the 470/485/488/170/190 engines.

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STERN DRIVES & INBOARDS

service bulletin

TO: SERVICE MANAGER ☐ TECHNICIANS ☐
PARTS MANAGER ☐

No. 87-17

Initial Timing Specification Change For All 3.7 Litre (224 CID) Engines

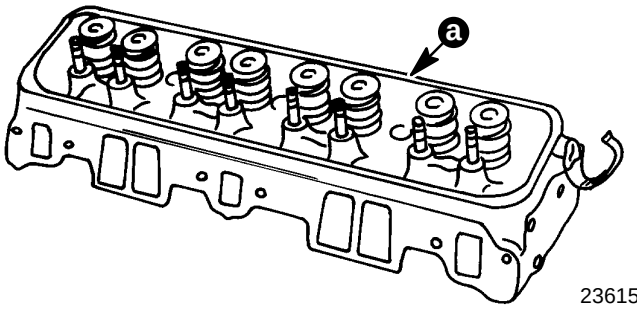
The quality of todays fuels have changed considerably over the last 5-10 years. Because of this, the 3.7 Litre and 3.7 LX Litre MerCruiser engine timing will be set (by the factory) at 4 degree BTDC. The timing specification will be unnoticeable in performance for all practical purposes and allowing for more tolerance to todays fuels.

It is suggested that when a dealer services one of the following engines, the ignition timing be reset to 4 degree BTDC instead of the original 8 degree BTDC. All service manuals will be changed in the future to reflect this timing change.

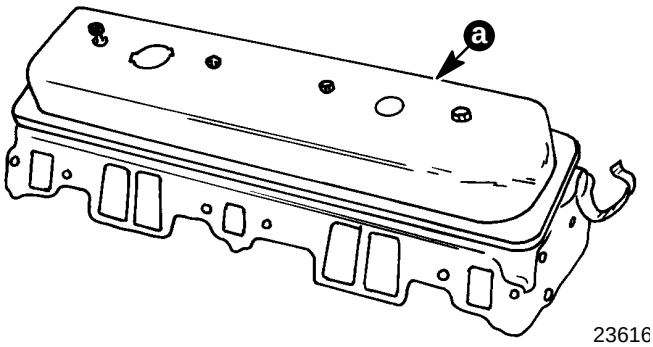
MIE 470
MCM 470
MCM 485
MCM 488
MCM 165
MCM 170
MCM 180
MCM 190
MCM 3.7 Litre
MCM 3.7 LX Litre

Thunderbolt IV HEI Amplifier Indentification

In August of 1986 General Motors made a design change to the 305/350 CID engines. Incorporated in this change was a new cylinder head design (Figure 1) and a different spark advance curve. Because the Thunderbolt IV HEI Amplifier controls the advance curve electronically, MerCruiser changed the advance curve of the amplifier to accomodate this change. In August of 1987 MerCruiser also had a cosmetic and electrical design change to the amplifier (Figure 2).

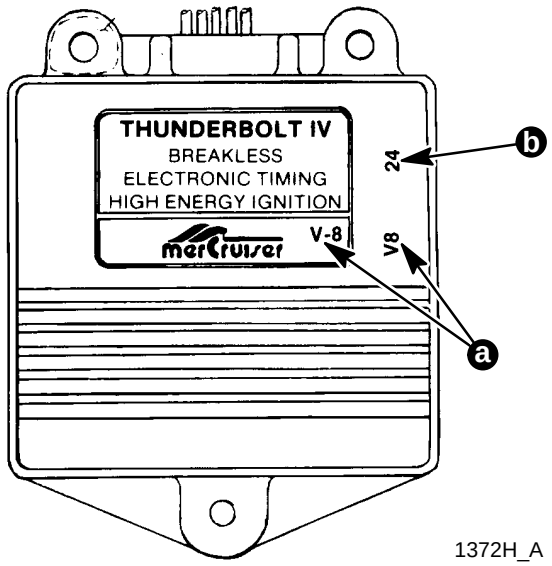


a - Raised Gasket Ridge

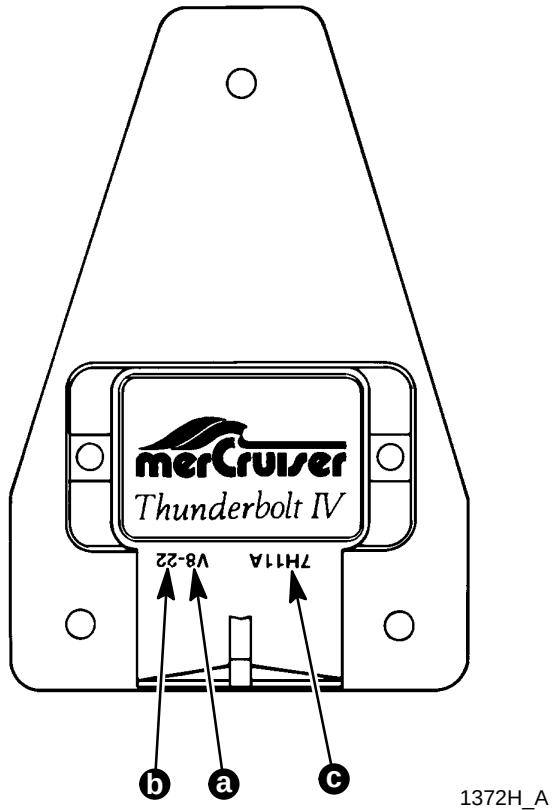


a - New Valve Cover

Figure 1. New Design Cylinder Head



a - Engine Type
b - Spark Advance Degrees



a - Engine Type
b - Spark Advance Degrees
c - Vendor Code

Figure 2. Amplifier Identification

The old design amplifier incorporated either the 22 degree or 24 degree advance curve. The amplifiers are marked or stamped for the amount of spark advance (Figure 2).

The new design amplifier will supersede the old design by part number. Care must be taken to install the correct amplifier.

NOTE: *Installing the wrong amplifier may result in poor engine performance and/or engine damage.*

Following is a list of Engine Model/Serial Number breakdown of amplifier application.

24 Degree Advance Curve

P/N 390-7804A3	Old Design
P/N 15248A1	New Design

22 Degree Advance Curve

P/N 390-9607A3	Old Design
P/N 15899A1	New Design

Engine Model	**24 Degree**	**22 Degree**
5.0 Litre/ 200 HP	B530021 & Below	B530022 & Up
5.0LX Litre/ 230 HP	B530160 & Below	B530161 & Up
5.7 Litre/ 260 HP	B525981 & Below	B525981 & Up
350 Magnum/ 270 HP	B530635 & Below	B530636 & Up
320 EFI/ 320 HP	B517602 & Below	B517603 & Up

The V6 (262 CID) engine is using the 14 degree amplifier. The amplifier is superseded to the new cosmetic design.

P/N 390-9355A2	Old Design
P/N 15247A1	New Design

The V8 (454 CID) standard products engines that use the Thunderbolt IV Ignition System use the 24 degree amplifiers.

P/N 390-7804A3	Old Design
P/N 15248A1	New Design

IMPORTANT: Also refer to Item "C" of this service bulletin.

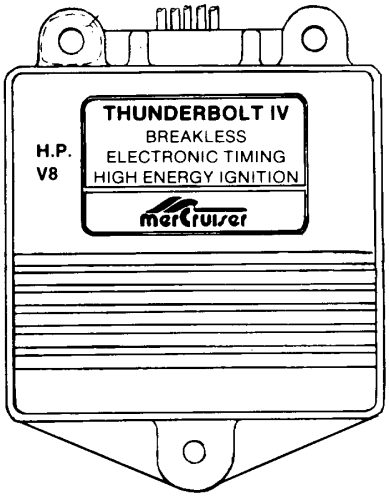
NOTE: *Checking the full advance of a running engine, the initial timing degree and the advance curve degree must be combined for a full advanced reading. (Figure 4)*

Example:	Initial Timing	8 Degrees
	Advance Curve	22 Degrees
	Full Advance	32 Degrees

Thunderbolt IV HEI Amplifier/ Initial Timing Change HP 420/ HP 575 Models

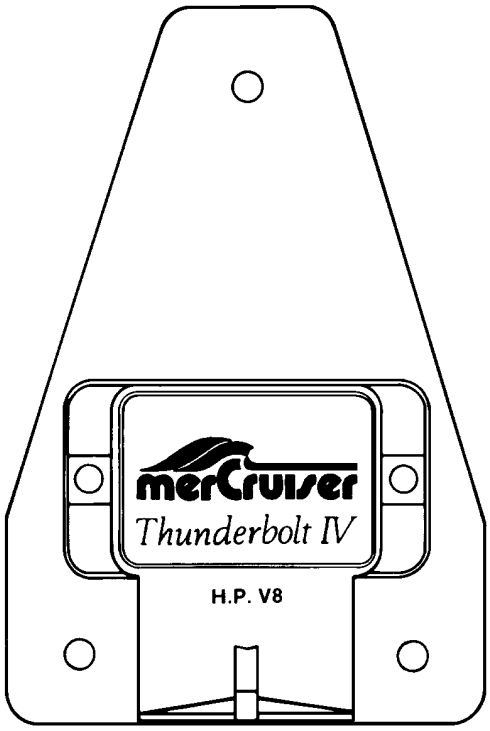
MerCruiser Performance Products is now using an amplifier (P/N 390-9571A1) with a revised advance curve on the HP 420/HP 575 engines. This change allows a better low RPM range performance through the advance curve. The initial timing must be changed using this amplifier. The new specification is 14 degrees BTDC.

Refer to Figure 3 for amplifier identification.



1372H_B

Old Design



1372H_B

New Design

Figure 3.

Early HP 420/HP 575 engines used amplifier (P/N 390-7804A3). When servicing these engines, or replacing the amplifier, the new amplifier can be used. The initial timing must be reset. It is recommended that the old amplifier (P/N 390-7804A3) not be used on the earlier engines if amplifier change is necessary.

Ignition Conversion Kit for MC 370/400 Cyclone/440 Cyclone and 460 Cyclone Engines with Mallory Distributors

Mercury Marine has received many requests from the field for a kit to convert breaker point ignition system (Mallory) to Thunderbolt IV (HEI) System.

An Ignition Conversion Kit (P/N 17336A1) is now available, containing all necessary parts, to convert to the Thunderbolt IV (HEI) System.

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STERN DRIVES & INBOARDS

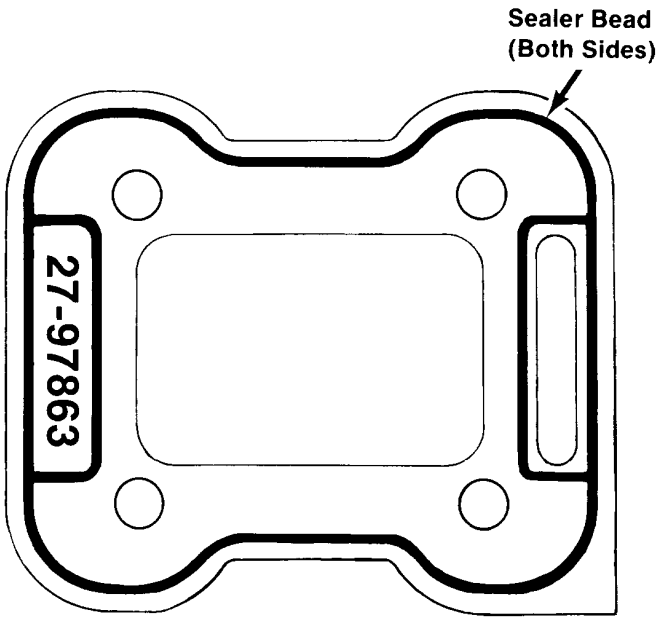
service bulletin

TO: SERVICE MANAGER ☐ TECHNICIANS ☐
PARTS MANAGER ☐

No. 88-2

Piston Knock in MCM 224 CID (3.7 Litre) Engines with Aluminum Exhaust Manifolds

There has been a few reports on the MerCruiser 224 CID 3.7 litre engines with aluminum exhaust manifolds having a piston knock caused by a tight piston pin. The starting serial numbers of engines with aluminum exhaust manifolds are 165/170 3.7L A528109 and up, 180/190 3.7 L/LX A528516 and up. The tight pin may be caused by engine coolant entering the cylinders because of a leaking exhaust elbow/reservoir to exhaust manifold gasket part number 27-97863. The early style 27-97863 gasket had a silicon seal on both sides. The later style 27-97863 gasket was changed to a graphite type (Figure 1). 27-97863 is now superseded to 27-18272 which is a graphoil/tin composite (Figure 1). Starting serial numbers of production engines, with the 27-18272 gaskets are 165 3.7L B742442 and up 180 3.7L/LX B743204 and up. Gasket part number 27-18272 is also in Quicksilver parts stock.



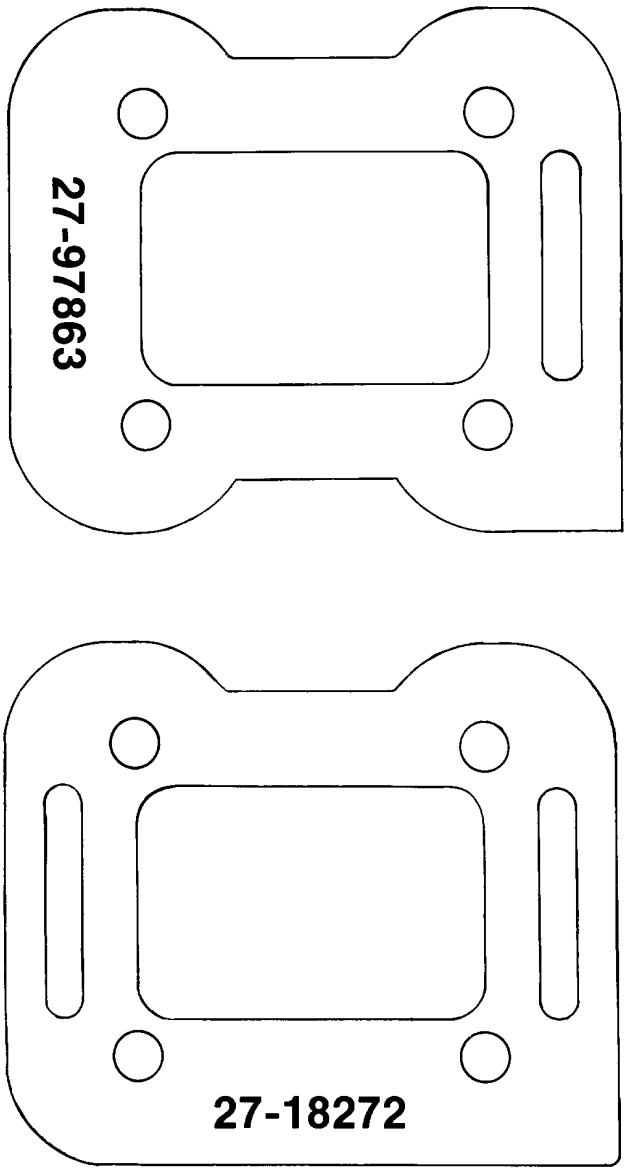


Figure 1.

Borg Warner V-Drive Oil Capacity Increase

Borg Warner V-Drive transmissions with dipstick located in V-Drive case (Figure 2) that have had intermediate shaft rear bearing failure should have oil capacity increased.

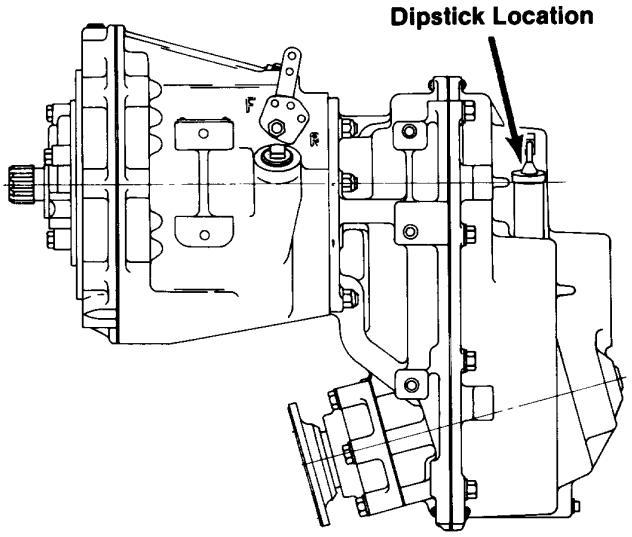


Figure 2.

Dipstick 10-05-559-001 (Figure 3) is now available for use in Velvet Drive® V-Drive transmissions which have the dipstick in the V-Drive case. The new dipstick will provide for additional oil capacity. Order new dipstick from your closest velvet drive distributor as shown on map. The following illustration shows the dimensions of the new dipstick. lt is recommended that the new dipstick be installed when servicing any V-Drive transmission which has the dipstick located in the V-Drive case.

Original dipsticks can be modified to current design by adding a mark 1” (2.5mm) above the original “full” mark. The original “full” mark then becomes the “low” or “add oil” mark.

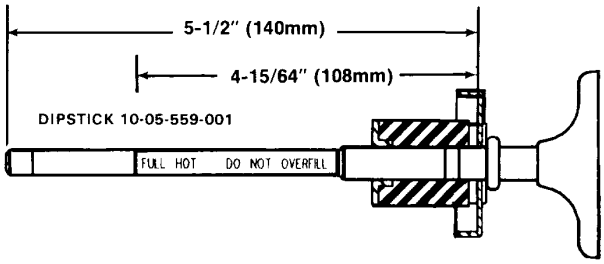
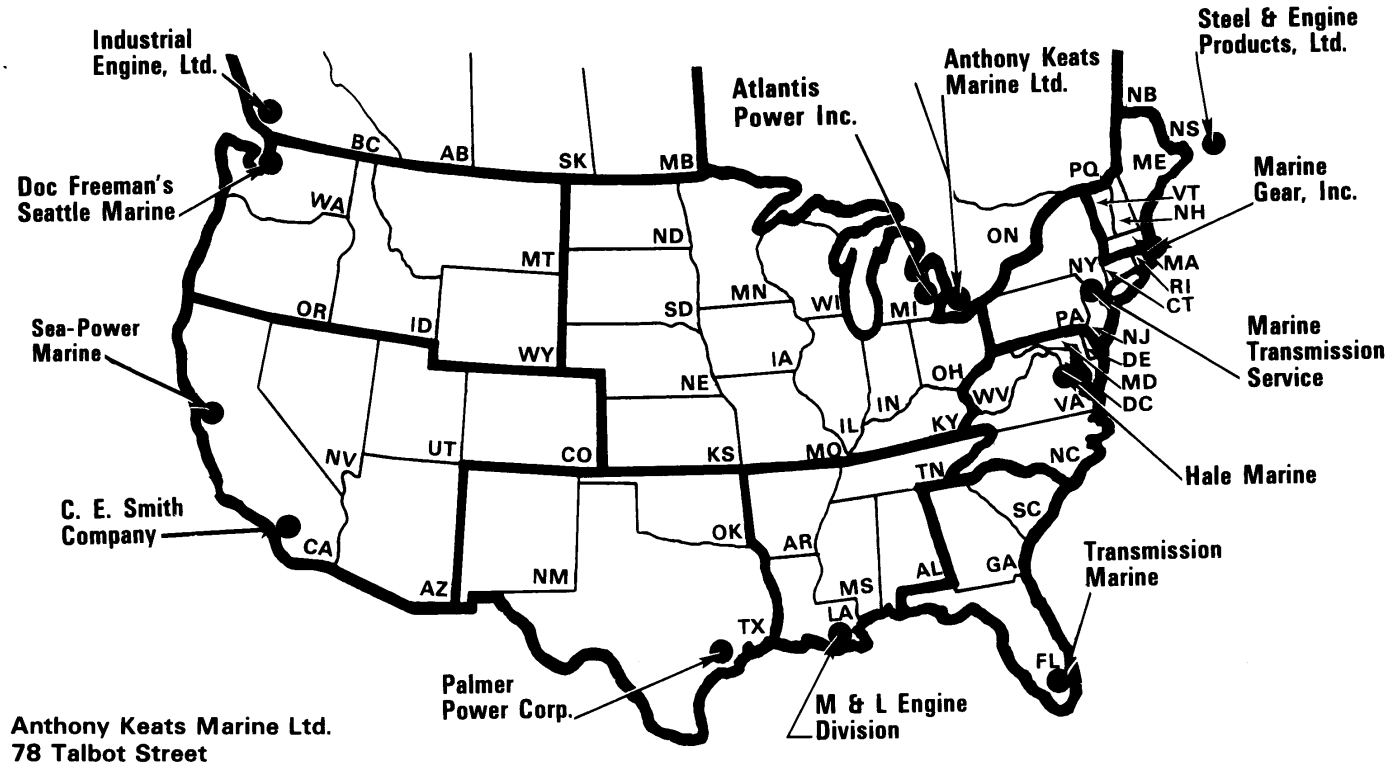


Figure 3.

The new dipstick has been installed in production transmissions beginning at the following serial numbers:

10-04-000-02	6473
10-04-000-03	1367
10-04-000-04	374
10-04-000-005	538
10-04-000-006	411
10-04-000-007	523
10-04-000-008	511
10-04-000-009	1201
10-04-000-010	809
10-04-000-011	7314
10-04-000-012	632
10-04-000-013	613
10-05-000-002	3860
10-05-000-003	1032
10-05-000-004	304
10-05-000-005	486
10-05-000-006	147
10-05-000-007	102
10-05-000-008	316
10-05-000-009	1614
10-05-000-010	1072
10-05-000-011	7672
10-05-000-012	457
10-05-000-013	201

VELVET DRIVE® DISTRIBUTORS



Anthony Keats Marine Ltd.
78 Talbot Street
Wheatley, Ontario, Canada NOP 2P0
Phone: 519/825-4631
Ontario; Quebec

Atlantis Power Inc.
34600 Klein
Fraser, MI 48026
Phone: 313/294-0140
Wisconsin; Illinois; Michigan; Indiana; Ohio; Minnesota; North Dakota; South Dakota; Nebraska; Kansas; Iowa; Missouri; Kentucky

Doc Freeman's, Inc.
999 North Northlake Way
Seattle, WA 98103
Phone: 206/633-1500
Washington; Oregon; Idaho; Montana; Wyoming; Alaska

Hale Marine
6080 Historyland Highway
Warsaw, VA 22572
Phone: 804/333-3677
Maryland; Virginia; West Virginia; District of Columbia; Delaware; North Carolina

Industrial Engine, Ltd.
8975 Oak Street
Vancouver B.C. Canada V6P 4B8
Phone: 604/266-4126
Western Canada (British Columbia, Alberta, Saskatchewan, Manitoba, Yukon, and Northwest Territory)

M & L Engine Division
M & L Industries, Inc.
1210 St. Charles Street
Houma, LA 70360
Phone: 504/876-2280
Arkansas; Louisiana; Mississippi; Alabama; Tennessee

Marine Gear Supply, Inc.
P. O. Box 796
RTE 1
Rowley, MA 01969
Phone: 617/948-7901
Maine; New Hampshire; Vermont; Massachusetts

Marine Transmission Service
2780 Hamilton Blvd.
South Plainfield NJ 07080
Phone: 201/668-0300
New York; Pennsylvania; Connecticut; New Jersey; Rhode Island

Palmer Power Corporation
6451 Rupley Circle,
Houston, TX 77087
Phone: 713/644-6410
Texas; Oklahoma; New Mexico

Sea-Power Marine
333 Kennedy Street
Oakland CA 94606
Phone: 415/533-9290
California; Arizona; Utah; Nevada; Colorado; Hawaii

C. E. Smith Company
16872 Milliken Ave.
Irvine, CA 92713
Phone: 714/863-1924
California; Arizona; Utah; Nevada; Colorado; Hawaii

Steel & Engine Products, Ltd.
P.O. Box 1120
Liverpool, Nova Scotia BOT 1KO
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Phone: 902/354-3483
Eastern Canada; New Brunswick; Nova Scotia; Newfoundland; Prince Edward Island

Transmission Marine, Inc.
440 N.W. First Ave.,
Fort Lauderdale, FL 33301
Phone: 305/467-1508
Florida; Georgia; South Carolina

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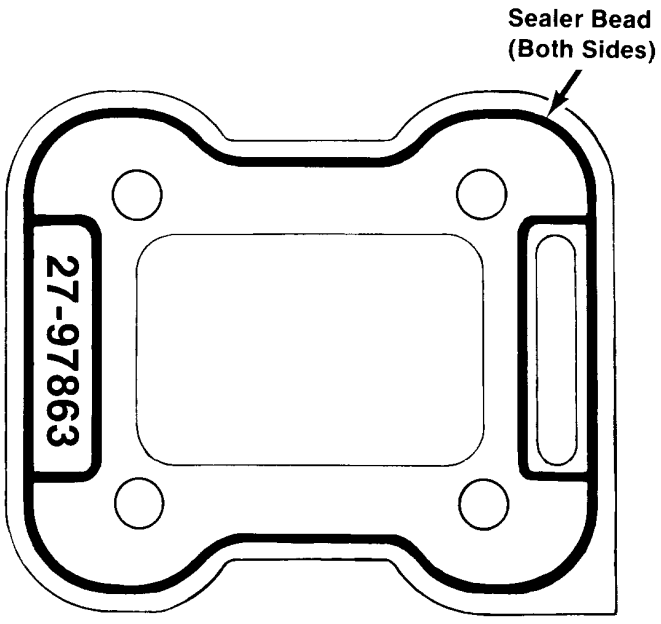
service bulletin

TO: SERVICE MANAGER ☐ TECHNICIANS ☐
PARTS MANAGER ☐

No. 88-2

Piston Knock in MCM 224 CID (3.7 Litre) Engines with Aluminum Exhaust Manifolds

There has been a few reports on the MerCruiser 224 CID 3.7 litre engines with aluminum exhaust manifolds having a piston knock caused by a tight piston pin. The starting serial numbers of engines with aluminum exhaust manifolds are 165/170 3.7L A528109 and up, 180/190 3.7 L/LX A528516 and up. The tight pin may be caused by engine coolant entering the cylinders because of a leaking exhaust elbow/reservoir to exhaust manifold gasket part number 27-97863. The early style 27-97863 gasket had a silicon seal on both sides. The later style 27-97863 gasket was changed to a graphite type (Figure 1). 27-97863 is now superseded to 27-18272 which is a graphoil/tin composite (Figure 1). Starting serial numbers of production engines, with the 27-18272 gaskets are 165 3.7L B742442 and up 180 3.7L/LX B743204 and up. Gasket part number 27-18272 is also in Quicksilver parts stock.



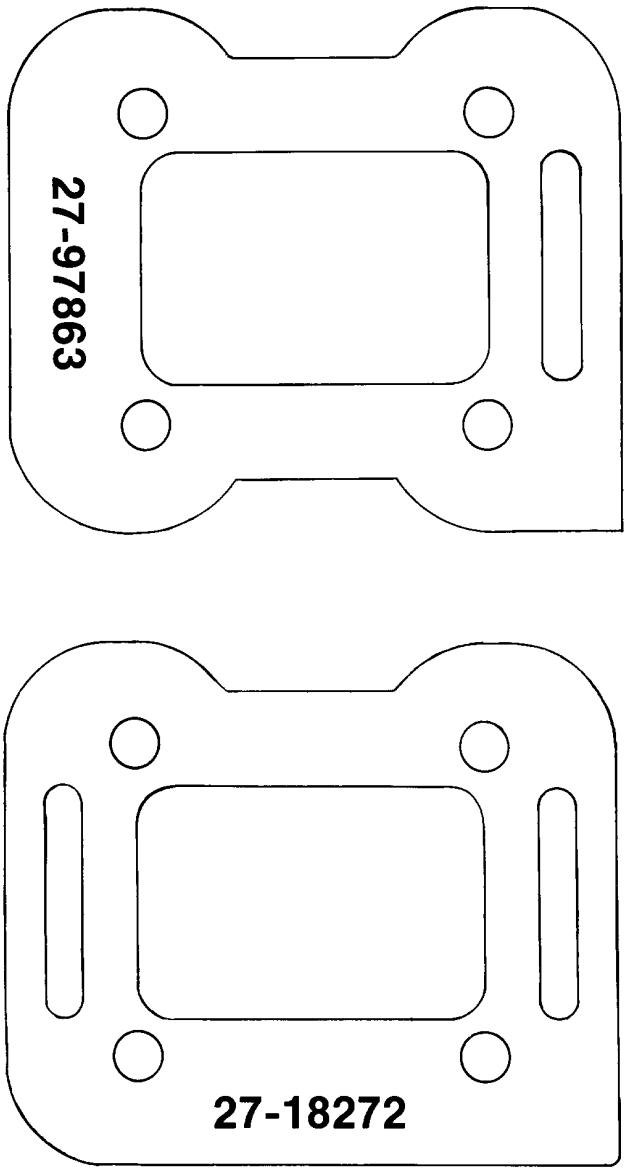


Figure 1.

Borg Warner V-Drive Oil Capacity Increase

Borg Warner V-Drive transmissions with dipstick located in V-Drive case (Figure 2) that have had intermediate shaft rear bearing failure should have oil capacity increased.

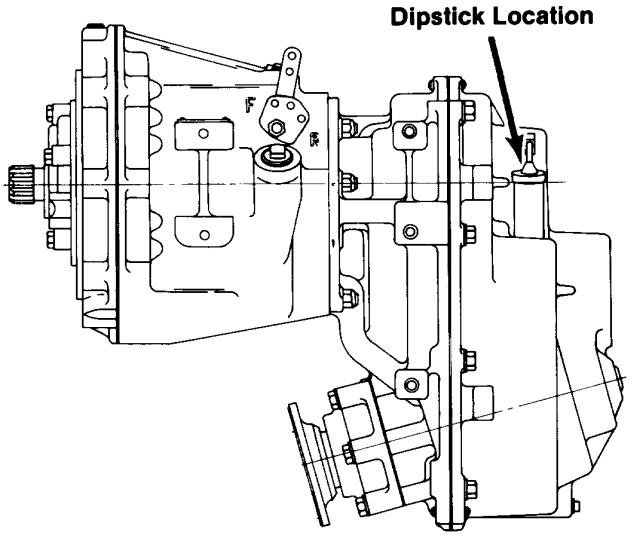


Figure 2.

Dipstick 10-05-559-001 (Figure 3) is now available for use in Velvet Drive® V-Drive transmissions which have the dipstick in the V-Drive case. The new dipstick will provide for additional oil capacity. Order new dipstick from your closest velvet drive distributor as shown on map. The following illustration shows the dimensions of the new dipstick. lt is recommended that the new dipstick be installed when servicing any V-Drive transmission which has the dipstick located in the V-Drive case.

Original dipsticks can be modified to current design by adding a mark 1” (2.5mm) above the original “full” mark. The original “full” mark then becomes the “low” or “add oil” mark.

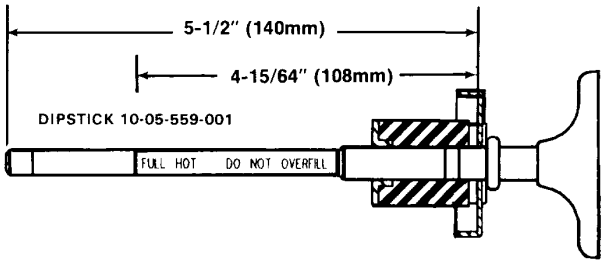
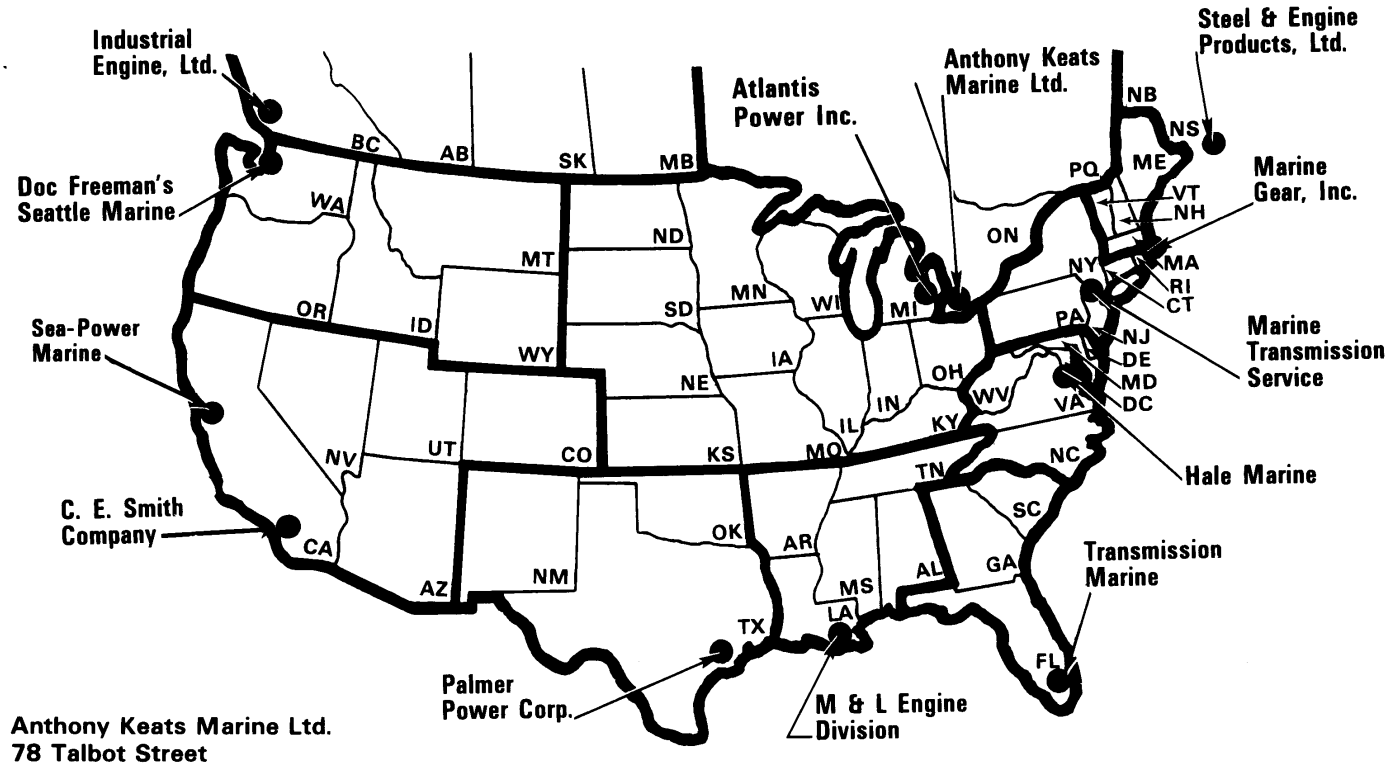


Figure 3.

The new dipstick has been installed in production transmissions beginning at the following serial numbers:

10-04-000-02	6473
10-04-000-03	1367
10-04-000-04	374
10-04-000-005	538
10-04-000-006	411
10-04-000-007	523
10-04-000-008	511
10-04-000-009	1201
10-04-000-010	809
10-04-000-011	7314
10-04-000-012	632
10-04-000-013	613
10-05-000-002	3860
10-05-000-003	1032
10-05-000-004	304
10-05-000-005	486
10-05-000-006	147
10-05-000-007	102
10-05-000-008	316
10-05-000-009	1614
10-05-000-010	1072
10-05-000-011	7672
10-05-000-012	457
10-05-000-013	201

VELVET DRIVE® DISTRIBUTORS



Anthony Keats Marine Ltd.
78 Talbot Street
Wheatley, Ontario, Canada NOP 2P0
Phone: 519/825-4631
Ontario; Quebec

Atlantis Power Inc.
34600 Klein
Fraser, MI 48026
Phone: 313/294-0140
Wisconsin; Illinois; Michigan; Indiana; Ohio; Minnesota; North Dakota; South Dakota; Nebraska; Kansas; Iowa; Missouri; Kentucky

Doc Freeman's, Inc.
999 North Northlake Way
Seattle, WA 98103
Phone: 206/633-1500
Washington; Oregon; Idaho; Montana; Wyoming; Alaska

Hale Marine
6080 Historyland Highway
Warsaw, VA 22572
Phone: 804/333-3677
Maryland; Virginia; West Virginia; District of Columbia; Delaware; North Carolina

Industrial Engine, Ltd.
8975 Oak Street
Vancouver B.C. Canada V6P 4B8
Phone: 604/266-4126
Western Canada (British Columbia, Alberta, Saskatchewan, Manitoba, Yukon, and Northwest Territory)

M & L Engine Division
M & L Industries, Inc.
1210 St. Charles Street
Houma, LA 70360
Phone: 504/876-2280
Arkansas; Louisiana; Mississippi; Alabama; Tennessee

Marine Gear Supply, Inc.
P. O. Box 796
RTE 1
Rowley, MA 01969
Phone: 617/948-7901
Maine; New Hampshire; Vermont; Massachusetts

Marine Transmission Service
2780 Hamilton Blvd.
South Plainfield NJ 07080
Phone: 201/668-0300
New York; Pennsylvania; Connecticut; New Jersey; Rhode Island

Palmer Power Corporation
6451 Rupley Circle,
Houston, TX 77087
Phone: 713/644-6410
Texas; Oklahoma; New Mexico

Sea-Power Marine
333 Kennedy Street
Oakland CA 94606
Phone: 415/533-9290
California; Arizona; Utah; Nevada; Colorado; Hawaii

C. E. Smith Company
16872 Milliken Ave.
Irvine, CA 92713
Phone: 714/863-1924
California; Arizona; Utah; Nevada; Colorado; Hawaii

Steel & Engine Products, Ltd.
P.O. Box 1120
Liverpool, Nova Scotia BOT 1KO
Canada
Phone: 902/354-3483
Eastern Canada; New Brunswick; Nova Scotia; Newfoundland; Prince Edward Island

Transmission Marine, Inc.
440 N.W. First Ave.,
Fort Lauderdale, FL 33301
Phone: 305/467-1508
Florida; Georgia; South Carolina

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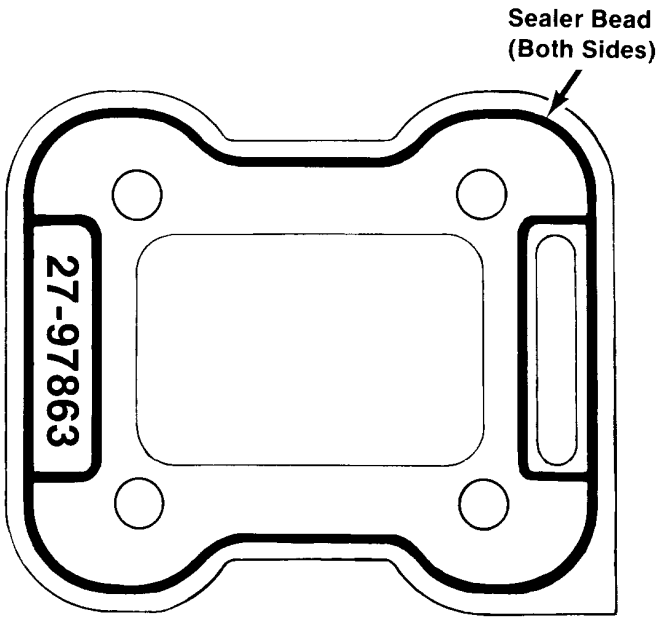
service bulletin

TO: SERVICE MANAGER ☐ TECHNICIANS ☐
PARTS MANAGER ☐

No. 88-2

Piston Knock in MCM 224 CID (3.7 Litre) Engines with Aluminum Exhaust Manifolds

There has been a few reports on the MerCruiser 224 CID 3.7 litre engines with aluminum exhaust manifolds having a piston knock caused by a tight piston pin. The starting serial numbers of engines with aluminum exhaust manifolds are 165/170 3.7L A528109 and up, 180/190 3.7 L/LX A528516 and up. The tight pin may be caused by engine coolant entering the cylinders because of a leaking exhaust elbow/reservoir to exhaust manifold gasket part number 27-97863. The early style 27-97863 gasket had a silicon seal on both sides. The later style 27-97863 gasket was changed to a graphite type (Figure 1). 27-97863 is now superseded to 27-18272 which is a graphoil/tin composite (Figure 1). Starting serial numbers of production engines, with the 27-18272 gaskets are 165 3.7L B742442 and up 180 3.7L/LX B743204 and up. Gasket part number 27-18272 is also in Quicksilver parts stock.



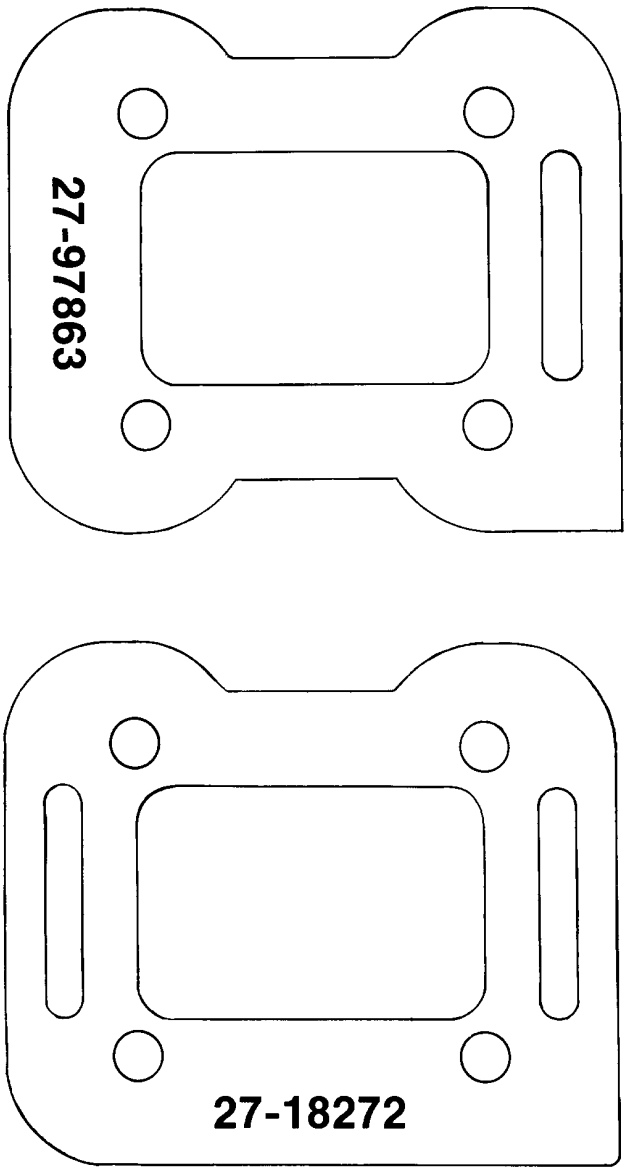


Figure 1.

Borg Warner V-Drive Oil Capacity Increase

Borg Warner V-Drive transmissions with dipstick located in V-Drive case (Figure 2) that have had intermediate shaft rear bearing failure should have oil capacity increased.

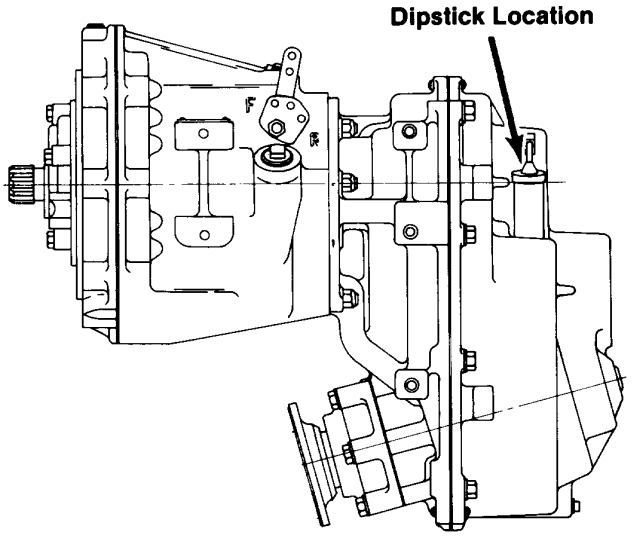
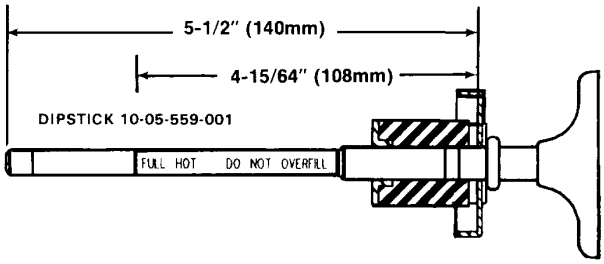


Figure 2.

Dipstick 10-05-559-001 (Figure 3) is now available for use in Velvet Drive® V-Drive transmissions which have the dipstick in the V-Drive case. The new dipstick will provide for additional oil capacity. Order new dipstick from your closest velvet drive distributor as shown on map. The following illustration shows the dimensions of the new dipstick. lt is recommended that the new dipstick be installed when servicing any V-Drive transmission which has the dipstick located in the V-Drive case.

Original dipsticks can be modified to current design by adding a mark 1” (2.5mm) above the original “full” mark. The original “full” mark then becomes the “low” or “add oil” mark.



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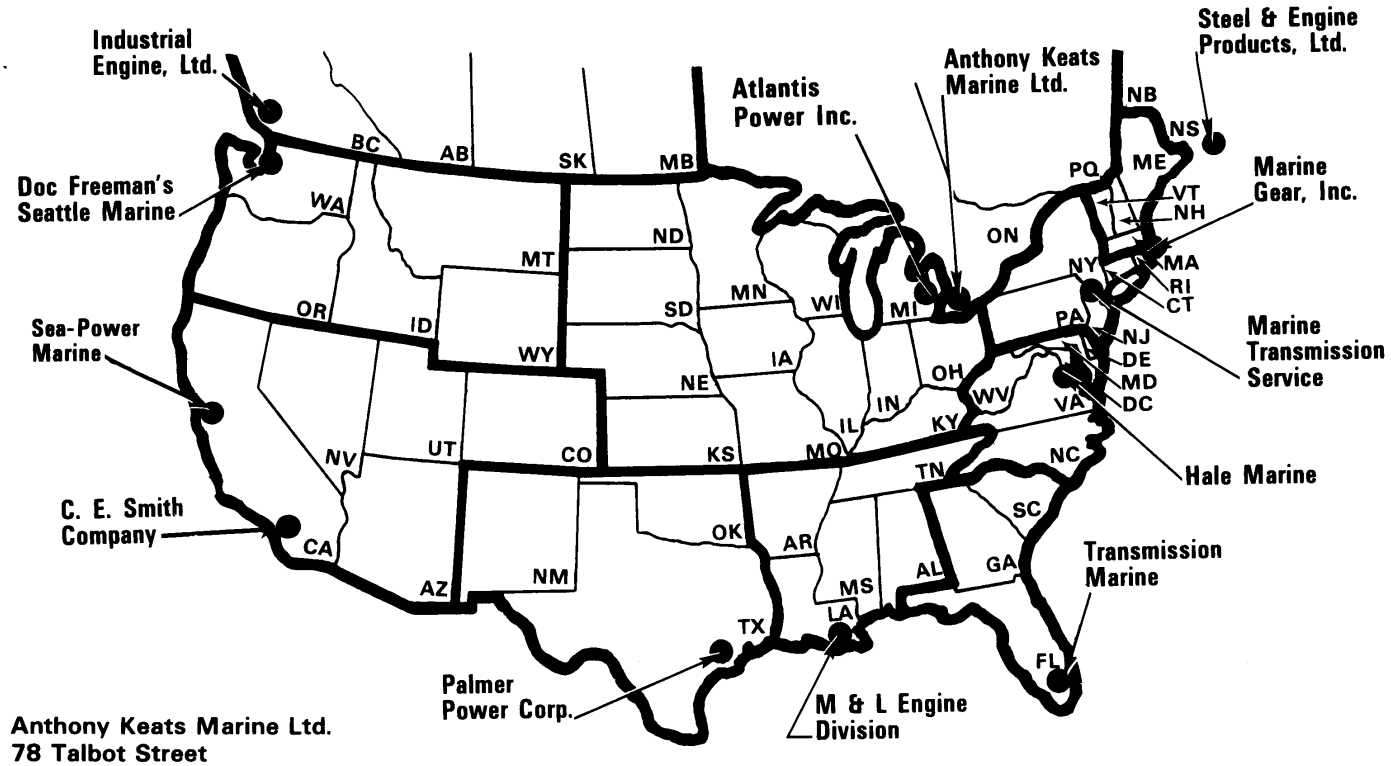
10-05-000-012	457
10-05-000-013	201

VELVET DRIVE® DISTRIBUTORS



Anthony Keats Marine Ltd.
78 Talbot Street
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Phone: 519/825-4631
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Atlantis Power Inc.
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Wisconsin; Illinois; Michigan; Indiana; Ohio; Minnesota; North Dakota; South Dakota; Nebraska; Kansas; Iowa; Missouri; Kentucky

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Warsaw, VA 22572
Phone: 804/333-3677
Maryland; Virginia; West Virginia; District of Columbia; Delaware; North Carolina

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Phone: 504/876-2280
Arkansas; Louisiana; Mississippi; Alabama; Tennessee

Marine Gear Supply, Inc.
P. O. Box 796
RTE 1
Rowley, MA 01969
Phone: 617/948-7901
Maine; New Hampshire; Vermont; Massachusetts

Marine Transmission Service
2780 Hamilton Blvd.
South Plainfield NJ 07080
Phone: 201/668-0300
New York; Pennsylvania; Connecticut; New Jersey; Rhode Island

Palmer Power Corporation
6451 Rupley Circle,
Houston, TX 77087
Phone: 713/644-6410
Texas; Oklahoma; New Mexico

Sea-Power Marine
333 Kennedy Street
Oakland CA 94606
Phone: 415/533-9290
California; Arizona; Utah; Nevada; Colorado; Hawaii

C. E. Smith Company
16872 Milliken Ave.
Irvine, CA 92713
Phone: 714/863-1924
California; Arizona; Utah; Nevada; Colorado; Hawaii

Steel & Engine Products, Ltd.
P.O. Box 1120
Liverpool, Nova Scotia BOT 1KO
Canada
Phone: 902/354-3483
Eastern Canada; New Brunswick; Nova Scotia; Newfoundland; Prince Edward Island

Transmission Marine, Inc.
440 N.W. First Ave.,
Fort Lauderdale, FL 33301
Phone: 305/467-1508
Florida; Georgia; South Carolina

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STERN DRIVES & INBOARDS

service bulletin

TO: SERVICE MANAGER ☐ TECHNICIANS ☐
PARTS MANAGER ☐

No. 89-29

224 C.I.D. Engine Push Rod Length

Over the years, the push rod has been superseded and new lengths have been provided for newer model engine applications.

Listed below are the latest part numbers, color code and size of the push rod in relationship to the standard length.

Part Number	Color Code	Length
67502T1	No Dye	Standard
67502--3	Red Dye	.030 Undersize
67502T	Blue Dye	.030 Oversize
67502T2	Yellow Dye	.060 Oversize

When assembling the valve train the above chart will aid in ordering and/or installing the correct length push rod.

Refer to the proper MerCruiser Service Manual engine section for the correct measuring procedure.

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service bulletin

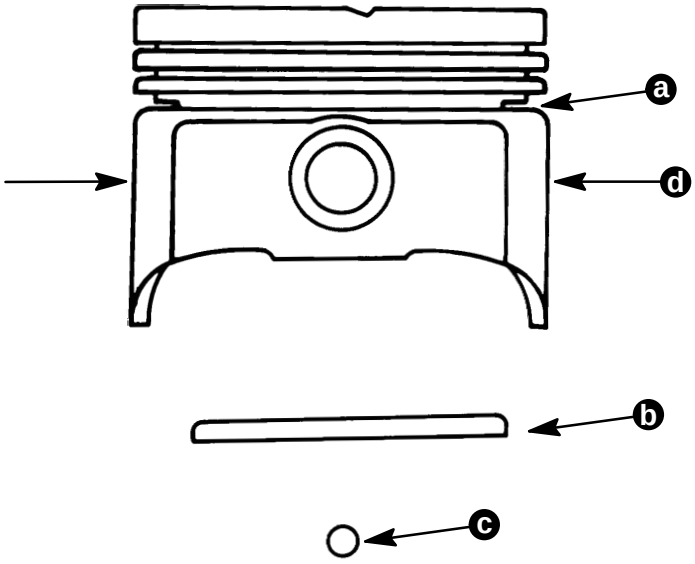
TO: SERVICE MANAGER ☐ TECHNICIANS ☐
PARTS MANAGER ☐

▲ = **Revised October 1993**

A. 224 CID (3.7L) PISTON IDENTIFICATION, TYPE AND CLEARANCE

▲ The four forged pistons, P/N 759-5920, -6610, -8312, and -806661, can be intermixed in an engine. They cannot be mixed with the cast pistons.

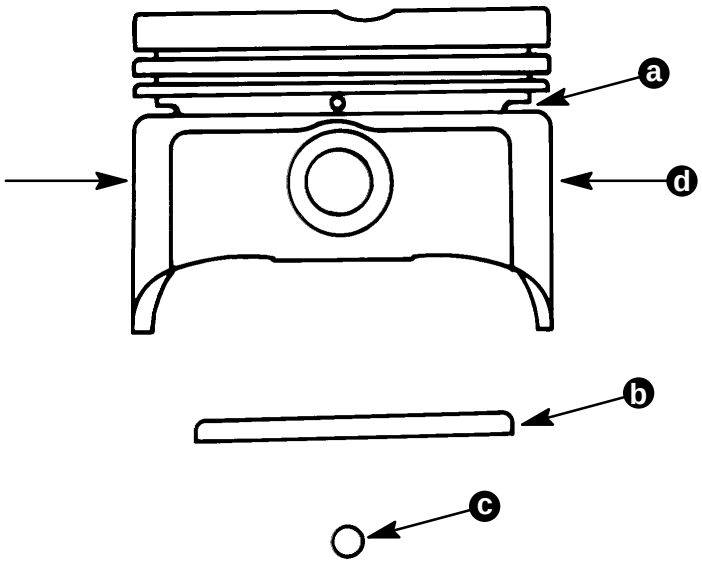
▲ The two cast pistons, P/N 778-9015 and -9441 cannot be intermixed with each other or with forged pistons because of a weight difference.



a - Oil Ring Groove
b - 2 Slots (In Oil Ring Groove)
c - 1 Hole (In Oil Ring Groove)
d - Measure Piston Diameter Here

759-5920 Forged Aluminum Piston
Clearance: .002-.0037 in. (0.05-0.09 mm)

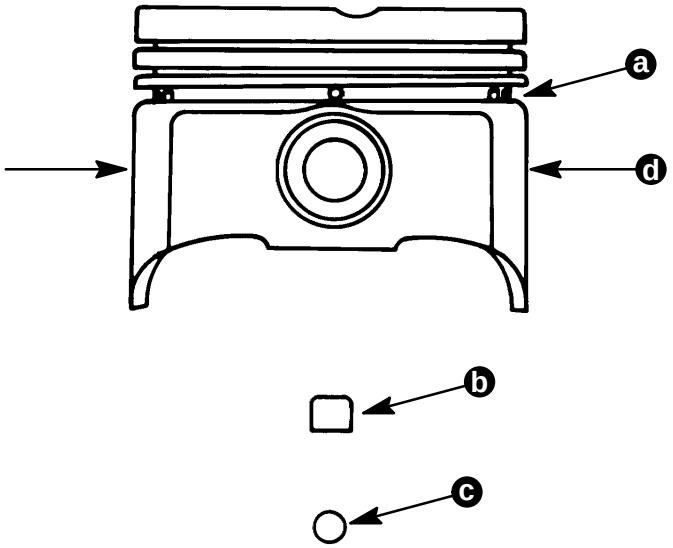
70108



a - Oil Ring Groove
b - 2 Slots (In Oil Ring Groove)
c - 2 Holes (In Oil Ring Groove)
d - Measure Piston Diameter Here

759-6610 Forged Aluminum Piston
Clearance: .002-.0037 in. (0.05-0.09 mm)

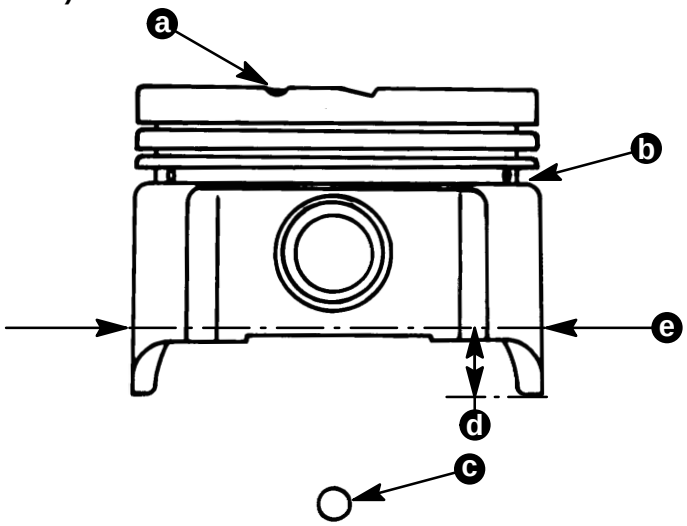
70109



a - Oil Ring Groove
b - 8 Square Holes (In Oil Ring Groove)
c - 2 Round Holes (In Oil Ring Groove)
d - Measure Piston Diameter Here

▲ **759-8312 or -806661 Forged Aluminum Piston**
Clearance: .004-.0057 in. (0.1-1.5 mm)

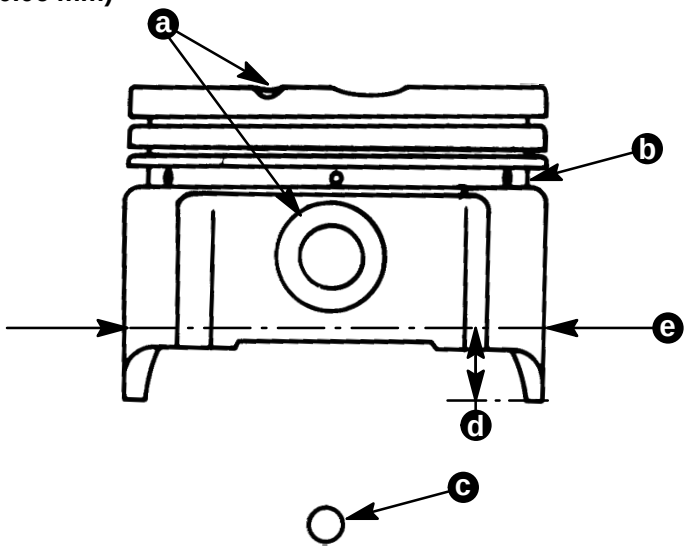
70110



a - Notch
b - Oil Ring Groove
c - 4 Holes (In Oil Ring Groove)
d - 13/16 in. (20 mm)
e - Measure Piston Diameter Here

778-9015 Cast Aluminum Piston
Clearance: .001-.0027 in. (0.03-0.06 mm)

70111



a - Larger Notch and Thicker Wrist Pin
b - Oil Ring Groove
c - 6 Holes (In Oil Ring Groove)
d - 13/16 in. (20 mm)
e - Measure Piston Diameter Here

778-9441 Cast Aluminum Piston
Clearance: .001-.0027 in. (0.03-0.06 mm)

70112

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STERN DRIVES & INBOARDS

service bulletin

TO: SERVICE MANAGER ☐ MECHANICS ☐
PARTS MANAGER ☐

No. 93-8

A. 224 CID (3.7L) MINIMUM OIL PRESSURE

Model

MCM 470, 485, 165, 170, 180, 190, 3.7L, 3.7LX, MIE 470 Engines
Serial Number: All

Change

All literature out in the field says that the oil pressure should be 30-60 psi (207-414 kPa) at 2000 RPM. This specification is being changed to the following;

Minimum Oil Pressure @ 2000 RPM 15 psi (103 kPa)

Reason for Change

We've made this change to stop confusion about what is good oil psi and what is not. If the engine is started and brought up to operating temperature then run at 2000 RPM, the oil psi will be 30-60 psi (207-414 kPa). If the engine is run for a period of time at 3000 + RPM, and then brought back down to 2000 RPM, the oil psi may fall below 30 psi (207 kPa). During some of our testing, we ran an engine at 4500 RPM for 10 minutes and then lower the RPM to 2000. The engine then had 20 psi (137 kPa). After the engine ran for 3-6 minutes at 2000 RPM, it had 32 psi (220 kPa) oil pressure. This 3-6 minute run at 2000 RPM allowed the engine and oil to cool back down after a high RPM run. The most important item in engine lubrication is the volume of oil that flows thru an engine. There is a sufficient amount of oil flowing thru this engine at 15 psi (103 kPa) at 2000 RPM.

Service Manuals

Please make this change to your number 3 and 8 Service Manuals. We will be making this change to those manuals at the time of their next update.

mercruiser
STERN DRIVES & INBOARDS

service bulletin

TO: SERVICE MANAGER ☐ MECHANICS ☐
PARTS MANAGER ☐

No. 93-16

A. EXHAUST BELLOWS FALLING OFF

Models

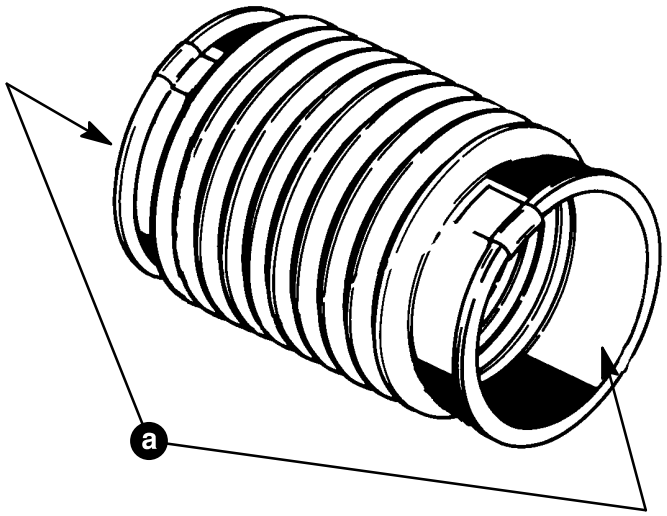
All Alpha Generation II / Bravo One / Bravo Two

Problem

Exhaust bellows coming off of a new Alpha One Generation II or from a new Bravo One / Two.

Fix

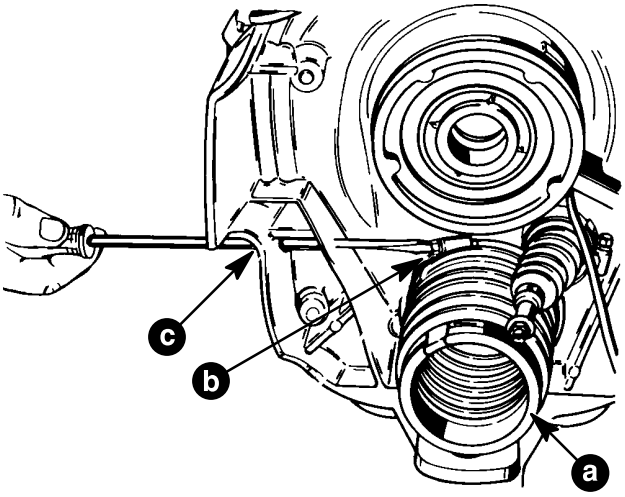
1. Remove the stern drive unit
2. Clean old adhesive from bellows mounting flanges on the gimbal housing and bell housing using either Quicksilver spray paint leveler or lacquer thinner.
3. Clean old adhesive from mounting surfaces of exhaust bellows.
4. Apply bellows adhesive 92-86166 to mounting surfaces on inside of bellows. Allow adhesive to dry until no longer tacky (approximatley 10 minutes).



22079

a - Mounting Surface (Apply Bellows Adhesive)

5. Install exhaust bellows onto gimbal housing. Position hose clamp as shown. Tighten hose clamp screw using a screw driver thru access holes in gimbal housing.



22081

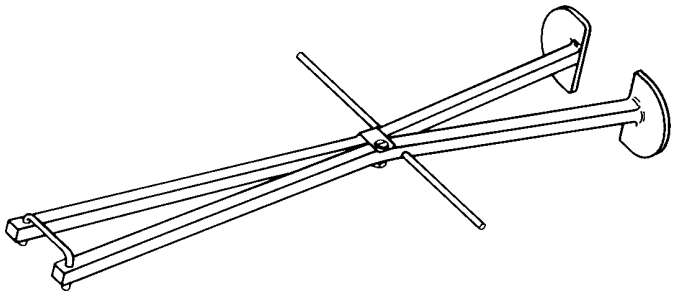
a - Exhaust Bellows
b - Hose Clamp
c - Gimbal Housing Access Hole

6. Install exhaust bellows on bell housing as follows:

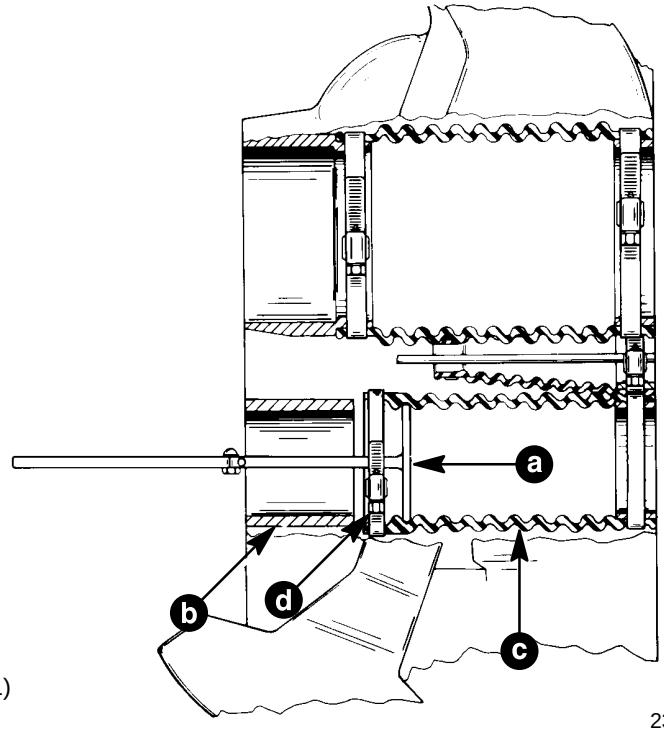
   a. Remove the shift shaft from the bell housing by first applying heat to the aluminum shift lever at the screw with a torch lamp to soften the lock tite to ease the removal of the small stainless steel screw. If no heat is applied the screw may be damaged and you will have to split the lever to remove it and replace it with a new one.

   b. Place a hose clamp over bellows end.

   c. Place expander tool 91-45497A1 into the first convolution of the bellows.


22161

d. Pull the tool until tool touches the flange on the bell housing (hose starts to slip onto the flange); then release the tool.



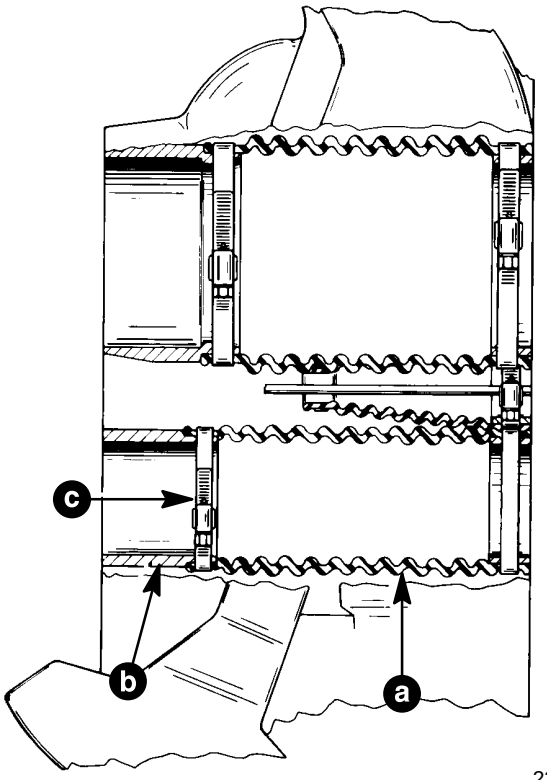
23154

a - Expander Tool (91-45497A1)
b - Bell Housing Flange
c - Exhaust Bellows
d - Hose Clamp

e. Reposition the tool into the third bellows convolution.

f. Pull the bellows the rest of the way onto the bell housing flange.

g. Tighten hose clamp.



23158

a - Exhaust Bellows
b - Bell Housing Flange
c - Hose Clamp

7. Reinstall the stern drive unit.

Warranty

If the unit is under warranty, fill out a warranty claim and send to your normal warranty processing center.

Labor Code: MT23

Labor: 1.5 Hours

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STERN DRIVES & INBOARDS

service bulletin

TO: SERVICE MANAGER ☐ MECHANICS ☐
PARTS MANAGER ☐

No. 93-17

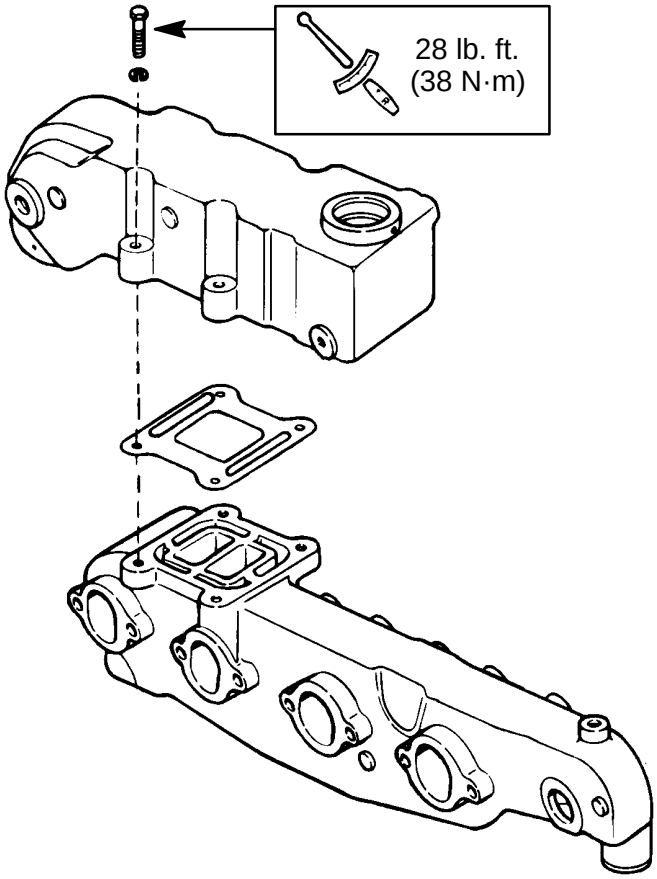
A. 224 CID (3.7L) EXHAUST ELBOW/RESERVOIR TORQUE AND RETORQUE

Model

MCM 470, 165, 170, 180, 190, 3.7L 3.7LX Engines.
Serial Number: All, that use an aluminum exhaust manifold.

Torque and Retorque

This is just a reminder to retorque the 4 bolts that hold the exhaust elbow/reservoir to the manifold anytime the elbow/reservoir is removed and reinstalled.



1. Torque 4 bolts to 28 lb. ft. (38 N·m).
2. Start engine and bring up to operating temperature.
3. After engine has cooled down, retorque 4 bolts to 28 lb. ft. (38 N·m).

Technical Bulletin

1/06

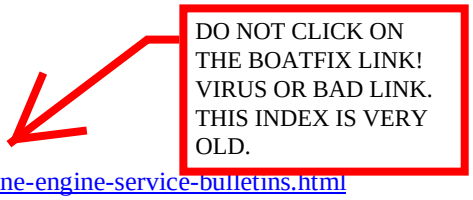
Revised Initial Ignition Timing For MerCruiser 3.7L Engines

The AERA Technical Committee offers the following information regarding revised initial ignition timing for MerCruiser 3.7L engines. This revision is to help prevent engine damage due to the unknown quality of gasoline being used today.

Since the decline of gasoline quality over the past number of years, it has been recommended by Mercury Marine to set the initial timing at 4° BTDC. This is in place of the original factory setting of 8° BTDC, which is also published in the older factory service manuals. Doing so will make the engine more tolerant of today's unknown quality gasoline, with an unnoticeable change in engine performance.

Engines were originally set at 8° BTDC and piston failures in the #1 and #4 cylinders were common. The root cause of those failures is the unknown quality of gasoline for the amount of ignition timing and compression being used. The poorer the quality of gasoline, the more likely a piston will burn. Poor fuel burns differently, and in these cases, it has caused piston failures that appear like over-advanced ignition timing. Due to the quality of gasoline declining over time, and the resulting engine failures, the initial timing should be set to 4° BTDC for these engines.

MerCruiser refers to the 3.7L engine as 3.7 LX, MIE 470, MCM 470, 485, 488, 165, 170, 180 and 190. The timing information has been updated in current MerCruiser factory service manuals published after 1987.



1989 Mercruiser Service Bulletins
http://www.boatfix.com/bulletins.htm
http://www.marinepartsman.com/mercury-marine-engine-service-bulletins.html
www.sterndrives.com
www.allexperts.com
http://www.jasperengines.com/pdf/37LMerCruiserIgnitionTB.pdf

1988 Mercruiser Service Bulletins

Torquing Bravo One U-Joint

Piston Knock in MCM 224

Replacement starter motor P/N 50-12872 for Mer-Cruiser

Loose Hinge Pins – Bravo

Overrich Acceleration "Bog"
on MerCarb Equipped Models MCM 120/140/2.5L/3.0L

Possible Water Leak in Transom Assembly

Diesel Bravo Two/Inboard Engine Packages

Power Trim Control P/N 55642A13 Assembled Wrong

Alpha One and Bravo One
Upper Swivel Shaft Bushing Removal Tools a

Tilt Steering Wheel Mount

MerCruiser 215E Shift

Required Spark Plug Wire

Laser II Propeller Vent Plug

Possible Water Leak Caused by TR/TRS Transom Cutout

MerCarb Flooding / Hurth Transmission Fluid

New Distributor Gear / 454 Magnum (365 HP) Rocker arms

Alpha One Shift Assist
Assembly and Remote Control Shift
Cable Adjustment

1989 Mercruiser Service Bulletins

1988/89 MerCruiser/Sea Ray Engine Identification GM Engine Models

B.M.W. D190/D150 Models Overheating

MerCruiser Diesel Injector & Pump Diagnosis

MR and Alpha One Shift Cable Adjustment

Use of Proper Anti-Freeze in Diesels

Engine Timing Changes MIE 5.7 / 420 & 575
Water Separating Fuel Filter

HEI Distributor Shaft Roll Pin Oversized hole
Carter Fuel Pump Use on 7.4 / New Prestolite Alternator

Hinge Pin Torque Change
120R-MR - 260R-MR and All Alpha Ones
Shift Spool Assembly All

Digital Distributorless Ignition

Wiring Harness Changes All

Hurth Transmission Tool List

MerCruiser Diesel Service
Bosch Diesel Nozzle Tester

1988 vs. 1989 Bravo Drive
Unit and Transom Assembly Interchangeability

Rattling Sound on MIE 7.4L

Paint Blistering on Oyster

Installation of Dual Engine Console Mount Commander Remote Controls

B.M.W. Stern Drive/Inboards

New Heavy Duty Gears in
1.50:1 Alpha One Upper
Drive Shaft Housing Assembly
Near Net Forged Forward and Pinion Gears in 350 Magnum Alpha One Lower Unit

MCM and MIE 7.4L (454 CID) Cylinder Head Bolts

Selecting A Propeller For Diesel

Bravo Transom Plate Oil Hose
Starting Procedure if Gasoline Engine is Shut-Off
or Stops with the Bravo Drive Unit in Gear

MerCarb Flooding

Alpha One Transom Shift

Attachment of Gear Lube Monitor

Installation of Stop-Start Panel STOP-START PANEL

MerCruiser Diesel Service Manuals

4.3LX and 5.7L Choke Rod
Solid State DC Voltage Regulators

Fuel Recommendations

224 C.I.D. Engine Push Rod

Elimination of Water Drain Petcocks

Alpha One - Bravo One and Bravo Two Trim Sender
Indexing Marks Misaligned

Water Ingestion on MerCruiser V6/V8 Stern Drive
and Inboard Engines

1990 Mercruiser Service Bulletins

USA and Canada Gasoline

Merc Carbs Having Incorrect Choke

Alpha One Bell Housing Shift

Borg Warner Velvet Drive

Removal of Upper Swivel Pin

Shift Plate Inspection

Spark Plug Wire Terminal and Boot Change

Rough Idle or Can't Adjust Idle Mixture Screws

Diesel Engine Idle RPM

Incorrect Engine Maximum RPM on Serial Number Plate

Wrong Diameter Water Hose Being Connected

Use of Propylene Glycol Antifreeze

OIL LEAK AT FRONT OF ENGINE

Possible Cause for Engine Overheating

Delco EST Ignition System

Timing and Maximum RPM Changes

REPLACEMENT OF GIMBAL HOUSING STUDS
JUST BELOW THE INNER TRANSOM PLATE ENGINE SUPPORTS ON
ALPHA ONE GENERATION II TRANSOM ASSEMBLY

31-35988A12 Bearing Set

POSSIBLE DIFFICULTY SHIFTING OUT OF GEAR
ON BRAVO DRIVE 1.36:1 AND 1.81:1

1991 Mercruiser Service Bulletins

NEW BATTERY AND BATTERY CABLE REQUIREMENTS FOR MERCRUISER PRODUCTS

ENGINE SPECIFICATION CORRECTIONS IN #9 MANUAL

MCM 502 Magnum Specs

815471A3 BRAVO SHIFT CABLE REPLACEMENT KIT

SEAWATER/FUEL PUMP MAINTENANCE

MCM 7.4L Bravo, MIE 7.4L Specs

NEW ENGINE BREAK-IN PROCEDURE FOR DIESEL ENGINES

MCM 350 Magnum Alpha, and Bravo Specs

OIL LEAKING FROM WATER PICKUP HOLES IN GEAR HOUSING ON ALPHA ONE
GENERATION II DRIVE

STARTER RELAY "CHATTER" ON DIESEL ENGINES

WARRANTY FRAUD/ Super Chargers

PRIMING 4-CYCLE ENGINES WITH OIL

REPLACEMENT TRIM PUMP FOR THE PRESTOLITE STYLE PUMP

Alpha One Generation II Tool List

MCM 454 Magnum Bravo

MCM 4.3L, 4.3LX Alpha

MERCRUISER INSTRUCTIONAL VIDEO TAPES

ANODE MATERIAL CHANGE

BRAVO DRIVE UNIT/HOUSING COMPARISON AND IDENTIFICATION

DRIVE UNIT GEAR RATIO IDENTIFICATION

ALPHA ONE VERSUS ALPHA ONE GENERATION II UPPER DRIVE SHAFT

USE OF PRIORITY VALVE KIT FOR DUAL POWER STEERING ON 3.0 L AND 3.0 LX

ALPHA ONE/MCI 1990 AND PRIOR, LOWER DRIVE SHAFT

NEW OIL SEAL BUSHING FOR BELL HOUSING
BRAVO CONE CLUTCH
Required Water Separating Fuel Filter Replacement
REQUIRED WATER SEPARATING FUEL FILTER REPLACEMENT

1992 Mercruiser Service Bulletins

224 CID (3.7L) PISTON IDENTIFICATION, TYPE AND CLEARANCE
TRIM PUMP 110 AMP FUSE
BRAVO LOWER GEAR HOUSING PINION NUT
NEW TRIM CYLINDER SPANNER WRENCH TOOL 91-821709
REQUIRED WARNING DECAL INSTALLATION
SEAWATER/FUEL PUMP HOSE CONNECTIONS
ENGINE RPM “HUNTS” AT IDLE SPEED
ENGINE ALIGNMENT TOOL MODIFICATION
REQUIRED DISTRIBUTOR CAP GASKET INSTALLATION
TESTING THUNDERBOLT IV HEI IGNITION SYSTEM
NEW TRIM LIMIT SWITCH AND TRIM SENDER KIT
LEAKAGE BETWEEN EXHAUST PIPE AND GIMBAL HOUSING ASSEMBLY
MCM 502 Magnum/MIE 8.2L
REQUIRED ELECTRIC FUEL PUMP RFI FILTER REPLACEMENT
MCM 5.7L Alpha, MIE 5.7L Inboard and 5.7L Competition Ski Engines
ADDITIONAL IGNITION SYSTEM ADVANCE CURVE SPECIFICATIONS
WEBER CARBURETOR ADJUSTABLE ACCELERATOR PUMP
TORSIONAL (CRANKSHAFT) DAMPER BOLT TORQUE CHANGE
V6/V8 THERMOSTAT HOUSING CHANGE

1993 Mercruiser Service Bulletin

MCM 7.4L Bravo Three GM Generation V Engine
A. VAPOR SEPARATOR TANK (VST) RECALL
B. ELECTRIC CONTROL MODULE (ECM) RECALL
UNIVERSAL JOINT CROSS & BEARING CUP SEAL
REQUIRED FLAME ARRESTOR REPLACEMENT
REQUIRED FUEL PUMP PUSH ROD REPLACEMENT
ADD WATER INLET HOSE CLAMP
ALTERNATE GEAR RATIO STERN DRIVE UNITS FOR HIGH ALTITUDE
224 CID (3.7L) MINIMUM OIL PRESSURE
NEW REVERSE GEAR 43-824109 AND THRUST SPACER 23-824108
BRAVO SHIMMING PROCEDURE CHANGE FOR THE GEAR CASE BEARING CARRIER
REQUIRED STARBOARD ENGINE MOUNT BOLT REPLACEMENT

REQUIRED FUEL INLET FITTING REPLACEMENT ON WEBER CARBURETOR

ROCHESTER 4 BBL QUADRAJET CARBURETOR

EXHAUST BELLOWS FALLING OFF

224 CID (3.7L) EXHAUST ELBOW/RESERVOIR TORQUE AND RETORQUE

V6 AND V8 THERMOSTAT HOUSINGS

Blackhawk Drive Applications

Service/Repair Of Electrical Test Equipment

POSSIBLE WATER LEAKAGE PAST TRANSOM MOUNTING STUDS ON ALPHA AND BRAVO TRANSOM ASSEMBLIES.

Stern Drive Setback System

MERCRUISER EFI TESTER

BRAVO THREE BEARING CARRIER OIL SEALS

MCM 454 Magnum EFI, MIE 454 EFI Ski GM Gen V 454 Magnum 454 EFI

REQUIRED EFI VST FUEL FILTER REPLACEMENT

ENGINE CONTROL MODULE (ECM) RECALL

DHB Power Steering Valve (806034A1)

MCM 350 EFI Magnum

INCORRECT ANEROID ADJUSTMENT

1994 Mercruiser Service Bulletins

BRAVO TRIM IN LIMIT SPACER KITS

THUNDERBOLT V IGNITION SYSTEM

A. CYLINDER HEAD BOLT CHANGE
B. CYLINDER HEAD TORQUE SEQUENCE CHANGE
C. THRU-HULL WATER PICK UP ELIMINATED ON MCM D4.2L

GASOLINE RECOMMENDATION FOR ALL MERCRUISER MODELS

Drive Unit Trim Tab / New Anodic Plate

DHB POWER STEERING CONTROL VALVE

STERN DRIVE – REAR ENGINE MOUNT BOLT TORQUE

REQUIRED FUEL INJECTOR “POD” AND ECM REPLACEMENT

BATTERY REQUIREMENTS FOR MERCRUISER PRODUCTS

REQUIRED ENGINE GROUNDING STUD REPLACEMENT

SEAWATER HOSE / POWER STEERING LINE INTERFERENCE

EFI GASOLINE RECOMMENDATION CHANGES NUMBER 1 and 2

Universal-Joint & Gimbal Bearing Grease

WIRING MODIFICATION Diesel Engines

REQUIRED ENGINE FUEL FILTER REPLACEMENT

BRAVO THREE TRIM “IN” LIMIT BLOCKS

OPERATION AND MAINTENANCE MANUALS FOR BODENSEE EMISSIONS MODELS

1995 Mercruiser Service Bulletins

ALPHA ONE GENERATION II UPPER GEARS
OILDYNE TRIM PUMP ADAPTOR CONNECTORS
MCM 3.0L, LX Starter Motor Bolt Breakage
Hino Diesel - Excessive Black Smoke Emission
MerCruiser GM Engine Identification
OilDyne Trim Pump Trouble Shooting Chart
Reformulated Gasoline (USA)
Mercruiser Steering Recommendations
Diesel Fuel Filters and Fuel Additives
MerCruiser MCM D7.3L/270 Diesel Stern Drive Replacement
Ignition Advance Curves and Point Setting
Engine Compartment Temperature
Alpha One Generation II Over Heat
Cooling Systems Maintenance
MerCruiser MCM D7.3L Diesel Overheat
Low Sulfur Diesel Fuels
Engine Noise or Noisy Lifters
Hino Diesel-Excessive Black Smoke
Turbo Charger Waste-Gate
Bearing Cup Installation In The Bravo One Bearing Carrier
Shrink Wrapping Boats
Velvet Drive Distributors
Hurth Marine Gear Distributors

1996 Mercruiser Service Bulletins

Bravo Transom Assemblies for the 1996-1/2 Model Year
Water In Fuel Module (WIF) Warning Light
Serpentine Belt Adjustment
Quicksilver Digital Diagnostic Terminal (DDT)
Troubleshooting Shift Problems
Modifying MerCruiser Engines To Increase Performance Or Horsepower
Modifying MerCruiser's Exhaust System
Brass Power Steering Hose Coupling
MerCruiser Scan Tool
Piston Ring End Gap
Hurth Transmissions
Changes To The 1997 Operation And Maintenance Manuals

Commander 3000 Remote Control Recall
Aftercooler Torque Specifications
Required ECM Replacement
Hurth V-Drive Output Flange Torque

1997 Mercruiser Service Bulletins

Torquing Intake Manifold on Gen+ Engines
MerCruiser MCM/MIE Inline Diesel Heat Exchanger End Cover Torque
Required Flame Arrestor Replacement
MCI /Alpha One / Alpha One Generation II Gear Case and Bearing Bore Differences
Multiple EFI Engine Battery Precautions
MerCruiser GM Engine Identification
Bravo Drives and Transoms
MerCarb 2 bbl Carburetor
Weber 4 bbl Carburetor
Alternate Gear Ratio Sterndrive Units for High Altitude
AC Spark Plug Replacement
Battery and Battery Cable Requirements for MerCruiser D-tronic Diesels
Service/Repair Of Electrical Test Equipment
Engine Specification Model: 1998 MCM 5.0L Alpha and Bravo.
Timing 1998 350 Mag MPI and 7.4L MPI Models
Engine Specifications Model: 1998 MCM/MIE D-Tronic D4.2L
Engine 'Dieseling' or 'Running-On'
1997 1/2 Shift Changes for Bravo One / Two / Three and BlackHawk
Extended Life Coolant (Antifreeze) In Gasoline Engines
EFI and MPI Fuel Line Replacement
Required ECM Replacement
Engine Oil Level - D2.8L D-Tronic
MerCruiser Gasoline Engine Oil Recommendation
Heat Transfer Compound
Fuel Pressure Gauge Kit
Gasoline Engine Compression Test

1998 Mercruiser Service Bulletins

MCM 3.0L Flame Arrestor Decal
Operating a Bravo One Performance Drive with Low Water Inlets in shal-low water
Regulator Piston for Velvet Drive Transmissions
Electric Fuel Pump Check Valve Sticking
USA Gasoline Additive Causing Fuel System Component Problems

7.4L (L29) Exhaust Valve Inspection

MerCruiser Lower Unit Shift Shaft Tool

New One Piece Oil Seal Carrier for Alpha One Generation II

Installation Issues With MCM D7.3L D-Tronics

Injection Pump Timing Specifications

Required MIE 7.4L MPI (L29) ECM Replacement

Gimbal Housing Oil Reservoir Bulkhead Fitting -Material Change

Required #1 Injector Replacement

3.0L Engines with Blown Head Gasket

Shift Cable Measurements For Transmissions

Modification of Tool Kit 91-806563A1 for D-Tronic Diesels

Second Station Start/Stop Kit Instruction Sheets

1999 Mercruiser Service Bulletins

Delco Starter Motors

V6 and V8 305/350 cid Engines with MEFI-3

MEFI-3 Diagnostic Trouble Codes and Audio Warning System

Sensor Failures in MEFI-3 Mercury Distributors Used on V6 and V8 305/350 cid Engines

Proper Oil Fill Level On Velvet Drive Transmissions

Proper Shift Set-up For The Commander 3000 Classic Control When Used With Alpha One Product

Gasoline Engine Vapor Locking

EFI / MPI Fuel Pumps With Low Pressure

New Flushing Procedure for Alpha and Bravo Engines When Using a Flush Attachment on the Sterndrive

Exhaust Manifolds, Risers and Exhaust Elbows

MCM 3.0L Flame Arrestor Decal

Water Drain Plugs Installed

Delco Starter Motors

2000 Mercruiser Service Bulletins

-Alpha One Delayed Shift

Bravo Three / BlackHawk Lower Unit Oil Seal Installation Tool Modification

Serpentine Belt Power Steering Pulleys

-Stainless Steel Electric Fuel Pumps

Commander 3000 Classic Remote Control Decal