COOLING SYSTEM

CLOSED COOLED MODELS
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### Torque Specifications

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<th>Lb. Ft.</th>
<th>N·m</th>
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<tr>
<td>Heat Exchanger End Cap</td>
<td>36-72</td>
<td>4-8</td>
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<td>Thermostat Cover</td>
<td>30</td>
<td></td>
<td>41</td>
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<td>Heat Exchanger Mounting Brackets</td>
<td></td>
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<td>Hose Clamps</td>
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<td>Securely</td>
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<td>Drain Plugs</td>
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### Lubricants/Sealants

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
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<tbody>
<tr>
<td>Quicksilver 2-4-C Marine Lubricant With Teflon</td>
<td>92-825407A3</td>
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<tr>
<td>Quicksilver Perfect Seal</td>
<td>92-34227-1</td>
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<tr>
<td>Quicksilver Liquid Neoprene</td>
<td>92-25711-2</td>
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<td>Loctite Pipe Sealant With Teflon</td>
<td>Obtain Locally</td>
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### Specifications

#### Closed Cooling System Capacity

<table>
<thead>
<tr>
<th>MODEL</th>
<th>MCM AND MIE 454 CID / 7.4L</th>
<th>MCM AND MIE 7.4L MPI</th>
<th>MCM AND MIE 502 CID / 8.2L</th>
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<tbody>
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<td>Seawater Cooling System</td>
<td></td>
<td></td>
<td>20 (19)</td>
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<tr>
<td>Closed Cooling System</td>
<td>28 (26.5) (^1) 18 (17) (^2)</td>
<td>18 (17) (^2)</td>
<td>28 (26.5) (^2)</td>
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</table>

\(^1\) Closed cooling system with manifolds included in coolant side of system.

\(^2\) Closed cooling system without manifolds included in coolant side of system.

### Thermostat

<table>
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<tr>
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<th>Specification</th>
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<td>143°F (62°C)</td>
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<tr>
<td>Engines With Thunderbolt V Or Fuel Injection</td>
<td>160°F (71°C)</td>
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### Pressure Cap Rating

<table>
<thead>
<tr>
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<tr>
<td>All Engines</td>
<td>16 PSI (110 kPa)</td>
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CLOSED COOLING SYSTEMS - 6B-1
Description

There are several configurations of this cooling system, but the operation is essentially identical. Basically, the system is composed of two separate subsystems: the seawater system and the closed cooling system. The seawater system is similar in function to the fan used in an automobile because it absorbs heat (from the closed cooling system) as it passes through the heat exchanger. The closed cooling system is similar in function to the rest of the cooling system in an automobile.

The coolant recovery system keeps the reservoir full. Normal coolant overflow into recovery bottle is approximately 1/2 pint (230 mL) 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.

IMPORTANT: The coolant (antifreeze) flows around the outside of the cooling tubes while seawater flows through the inside of the cooling tubes in the heat exchanger.

Maintaining Coolant Level

Before starting engine each day, check to ensure that coolant is visible in coolant recovery bottle.

If coolant is not visible, check fresh water section of cooling system (including coolant recovery system) for leaks and repair, as necessary. Refill fresh water section with recommended coolant solution, as outlined under “Changing Coolant,” following.

If coolant is visible, start engine and run until it reaches normal operating temperature, then recheck coolant level in coolant recovery bottle. Coolant level MUST BE between the ADD and FULL marks (on front of bottle).

![WARNING]

Allow engine to cool before removing pressure cap, as sudden loss of pressure could cause hot coolant to boil and discharge violently. After engine has cooled, turn cap 1/4 turn to allow any pressure to escape slowly, then push down and turn cap all the way off.

If level is low, remove fill cap from coolant recovery bottle and add required amount of coolant solution. Use a 50/50 mixture of ethylene glycol antifreeze and pure, soft water for coolant additions. If frequent additions of coolant are required, check fresh water section for leaks.

IMPORTANT: ALCOHOL OR METHANOL BASE ANTIFREEZE OR PLAIN WATER ARE NOT RECOMMENDED FOR USE IN COOLING SYSTEM AT ANY TIME. In areas where ethylene glycol is not available, and the possibility of freezing does not exist, it is permissible to use a solution of rust inhibitor and pure, soft water (mixed to manufacturer’s recommendations).

Occasionally, check to ensure that coolant recovery system is functioning properly by removing pressure cap from heat exchanger and checking level. Coolant level should be up to bottom of heat exchanger filler neck. If low, examine entire fresh water section (especially coolant recovery system) for leaks and repair, if necessary.

IMPORTANT: When reinstalling pressure cap, be sure to tighten it until it contacts stops on filler neck.
Pressure Cap Maintenance

Pressure cap is designed to maintain pressure in fresh water section of closed cooling system once the engine has attained normal operating temperature. This raises the boiling point of the coolant, thereby increasing the efficiency of the cooling system. To help ensure proper operation, cap should be cleaned, inspected and pressure tested periodically as follows:

**WARNING**

Allow engine to cool before removing pressure cap (in next step), as sudden loss of pressure could cause hot coolant to boil and discharge violently. After engine has cooled, turn cap 1/4 turn to allow any pressure to escape slowly, then push down and turn cap all the way off.

1. Remove pressure cap from heat exchanger.
2. Wash cap with clean water to remove any deposits or debris from sealing surfaces.
3. Inspect rubber seal on cap for cuts, cracks or other signs of deterioration. If seal is damaged, cap MUST BE replaced.
4. Inspect coolant recovery gasket for deterioration and replace if bad.
5. Check condition of locking tabs on cap. Replace cap if tabs are bent or cracked.
6. Refer to “Testing Pressure Cap” and test pressure cap as outlined.
7. Clean sealing surfaces on heat exchanger filler neck with a cloth. Inspect surfaces for any damage or deposits that may prevent cap from sealing properly.
8. Clean coolant recovery passage in heat exchanger filler neck with a wire and blow out with compressed air.

Seawater Pickup Pump Maintenance

Whenever insufficient water flow is suspected, seawater pickup pump should be disassembled and inspected (by an authorized MerCruiser Dealer).

Heat Exchanger Repair

**IMPORTANT**: Braze with BCUP 2 rod or silver solder. Care must be taken not to melt other joints during repair.

1. Internal leaks can be repaired by brazing 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 three tubes.
2. Nipples and drains that have been broken off the heat exchanger can be reattached by brazing.
Testing Closed Cooling System

Testing Coolant for Alkalinity

⚠️ WARNING
Allow engine to cool before removing pressure cap as sudden loss of pressure could cause hot coolant to boil and discharge violently. After engine has cooled, turn cap 1/4 turn to allow any pressure to escape slowly, then push down and turn cap all the way off.

Coolant in fresh water section should be changed every two years and should be checked for alkalinity at least once between change intervals. To check coolant for alkalinity, proceed as follows:

1. Obtain pink litmus paper from a local supplier (drug store, pet shop, etc.).
2. Remove pressure cap from heat exchanger and insert one end of litmus paper into coolant.
3. If pink litmus paper turns blue, coolant is alkaline and need not be replaced.
4. If pink litmus paper remains pink, coolant is not alkaline and MUST BE REPLACED, as explained under “Changing Coolant.”

Pressure Testing System

⚠️ WARNING
Allow engine to cool before removing pressure cap. Sudden loss of pressure could cause hot coolant to boil and discharge violently. After engine has cooled, turn cap 1/4 turn to allow any pressure to escape slowly, then push down and turn cap all the way off.

If coolant section of closed cooling system is suspected of leaking or not holding sufficient pressure, and no visible signs of leakage can be found, perform the following test:

1. Remove pressure cap from heat exchanger or reservoir.
2. Clean, inspect and pressure test pressure cap, as outlined under “Testing Pressure Cap,” to eliminate the possibility that cap is not maintaining proper pressure in system and is causing coolant to boil over.

3. Clean inside of filler neck to remove any deposits or debris. Examine lower inside sealing surface for nicks or other damage. Surface must be perfectly smooth to achieve a good seal between it and rubber seal on cap. Also check locking cams on sides of filler neck to be sure that they are not bent or damaged. If locking cams are bent or damaged, pressure cap will not hold the proper pressure.
4. Adjust coolant level in fresh water section to 1 in. (25 mm) below filler neck.
5. Attach an automotive-type cooling system pressure tester to filler neck and pressurize closed cooling section to amount specified in following chart, based on pressure cap rating for your engine.

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<th>Pressure Cap Rating</th>
<th>Amount of Pressure Applied to Closed Cooling System</th>
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<td>16 PSI (110 kPa)</td>
<td>20 PSI (138 kPa)</td>
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6. Observe gauge reading for approximately two minutes; pressure should not drop during this time. If pressure drops, proceed with the following steps until leakage is found.

7. While maintaining specified pressure on closed cooling section, visually inspect external portion of cooling system (hoses, gaskets, drain plugs, petcocks, core plugs, circulating pump seal, etc.) for leakage. Also listen closely for bubbling or hissing, as they usually are a sure indication of a leak.
8. Refer to “Testing Heat Exchanger” in this section and test as outlined.
9. If no leakage could be found in above steps, engine is leaking internally, and it probably is due to one or more of the following: (1) loose cylinder head bolts or damaged gasket, (2) loose intake manifold bolts or damaged gasket, (3) loose exhaust elbow or distribution block retaining nuts or damaged gasket, (4) cracked or porous cylinder head or block, or (5) cracked or porous exhaust manifold. Proceed as follows until location of internal leak is found.

a. Start engine. Re-pressurize system to previously specified amount and observe pressure gauge on tester. If needle in gauge vibrates, compression or combustion is leaking into closed cooling section from a leak in the combustion chamber. Exact cylinders, where leakage is taking place, sometimes can be found by removing spark plug wire (one at a time) while observing pressure gauge.
tion will decrease or stop when plug wire is removed from leaking cylinder. Stop engine.

b. Remove spark plugs (one at a time) from cylinders and examine for presence of coolant. A spark plug that is perfectly clean or milky appearing is a sure indication of a leak.

c. Drain oil from engine and examine for presence of coolant. Oil usually will be milky if coolant is present. If coolant is present, remove engine from boat and drop the oil pan. With engine in the upright position, re-pressurize closed cooling section to previously specified amount and examine internal surfaces of engine to locate leak.

d. If no leakage can be found in above steps, entire engine must be disassembled and inspected for leakage.

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:

IMPORTANT: 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. (610-910 mm) 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 (100-130 mm) 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 five 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.

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 five minutes at a given RPM. A head gasket leak will not stop because the one thing that marks a failed head gasket is the continued passage of air. This 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.

1. Remove a seawater hose from the exchanger. Do not drain the exchanger.
2. Pressurize the closed cooling circuit to 16-20 PSI (110-138 kPa) with a radiator tester.
3. If seawater begins to flow from the nipple there is a leak.

FOR BLOCKAGE:

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

1. Remove end caps and inspect for any blockage in the seawater circuit (broken impeller blades, weeds, etc.).
2. 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.

Testing Pressure Cap

Pressure cap is designed to maintain a pressure of approximately its rated capacity (refer to “Specifications”) in closed cooling section once engine has attained operating temperature. Cap should be cleaned, inspected and pressure-tested at regular tune-up intervals or whenever cap is suspected of maintaining improper pressure as follows:

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**WARNING**

Allow engine to cool before removing pressure cap. Sudden loss of pressure could cause hot coolant to boil and discharge violently. After engine has cooled, turn cap 1/4 turn to allow any pressure to escape slowly, then push down and turn cap all the way off.

1. Carefully remove pressure cap from reservoir or heat exchanger.
2. Wash cap with clean water to remove any deposits or debris from sealing surfaces.
3. Inspect gasket (if used) and rubber seal on cap for tears, cuts, cracks or other signs of deterioration. Replace gasket, if damaged, or entire cap if rubber seal is damaged.

4. Check that locking tabs on cap are not bent or damaged.
5. Using a cooling system pressure tester (similar to one shown), test cap to be sure that it releases at proper pressure and does not leak. (Refer to instructions which accompany tester for correct test procedure.) Cap must relieve pressure at 16 PSI (110 kPa), and must hold rated pressure for 30 seconds without going below 11 PSI. Replace cap if it fails to fall within these limits.

6. Reinstall cap on reservoir or heat exchanger.

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6B-6 - CLOSED COOLING SYSTEMS

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Thermostat

Removal

1. Follow instructions “a” and “b”:
   a. Drain coolant from exhaust manifolds by removing lower hose or plug from each manifold. Be sure to drain both port and starboard sides.
   
   NOTE: If coolant flow is restricted or fails to occur, a wire should be repeatedly inserted into all drain holes to insure there are no obstructions in passages. Remove petcock, if necessary, to insert wire completely into drain hole.
   b. Drain engine block by removing drain plug. Be sure to drain both port and starboard sides.

2. Disconnect hoses from thermostat cover.
3. Remove thermostat cover attaching bolts and lockwashers, then remove cover and gasket.
4. Remove thermostat from thermostat housing.

MCM Model Shown - MIE Models Not Equipped with Lifting Eye

a - Bolts
b - Lockwashers
c - Lifting Eye (MCM Models Only)
d - Hex Head Bleeder
e - Cover
f - Gasket
g - Thermostat (Typical)
h - Housing
i - Gasket With Continuity Rivets

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MCM / MIE Models With Seawater Flow Through Exhaust Manifolds

a - Thermostat Housing
b - Thermostat
c - Gasket
d - Thermostat Housing Cover

Testing

1. Clean thermostat in soap and water to remove any deposits or debris.
2. Inspect thermostat for corrosion or other visible damage.
3. If thermostat is suspected of producing insufficient engine temperature, check thermostat for leakage by holding it up to lighted background. Light leakage around the thermostat valve indicates that thermostat is not closing completely and should be replaced. (A small amount of leakage at one or two points around the valve perimeter is acceptable.)

Brass Thermostat Shown (Stainless Similar)

a - Check For Light Leakage Around Perimeter Of Valve

4. Check opening and closing temperature of thermostat (using a tester similar to the one shown), as follows:
   a. Fill tester to within 1 in. (25 mm) of top with tap water. Do not use distilled water.
   b. Open thermostat valve and insert thread. Position thermostat on nylon string so that it will be just below water level when suspended, then allow valve to close. Suspend thermostat in water.
c. Place thermometer in container and position so that bottom of thermometer is even with bottom of thermostat. Do not allow thermometer to touch container.

**IMPORTANT:** When performing instructions “d” and “e,” water must be agitated thoroughly to obtain accurate results.

d. Plug in tester and observe temperature at which thermostat opens (thermostat drops off thread).

e. Unplug tester and allow water to cool to a temperature 10°F (5°C) below specified temperature on thermostat. Thermostat must be completely closed at this temperature.

f. Replace a thermostat that fails to meet all of the preceding tests.

**Installation**

1. Brass Thermostat
2. Stainless Steel Thermostat

a - Install Thermostat with This End Toward Thermostat Housing

**CAUTION**

Do not operate engine without cooling water being supplied to the seawater pickup pump, or pump impeller will be damaged.

1. Remove thermostat housing and gaskets. Discard gaskets.

2. Clean gasket surfaces on thermostat cover, thermostat housing and intake manifold.

3. Position lower gasket (with continuity rivets) on intake manifold. Place thermostat housing on gasket.

**IMPORTANT:** If gasket has continuity rivets, do not coat with Quicksilver Perfect Seal, or audio

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**CAUTION**

Avoid seawater pickup pump impeller damage. DO NOT operate engine without cooling water being supplied to seawater pickup pump.

7. With boat in the water and/or cooling water properly supplied to seawater pickup pump, start engine and inspect for leaks.
Changing Coolant

NOTICE
For information and procedures on draining the seawater cooling system of Seawater Cooled (Raw-water) Cooled Models, refer to SECTION 6A. For information and procedures on draining the Seawater Section of Closed Cooling (Coolant) Models refer to SECTION 1B. For cold weather or extended storage, refer to SECTION 1B.

Closed Cooling Section
Closed cooling section of closed cooling system should be kept filled year-round with recommended coolant solution. Do not drain closed cooling section for storage, as this will promote rusting of internal surfaces. If engine will be exposed to freezing temperatures, make sure that closed cooling section is filled with an ethylene glycol antifreeze and water solution, mixed to manufacturer’s recommended proportions, to protect engine to lowest temperature to which it will be exposed. If necessary, change coolant.

Coolant Recommendations

CAUTION
Alcohol or Methanol base antifreeze or plain water are not recommended for use in fresh water section of cooling system at any time.

It is recommended that the coolant section of closed cooling system be filled with 50/50 mixture of ethylene glycol antifreeze and water. In areas where the possibility of freezing DOES NOT exist, it is permissible to use solution of rust inhibitor and water (mixed to manufacturer’s recommendations).

Change Intervals
Drain and flush coolant from the closed cooling system at least every two years or whenever exhaust gases have entered the system.

Draining Instructions

WARNING
Allow engine to cool before removing pressure cap. Sudden loss of pressure could cause hot coolant to boil and discharge violently. After engine has cooled, turn cap 1/4 turn to allow any pressure to escape slowly, then push down and turn cap all the way off.

IMPORTANT: A wire should be inserted into drain holes to ensure that foreign material is not obstructing the drain holes. On some models with two piece petcock, removal of petcock may be required so that wire can be inserted completely into drain hole.

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

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

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

The following draining instructions apply to all engines equipped with closed cooling. The location of petcocks that require opening and hoses that require removal are represented on the following pages for the individual engines.

IMPORTANT: Observe precautions previously outlined before proceeding.
1. Remove pressure cap from coolant tank.
2. Drain coolant from locations as shown for your model and engine. (Refer to the appropriate diagram on the following “Draining Diagrams” pages.)
3. After coolant has drained completely, reinstall petcocks and hoses. Tighten clamps and petcocks securely.
4. Remove coolant recovery bottle from mounting bracket and pour out coolant.
5. Clean system as outlined in “Cleaning System.”
6. Fill system as outlined in “Filling Closed Cooling Section.”
Draining Diagrams - Coolant Side

FRONT MOUNTED CLOSED COOLING WITH COOLANT FLOW THROUGH EXHAUST MANIFOLDS

**Legend**
- FRESHWATER
- SEAWATER

**Instructions**
- a - Remove Hoses (Lift, Lower or Bend To Completely Drain).
- b - Remove Block Plugs (Repeatedly Clean Out Holes Using A Stiff Wire Until Entire System Is Drained).

1. Coolant Recovery Bottle
2. Heat Exchanger
3. Thermostat Housing
4. Thermostat
5. Thermostat Housing Cover
6. Bleeder Valve
7. Seawater Pickup Pump
8. Transmission Cooler
9. Seawater Inlet
10. Overboard
11. Circulating Pump
12. Oil Cooler
13. Exhaust Elbow
14. Separator Gasket
15. Exhaust Manifold

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CLOSED COOLING SYSTEMS - 6B-11
a - Remove Hoses (Lift, Lower or Bend To Completely Drain).

b - Remove Block Plugs (Repeatedly Clean Out Holes Using A Stiff Wire Until Entire System Is Drained).

1 - Coolant Recovery Bottle
2 - Heat Exchanger
3 - Thermostat Housing
4 - Thermostat
5 - Thermostat Housing Cover
6 - Seawater Pickup Pump
7 - Transmission Cooler
8 - Seawater Inlet
9 - Oil Cooler
10 - Overboard
11 - Circulating Pump
12 - Exhaust Elbow
13 - Separator Gasket
14 - Exhaust Manifold

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6B-12 - CLOSED COOLING SYSTEMS
MIE 454 CID / 7.4L 502 CID / 8.2L WITH VERTICAL MOUNTED OIL COOLER / PORT SIDE MOUNTED TRANSMISSION COOLER / OPTIONAL FUEL COOLER AND MCM 454 CID / 7.4L WITHOUT COOLANT FLOW THROUGH EXHAUST MANIFOLDS

1. Coolant Recovery Bottle
2. Heat Exchanger
3. Thermostat Housing
4. Thermostat
5. Seawater Pickup Pump
6. Fuel Cooler
7. Transmission Cooler
8. Vertical Mounted Oil Cooler
9. Seawater Inlet
10. Overboard
11. Circulating Pump
12. Exhaust Elbow
13. Separator Gasket
14. Exhaust Manifold

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- Remove Hoses (Lift, Lower or Bend To Completely Drain).
- Remove Block Plugs (Repeatedly Clean Out Holes Using A Stiff Wire Until Entire System Is Drained).
Cleaning System

Closed Cooling Section

Closed cooling section of closed cooling system should be cleaned at least once every two years or whenever decreased cooling efficiency is experienced.

A good grade automotive cooling system cleaning solution may be used to remove rust, scale or other foreign material. Always follow manufacturer’s instructions for the cleaner.

If closed cooling section is extremely dirty, a pressure flushing device may be used to flush out remaining deposits. Flushing should be done in direction opposite normal coolant flow to allow water to get behind deposits and force them out. Refer to instructions which accompany flushing device for proper hookup and flushing procedure.

**NOTICE**

For information and procedures for draining and flushing Seawater Section of Closed Cooling (Coolant) Models, refer to SECTION 1B. For cold weather or extended storage, refer to SECTION 1B.

Seawater Section

Cooling efficiency of an engine with closed cooling is greatly dependent upon heat transfer through the tubes within the heat exchanger. During engine operation, contaminants within the seawater (such as salt, silt, lime, etc.) collect on the inside of the tubes, thus reducing heat transfer and greatly decreasing heat exchanger efficiency. It is, therefore, recommended that the seawater section of the heat exchanger be cleaned at least once every two years or whenever decreased cooling efficiency is suspected, as follows:

**IMPORTANT:** It may be necessary to remove heat exchanger on some models. If heat exchanger is removed, be sure to refill closed cooling section with coolant.

1. Remove seawater drain plug from bottom of heat exchanger and allow water to drain. After water has drained completely, coat threads of drain plug with Quicksilver Perfect Seal and reinstall.

2. Remove bolts which secure end plates to each end of heat exchanger, then remove end plates, seal washers and gaskets. Discard seal washers and gaskets. Clean gasket material from end plates and heat exchanger.

3. Clean water passages in heat exchanger by inserting a suitable size wire brush into each passage. Use compressed air to blow loose particles out of water passages.

4. Apply Quicksilver Perfect Seal to both sides of new end plate gaskets, then reinstall end plates, using new gaskets and seal washers. (Be sure to install seal washers between end plates and gaskets.) Torque end plate bolts to specifications.

**CAUTION**

Avoid seawater pickup pump impeller damage. DO NOT operate engine without water being supplied to seawater pickup pump.

5. With boat in the water and/or cooling water properly supplied to seawater pickup pump, start engine and inspect for leaks.
Filling Closed Cooling Section

Fresh Water Flow Thru Exhaust Manifold

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>See “Specifications” for approximate closed cooling system capacity and coolant recommendation.</td>
</tr>
</tbody>
</table>

**WARNING**

Do not remove coolant cap when engine is hot. Coolant may discharge violently.

**CAUTION**

Alcohol or Methanol based antifreeze or plain water are not recommended for use in fresh water section of cooling system at any time.

**CAUTION**

Front of engine should be higher than rear to purge trapped air out of the system during initial filling. This will minimize the possibility of air being trapped in the closed cooling section which can cause engine to overheat.

1. Remove coolant cap on heat exchanger.

2. Open hex bleeder on thermostat.

3. Fill closed cooling system with coolant mixture through heat exchanger fill neck until coolant appears at bleeder valve.


5. Continue filling closed cooling section until coolant level is 1 in. (25 mm) below filler neck.

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoid seawater pickup pump impeller damage and subsequent overheating damage to stern drive unit. DO NOT operate engine without water being supplied to seawater pickup pump.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Models with belt drive seawater pickup pump must be in the water when running engine because garden hose will not supply enough water to system at higher RPM.</td>
</tr>
</tbody>
</table>

6. With pressure cap off, start engine and run at fast idle (1500-1800 RPM). Add coolant solution to heat exchanger, as required, to maintain coolant level 1 in. (25 mm) below filler neck.

7. After engine has reached normal operating temperature (thermostat is fully open), and coolant level remains constant, fill heat exchanger to bottom of filler neck.

8. Observe engine temperature gauge to make sure that engine operating temperature is normal. If gauge indicates excessive temperature, stop engine immediately and examine for cause.

9. Install pressure cap on heat exchanger.

10. Remove cap from coolant recovery reservoir and fill to FULL mark with coolant solution. Reinstall cap.


**IMPORTANT**: Engine overheating is often due to air being trapped in closed cooling section. Purge air by running engine at 2000 RPM for 10 minutes.

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allow engine to cool before removing pressure cap. Sudden loss of pressure could cause hot coolant to boil and discharge violently. After engine has cooled, turn cap 1/4 turn to allow any pressure to escape slowly, then push down and turn cap all the way off.</td>
</tr>
</tbody>
</table>

12. Recheck coolant level after first open-throttle boat test and add coolant, if necessary.

13. Maintain coolant level in coolant recovery reservoir between ADD and FULL marks with engine at normal operating temperature.

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Seawater Flow Thru Exhaust Manifolds

⚠️ CAUTION

Alcohol or Methanol base antifreeze or plain water, are not recommended for use in coolant section of Closed Cooling System at any time.

It is recommended that coolant section of Closed Cooling System be filled with a 50/50 mixture of ethylene glycol antifreeze and pure, soft water. Antifreeze MUST BE used regardless of whether freezing temperatures are or are not expected to provide adequate corrosion protection. In areas where ethylene glycol antifreeze is not available and the possibility of freezing DOES NOT exist, it is permissible to use a solution of rust inhibitor and pure, soft water (mixed to manufacturer’s recommendations).

NOTE: Coolant section capacity is approximately 4 U.S. Gallons (15 L).

1. Fill coolant section of Closed Cooling System with coolant mixture as follows:
   a. Open bleeder valve on thermostat housing.
   b. Fill with coolant mixture through heat exchanger fill neck until coolant appears at bleeder valve opening.
   c. Close bleeder valve securely.
   d. Continue filling until coolant level is into filler neck and begins to flow into coolant recovery bottle plastic tubing.

⚠️ CAUTION

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

- Front of engine should be higher than rear to purge trapped air out of the system during initial filling. This will minimize the possibility of air being trapped in the closed cooling section which can cause engine to overheat.

IMPORTANT: This closed cooling system flows coolant at a high rate. Higher idle speeds increase dispersion of trapped air into system making it more difficult to purge trapped air. Operate at idle during filling and air purging when specified.

2. Start engine and run AT IDLE. Add coolant solution to heat exchanger, as required, to maintain coolant level at filler neck. After engine has reached normal operating temperature (thermostat is fully open), and coolant level remains constant, fill heat exchanger until coolant level is into filler neck and begins to flow into coolant recovery bottle plastic tubing.

3. Remove cap from coolant recovery reservoir and fill to “Full” mark with coolant solution. Reinstall cap.

4. Lift recovery bottle and plastic tubing above heat exchanger filler neck. Allow coolant to flow down through tubing to purge air through filler neck fitting.

5. Install pressure cap on heat exchanger.

6. With engine still running, check hose connections, fittings and gaskets for leaks. Also observe engine temperature gauge to make sure that engine operating temperature is normal. If gauge indicates excessive temperature, stop engine immediately and examine for cause.

⚠️ WARNING

Allow engine to cool down before removing pressure cap. Sudden loss of pressure could cause hot coolant to boil and discharge violently. After engine has cooled down, turn cap 1/4-turn to allow any pressure to escape slowly, then, push down and turn cap all-the-way off.

7. Recheck coolant level after first open-throttle boat test and add coolant, if necessary.

8. Maintain coolant level in coolant recovery reservoir between “Add” and “Full” marks with engine at normal operating temperature.

Coolant section of Closed Cooling System should be kept filled year around with recommended coolant solution. DO NOT drain coolant, fresh water section, for storage, as this will promote rusting of internal surfaces. If engine will be exposed to freezing temperatures, make sure that coolant section is filled with ethylene glycol antifreeze and water solution, mixed to manufacturer’s recommended proportion, to protect engine to lowest temperature to which it will be exposed.
Auxiliary Hot Water Heater Installation

IMPORTANT: When connecting a cabin heater or hot water heater, certain requirements must be met.

- Supply hose (from engine to heater) and return hose (from heater to engine) MUST NOT EXCEED 5/8 in. (15.8 mm) I.D. (inside diameter).

- Engine with a Closed Cooling System: Heater MUST BE LOWER than fill cap on the heat exchanger. If the heater is higher than the fill cap on the heat exchanger and some coolant is lost in the system, an air pocket may form in the closed cooling system. This, in turn, can cause the engine to overheat.

- Make heater connections ONLY at locations described in the following instructions.

- Check complete system for leaks after heater is connected into cooling system.

- Check for overheating condition (of engine) after heater is connected.
  1. Refer to “Changing Coolant - Draining Instructions”; drain closed cooling system.
  2. Inspect for appropriate location of supply hose at following:

  **CAUTION**

  Avoid a performance loss and/or possible engine damage. Engine coolant must flow continuously from the engine intake manifold to the engine water circulating pump. NEVER close-off or block the coolant flow to or from a heater. All heater installations must be plumbed in series with the supply and return connections.

  **NOTE:** Hot water heater supply hose can be connected at several different locations. On some models, there may be other accessories and options that are utilizing these hot water supply locations. One of the following should be available for use when installing a hot water heater system.

  **NOTE:** On some models it may be necessary to remove the audio warning heat switch from port side of thermostat housing and reposition to water circulating pump opening as outlined following.

  **IMPORTANT:** Do not reposition engine temperature switch; it must remain where installed by factory.

Recommended Supply Locations

**Thermostat Housing With Two Hose Connection**

a - Audio Warning Switch Relocation
b - Water Supply Location

**MIE 7.4L / MCM 7.4LX Throttle Body Injection**

a - Location For Hot Water Supply
b - Factory Hose
Multi-Port Injection Models Models Seawater Flow Through Exhaust Manifolds

- Location for Hot Water Supply (Bayonet Fitting Replaces Brass Plug)
- Thermostat Housing

Recommended Return Locations

- T-Fitting
- Hose Clamps

Thermostat Housing With Two Hose Connection

MIE 7.4L / MCM 7.4LX Throttle Body Injection

- Location For Hot Water Return
- Factory Hose

MIE Rear Mounted Closed Cooling (Starboard View)

- T-Fitting
- Hose Clamps
Closed Cooling System Flow Diagrams

MCM Bravo Models - 7.4L/454 Magnum

COOLANT FLOW THROUGH THERMOSTAT HOUSING WITH THERMOSTAT CLOSED (ENGINE COLD)

COOLANT FLOW THROUGH THERMOSTAT HOUSING WITH THERMOSTAT OPEN (ENGINE WARM)

ENGINE BLOCK LEGEND

FRESHWATER
SEAWATER

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CLOSED COOLING SYSTEMS - 6B-19
MCM Model - 502 Magnum

Engine Block, Intake Manifold and Cylinder Block Assy.

Coolant Recovery Bottle

Circulating Pump

Heat Exchanger

Oil & P/S Cooler

Exhaust Elbow

Stainless Steel Separator Plate

Exhaust Manifold

THERMOSTAT HOUSING COVER

THERMOSTAT

TO EXHAUST MANIFOLDS

BLEEDER

COOLANT FLOW THROUGH THERMOSTAT HOUSING WITH THERMOSTAT CLOSED (ENGINE COLD)

COOLANT FLOW THROUGH THERMOSTAT HOUSING WITH THERMOSTAT OPEN (ENGINE WARM)

THERMOSTAT HOUSING LEGEND

FRESHWATER

SEAWATER

ENGINE BLOCK LEGEND
NOTE: ON ENGINES WITH V-DRIVE TRANSMISSIONS, EXHAUST ELBOWS WILL BE REVERSED; COOLANT FLOW REMAINS THE SAME.

COOLANT FLOW THROUGH THERMOSTAT HOUSING WITH THERMOSTAT CLOSED (ENGINE COLD)

COOLANT FLOW THROUGH THERMOSTAT HOUSING WITH THERMOSTAT OPEN (ENGINE WARM)

NOTE: ON ENGINES WITH V-DRIVE TRANSMISSIONS, EXHAUST ELBOWS WILL BE REVERSED; COOLANT FLOW REMAINS THE SAME.
MIE 454 CID / 7.4L 502 CID / 8.2L with Vertical Mounted Oil Cooler / Port Side Mounted Transmission Cooler / Optional Fuel Cooler And MCM 454 CID / 7.4L Without Coolant Flow Through Exhaust Manifolds