COOLING SYSTEM

CLOSED COOLED MODELS
262 CID / 4.3L

TORQUE SPECIFICATIONS

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>Lb. In.</th>
<th>Lb. Ft.</th>
<th>N·m</th>
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<tbody>
<tr>
<td>Heat Exchanger End Caps</td>
<td>36-72</td>
<td></td>
<td>4-8</td>
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<tr>
<td>Seawater Pump Brace</td>
<td></td>
<td></td>
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<tr>
<td>Seawater Pump Bracket to Block</td>
<td></td>
<td>30 (41)</td>
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<tr>
<td>Seawater Pump Cover</td>
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<tr>
<td>Seawater Pump Mounting Nuts to Stamped Steel Brackets</td>
<td></td>
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<td>Thermostat Cover</td>
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<tr>
<td>Thru Hull Pickup Nut</td>
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<tr>
<td>Drain Plugs</td>
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<tr>
<td>Heat Exchanger Mounting Brackets</td>
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<tr>
<td>Hose Clamps</td>
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LUBRICANTS, SEALERS AND ADHESIVES

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<tr>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
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<tr>
<td>Quicksilver 2-C-4 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>Quicksilver Loctite Type 8831</td>
<td>92-823089-1</td>
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<td>Loctite 514</td>
<td>9275505-1</td>
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<td>Quicksilver Special Lubricant 101</td>
<td>92-13872A1</td>
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<td>Loctite Pipe Sealant with Teflon</td>
<td>Obtain Locally</td>
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SPECIFICATIONS

<table>
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<tr>
<th>DESCRIPTION</th>
<th>Value</th>
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<tr>
<td>Cooling System Capacity</td>
<td>20 (19)</td>
</tr>
<tr>
<td>Thermostat Stainless Steel</td>
<td>160° F (71 °C)</td>
</tr>
<tr>
<td>Thermostat Brass</td>
<td>140° F (67 °C)</td>
</tr>
<tr>
<td>Cap Pressure</td>
<td>14 PSI (97 kPa)</td>
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Water Flow Diagrams

Engines With Coolant Flow Thru Exhaust Manifolds (Excluding Gen +)

Typical Thermostat and Thermostat Housing Shown (All Similar)

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).
c - Remove Drain Plugs From Exhaust Exhaust Manifold Drain Elbows (Repeatedly Clean Out Holes Using A Stiff Wire Until Entire System Is Drained)

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6B-2 - CLOSED COOLING MODELS
Engines With Raw Water Flow Thru Exhaust Manifolds

- 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).
- Remove Drain Plugs From Exhaust Manifold Drain Elbows (Repeatedly Clean Out Holes Using A Stiff Wire Until Entire System Is Drained)
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.

All V-6 engine exhaust manifolds are cooled by coolant in the closed cooling system. V-6 engines operated in seawater (lakes, oceans, etc) having an ambient temperature above 80°F (26°C) may have an optional belt driven seawater pickup pump mounted on the block. Otherwise, the seawater pickup pump in the Alpha stern drive cools the stern drive, flows through the heat exchanger and is then discharged overboard.

Seawater Pickup Pump (If Equipped)

Maintenance

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

Stern Drive Unit Seawater Pickup Pump

NOTICE
Refer to SECTION 6A for information and service procedures on Stern Drive Unit Seawater Pickup Pump.

Belt Driven Seawater Pickup Pump

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6B-4 - CLOSED COOLING MODELS 90-823226--1 996
OUTPUT TEST

If an overheating problem exists, use this test to determine if a sufficient amount of water is being supplied to cool engine.

IMPORTANT: The following information should be observed before proceeding with test:

- **BOAT MUST BE IN THE WATER FOR THIS TEST.** This test CANNOT be performed with a flush-test device and water hose.

- The ability of this test to detect a problem is greatly dependent upon the accuracy in which it is performed. An error in setting the engine RPM, timing the test or measuring the water output will affect the overall accuracy of the test and may produce misleading results. To help ensure accurate results, a shop tachometer with an error of less than 5% should be used. The boat tachometer definitely should not be used as its accuracy is questionable. A stop watch should be used to time the duration of the test to help ensure that the accuracy is maintained within one second. An 8 U.S. qt. (7.6 L) or larger capacity container should be used to measure water output.

- Due to the manner in which this test is performed, it may not be possible to detect a marginal condition or a high-speed water pump output problem.

1. Remove water hose, which runs between pump outlet and engine, and replace with another hose of same diameter, but approximately 3 ft. (1 m) longer. Hose should be wire reinforced or of adequate wall thickness to prevent it from kinking when performing test. Clamp hose at pump outlet only. Do not clamp hose at engine end.

2. Place an 8 U.S. qt. (7.6 L) or larger container near unclamped end of hose.

   **CAUTION**

   Do not run engine for more than 15 seconds with hose disconnected, in next step, as internal damage to engine and exhaust system may result.

3. With assistance of another person, start engine and adjust speed to exactly 1000 RPM while holding unclamped end of hose on connection on engine. Remove hose from connection on engine and direct water flow into container for exactly 15 seconds. At the end of 15 seconds, direct the water flow overboard, return engine to idle and stop engine. Reconnect hose to engine.

4. Measure quantity of water discharged into container and compare with specifications given in chart following.

5. Repeat test four times to check repeatability of results.

<table>
<thead>
<tr>
<th>Belt Driven Pump Output for 15 Second Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.5 U.S. Qts. (7.1 L) Minimum</td>
</tr>
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</table>
REMOVAL

⚠️ CAUTION ⚠️

If boat is in the water, be sure to close seacock before removing inlet hose from pump to prevent water from draining into boat. If boat is not fitted with a seacock, disconnect and plug seawater inlet hose after removing.

IMPORTANT: The following procedure describes removal of both pump and mounting bracket from engine. On some installations, however, it may be possible to remove pump with mounting bracket left installed on engine.

1. Close seacock, if so equipped, or disconnect and plug seawater inlet hose.
2. Disconnect water inlet and outlet hoses from pump.
3. If pump is to be disassembled, loosen the four pump pulley attaching screws. Do not remove screws at this time.
4. Remove power steering pump drive belt to allow removal of seawater pickup pump drive belt.
5. Remove pulley attaching screws, then remove pulley.
6. Remove attaching hardware which secures pump brace to cylinder block.
7. Remove pump mounting bracket-to-cylinder block attaching hardware and remove pump, mounting bracket and brace as an assembly.
8. Remove fasteners securing bracket and brace to pump and remove both from pump body.
Two Piece Pump Assembly

1 - Screw (5)
2 - Washer (5)
3 - Cover
4 - Gasket
5 - Wear Plate (Outer)
6 - Gasket
7 - Plug
8 - Impeller
9 - Body
10 - Gasket
11 - Wear Plate (Inner)
12 - O-Ring or Quad Ring
13 - Oil Seal
14 - Housing
15 - Ball Bearing
16 - Shaft
17 - Ball Bearing
18 - Snap Ring
19 - Oil Seal
20 - Hub

One Piece Pump Assembly

1 - Screw (5)
2 - Washer (5)
3 - One Piece Body
4 - Quad Ring
5 - Impeller
6 - Wear Plate
7 - Oil Seal
8 - Housing
9 - Ball Bearing
10 - Shaft
11 - Ball Bearing
12 - Snap Ring
13 - Oil Seal
14 - Hub
**DISASSEMBLY (TWO PIECE BODY)**

1. Remove cover and body attaching screws and washers.

![Image](image1.png)

- Cover

2. Remove gasket, outer wear plate and gasket (discard gaskets).

![Image](image2.png)

- Gasket (with Large Opening)
- Wear Plate (Outer)
- Gasket (with Two Openings)

3. Slide pump body off shaft. Remove impeller from pump body and rubber plug from impeller.

![Image](image3.png)

- Rubber Plug
- Impeller

**Index**

6B-8 - CLOSED COOLING MODELS
SEAWATER PUMP DISASSEMBLY
(ONE PIECE BODY)

1. Remove the five screws from the seawater pump body.

2. Remove seawater pump body and wear plate from bearing housing.

3. Remove the impeller from seawater pump body.

HOUSING DISASSEMBLY

4. Remove gasket, inner wear plate and quad ring seal. Discard gasket and quad ring seal.
5. Press hub off shaft with Universal Puller Plate and an arbor press.

6. Puncture front oil seal with a tool and pry from bearing housing.

7. Remove snap ring from bearing housing bore and press shaft and bearings out pulley end of housing. Bearings have a slip fit in housing; do not use excessive force.
8. If bearings require replacement, remove bearings from shaft with Universal Puller Plate and an arbor press. Bearings must be replaced, if removed.

9. If rear seals require replacement, press seals from bearing housing with an appropriate tool.

CLEANING AND INSPECTION

1. Clean metal parts in solvent and blow dry with compressed air.

   IMPORTANT: Do not spin bearings at high speed when drying with compressed air, as bearings may be scored.

2. After cleaning, apply a coat of light engine oil to shaft and bearings to prevent rust.

3. Clean all gasket material and sealer from sealing surfaces.

4. Inspect bearing housing. Examine surfaces (where bearings contact housing) for evidence of bearing outer races turning in housing.

5. Inspect seals in bearing housing.

6. Inspect pump shaft bearings.

7. Inspect pump shaft for grooves in surface where seals contact shaft. Also inspect surface where bearings contact shaft for evidence of inner races turning on shaft.

8. Inspect pump body.

9. Inspect inner and outer wear plate.

10. Inspect pump impeller for wear on sides and tips of blades. Also inspect blades for cracks in area where blades flex. Replace impeller if blades have taken a set (remain in curved position).

11. Inspect pump pulley.

12. Check drive belt for excessive wear.

REASSEMBLY

Refer to exploded view also.

1. Apply a thin coat of Quicksilver Loctite 8831 to outside diameter of two new bearing housing rear seals; then install seals in housing with seal lips facing impeller end. (Press first seal in until it bottoms out and second seal in until flush with housing.)

   a - Outer (Water) Seal
   b - Face of Housing

   IMPORTANT: It is recommended that Shell Alvania No. 2 Grease be used when packing seal and bearings in the following steps. If Shell Alvania No. 2 Grease is not available, it is permissible to use Quicksilver 2-4-C Marine Lubricant. With Teflon However, Quicksilver 2-4-C Marine Lubricant With Teflon is not recommended for applications where continuous high speed heavy-duty operation will be encountered.

2. Pack cavity between seals with Shell Alvania No. 2 Grease or substitute.
3. Using an arbor press and suitable tool, press ball bearings onto shaft until they seat. Press on inner race of bearing only.

4. Pack bearings and cavity between bearings with Shell Alvania No. 2 Grease or substitute. Slide bearings and shaft into bearing housing bore and install snap ring.

5. Apply a thin coat of Quicksilver Loctite 8831 to outside diameter of new bearing housing front oil seal and press seal into housing (with seal lip facing inward) until it bottoms out.

IMPORTANT: Be sure to support impeller end of pump shaft when installing pulley hub in next step to prevent placing a load on bearings.

6. Apply Quicksilver Special Lubricant 101 to pump shaft. Using an arbor press and appropriate tool, press pulley hub onto pump shaft to dimension shown.

IMPORTANT: Pulley hub must be pressed onto shaft to exact dimension on pumps with stamped steel mounting bracket as this establishes proper drive belt alignment.
7. Clamp bearing housing in a soft jaw vise with flange end up.

8. Coat quad ring seal with Quicksilver 2-4-C Marine Lubricant With Teflon and install into groove in housing.

9. Place inner wear plate on housing and align holes. Coat both sides of a new wear plate gasket with a thin film of Quicksilver Perfect Seal and position on wear plate.

10. Install impeller into pump body by turning impeller in direction that it will be turning in operation, while simultaneously pushing inward. All impeller blades must face in same direction.
11. Slide impeller and pump body assembly onto shaft. Position pump body so that holes align with holes in wear plate, gasket and bearing housing. Install rubber plug into end of impeller.

12. Coat both sides of new cover gasket and wear plate gasket with a thin film of Quicksilver Perfect Seal. Install outer wear plate with new gaskets on each side, aligning holes in plate and gaskets with holes in pump body.

13. Install pump cover and secure with five bolts and washers. Torque bolts to specifications.

**SEAWATER PUMP REASSEMBLY (ONE PIECE BODY)**

1. Lubricate seawater pump impeller with a water and soap solution. Install impeller into housing by rotating and pushing it into place. Push it down until flush with housing.
2. Place wear plate over bearing housing shaft.
3. Place quad ring in groove in seawater pump body.

![Diagram of seawater pump and bearing housing]

- a - Quad Ring
- b - Seawater Pump

4. Align flats on impeller and bearing housing shaft, slide seawater pump body on shaft.
5. Install two screws in seawater pump body holes as shown. Use these two screws to align pump, then install the remaining screws.

![Diagram showing bolt holes for alignment]

- a - Bolt Holes For Alignment

**INSTALLATION**

1. Position pump in mounting bracket so that outlet connection will be directly above inlet connection when pump is installed.

![Diagram showing LH Out at Top]

- a - LH Out - At Top

**IMPORTANT:** Pump must be positioned correctly or overheating of engine may occur.

**IMPORTANT:** Flat washer must be installed between mounting bracket clamping bosses or damage to pump may result (if clamping screw is over-tightened).
2. Install pulley on pump and secure with four screws, lockwashers and clamping ring (some models). Tighten screws finger-tight only at this time.

3. Attach pump, mounting bracket and brace assembly to engine. Do not tighten attaching screws at this time.

4. Torque pump pulley attaching screws.

5. Position drive belt on pulleys and adjust belt tension as outlined in “Drive Belt Tension Adjustment.”

6. Connect seawater inlet hose to lower fitting on pump.

7. Connect outlet hose to upper fitting on pump.

8. Tighten hose clamps securely.

9. If applicable, reinstall power steering drive belt. Adjust tension as outlined in “Drive Belt Tension Adjustment.”
Closed Cooling Systems
With Coolant Flow Thru
Exhaust Manifolds
(Excluding Engines With
Serpentine Belt)

Maintaining Coolant Level

Coolant Recovery Bottle

a - Fill Cap

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.

10. Remove pressure cap from heat exchanger.
11. Wash cap with clean water to remove any deposits or debris from sealing surfaces.
12. Inspect rubber seal on cap for cuts, cracks or other signs of deterioration. If seal is damaged, cap MUST BE replaced.
13. Inspect coolant recovery gasket and replace if bad.

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.

10. Remove pressure cap from heat exchanger.
14. Check condition of locking tabs on cap. Replace cap if tabs are bent or cracked.

15. Refer to “Testing Pressure Cap” and test pressure cap as outlined.

16. 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.

17. Clean coolant recovery passage in heat exchanger filler neck with a wire and blow out with compressed air.

18. Reinstall pressure cap, being sure to tighten until it contacts stops on filler neck.

**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.

<table>
<thead>
<tr>
<th>Pressure Cap Rating</th>
<th>Amount Of Pressure Applied To Closed Cooling System</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 PSI (97 kPa)</td>
<td>17 PSI (117 kPa)</td>
</tr>
</tbody>
</table>

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. Repressurize 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 wires (one at a time) while observing pressure gauge. Vibration 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, repressurize 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. (61-91 cm) 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 (10-13 cm) 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.

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 14-20 PSI (97-138 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:

![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 14 PSI (97 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.

**Thermostat**

**Removal**

1. Follow instructions “a” and “b”:

   a. Drain coolant from exhaust manifolds by removing lower hose or drain plugs 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 plug or opening petcocks. Be sure to drain both port and starboard sides.

Port Side Shown
a - Drain Plug (Cylinder Block)
b - Hose

Models Without Sleeve
a - Bolts
b - Lockwashers
c - Cover
d - Gasket
e - Thermostat (Typical)
f - Housing
g - Gasket With Continuity Rivets

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

NOTE: Some engines may be equipped with a Lifting Eye bracket (not shown following) under thermostat cover bolts. Observe orientation so that it may be installed during reassembly exactly as before removal.

4. Remove thermostat from thermostat housing.
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 (Stainless Steel Similar)

- Check for Light Leakage Around Perimeter of Valve

Models With Sleeve

- a - Bolts
- b - Lockwashers
- c - Cover
- d - Gasket
- e - Thermostat
- f - Cork Gasket (DO NOT Use Perfect Seal)
- g - Sleeve (Turned in Lip Toward Thermostat)
- h - Housing
- i - Plugs (2)
- j - Gasket With Continuity Rivets
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). Thermostat must open at 138-145°F (59-63°C). Thermostat must be completely open at 170°F (77°C).
   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.

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**Installation**

### **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 warning temperature switch may not work properly.
4. Install thermostat as shown, into thermostat housing.
5. Position gasket on thermostat housing and reinstall thermostat cover. Install lifting eye (not shown following) if so equipped. Torque bolts to 30 lb. ft. (41 N·m).

Models Without Sleeve
a - Bolts
b - Lockwashers
c - Cover
d - Gasket
e - Thermostat (Typical)
f - Housing
g - Gasket With Continuity Rivets

Models With Sleeve
a - Bolts
b - Lockwashers
c - Cover
d - Gasket
e - Thermostat
f - Cork Gasket (DO NOT Use Perfect Seal)
g - Sleeve (Turned in Lip Toward Thermostat)
h - Housing
i - Gasket With Continuity Rivets
6. Connect hoses to thermostat cover. Tighten hose clamps securely.

**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.

### Models With Serpentine Belt
- a - Thermostat Housing
- b - Thermostat
- c - Quad-Ring Seal
- d - Screws with Lockwashers
- e - Thermostat Cover
- f - Gasket
- g - Bleeder Valve

### 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 closed 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 later 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” page.)
3. After coolant has drained completely, coat threads of drain plugs with Quicksilver Perfect Seal and install drain plugs and hoses. Tighten clamps and drain plugs 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.”

Cleaning System

Closed Cooling Section

Closed cooling section of the 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 cooling system, refer to SECTION 6A. 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.

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

Flushing Seawater Section

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90-823226-1 996
a. All Models:
   (1) Install Quicksilver Flushing Attachment (or equivalent) over water intake openings in gear housing.
   (2) Connect hose between flushing attachment and water tap.

b. Models Equipped with Belt Driven Seawater Pickup Pump: In addition to supplying water to the drive (as previously outlined for “All Models”), perform the following.

   - Quicksilver Flushing Attachment
   - Garden Hose

   ! CAUTION

   If cooling system is to be flushed with boat in the water, seacock (if so equipped) must be closed, or water inlet hose must be disconnected and plugged to prevent water from flowing into boat.

   (1) Close seacock (if so equipped) or disconnect and plug seawater inlet hose.
   (2) Loosen hose clamp and remove seawater inlet hose at location shown. Connect an additional tap water hose to inlet fitting using an appropriate adaptor.

   NOTE: Drive unit is full when water is discharged out of drive unit, and/or seawater section of closed cooled system is full when water is discharged through propeller.

2. Partially open water tap (approximately 1/2 maximum capacity) and allow drive unit and cooling system to fill completely. Do not use full tap water pressure.

3. Place remote control lever in NEUTRAL position and start the engine. Operate engine at idle speed in NEUTRAL gear for 10 minutes or until discharge water is clear, then stop engine.

4. Shut off tap water. Remove hose and flushing attachment from drive unit. On belt driven seawater pickup pump models, also remove hose and flushing attachment from pump inlet.

5. Follow instructions “a” or “b.”

   ! CAUTION

   If boat is in the water, seacock (if so equipped) must remain closed until engine is to be restarted, to prevent contaminated water from flowing back into cooling system. If boat is not fitted with a seacock, water inlet hose must remain disconnected and plugged, to prevent water from flowing into cooling system and/or boat. As a precautionary measure, attach a tag to the ignition switch or steering wheel with the warning that the seacock must be opened or the water inlet hose reconnected prior to starting the engine.
a. If equipped with seacock: Observing precaution above, open seacock.

b. If NOT equipped with seacock: Observing precaution above, remove plug from seawater inlet hose and reconnect seawater inlet hose. Tighten hose clamps securely.

Draining Seawater Section of Closed Cooling System

**NOTICE**
For cold weather or extended storage information and procedures, refer to SECTION 1B.

Draining Precautions

**CAUTION**
If boat is in the water, seacock (water inlet valve), if so equipped, must be left closed until engine is to be restarted to prevent water from flowing back into cooling system and/or boat. If boat is not fitted with a seacock, water inlet hose must be left disconnected and plugged to prevent water from flowing back into cooling system and/or boat. As a precautionary measure, attach a tag to the ignition switch or steering wheel of the boat with the warning that the seacock must be opened or the water inlet hose reconnected prior to starting the engine.

IMPORTANT: Observe the following information to ensure complete draining of cooling system.
- Engine must be as level as possible.
- A wire should be repeatedly inserted into all drain holes to ensure there are no obstructions in passages.

IMPORTANT: To prevent threads in manifolds, elbows and cylinder blocks from rusting out during storage, reinstall plugs using Quicksilver Perfect Seal on threads. Never leave drain plugs out during storage.

**NOTE:** If possible, place a container under drains and hoses to prevent water from draining into boat.

1. Close seacock (if so equipped) or disconnect and plug seawater inlet hose.

2. Check that engine is as level as possible to ensure complete draining of cooling system.

3. Remove drain plugs from port and starboard exhaust elbows (if equipped).

4. Remove drain plug from heat exchanger.

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5. If equipped with 3 in. (76 mm) or 6 in. (152 mm) risers, remove drain plug as shown from port and starboard risers (if equipped).

![Image of drain plug](73175)

a - Drain Plug (Removed)

6. Repeatedly clean out drain holes using a stiff piece of wire. Do this until entire system is drained.

**NOTE:** It may be necessary to lift, bend, or lower hoses to allow water to drain completely when hoses are disconnected.

7. Remove the power steering fluid cooler seawater hose, as shown.

![Image of fluid cooler](72588)

Port Side Mounted Fluid Cooler

a - Hose, Seawater Pump to Cover

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Rear Mounted Fluid Cooler

a - Hose, From Seawater Pump (Bravo) Or From Transom Assembly (Alpha)

8. **On Engines Equipped with a Belt Driven Sea-water Pickup Pump:** Remove seawater inlet hose, as shown.

![Image of pickup pump](72532)

a - Seawater Pickup Pump
b - Seawater Inlet Host

9. Crank engine over SLIGHTLY with starter motor to purge any water trapped in seawater pickup pump. **DO NOT ALLOW ENGINE TO START.**

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**CAUTION**

If boat is in the water or is to remain in the water, seacock (if so equipped) must remain closed until engine is to be restarted, to prevent contaminated water from flowing back into cooling system. If boat is not fitted with a seacock, water inlet hose must be left disconnected and plugged, to prevent contaminated water from flowing into cooling system and/or boat. As a precautionary measure, attach a tag to the ignition switch or steering wheel with the warning that the seacock must be opened or the water inlet hose reconnected prior to starting the engine.
10. After seawater section of cooling system has been drained completely, coat threads of drain plugs with Quicksilver Perfect Seal and reinstall. Tighten drain plugs securely. Reconnect hoses and tighten all hose clamps securely. If **NOT equipped with seacock**: seawater inlet hose must remain disconnected and plugged until engine is to be restarted.

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### Filling Closed Cooling Section

**NOTICE**

See “Specifications” for approximate closed cooling system capacity and coolant recommendation.

**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. Fill closed cooling system with coolant mixture through heat exchanger fill neck until coolant level is 1 in. (.25 mm) below filler neck.

**CAUTION**

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.

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**CAUTION**

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.

3. 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.
4. After engine has reached normal operating temperature (thermostat is fully open), and coolant level remains constant, fill heat exchanger to bottom of filler neck.
5. 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.
6. Install pressure cap on heat exchanger.
7. Remove cap from coolant recovery reservoir and fill to FULL mark with coolant solution. Reinstall cap.
8. With engine still running, check hose connection, fittings and gaskets for leaks.

**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.

**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.

9. Recheck coolant level after first open-throttle boat test and add coolant, if necessary.
10. Maintain coolant level in coolant recovery reservoir between ADD and FULL marks with engine at normal operating temperature.
Closed Cooling System With Raw Water Flow Thru Exhaust Manifold (Engines With Serpentine Belt Only)

Maintaining Closed Cooling System Coolant

At least weekly, before starting engine, check to ensure that coolant is visible in coolant recovery bottle.

If coolant is not visible, check coolant section of cooling system (including coolant recovery system) for leaks and repair, as necessary. Refill coolant section with recommended coolant solution, as outlined under “Changing Closed Cooling System 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). 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 coolant section for leaks.

IMPORTANT: ALCOHOL OR METHANOL BASE ANTIFREEZE OR PLAIN WATER ARE NOT RECOMMENDED FOR USE IN CLOSED 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).

WARNING

Coolant section of Closed Cooling System is equipped with a 16 psi (110 kPa) pressure cap (fill cap). Before removing pressure cap, following, first allow engine to cool down, as sudden loss of pressure could cause hot coolant to boil and discharge violently. After engine has cooled down, turn pressure cap 1/4-turn to allow any pressure to escape slowly, then push down and turn cap all-the-way off.

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, inspect entire coolant section (especially coolant recovery system) for leaks and repair, as necessary.

IMPORTANT: When reinstalling pressure cap, be sure to tighten it until its contact stops on filler neck.
Checking Coolant for Alkalinity

**WARNING**

Coolant section of Closed Cooling System is equipped with a 16 psi (110 kPa) pressure cap (fill cap). Before removing pressure cap (in next step), first allow engine to cool down, as sudden loss of pressure could cause hot coolant to boil and discharge violently. After engine has cooled down, turn pressure cap 1/4-turn to allow any pressure to escape slowly, then push down and turn cap all-the-way off.

Coolant in closed cooling section of cooling system 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 pink 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 Fresh Water Coolant,” following.

Changing Coolant

**DRAINING INSTRUCTIONS**

1. Remove coolant recovery bottle and pour out coolant.

**WARNING**

Coolant section of Closed Cooling System is equipped with a 16 psi (110 kPa) pressure cap (fill cap). Before removing pressure cap, first allow engine to cool down, as sudden loss of pressure could cause hot coolant to boil and discharge violently. After engine has cooled down, turn pressure cap 1/4-turn to allow any pressure to escape slowly, then, push down and turn cap all-the-way off.

2. Remove pressure cap from heat exchanger.
3. Remove drain plugs on each side of cylinder block or fitting, as shown.

**CAUTION**

Avoid product damage. Do not disturb the Y-fitting when removing the drain plug. There is an ignition control “Knock Sensor” in the upper hole of the fitting. This sensor must not be loosened or removed. It is tightened to a critical specification at the factory.
4. Disconnect heat exchanger-to-circulating pump hose from pump and allow coolant to drain.

Typical Engine Shown
a - Heat Exchanger
b - Heat Exchanger-to-Circulating Pump Hose

5. After coolant has drained completely, reconnect hose, but, do not tighten hose clamps.

6. With drain plugs still removed, flush closed cooling section with plain water until discharge water is clear.

7. Disconnect heat exchanger-to-circulating pump hose once again and drain water.

8. After water has drained completely, apply Perfect Seal to threads of drain plugs and reinstall. Reconnect hose. Be sure to tighten drain plugs and hose clamps securely. Refill section with coolant, as explained following.

FILLING INSTRUCTIONS

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.
Pressure Cap Maintenance

**WARNING**

Allow engine to cool down 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 down, turn cap 1/4-turn to allow any pressure to escape slowly, then, push down and turn cap all-the-way off.

Pressure cap is designed to maintain a pressure of approximately 16 psi (110 kPa) in coolant 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 clean, inspected and pressure tested (at intervals specified in chart), as follows:

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. Have pressure cap pressure-tested by your local servicing dealer.
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.
9. Reinstall pressure cap, being sure to tighten until its contacts stops on filler neck.

![Diagram of Pressure Cap Maintenance](image_url)

a - Pressure Cap Sealing Surfaces
b - Coolant Recovery Passage

a - Rubber Seal
b - Coolant Recovery Gasket
c - Locking Tabs (1 Hidden)
Flushing Seawater Section

If boat is operated in salty, polluted or mineral-laden waters, seawater section of cooling system should be flushed periodically (preferably after each use) to remove corrosive water and prevent the accumulation of deposits in the system. Seawater section also should be thoroughly flushed prior to storage. To flush seawater section of cooling system, proceed as follows:

**IMPORTANT:** If cooling system is to be flushed with boat in the water, water inlet valve (if so equipped) MUST BE closed, or water inlet hose MUST BE disconnected and plugged, to prevent water from flowing into boat and/or cooling system.

**IMPORTANT:** If a valve is to be installed for the purpose of draining or flushing seawater section, valve MUST have an internal cross-sectional area equal to or greater than water inlet hose to prevent restricting water flow during normal operation. A 1-1/4 in. (32mm) or larger brass ball valve or gate valve is recommended.

1. Disconnect water inlet hose from end of seawater pickup pump.
2. Using appropriate connector, connect city water tap to pump inlet connection and partially open water tap (approximately 1/2 minimum capacity). DO NOT use full city water pressure.

**WARNING**

When flushing cooling system with boat out of the water, be certain that area in vicinity of propeller is clear and that no person is standing nearby. As a precautionary measure, it is recommended that propeller be removed.

**CAUTION**

DO NOT run engine above 1500 RPM, as suction created by seawater pickup pump may collapse water supply hole, interrupting water flow and causing engine to overheat.

**CAUTION**

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

3. Place the remote control lever in neutral position and start engine. Operate engine at idle speed in neutral gear for 10 minutes or until discharge water is clear, then stop engine.
4. Shut off water tap. Remove flushing connector from pump inlet and reconnect water inlet hose. Be sure to tighten hose clamp securely.

**IMPORTANT:** If boat is in the water, DO NOT open water inlet valve until engine is to be restarted, to prevent contaminated water from flowing back into engine. If boat is not fitted with a valve, leave water inlet hose disconnected and plugged. As a precautionary measure, attach a tag to the ignition switch or steering wheel with the warning that the seacock must be opened or the water inlet hose reconnected prior to starting the engine.
Cleaning Seawater Section of Heat Exchanger and Fluid Coolers

During operation, contaminants in the seawater may collect on tubes within the heat exchanger and fluid coolers reducing their cooling efficiency. This will cause coolant temperature to gradually rise until an overheating condition exists. To prevent this from happening, the seawater section of heat exchanger, and fluid coolers should be cleaned at least once a year or whenever a gradual rise in temperature is observed on water temperature gauge. Clean seawater section of heat exchanger and coolers.

1. Refer to “Cold Weather or Extended Storage - Seawater Section Draining Instructions” and drain seawater section.

2. Remove end cover, attaching screw, O-ring and rubber gasket, from port and starboard ends of heat exchanger.

3. Follow appropriate instructions “a” or “b”:
   a. **On Engines Without Cool Fuel System:** Proceed to Step 4.
   b. **On Engines With Cool Fuel System:** Disconnect the fore and aft seawater hoses from Cool Fuel System cooler.

4. Disconnect hoses from ends of power steering cooler.

5. Remove any debris from cavities on ends of heat exchanger and fluid coolers.
6. Clean tubes (passages) in heat exchanger and coolers by running a suitable wire brush through each tube.

![Wire Brush, Sized To Fit Passage](image1)

7. Rinse out heat exchanger and fluid cooler tubes with tap water from a hose to remove loosened particles.

8. Install end covers on heat exchanger as follows:
   a. Clean gasket mating surfaces on end covers of heat exchanger.
   b. Inspect gaskets and O-rings for damage and replace if necessary.
   c. Reinstall end covers with components shown. Torque end cover screws to 1 to 1-1/2 turns past hand tight.

![End Cover (Heat Exchanger)](image2)

9. Install all hoses previously disconnected. Tighten hose clamps securely.

10. Start engine and check for leaks.

**Cleaning Closed Cooling Section**

Closed Cooling section of cooling system should be cleaned whenever decreased cooling efficiency (due to internal deposits) is experienced.

A good grade automotive cooling system cleaning solution, that is compatible with copper and cast iron may be used to remove rust, scale or other foreign material. Manufacturer’s instructions of particular cleaner being used, should be carefully followed to ensure a safe and effective cleaning operation.

If coolant 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 (with thermostat removed) to allow water to reach behind deposits and force them out (refer to “Cooling System Water Flow Diagram,” following). Follow instructions which accompany flushing device for proper hookup and flushing procedure.
Cold Weather or Extended Storage

⚠️ CAUTION
Seawater section of cooling system MUST BE COMPLETELY drained for winter storage, or immediately after cold weather use, if the possibility of freezing temperatures exist or if the boat is to be stored for an extended period. Failure to comply may result in trapped water causing freeze and/or corrosion damage to engine.

Seawater Section Draining Instructions

IMPORTANT: Observe the following information to ensure complete draining of cooling system.

- Engine must be as level as possible.
- A wire should be repeatedly inserted into all drain holes to ensure there are no obstructions in passages.
- It may be necessary to lift, lower or bend disconnected hoses to allow water to drain completely.

⚠️ CAUTION
If seawater section of the Closed Cooling System is to be drained with boat in the water, seacock (water inlet valve), if boat is so equipped, must be closed or water inlet hose MUST BE disconnected from seawater pickup pump and plugged, to prevent water from flowing into cooling system and/or boat.

IMPORTANT: If a seacock (water inlet valve) is to be installed for draining purpose, valve used MUST have an internal cross-sectional area equal or greater than water inlet hose to prevent restricting water flow during normal operation. A 1-1/4 in. (32mm) or larger brass ball valve or gate valve is recommended.
3. Follow instructions “a” or “b”:
   a. **On Engines With Cool Fuel System:** Remove drain plug from Cool Fuel System seawater pipe.
   b. **On Engines Without Cool Fuel System:** Remove drain plug from port side seawater pipe.

4. Repeatedly clean out drain holes using a stiff piece of wire. Do this until entire system is drained.

5. Remove end cover, attaching screw, O-ring and rubber gasket, from port and starboard ends of heat exchanger.

**IMPORTANT:** Use compressed air to blow any remaining water from tubes in the heat exchanger.

Typical Engine and Heat Exchanger Shown
- a - End Cover
- b - Screw
- c - O-ring
- d - Rubber Gasket

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6B-42 - CLOSED COOLING MODELS
6. Follow instructions “a” or “b”:


   b. **On Engines Equipped WITH Engine Mounted Seawater Pump**:

      (1) Disconnect water inlet and outlet hose from seawater pump. Lower hoses and allow to drain. Reconnect hoses and tighten clamps securely.

      (2) Crank engine over slightly, with starter motor, to purge any water trapped in seawater pickup pump. Do not allow engine to start.

7. After cooling system has drained completely, re-install drain plugs and connect all seawater hoses. Tighten each securely.

   | CAUTION |

   If boat is in the water, water inlet valve (if so equipped) MUST be left closed until engine is to be restarted, to prevent water from flowing back into cooling system. If boat is not fitted with a valve, water inlet hose MUST BE left disconnected and plugged. As a precautionary measure, attach a tag to the ignition switch or steering wheel with the warning that the valve MUST BE opened or the hose reconnected prior to starting the engine.
Serpentine Drive Belt Adjustment

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

Typical

a - 5/8 In. Locking Nut
b - Adjustment Stud

2. Install drive belt on pulleys. Route belt for your type of power package.

3. Belt deflection is to be measured on the belt at the location that has the longest distance between two (2) pulleys.

4. Use 5/16 in. socket and tighten adjusting stud until the correct deflection of 1/4 in. (6 mm) (with moderate thumb pressure, on the belt at location indicated by arrow and dashed lines of the belt) is obtained at location shown.

5. Operate the engine for a short period of time. Recheck belt adjustment.
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:

   **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.

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

   **Primary Location**
   a - Plug
   b - Reducer Bushing
   c - Hose Connector

   **Raw Water Cooling Models - Alternate Location**
   a - Location for Hot Water Supply (Install Bayonet Fitting Here)
RETURN HOSE CONNECTION - ENGINES WITH RAW WATER OR CLOSED COOLING SYSTEM

Earlier Style Quicksilver Kit Location
a - T-Fitting

Later Style Quicksilver Kit Location
a - Pipe Plug
b - Hose Connector
c - T-Fitting
d - Hose Clamps