

# Cooling System

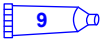
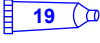


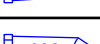
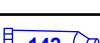

## Section 6A - All Models

### Table of Contents

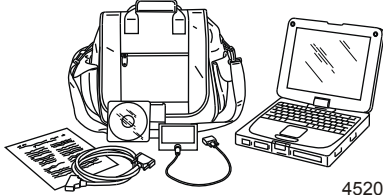


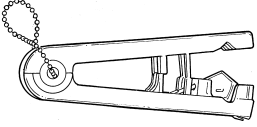
Specifications.....	6A-3	Brass Seawater Pump.....	6A-13
Flow Specifications.....	6A-3	Seawater Pump Exploded View.....	6A-13
Seawater Inlet Specifications.....	6A-3	Removal.....	6A-14
General Information.....	6A-3	Disassembly.....	6A-14
Seawater Pump Identification.....	6A-4	Cleaning and Inspection.....	6A-15
Seawater Inlet Hose.....	6A-4	Assembly.....	6A-15
Seawater Pump Output Test.....	6A-4	Installation.....	6A-21
Collecting Water Pressure Data.....	6A-5	Water Circulating Pump.....	6A-22
CDS Connection to the Engine.....	6A-6	Removal.....	6A-22
Seawater Pump Pulley Alignment.....	6A-6	Cleaning and Inspection.....	6A-22
Through-the-Hull Seawater Pickup System.....	6A-7	Installation.....	6A-22
Seawater Strainer.....	6A-8	Air-Actuated Drain System.....	6A-24
Seawater Pickup.....	6A-8	Air Manifold and Air Pump—Exploded View.....	6A-24
Seacock.....	6A-9	General Information.....	6A-26
Seawater Strainer.....	6A-10	Testing.....	6A-26
Seawater Strainer Mounting Requirements.....	6A-10	Air Manifold.....	6A-26
Seawater Strainer Installation.....	6A-10	Exhaust Manifold Drain Check Valve.....	6A-26
Cleaning the Seawater Strainer, if Equipped.....	6A-11	Check Valve.....	6A-27
Water Heater Installation.....	6A-11	Water Distribution Housing.....	6A-28
Supply Hose Connection—TKS Models.....	6A-12	Removal.....	6A-28
Supply Hose Connection—MPI Models.....	6A-12	Cleaning and Inspection.....	6A-28
Models with Closed Cooling.....	6A-12	Installation.....	6A-28
Return Hose Connection.....	6A-13		

**6  
A**

## Lubricant, Sealant, Adhesives

Tube Ref No.	Description	Where Used	Part No.
 9	Loctite 567 PST Pipe Sealant	Hose fitting threads and plastic plug threads	92-809822
 19	Perfect Seal	Water-circulating pump gasket and the threads of the attaching fasteners	92-34227Q02
 66	Loctite 242 Threadlocker	Impeller housing cover or seawater pump actuator housing screw threads	92-809821
 68	Loctite 609	Outer diameter of the front seal	Obtain Locally
 116	RTV 587 Ultra Blue Silicone Sealer	Sealing surfaces and screw shaft	92-809825
 139	Mercury 25W-40 Synthetic Blend 4-Stroke Engine Oil	Outer diameter of the bearings Seawater pump shaft	92-858052K01
 142	Loctite 598 RTV Sealant	Wear plate on the seawater pump housing cover or the actuator housing	Obtain Locally

## Special Tools

Computer Diagnostic System (CDS)	Bosch Automotive Service Solutions
 <p>4520</p>	<p>Monitors all electrical systems for proper function, diagnostics, and calibration purposes. For additional information, pricing, or to order the Computer Diagnostic System contact:</p> <p><a href="http://www.mercurymarinecds.spx.com/contact.aspx">www.mercurymarinecds.spx.com/contact.aspx</a> or call:</p> <p>USA - 1-800-345-2233 Canada - 800-345-2233 Europe - 49 6182 959 149 Australia - (03) 9544-6222</p>
Power Steering Pump Pulley Remover	SPX J-21239
 <p>25952</p>	Removes the pulley on the DHB power steering pumps and water pumps with smaller shafts.
Pulley Pusher Installer	91-93656A1
 <p>10047</p>	Installs the pulley onto the power steering pump.
Air Line Cutter	91-883502
 <p>24887</p>	Cuts water drain system air lines without collapsing them.

## Specifications

### Flow Specifications

#### Alpha Sterndrive Models

Model	Cooling	RPM	Minimum flow	Minimum pressure
All 4.3L models	Seawater cooling	4000	50 L/min (13 gal/min)	35 kPa (5 psi)
All 4.3L models	Closed cooling	4000	106 L/min (28 gal/min)	138 kPa (20 psi)

#### Bravo Sterndrive Models

Model	Cooling	RPM	Minimum flow	Minimum pressure
All 4.3L models	Seawater cooling	4000	50 L/min (13 gal/min)	69 kPa (10 psi)
All 4.3L models	Closed cooling	4000	106 L/min (28 gal/min)	138 kPa (20 psi)

### Seawater Inlet Specifications

Seawater Inlet Specifications	
Seawater inlet hose	32 mm (1-1/4 in.) I.D. (wire-reinforced)
Seawater pickup	Low restriction with 32 mm (1-1/4 in.) connections
Seacock (ABYC requirement)	
Seawater strainer (optional)	

## General Information

A Mercury MerCruiser engine has either a seawater-cooling system or a closed-cooling system. On engines with seawater cooling, the engine is cooled entirely by the water in which the boat is being operated. Closed-cooling systems use two cooling circuits, one of which mimics the seawater-cooling system. The second circuit uses a mixture of fresh water and coolant/antifreeze. Both types of systems are designed to maintain the engine operating temperature at approximately 71° C (160° F) for optimum performance, fuel economy, and durability.

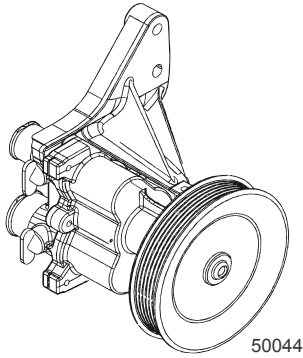
**NOTE:** *Seawater cooling is sometimes referred to as raw-water cooling or standard cooling. Closed cooling is also known as fresh-water cooling.*

The cooling system must receive a sufficient amount of seawater under all operating conditions to operate properly. The design and installation of the seawater supply system is the boat manufacturer's responsibility.

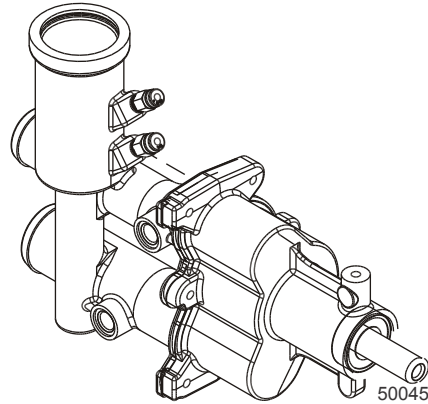
### **NOTICE**

**Without sufficient cooling water, the engine, the water pump, and other components will overheat and suffer damage. Provide a sufficient supply of water to the water inlets during operation.**

## Seawater Pump Identification



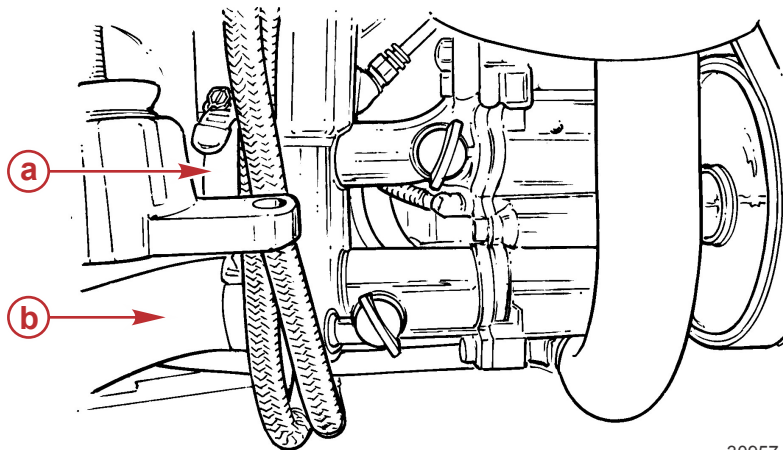
Brass seawater pump without air-actuated drain valve



Brass seawater pump with air-actuated drain valve

## Seawater Inlet Hose

- Use a 32 mm (1-1/4 in.) I.D. wire-reinforced hose that is capable of supporting 34 kPa (10 in. Hg) of vacuum to prevent the seawater inlet hose from collapsing from the seawater pump suction.
- The hose should be oil and seawater resistant.
- Use the shortest hose length possible, with minimal bends to maximize flow.
- All connections must be secured with hose clamps.
- Fasten the hoses to maintain proper routing and to prevent chafing or contact with other moving parts.



- a - Seawater inlet hose
- b - Seawater outlet hose to cooler

30957

## Seawater Pump Output Test

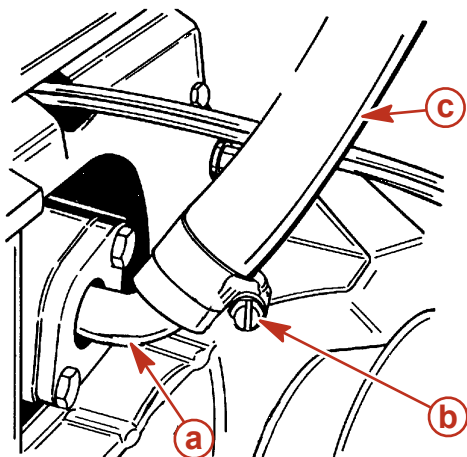
**IMPORTANT:** Note the following:

- The boat must be in the water for this test. This test cannot be performed with a flush-test device and water hose.
- 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.
- Perform this test accurately or problems may not be detected. 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:
  - Use a shop tachometer with an error rate of less than 5%. Do not use the boat tachometer as it may not have the necessary precision.
  - Use a stop watch to time the duration of the test to help ensure that accuracy is maintained.
  - Use a 9.5 L (10 US qt) or larger capacity container to measure the water output.

If the engine overheats, use this test to determine if a sufficient amount of water is being supplied to cool the engine:

1. **Models with engine-mounted seawater pumps:** Remove the water hose that is between the pump outlet and the engine, and replace it with another hose of the same diameter but approximately 1 m (3 ft) longer. The hose should have adequate wall thickness to prevent it from kinking when performing the test. Clamp the hose at the pump outlet only. Do not clamp the hose at the engine cooler end.

2. **Models with a sterndrive-mounted-seawater pump (Alpha Models):** Remove the water inlet hose, which is between the gimbal housing water tube and the engine, and replace it with another hose of the same diameter but approximately 1 m (3 ft) longer. The hose should be of adequate wall thickness to prevent it from kinking when performing the test. Clamp the hose at the gimbal housing water tube only. Do not clamp the hose at the engine end.



- a - Water tube
- b - Hose clamp
- c - Water hose

7802

3. Place a 9.5 L (10 US qt) or larger container near the unclamped end of the hose.
4. With the assistance of another person, using a shop tachometer, start the engine and adjust the speed to exactly 1000 RPM while holding the unclamped end of the hose on the connection on the engine. Remove the hose from the connection on the engine and direct the water flow into the container for exactly 15 seconds. At the end of 15 seconds, direct the water flow overboard, return the engine to idle and stop the engine. Reconnect the hose to the engine.
5. Measure the quantity of water discharged into the container and compare with the specifications given in the following chart.

**NOTE:** Values listed are minimum discharge quantities. Typical values at 1000 RPM are approximately 1.4 times those listed.

Engine-Mounted Seawater Pump Output for a 15-Second Period	
Model	Minimum Quantity
Bravo model with seawater cooling	7.1 L (7.5 US qt)
Bravo model with closed cooling and an external water pickup	9.0 L (9.5 US qt)
All inboard and tow sport models	9.0 L (9.5 US qt)

Alpha Sterndrive Seawater Pump Output for a 15-Second Period	
Model	Minimum Quantity
Alpha models	4.7 L (5.0 US qt)

6. Repeat the test four times to confirm the results.

## Collecting Water Pressure Data

Use the Mercury Computer Diagnostic System (CDS) to collect water pressure data on models equipped with a water pressure sensor.

Computer Diagnostic System (CDS)	Bosch Automotive Service Solutions
----------------------------------	------------------------------------

**IMPORTANT:** On seawater-cooled Alpha sterndrive models, collect the water pressure data between the transom and the seawater inlet on the power-assisted steering fluid cooler.

**IMPORTANT:** On Alpha and Bravo sterndrive models with closed cooling, the water pressure data must be collected within 152 mm (6 in.) of the seawater pump inlet.

## Specifications

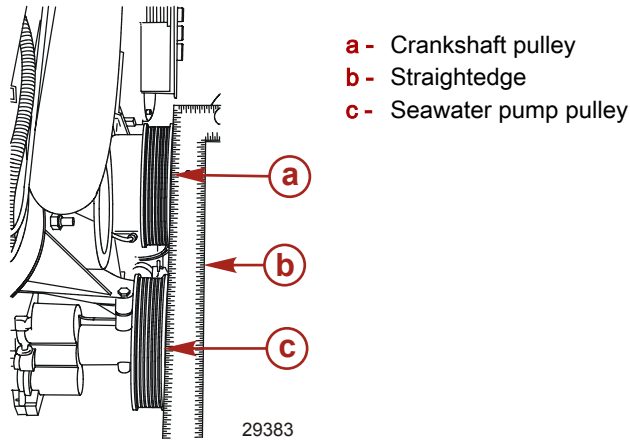
Refer to **Flow Specifications** at the beginning of this section.

## CDS Connection to the Engine

For complete information about selecting the appropriate engine interface cables, connecting CDS to the engine, and system program operation, refer to the CDS software help system provided with the CDS program. CDS Help is a quick-access reference tool that provides comprehensive information on all of the various topics related to the Mercury Marine Computer Diagnostic System including proper CDS connection to the engine.

## Seawater Pump Pulley Alignment

1. Place a straightedge across the seawater pump pulley and the crankshaft pulley.
2. The outer face of the seawater pump pulley may be slightly in front of or behind the outer face of the crankshaft pulley, but the two faces should be almost parallel.



3. The seawater pump pulley must be parallel within 1.5 mm (1/16 in.) of the straightedge. If it is not, replace the bracket.

## Seawater Pump Bracket Replacement

1. Install the pump onto the new bracket. Tighten the seawater-pump-to-bracket fasteners to the specified torque.

Description	Nm	lb-in.	lb-ft
Seawater pump attachment fasteners	10	88	–

**NOTE:** If the original seawater pump bracket had washers between it and the engine cylinder block, discard them. The new bracket does not use washers between it and the cylinder block.

**NOTE:** A stiffening tab has been added to the new bracket. Consequently, the location of the mounting stud and bolt has to be changed.

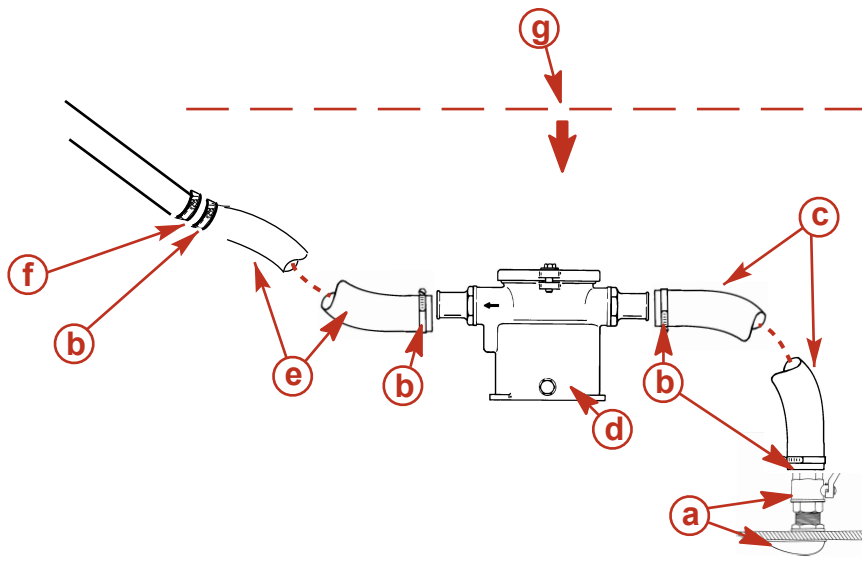
2. Move the stud from the lower cylinder block hole to the one that had the bolt in it.
3. Install the bracket onto the stud and then rotate it to install the original bolt through the lower bracket hole.
4. Tighten the seawater pump bracket fasteners to the specified torque.

Description	Nm	lb-in.	lb-ft
Seawater pump bracket fasteners	41	–	30

5. Install the serpentine belt and adjust it until there is a 13 mm (1/2 in.) deflection between the two upper pulleys.

## Through-the-Hull Seawater Pickup System

**IMPORTANT:** Use a 32 mm (1-1/4 in.) I.D. wire-reinforced hose that is capable of supporting 34 kPa (10 in. Hg) vacuum when suction is created by the seawater pump impeller.



Typical installation shown with a through-the-hull seawater pickup

- a - Seawater pickup and seacock
- b - Hose clamp
- c - Seawater hose to seawater strainer
- d - Quicksilver seawater strainer
- e - Seawater hose to engine
- f - Seawater pump hose connector (if equipped)
- g - Below seawater pump level

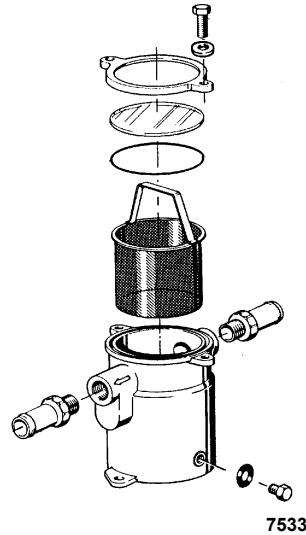
**IMPORTANT:** Do not install the seawater pickup directly in line with the propeller, as the pickup may create turbulence and allow air to flow into the propeller slipstream. This will cause propeller ventilation and will adversely affect boat performance.

**IMPORTANT:** Make gradual bends in the seawater hoses to avoid kinks. Hoses must not come in contact with steering system components, engine coupler, or driveshaft.

- The seawater pickup must be large enough to permit sufficient seawater flow to engine seawater pump for adequate engine cooling.
- The seawater pickup also must supply a positive head while underway.
- The seawater pickup should be located as close to the seawater pump inlet as possible and in an area where an uninterrupted, solid stream of seawater will flow when the boat is underway.

## Seawater Strainer

A seawater strainer is recommended if the boat is operated in an area with a high debris content. Use 32 mm (1-1/4 in.) I.D. wire-reinforced hoses on the inlet and outlet sides of the strainer fittings. The strainer must be sized to minimize restriction (refer to **Specifications**) and to provide a reasonable service interval. Locate the strainer in an area that is accessible for servicing. If the boat is not equipped with a seacock, the strainer should be located above the waterline to prevent seawater entry into the boat when servicing. The strainer must have a provision to allow draining in freezing temperatures.



Typical seawater strainer

## Seawater Pickup

Either a through-transom or through-hull seawater pickup can be used. Select the pickup location to minimize the length of the 32 mm (1-1/4 in.) I.D. wire-reinforced seawater inlet hose, while providing an optimum location for seawater pickup. The location should be in an area that provides a solid, air-free flow of seawater under all operating conditions. Avoid areas with a disturbed seawater flow, such as those behind or in close proximity to the propeller. Locations that are too far forward or outboard should also be avoided as these are prone to aeration problems at high boat-trim angles and while turning.

**IMPORTANT: Do not install the seawater pickup directly in line with the propeller, as the pickup may create turbulence and allow air to flow into the propeller slip-stream. This will cause propeller ventilation and will adversely affect boat performance.**

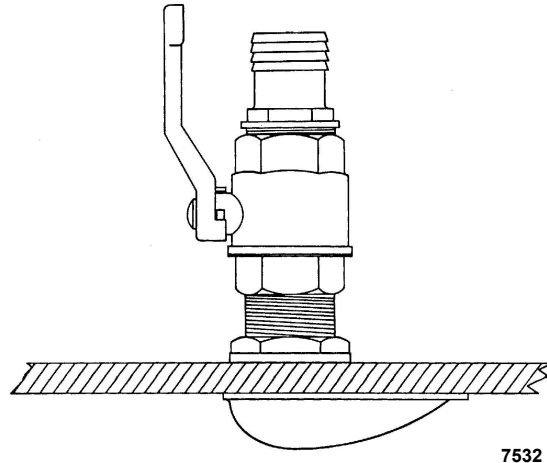
Openings in seawater pickup should be a maximum of approximately 3 mm (1/8 in.) to prevent large debris from entering and clogging the cooling system.

**IMPORTANT: Use a seawater strainer if the seawater pickup openings exceed 3 mm (1/8 in.).**

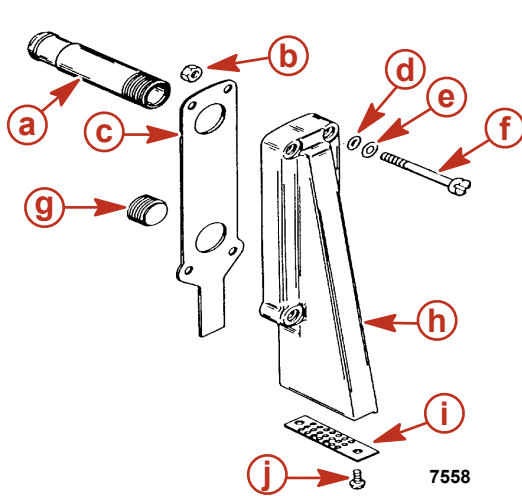
Some industry standards and regulations require that the pickup be connected into the boat's bonding system to minimize stray current corrosion. Refer to applicable standards and regulations for more details.



**IMPORTANT:** An external seawater pickup must have an integral seacock.





Seawater pickup with an integral seacock



**Transom pickup**

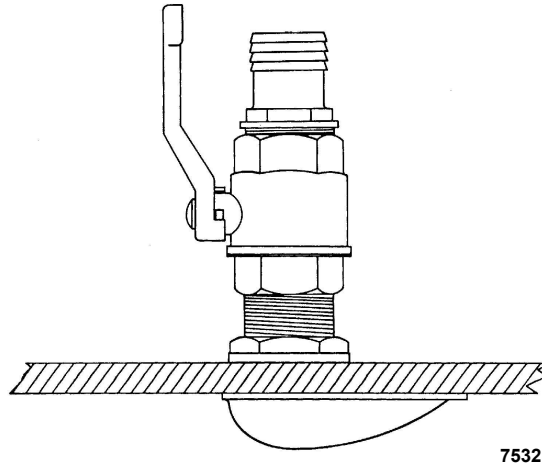
- a- Hose fitting - apply Loctite 567 to the threads
- b- Nut (4)
- c- Gasket
- d- O-ring (4)
- e- Washer (4)
- f- Screw (4)
- g- Plastic plug - apply Loctite 567 to the threads
- h- Pickup - apply RTV 587 to the sealing surfaces
- i- Screen
- j- Screw (2) - apply RTV 587 to the shaft

Tube Ref No.	Description	Where Used	Part No.
 9	Loctite 567 PST Pipe Sealant	Hose fitting threads and plastic plug threads	92-809822
 116	RTV 587 Ultra Blue Silicone Sealer	Sealing surfaces and screw shaft	92-809825

**Seacock**

The American Boat and Yacht Council (ABYC) and other industry standards and regulations require the use of a seacock on certain types of applications to stop the entry of seawater in the event of a leak in the cooling system. Refer to applicable standards and regulations for specific requirements. The seacock also allows the seawater to be shut off when servicing the engine.

The seacock must provide minimum restriction to seawater flow (refer to **Specifications**). A ball valve or gate valve is recommended. The ball valve is most common and is typically equipped with a lever type handle that operates in a 90° arc. This design gives a clear indication of whether the valve is open or shut. Industry standards require that the seacock be rigidly attached to the hull at the seawater pickup. The seacock's location should be accessible for quick, easy operation.



Typical seacock

## Seawater Strainer

### Seawater Strainer Mounting Requirements

Use a properly sized strainer to maintain an adequate supply of water for cooling the engine.

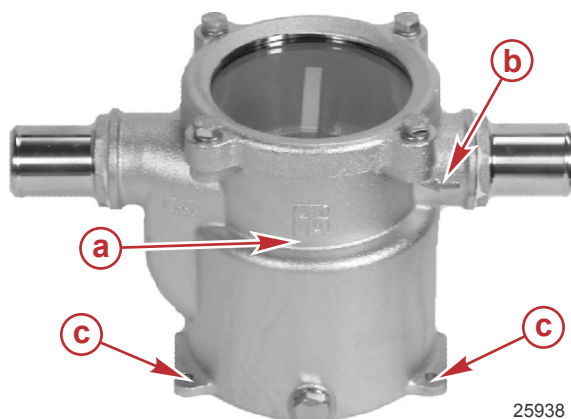
- Mount the seawater strainer in a location that will allow easy access for servicing, and maintenance.
- Mount the seawater strainer in a vibration free location.
- Do not mount the seawater strainer on the engine.
- If not equipped with a seacock, mount the seawater strainer above the seawater-line to prevent seawater entry into the boat when servicing.
- Use a 32 mm (1-1/4 in.) I.D. wire-reinforced hose.
- Do not allow hoses to contact hot or moving parts on the engine.

### Seawater Strainer Installation

Refer to the manufacturer's instructions for detailed installation, operation, and maintenance.

**IMPORTANT: Use the following guidelines when installing a Mercury seawater strainer.**

1. Position the seawater strainer in an appropriate location, below the level of the seawater pump.
2. Ensure that the arrow that indicates the direction of seawater flow points toward the seawater pump.
3. Install the seawater strainer using flat washers and lag bolts.



- a - Seawater strainer
- b - Arrow indicating direction of water flow
- c - Mounting bolt hole location (bolts not shown)

## Cleaning the Seawater Strainer, if Equipped

### NOTICE

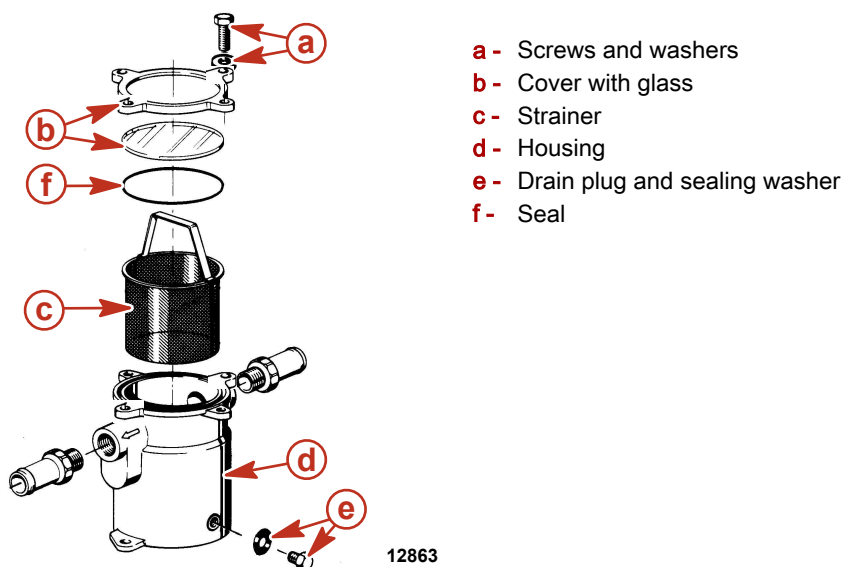
An open seawater strainer or seacock during some service or maintenance procedures can introduce water into the boat, causing damage or sinking the boat. Always close the water supply from the seawater pump, water inlet, or seacock when performing service or maintenance on the cooling system.

1. With the engine off, close the seacock, if equipped, or remove and plug the seawater inlet hose.
2. Remove the screws, washers, and cover.
3. Remove the strainer, drain plug, and sealing washer.
4. Clean all the debris from the strainer housing. Flush both the strainer and housing with clean water.
5. Check the cover gasket and replace when damaged or if it leaks.
6. Reinstall the strainer, drain plug, and sealing washer.

### CAUTION

Seawater leaking from the seawater strainer could cause excess water in the bilge, damaging the engine or causing the boat to sink. Do not overtighten the cover screws, or the cover may warp and introduce seawater into the bilge.

7. Install the seal and cover using the screws and washers. Do not overtighten the cover screws.



- a - Screws and washers
- b - Cover with glass
- c - Strainer
- d - Housing
- e - Drain plug and sealing washer
- f - Seal

8. Open the seacock, if equipped, or remove the plug and reconnect the seawater inlet hose.
9. Upon first starting the engine, check for leaks or air in the system that would indicate an external leak.

## Water Heater Installation

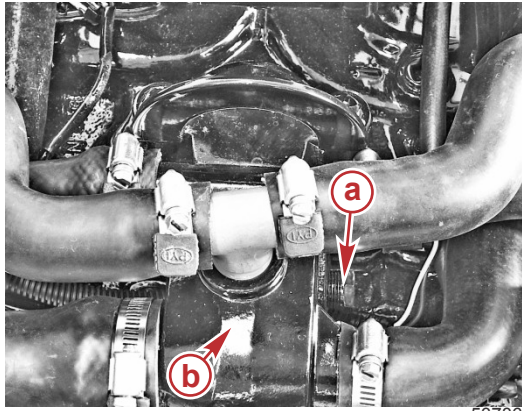
**IMPORTANT:** When connecting a cabin heater or water heater:

- The supply hose (from engine to heater) and return hose (from heater to engine) must not exceed 16 mm (5/8 in.) inside diameter (I.D.).
- Make heater connections only at the locations shown.
- Refer to the manufacturers' instructions for complete installation information and procedures.
- Do not reposition the engine temperature switch.

### NOTICE

Blocking the coolant flow at the heater can cause reduced engine performance or overheating. Check for continuous coolant flow from the engine to the water circulating pump.

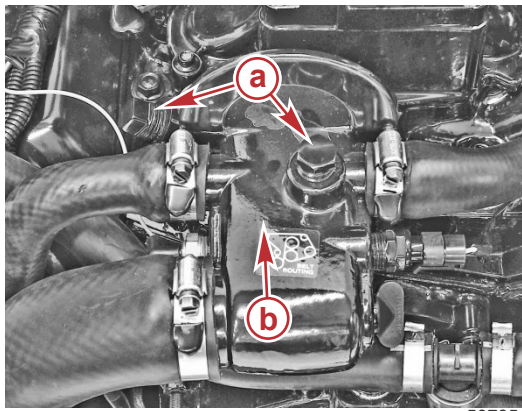
## Supply Hose Connection—TKS Models



53786

- a** - Location for hot water supply
- b** - Thermostat housing

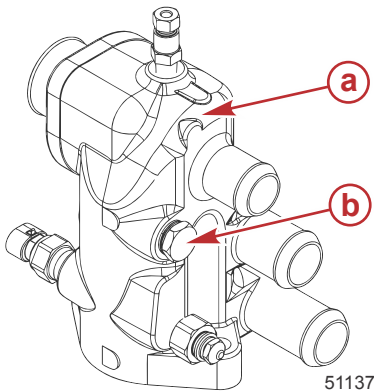
## Supply Hose Connection—MPI Models



53785

- a** - Location for hot water supply
- b** - Thermostat housing

## Models with Closed Cooling

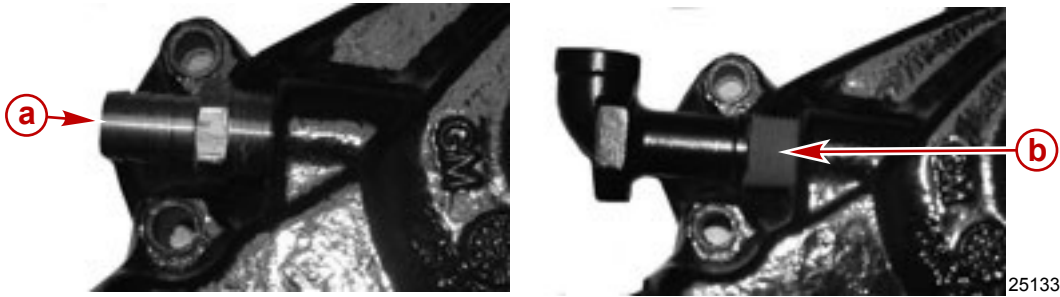


51137

- a** - Thermostat housing
- b** - Location for hot water supply

## Return Hose Connection

**IMPORTANT:** A special fitting, 865526, may be used if the hex of the standard hose barb fitting contacts the water pump housing, not allowing the fitting to turn before the fitting is tight.

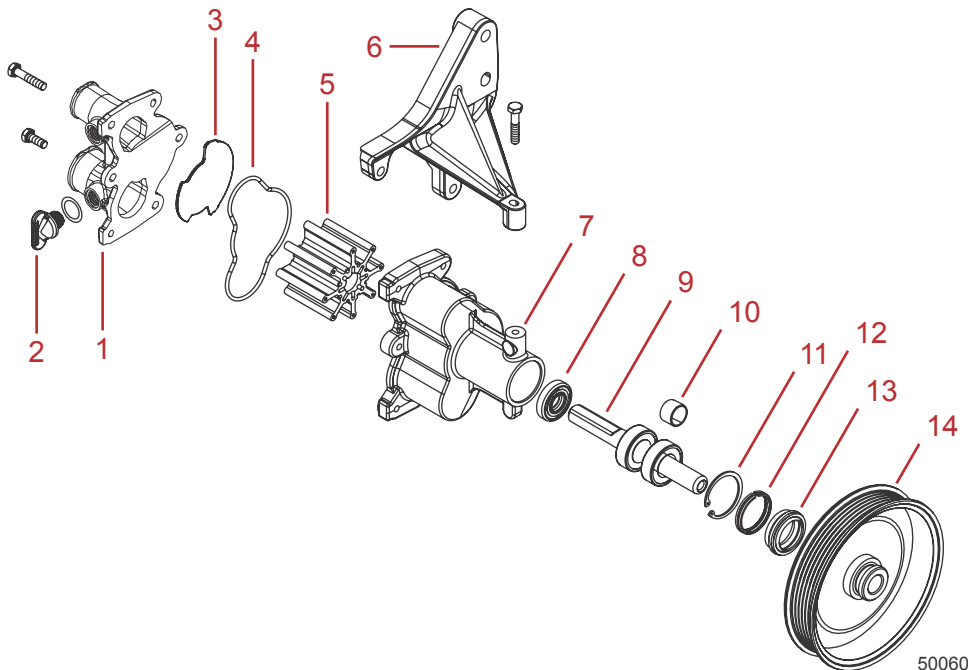


25133

- a - Standard fitting
- b - Special fitting

## Brass Seawater Pump

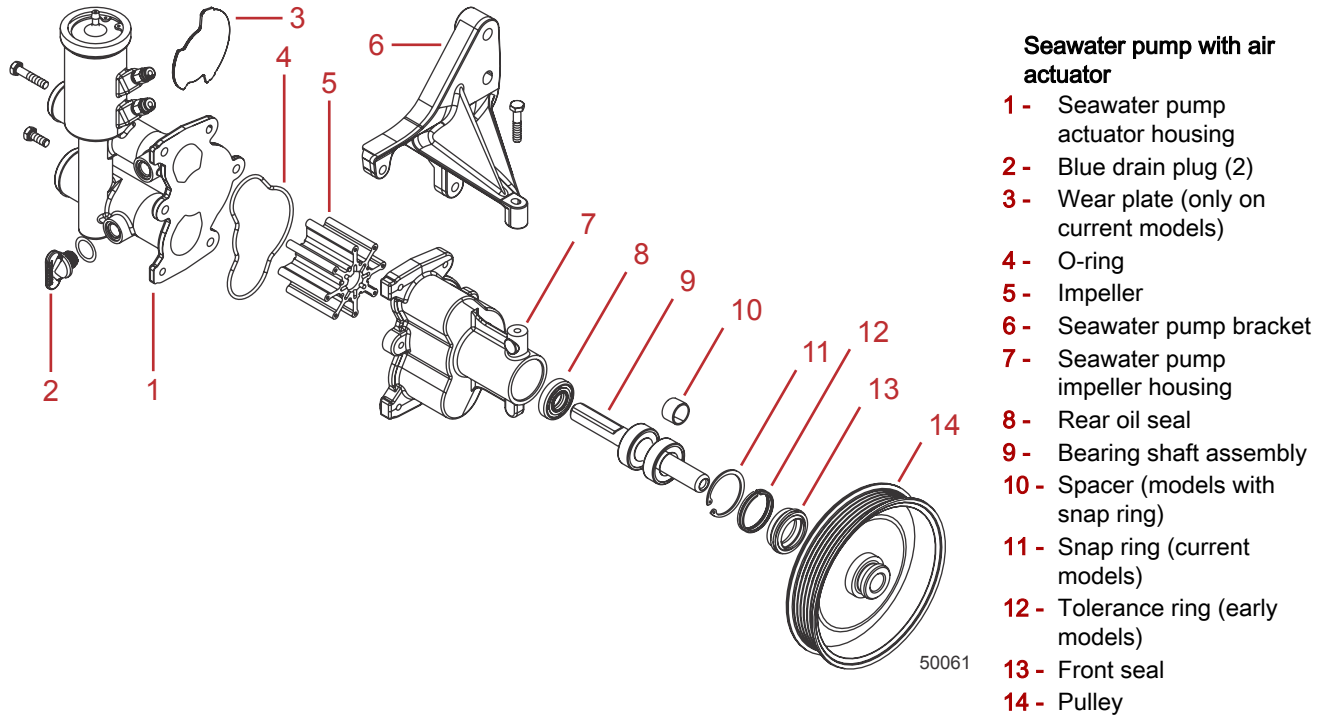
### Seawater Pump Exploded View



#### Seawater pump without air actuator

- 1 - Seawater pump impeller housing cover
- 2 - Blue drain plug (2)
- 3 - Wear plate (only on current models)
- 4 - O-ring
- 5 - Impeller
- 6 - Seawater pump bracket
- 7 - Seawater pump impeller housing
- 8 - Rear oil seal
- 9 - Bearing shaft assembly
- 10 - Spacer (models with snap ring)
- 11 - Snap ring (current models)
- 12 - Tolerance ring (early models)
- 13 - Front seal
- 14 - Pulley

50060



**Seawater pump with air actuator**

- 1 - Seawater pump actuator housing
- 2 - Blue drain plug (2)
- 3 - Wear plate (only on current models)
- 4 - O-ring
- 5 - Impeller
- 6 - Seawater pump bracket
- 7 - Seawater pump impeller housing
- 8 - Rear oil seal
- 9 - Bearing shaft assembly
- 10 - Spacer (models with snap ring)
- 11 - Snap ring (current models)
- 12 - Tolerance ring (early models)
- 13 - Front seal
- 14 - Pulley

**Removal**

1. Drain the seawater section of the cooling system.
2. Remove both of the hoses from the aft side of the seawater pump.
3. For models equipped with an air-actuated drain valve:
  - a. Disconnect the vent hose from the top of the drain valve.
  - b. Disconnect the air hoses from the drain valve, by pushing in and holding the plastic ring around the air hose, and pulling the air hose out of the fitting.

**IMPORTANT: If a belt is to be reused, it should be installed in the same direction of rotation as before.**
4. Remove the serpentine drive belt.
5. Remove the seawater pump and bracket assembly.

**Disassembly**

**CAUTION**

Removing the snap ring from the top of the air-actuated drain valve can allow the components to come apart forcefully, resulting in injury or product damage. Do not try to repair the valve or remove the snap ring.

1. Remove the seawater pump mounting bracket.
  2. Remove the seawater pump pulley using an appropriate puller.
- |                                    |             |
|------------------------------------|-------------|
| Power Steering Pump Pulley Remover | SPX J-21239 |
|------------------------------------|-------------|
3. Remove the seawater pump impeller housing cover or the seawater pump actuator housing, if applicable.
  4. Remove the O-ring.
  5. Remove the impeller.
  6. Remove the seal from the front of the seawater pump housing.
  7. Remove the tolerance ring or snap ring (whichever is present).
  8. Press the bearing shaft assembly out of the housing from the impeller side.
  9. Remove the rear oil seal.

## Cleaning and Inspection

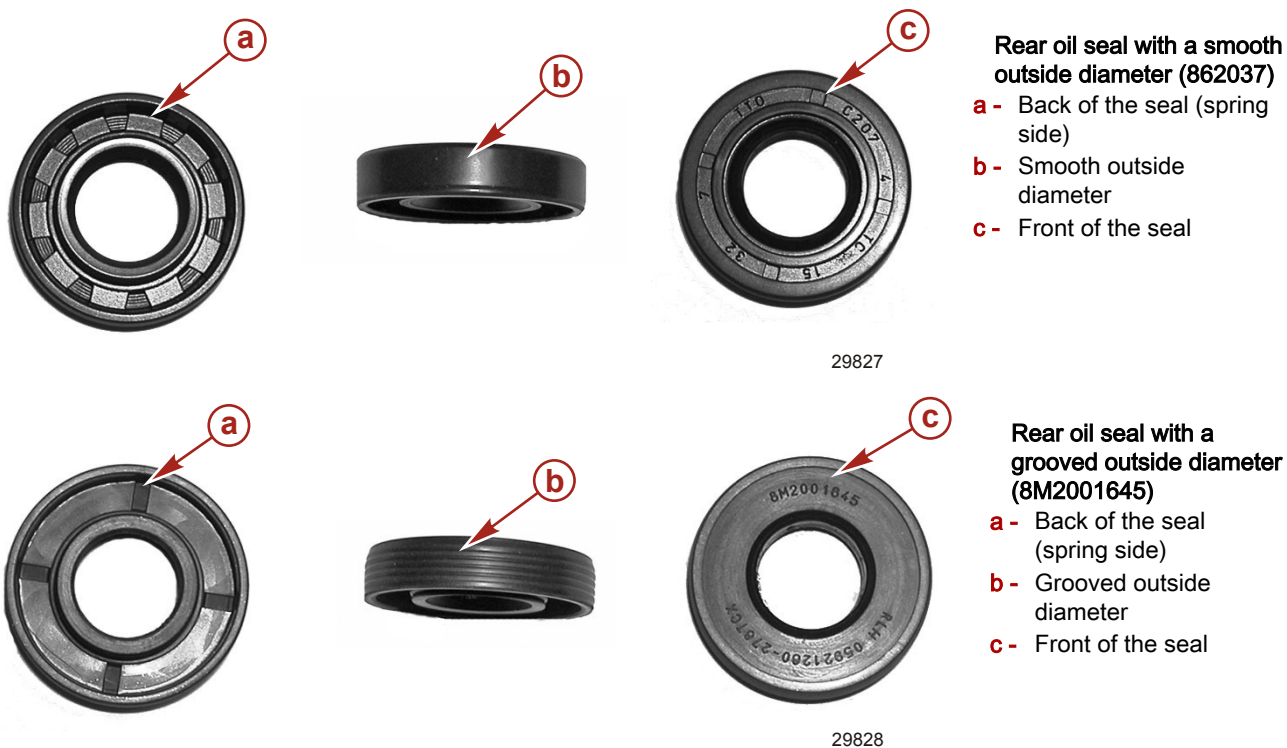
### ⚠ WARNING

Spin-drying bearings with compressed air can cause serious injury or death. The bearings can explode, even if spun at very slow speeds. Do not allow the bearings to spin when drying with compressed air.

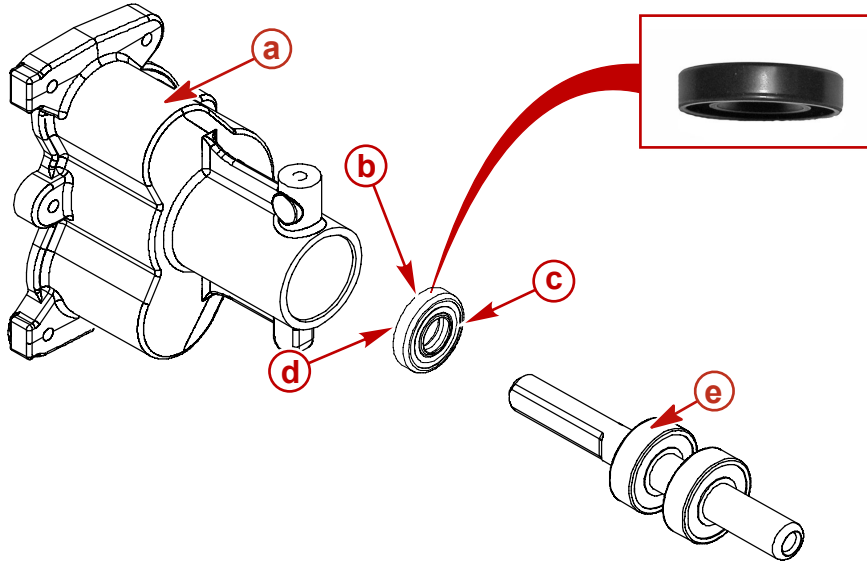
1. Clean the metal parts in solvent and dry with compressed air.
2. Clean the gasket material and sealant from the sealing surfaces.
3. Inspect the bearing housing. Examine the surfaces where the bearings contact the housing for evidence of the bearing outer races turning in the housing.
4. Inspect the seals in the bearing housing for signs of damage or leaks.
5. Rotate the bearing shaft in the bearing housing. Replace the bearing shaft assembly if the bearings feel rough or if either end of the shaft wobbles.
6. Inspect the impeller housing and impeller housing cover surfaces where the impeller rides. Replace the impeller housing if significant grooves exist.
7. If equipped with a wear plate, inspect the wear plate for grooves and replace as necessary.
8. If not equipped with a wear plate, inspect the face of the impeller housing cover for grooves. The face of a brass impeller housing cover can be resurfaced to remove grooves. Remove a maximum of 1.0 mm (0.040 in.) of material.
9. Inspect the pump impeller and replace it if any of the following conditions exist:
  - Wear on the ends and tips of the blades
  - Cracks in the area where the blades flex
  - Cracks in the impeller hub
  - Blade set (blades remain curved)
10. Inspect the pump pulley for bends or cracks.
11. Inspect the serpentine belt for excessive wear.

## Assembly

**IMPORTANT:** Rear oil seal 862037 is superseded by 8M2001645. However, the two seals are not installed in the same manner. Using the illustrations below, confirm the rear oil seal part number prior to assembling the seawater pump.



1. For the rear oil seal with a smooth outside diameter (862037), orient the back (spring side) of the seal toward the impeller housing.

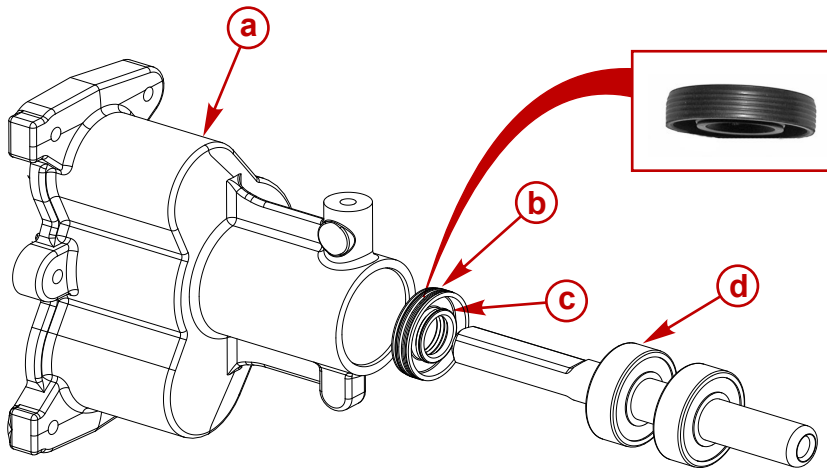


**Orientation of the rear oil seal with a smooth outside diameter (862037)**

- a** - Seawater pump impeller housing
- b** - Smooth outside diameter of the rear oil seal
- c** - Front of the rear oil seal
- d** - Back of the seal (spring side)
- e** - Shaft bearing

30205

2. For the rear oil seal with a grooved outside diameter (8M2001645), orient the front of the seal toward the impeller housing.

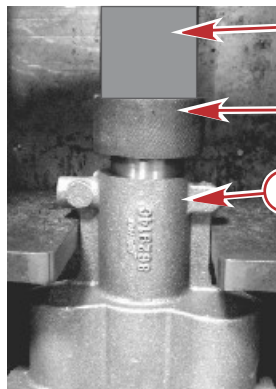


**Orientation of the rear oil seal with a grooved outside diameter (8M2001645)**

- a** - Seawater pump impeller housing
- b** - Grooved outside diameter of the rear oil seal
- c** - Back of the rear oil seal (spring side)
- d** - Shaft bearing

30206

3. Using a suitable mandrel, press the seal to seat it in the housing.




46185

- a** - Press
- b** - Suitable mandrel
- c** - Housing

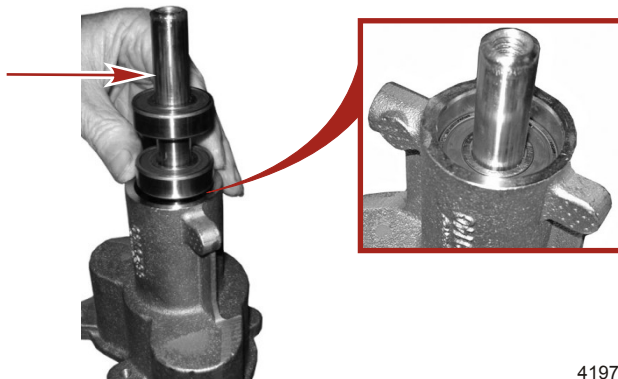
4. Lubricate the bearing shaft and the outer diameter of the bearings with clean engine oil.



Tube Ref No.	Description	Where Used	Part No.
 139	Mercury 25W-40 Synthetic Blend 4-Stroke Engine Oil	Outer diameter of the bearings	92-858052K01

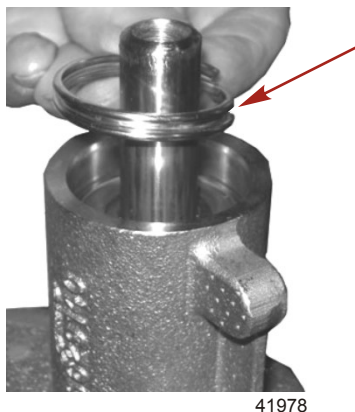
**IMPORTANT: The bearing shaft assembly should slip easily into the bearing housing using only minimal force.**

5. Install the bearing shaft assembly into the impeller housing. The end of the shaft with flat surfaces should extend into the impeller cavity. Clean any assembly lube or oil from the forward end of the impeller housing.




Bearing shaft assembly

6. Insert the tolerance ring (early models) or snap ring (current models) into the impeller housing.

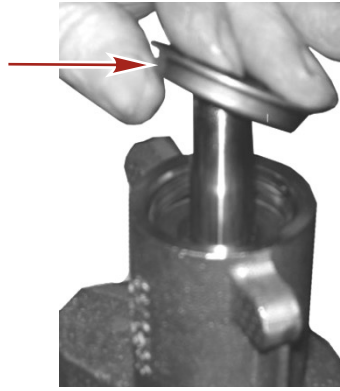


Tolerance ring (early models)

7. Apply Loctite 609 to the outer diameter of the front seal. Do not allow adhesive to contact the seal portion or the bearing shaft assembly.

Tube Ref No.	Description	Where Used	Part No.
 68	Loctite 609	Outer diameter of the front seal	Obtain Locally

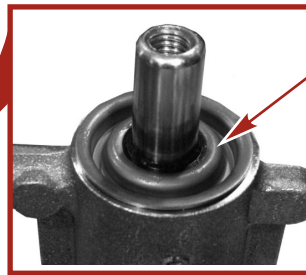
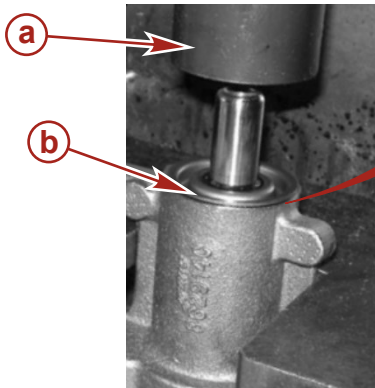
8. Install the front seal onto the bearing shaft assembly and slide it down until it contacts the end of the impeller housing.



41979

Front seal

9. Use a suitable mandrel that will press the front seal without contacting the bearing shaft. Press the front seal into place. Wipe away excess adhesive.

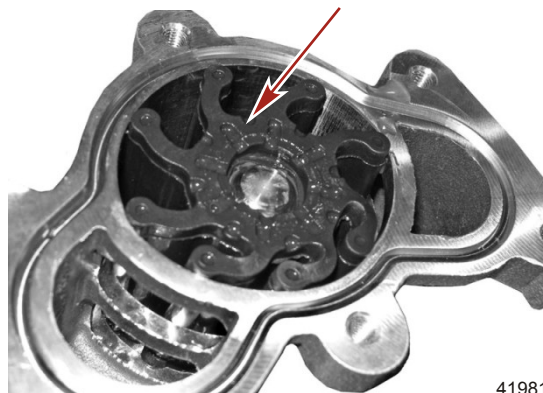


- a - Hollow mandrel on press
- b - Front seal
- c - Front seal seated

41980

**IMPORTANT:** Only use the inner wear plate with the shorter impeller. This impeller is colored orange on alternate vanes. The plate and shorter impeller come as a set. Standard length impellers are also available.

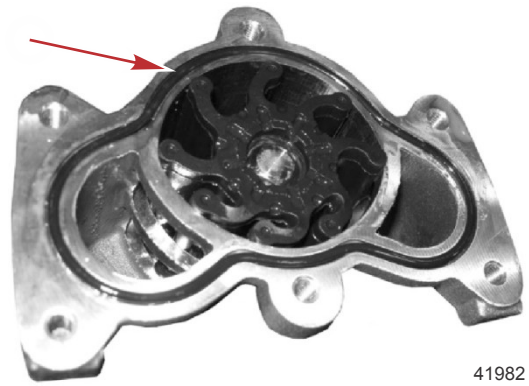
10. Lubricate the impeller with soapy water. Align the flat surfaces of the impeller hub and bearing shaft, and install the impeller into the impeller cavity.



41981

Impeller installed

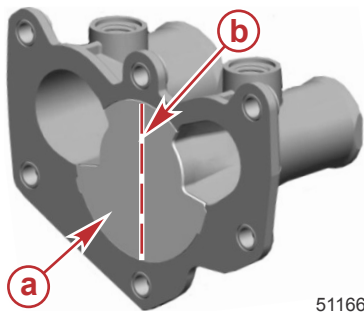
11. Install the O-ring into the groove in the impeller housing rear face.



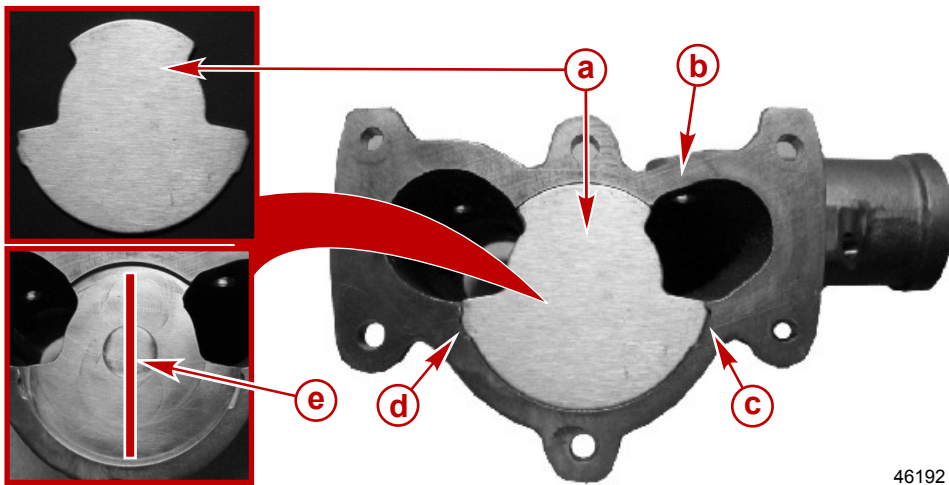
O-ring installed in groove

12. If the housing cover or actuator housing has a wear plate, and the plate is not already installed:


a. Apply a 3 mm (1/8 in.) bead of Loctite 598 to the housing cover.



**Composite housing cover with wear plate**  
**a -** Stainless steel wear plate  
**b -** Bead of adhesive (behind the wear plate)



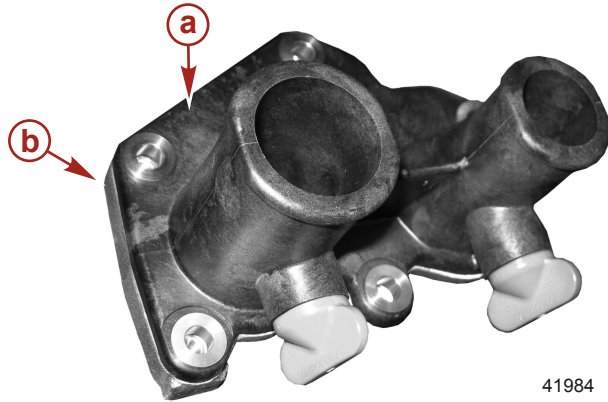
**Brass actuator housing with wear plate**  
**a -** Stainless steel wear plate  
**b -** Actuator housing  
**c -** Large tab  
**d -** Small tab  
**e -** Adhesive on the actuator housing

Tube Ref No.	Description	Where Used	Part No.
 142	Loctite 598 RTV Sealant	Wear plate on the seawater pump housing cover or the actuator housing	Obtain Locally

**IMPORTANT:** Position the wear plate on the housing cover or actuator housing and attach the assembly to the impeller housing within five minutes of applying the Loctite 598.

b. Install the stainless steel wear plate.

13. Align and install the impeller housing cover or the seawater pump actuator housing (if equipped) onto the impeller housing assembly.

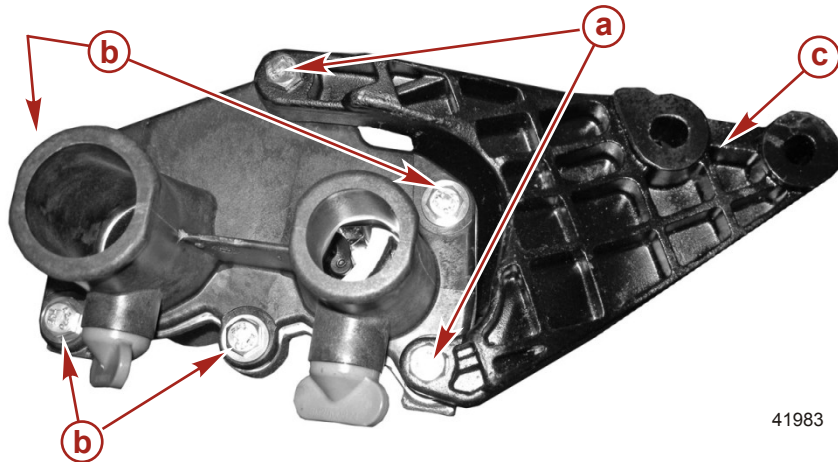


- Seawater pump actuator housing is not shown  
**a** - Impeller housing cover  
**b** - Seawater pump

14. Apply Loctite 242 to the threads of the impeller housing cover or the seawater pump actuator housing screws.

Tube Ref No.	Description	Where Used	Part No.
66	Loctite 242 Threadlocker	Impeller housing cover or seawater pump actuator housing screw threads	92-809821

15. Install the four screws and tighten to specification.



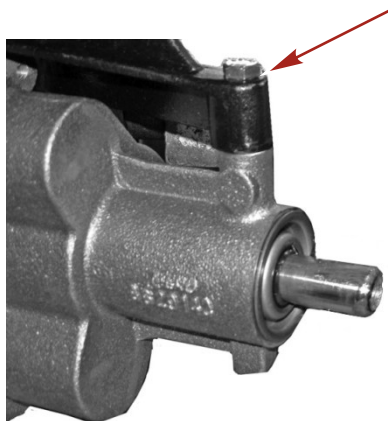
- a** - Seawater pump bracket screw (2)  
**b** - Impeller housing cover screw (4)  
**c** - Seawater pump bracket

Description	Nm	lb-in.	lb-ft
Impeller housing cover or seawater pump actuator housing screws	10	88	

16. Install the seawater pump bracket onto the seawater pump assembly. Install the two long screws through the bracket and into the seawater pump assembly. Tighten the screws to the specified torque.


Description	Nm	lb-in.	lb-ft
Seawater pump bracket to seawater pump assembly screws	10	88	

17. Apply Loctite 242 to the threads of the remaining seawater pump bracket screw that attaches the seawater pump bracket to the top of the seawater pump assembly. Install and tighten the screw to specification.



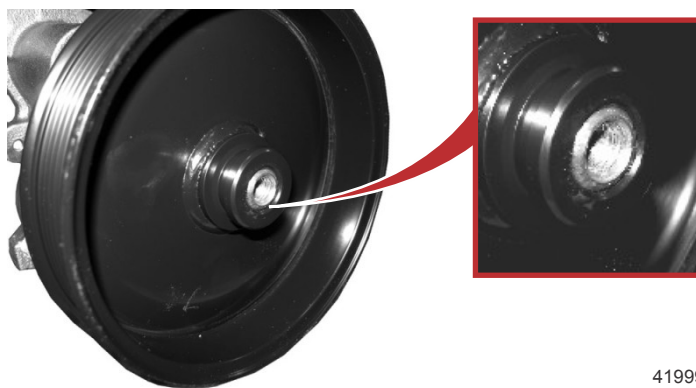
41985

Seawater pump bracket long screw

Tube Ref No.	Description	Where Used	Part No.
 66	Loctite 242 Threadlocker	Impeller housing cover or seawater pump actuator housing screw threads	92-809821


Description	Nm	lb-in.	lb-ft
Seawater pump bracket to seawater pump assembly screws	10	88	

18. Lubricate the seawater pump shaft with clean engine oil, and install the seawater pump pulley onto the shaft using an appropriate pulley installer. Ensure that the end of the shaft is even with the face of pulley hub.



41999

Seawater pump pulley installed

Tube Ref No.	Description	Where Used	Part No.
 139	Mercury 25W-40 Synthetic Blend 4-Stroke Engine Oil	Seawater pump shaft	92-858052K01

Pulley Pusher Installer	91-93656A1
Power Steering Pump Pulley Remover	SPX J-21239

19. Install the blue drain plugs in the seawater pump cover or actuator housing, if removed.

## Installation

1. Fasten the seawater pump and bracket to the engine. Tighten the bolts to specification.

Description	Nm	lb-in.	lb-ft
Seawater pump bracket bolt	40		30

2. Install the seawater inlet and outlet hoses. Tighten the hose clamps securely.
3. For models equipped with an air-actuated drain valve:
  - a. Install the vent hose onto the top of the drain valve.  
*NOTE: The air lines for the air-actuated drain valve are two different sizes.*
  - b. Install the appropriate air lines into the appropriate fittings on the air-actuated drain valve by fully inserting the air lines into the fittings. Pull on the air lines to ensure that they are properly installed.

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

## NOTICE

**Without sufficient cooling water, the engine, the water pump, and other components will overheat and suffer damage. Provide a sufficient supply of water to the water inlets during operation.**

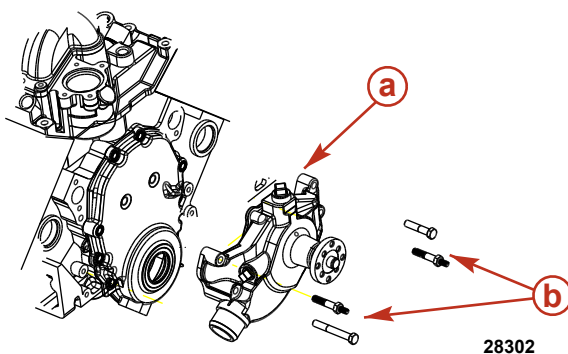
5. Supply cooling water to the engine.
6. Start the engine and check for leaks.

## Water Circulating Pump

### Removal

*NOTE: The water circulating pump pulley on warm manifold models with closed cooling is a new design and cannot be replaced with a previous Mercury MerCruiser water circulating pump pulley.*

1. Allow the engine to cool.
2. Drain the seawater or closed-cooling section of the engine.
3. Remove the hoses attached to the water circulating pump.
4. With the drive belt installed to prevent rotation, loosen the water circulating pump pulley bolts.  
**IMPORTANT: If a belt is to be reused, it must be installed in the same direction of rotation as before.**
5. Mark the direction of belt rotation and remove the serpentine drive belt.
6. Remove the water circulating pump bolts and pulley.
7. Remove the fasteners and the water circulating pump.



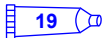
- a - Water circulating pump
- b - Fasteners

### Cleaning and Inspection

1. Clean all gasket material and sealant from the sealing surfaces.
2. Check the bearing for excessive play.
3. Check the bearing for abnormal noise when turning the shaft.
4. Check the pump body for cracks.
5. Check the seal for signs of leaking.

### Installation

1. Coat both sides of the new water circulating pump gaskets and the threads of the attaching fasteners with Perfect Seal.

Tube Ref No.	Description	Where Used	Part No.
 19	Perfect Seal	Water-circulating pump gasket and the threads of the attaching fasteners	92-34227Q02

2. Install the new water circulating pump gaskets onto the cylinder block.
3. Install the water circulating pump. Tighten the bolts to specification.

Description	Nm	lb-in.	lb-ft
Water circulating pump fasteners	47		35

4. Install the water circulating pump pulley onto the water circulating pump. Tighten the bolts securely.
5. Reconnect the hoses to the water circulating pump. Tighten the hose clamps securely.
6. Install the serpentine drive belt and adjust the belt tension.
7. Fill the closed-cooling system, if equipped.

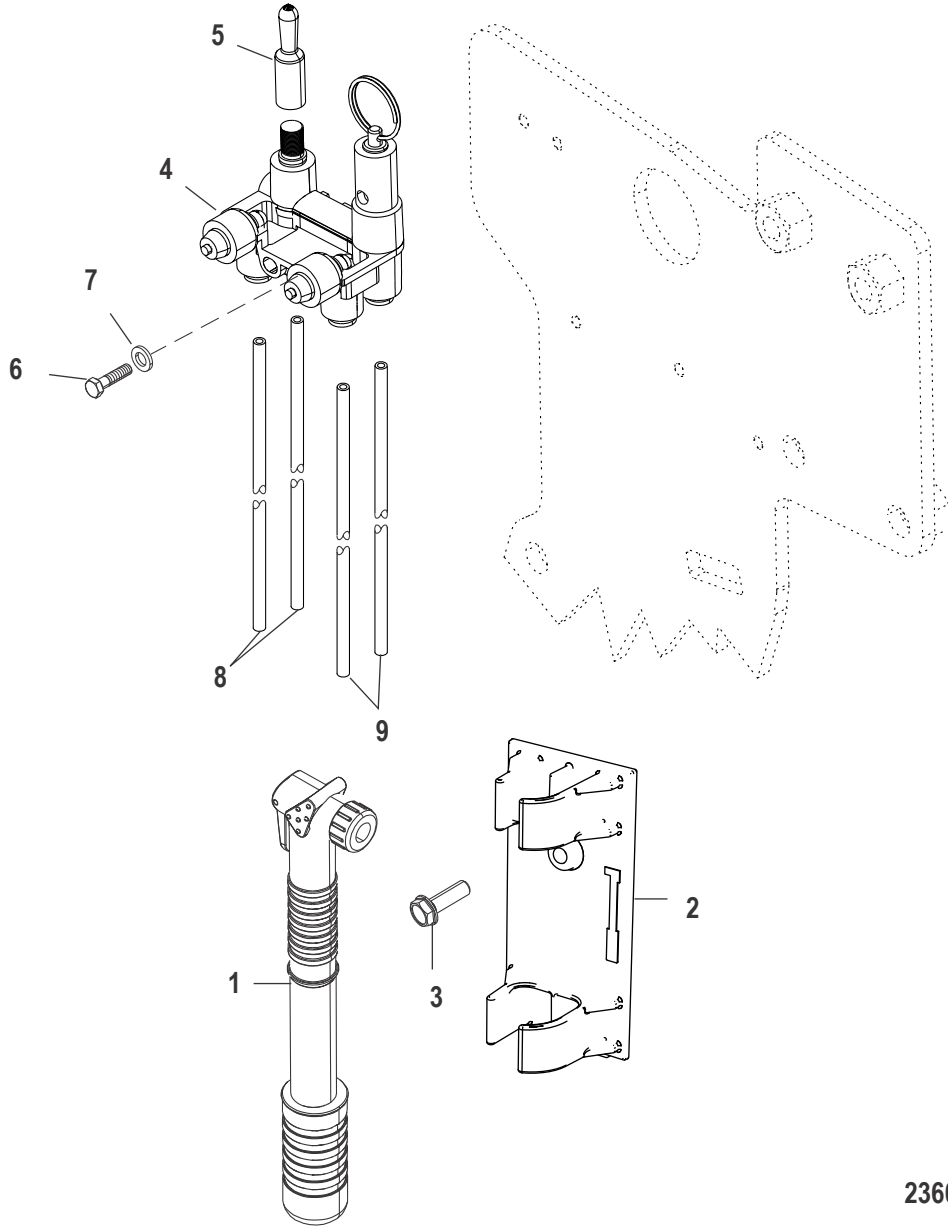
### *NOTICE*

**Without sufficient cooling water, the engine, the water pump, and other components will overheat and suffer damage. Provide a sufficient supply of water to the water inlets during operation.**

8. Supply cooling water to the engine.
9. Start the engine and check for leaks.

# Air-Actuated Drain System

## Air Manifold and Air Pump—Exploded View



2360



## Air Manifold and Air Pump—Exploded View

Ref. No.	Qty.	Description
1	1	Pump
2	1	Air pump bracket
3	1	Screw
4	1	Air manifold assembly
5	1	Service point cap
6	2	Screw
7	2	Washer
8	2	Green air hose (color may differ in later production models)
9	2	Gray air hose (color may differ in later production models)

## General Information

The air-actuated drain system uses compressed air to move a piston that pulls a plug out of a drain port or moves a drain tube to expose a hole to a water passage allowing water to drain into the engine compartment. All of the drain locations are arranged to allow any debris to be continually flushed away from the drains during normal engine operation. A feedback mechanism provides positive indication of proper piston movement. When each piston moves far enough in its cylinder, a port is uncovered that allows compressed air to flow back to the air manifold and cause the green indicator to extend. The drains are closed by opening the manual release valve that releases the compressed air from the system. The manual release valve also functions as an automatic pressure relief valve that opens at approximately 482.7 kPa (70 psi), thereby protecting the compressed air circuit from damage due to excess pressure.

## Testing

### ⚠ CAUTION

Water can enter the bilge when the drain system is open, damaging the engine or causing the boat to sink. Remove the boat from the water or close the seacock, disconnect and plug the seawater inlet hose, and ensure the bilge pump is operational before draining. Do not operate the engine with the drain system open.

### ⚠ CAUTION

Removing the snap ring from the top of the air-actuated drain valve can allow the components to come apart forcefully, resulting in injury or product damage. Do not try to repair the valve or remove the snap ring.

1. Remove the boat from the water.
2. Using the hand pump or other air source, pump air into the system until both of the green indicators extend and the manual release valve opens to relieve excess pressure. If one or both of the green indicators have not extended when the relief valve opens, the corresponding air-actuated drain valve has not opened and may be seized.
3. Release the compressed air from the air circuit by pulling up on the manual release valve ring.
4. Ensure both of the air-actuated drain valves have closed by verifying that water is no longer draining from either valve. If water continues to drain from an air-actuated drain valve after the air pressure has been released, the valve is seized and must be replaced.

## Air Manifold

### Removal

1. Remove the air manifold assembly from the air manifold bracket. Retain the washers and screws.
 

**NOTE:** The air lines are arranged in pairs of one gray and one green air line for each drain valve. To avoid reconnecting these hoses incorrectly, note which side of the air manifold each pair of air lines is connected to before removing them from the air manifold.
2. Disconnect the air lines from the air manifold. Push in and hold the plastic ring around the air line and pull the air line out of the fitting.

### Installation

1. Connect each pair of air lines to the proper side of the air manifold by fully inserting the air lines into the fittings on the air manifold.
2. Install the air manifold assembly onto the air manifold bracket using the washers and screws. Tighten the screws to the specified torque.

Description	Nm	lb-in.	lb-ft
Air manifold assembly to bracket screw	5	44	–

3. Test the drain system for proper operation.

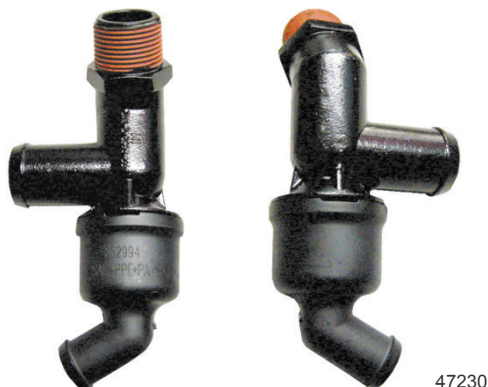
## Exhaust Manifold Drain Check Valve

### General Information

Engines with 3-point drain, single-point drain, and air-actuated drain systems are equipped with drain check valves on the exhaust manifolds.

- The check ball within the valve is forced upward by water pressure from the seawater pump. This seals the drain fitting.

- When there is no water pressure from the seawater pump, such as when the engine is off, the check ball falls down into the grooved drain fitting. This allows water to drain from the exhaust manifold and elbow.

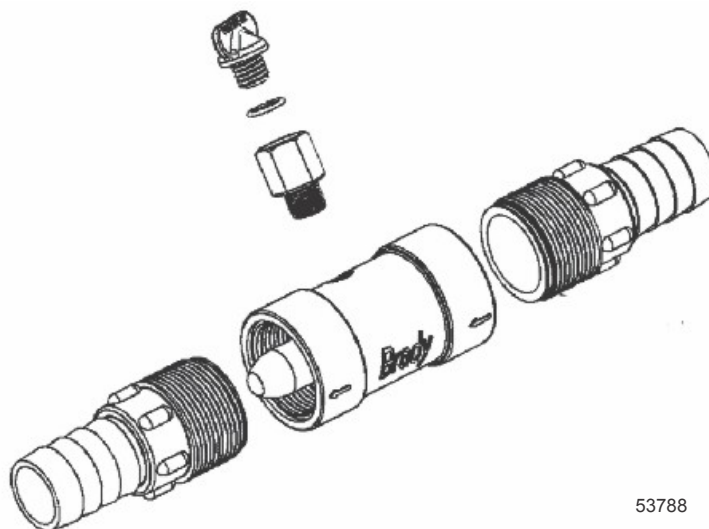


47230

## Check Valve

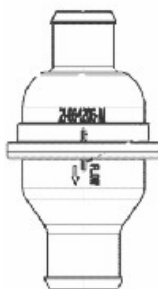
### General Information

A check valve is located in the water supply hose between the power steering cooler and the cool fuel cooler. The check valve prevents hot water from settling in the fuel cooler and causing fuel to vaporize when the engine is turned off.



53788

4.3L MPI with multipoint drain, S/N 0M300000 and above



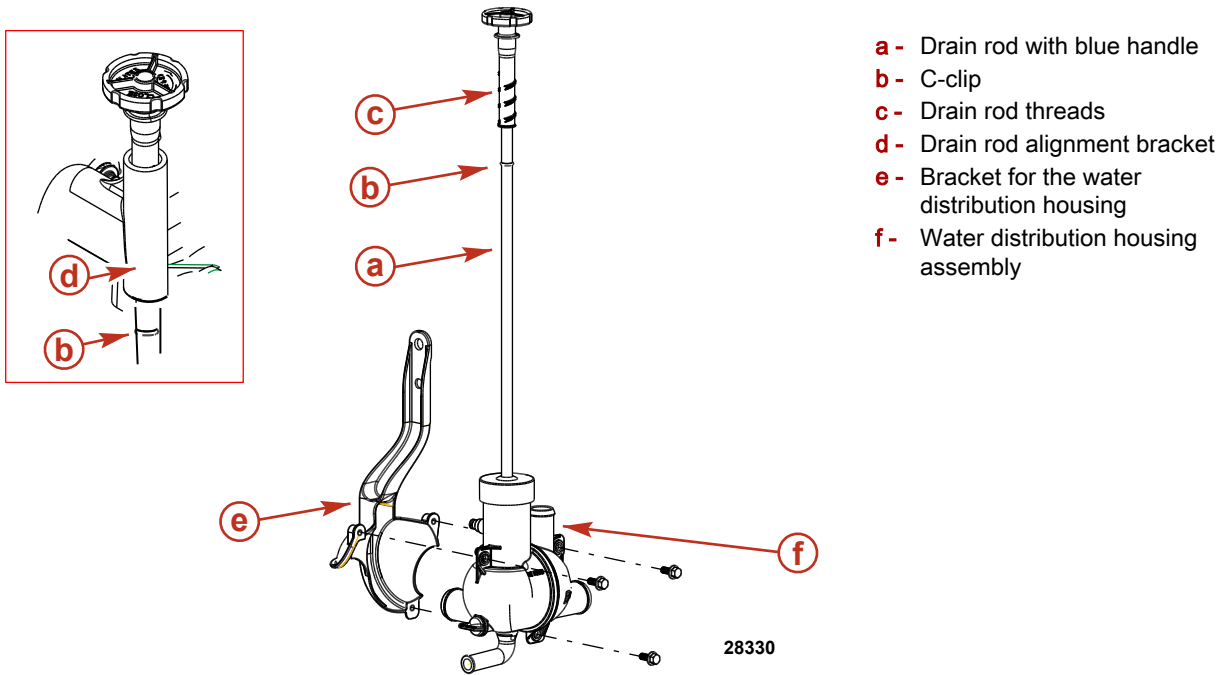
53789

4.3L MPI with closed cooling and easy drain, S/N 0M300000 and above

# Water Distribution Housing

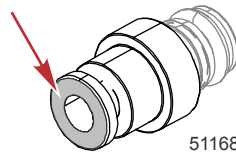
## Removal

1. Drain the seawater section of the cooling system.
2. On an Alpha manual single-point drain, remove the drain rod from the water distribution housing.
  - a. Remove the C-clip from the drain rod. Retain the C-clip.
  - b. Turn the drain rod handle counterclockwise until the drain rod threads clear the alignment bracket. Pull the drain rod straight up to remove.



- a - Drain rod with blue handle
- b - C-clip
- c - Drain rod threads
- d - Drain rod alignment bracket
- e - Bracket for the water distribution housing
- f - Water distribution housing assembly

3. On an air-actuated single-point drain, remove each air line from the water distribution housing by pressing on the air valve fitting's release location and pulling the line out.



Release location on the air valve fitting

4. Disconnect the hoses from the water distribution housing.
5. Remove the bolt and nut attaching the water distribution housing and bracket to the engine.
6. Remove the bracket from the water distribution housing.

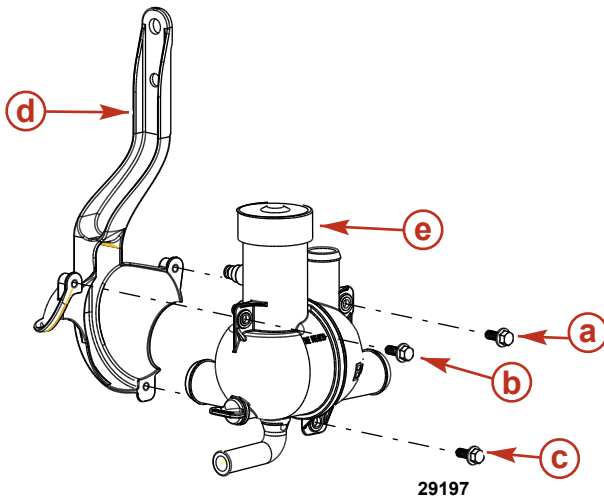
## Cleaning and Inspection

1. Clean the water distribution housing with water and dry with a clean cloth or compressed air.
2. Inspect the housing for leaks, cracks, or corrosion damage. Replace, if necessary.

## Installation

1. Align the water distribution housing with the bracket.
2. Install and tighten the screws to specification in the order listed.
  - a. Top right screw
  - b. Top left screw

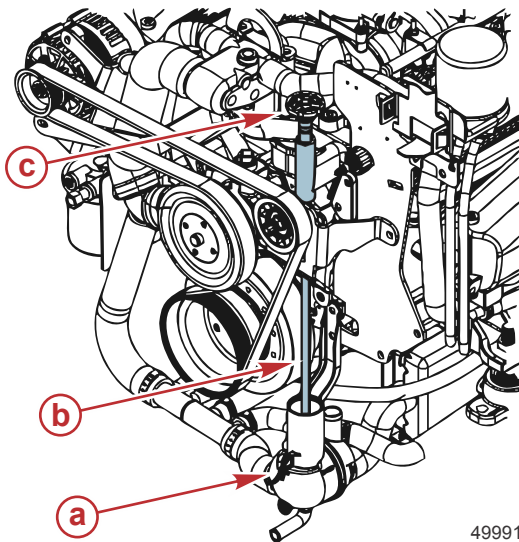
c. Bottom screw



- a - Top right screw
- b - Top left screw
- c - Bottom screw
- d - Bracket for the water distribution housing
- e - Water distribution housing assembly

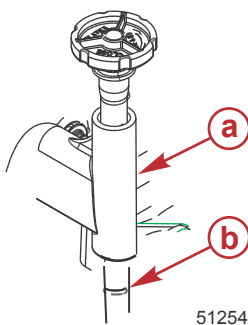
Description	Nm	lb-in.	lb-ft
Water distribution housing bracket screws	13	120	

3. Install the bracket and water distribution housing to the engine. Do not tighten the bolt and nut at this time.
4. On a manual single-point drain:
  - a. To obtain correct alignment, leave the hoses disconnected from the water distribution housing during installation.
  - b. Position the water distribution housing assembly to align with the drain rod.
  - c. Insert the drain rod into the water distribution housing to complete the alignment.



- a - Water distribution housing
- b - Drain rod
- c - Drain rod handle

- d. Ensure that the rod is correctly aligned. The rod must screw in and out of the water distribution housing easily and with minimal pressure.
- e. Install the C-clip onto the drain rod.



- a - Drain rod alignment bracket
- b - C-clip

- Tighten to specification the bolt and nut that secure the water distribution housing bracket to the engine.

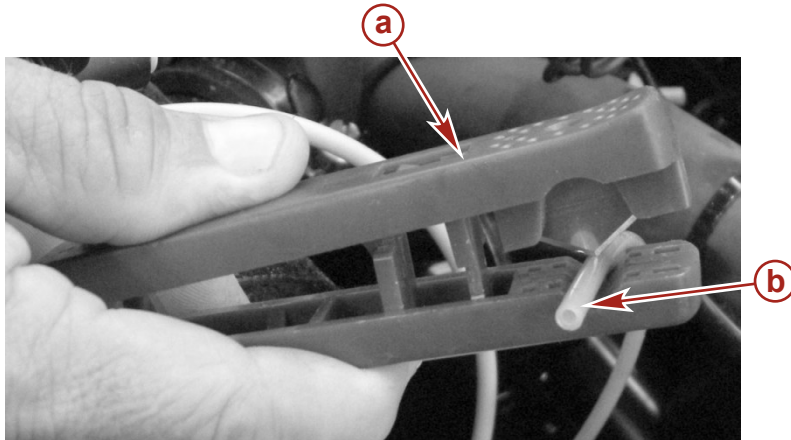
Description	Nm	lb-in.	lb-ft
Water distribution housing bracket bolt and nut	38		28

- On an air-actuated single-point drain, connect the air lines to the air manifold.
 

**IMPORTANT: Ensure that the air lines are routed to avoid sharp bends and contact with moving parts.**

**NOTE: The air line must remain cylindrical. The air line must not be distorted when cut. The end of the air line must be within 1 mm (0.04 in.) of square.**

  - Using an air line cutter, cut the bulk air line to the appropriate length.

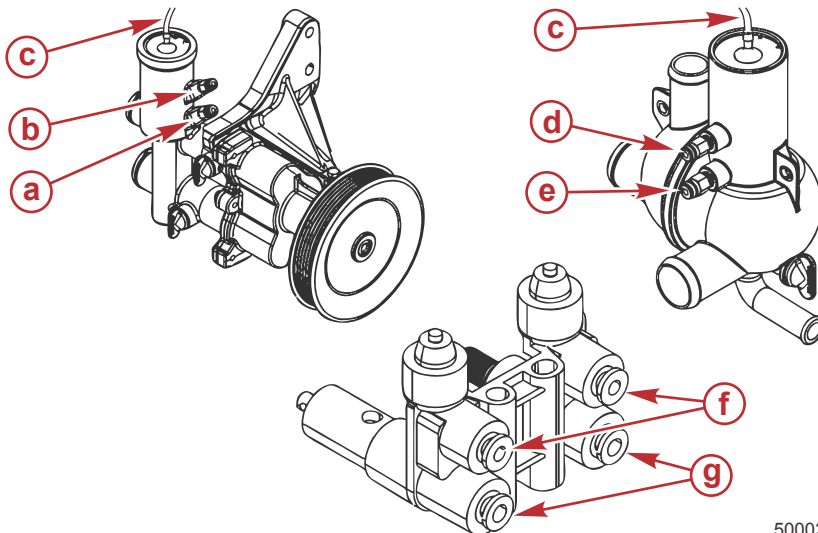


42000

- a - Air line cutter
- b - Air line

Air Line Cutter	91-883502
-----------------	-----------

- Connect the air lines from the air manifold assembly to the seawater pump connectors and the water distribution housing connectors by inserting the end of the air lines approximately 6 mm (1/4 in.) onto the connectors.
- Connect the 3/16 in. O.D. air lines into the lower connectors on the air manifold, the water distribution housing, and the seawater pump.
- Connect the 5/32 in. O.D. air lines into the upper line connectors on the air manifold, the water distribution housing, and the seawater pump.
- Connect the 5/16 in. O.D. vent tube onto the water distribution housing air actuator. Secure the tube with cable ties.



50002

- a - Lower seawater pump air actuator air line connector (3/16 in.)
- b - Upper seawater pump air actuator air line connector (5/32 in.)
- c - Vent tubing connection (5/16 in.)
- d - Upper water distribution housing air actuator air line connector (5/32 in.)
- e - Lower water distribution housing air actuator air line connector (3/16 in.)
- f - Upper air manifold assembly air line connector (5/32 in.)
- g - Lower air manifold assembly air line connector (3/16 in.)

- Pull on the lines to ensure that each air line is securely connected.
- Secure the air lines with cable ties.
- Connect the hoses to the water distribution housing. Securely tighten the hose clamps.