

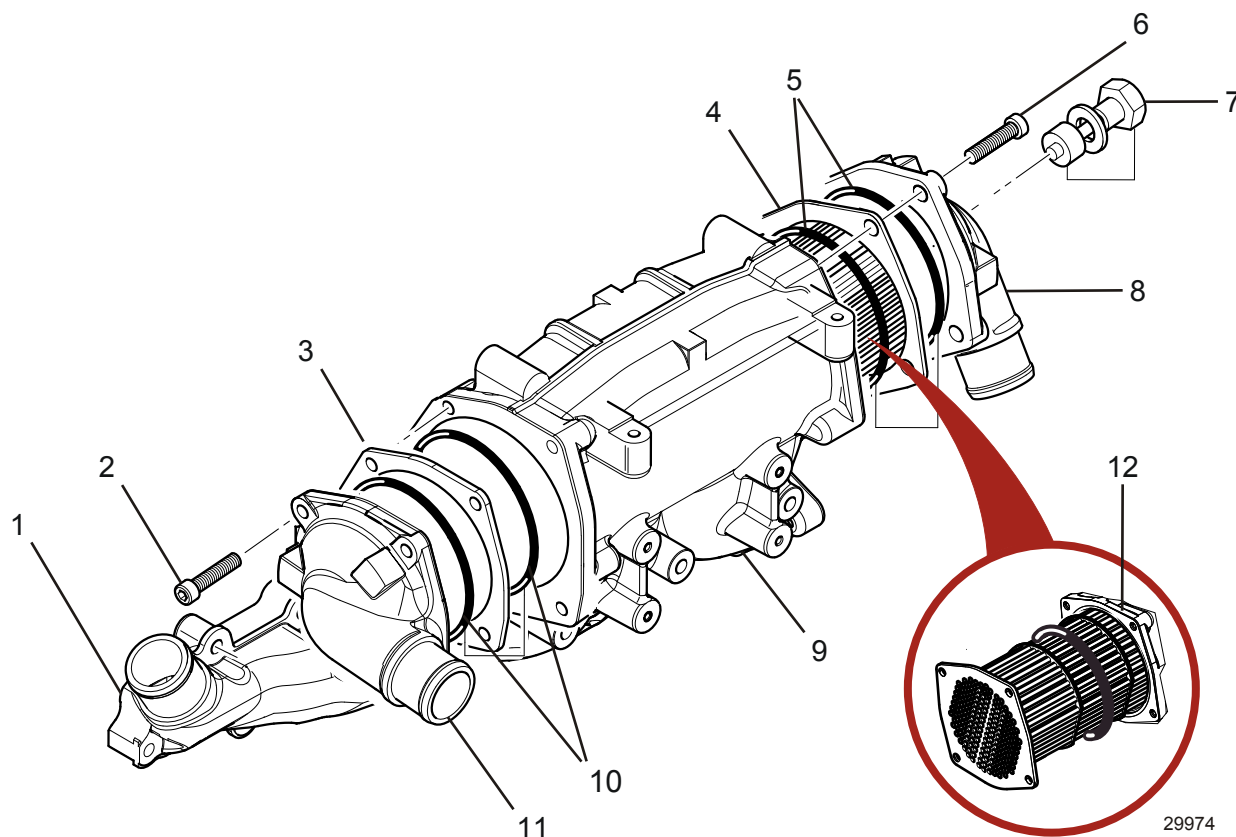
Intake and Exhaust System

Section 7A - Intake Manifold and Aftercooler Assembly

Table of Contents

Exploded View—Intake Manifold and Aftercooler Assembly.....	7A-2	Assembly.....	7A-7
Intake Manifold and Aftercooler Assembly.....	7A-2	Installation.....	7A-10
Removal.....	7A-2	Air Intake Pipe.....	7A-14
Disassembly.....	7A-5	Removal.....	7A-14
Cleaning and Inspection.....	7A-7	Cleaning and Inspection.....	7A-14
		Installation.....	7A-15

Exploded View—Intake Manifold and Aftercooler Assembly



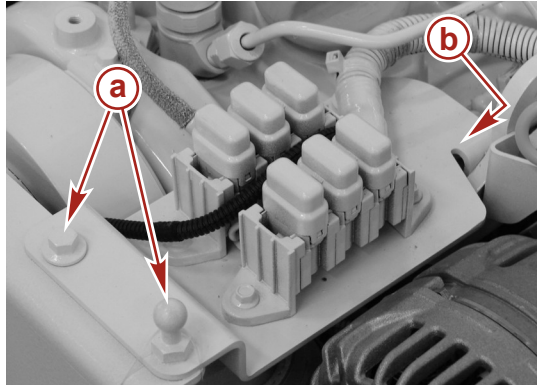
Ref. No.	Qty.	Description	Torque		
			Nm	lb-in.	lb-ft
1	1	Intake manifold			
2	4	Bolt	23	–	17
3	1	Spacer			
4	1	Spacer			
5	2	O-ring			
6	4	Bolt	23	–	17
7	1	Plug and Anode Assembly	17	150	–
8	1	Cover			
9	1	Heat exchanger			
10	2	O-ring			
11	1	Cover			
12	1	Tube nest, heat exchanger			

Intake Manifold and Aftercooler Assembly

Removal

1. Remove the engine cover.
2. Drain the seawater system. See **Section 6A—Draining the Seawater System**.
3. Drain the closed cooling system. Retain or dispose of the coolant properly. See **Section 6A—Draining the Closed Cooling System**.

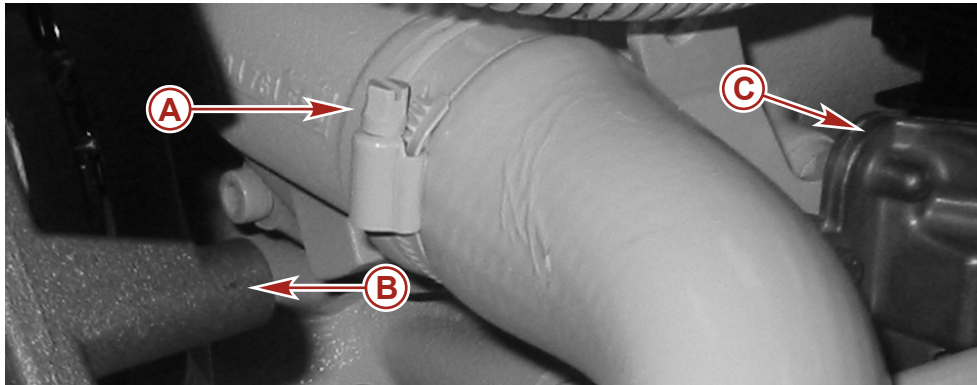
4. Remove the fasteners attaching the engine fuse panel. Position the fuse panel out of the way.



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- a** - Screw and stud
- b** - Nut and bolt

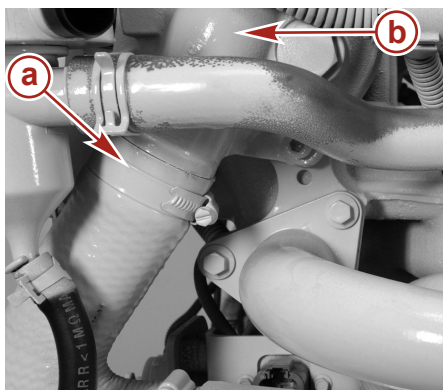
5. Remove the alternator. See **Section 4B—Charging System**.
6. Remove the intake manifold seawater inlet hose.



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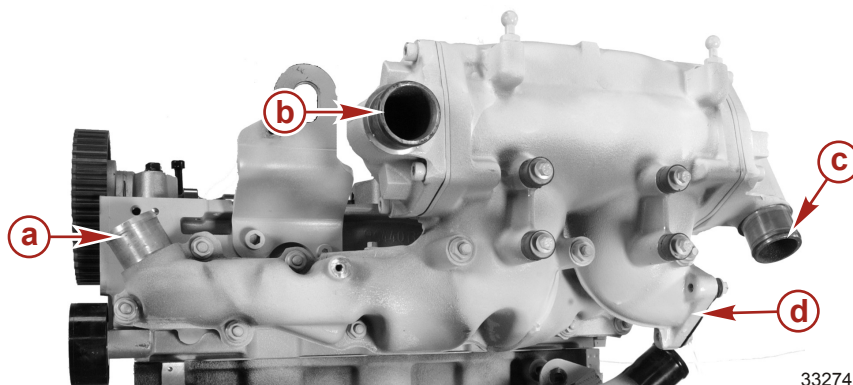
- a** - Intake manifold seawater inlet
- b** - Alternator
- c** - ECM

7. If applicable, remove the fuel cooler. See **Section 6A—Fuel Cooler**.
8. Remove the intake manifold seawater outlet hose.



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- a** - Seawater outlet hose
- b** - Intake manifold and aftercooler assembly

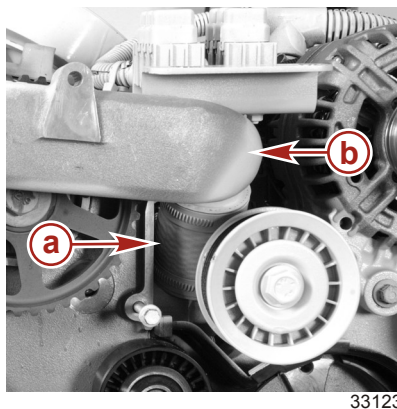


Surrounding components removed for clarity

Intake manifold and aftercooler assembly hose connection points

- a** - Coolant outlet
- b** - Seawater inlet
- c** - Seawater outlet
- d** - Air intake

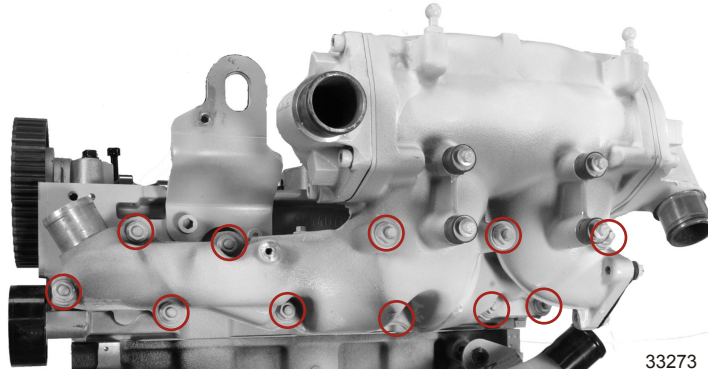
9. Remove the intake manifold air pipe. See **Section 7A—Intake Manifold Air Pipe**.
10. Disconnect and remove the electronic control module (ECM). See **Section 5G—Electronic Control Module (ECM)**.
11. Remove the ECM bracket.
12. Disconnect and remove the coolant manifold to intake manifold coolant hose.



- a** - Hose
- b** - Coolant manifold

13. Disconnect the MAP/IAT sensor electrical connector. See **Section 5G—Manifold Absolute Pressure and Intake Air Temperature Sensor**.

14. Remove the intake manifold and aftercooler assembly.



Intake manifold aftercooler assembly nuts

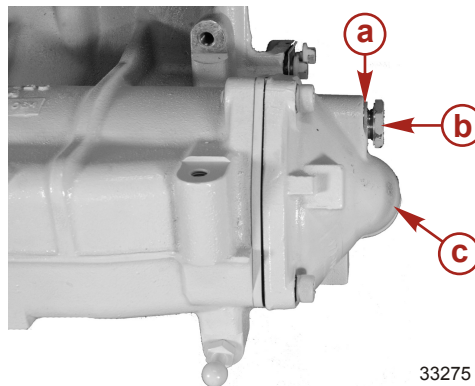
15. Remove and discard the used intake manifold gasket.

Disassembly

NOTICE

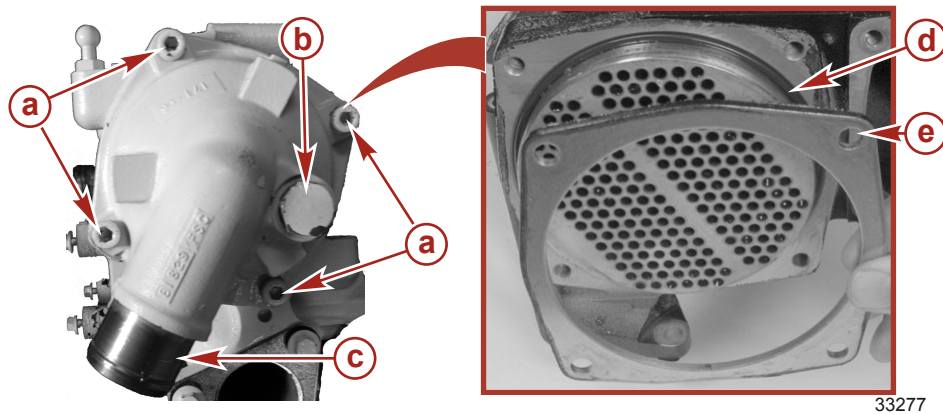
Seawater leaking into the air intake system will result in severe engine damage. Replace all O-ring seals whenever disassembling the aftercooler or removing the radiator insert (aftercooler core).

1. Loosen the two screws with washers, and remove the MAP/IAT sensor from the aftercooler.
2. Remove the drain plug anode assembly from the aftercooler rear cover.



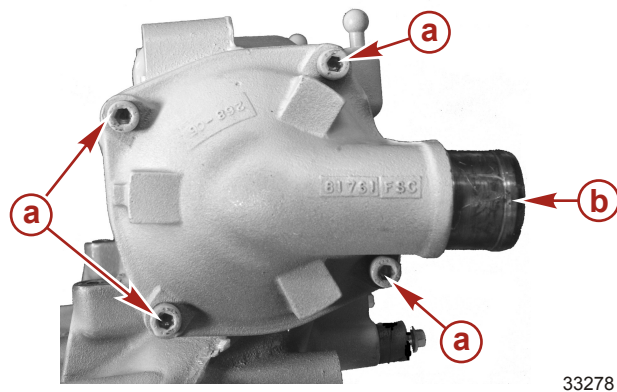
- a** - Sealing washer
- b** - Drain plug anode assembly
- c** - rear cover with seawater outlet

3. Remove the aftercooler housing rear cover.



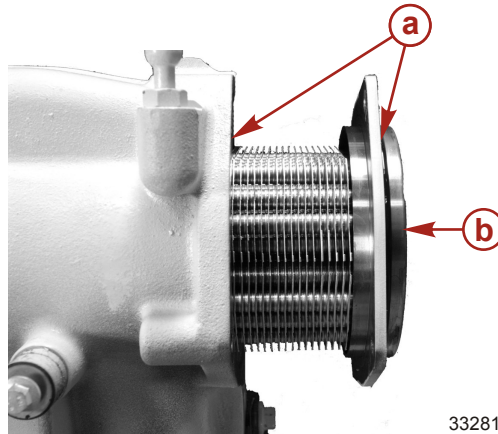
- a** - Rear cover screws
- b** - Drain plug anode assembly
- c** - Seawater outlet
- d** - O-ring
- e** - Spacer

4. Note the position of the O-ring in the cover, the plate, and second O-ring on the aftercooler housing.
5. Remove the aftercooler housing front cover. Note the O-ring positions.



- a** - Screw
- b** - Seawater inlet

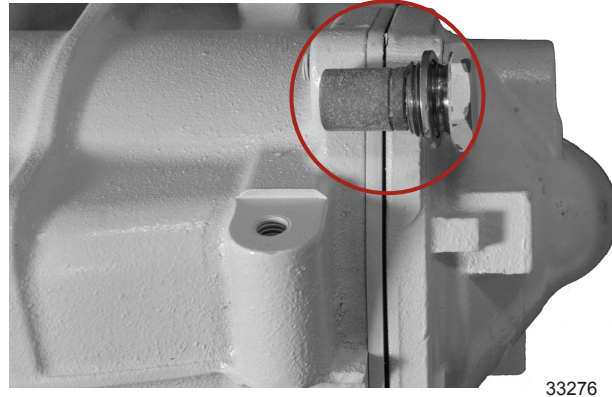
- Slide the aftercooler heat exchanger core out of the front of the aftercooler housing. Note the O-ring positions.



- a** - O-ring
b - Aftercooler heat exchanger core

Cleaning and Inspection

- Clean the old gasket material from the intake manifold aftercooler assembly and cylinder head. Do not damage the sealing surfaces.
- Use a 4.4 mm x 610 mm (11/64 in. x 24 in.) diameter long rod to clean out the aftercooler insert (core) tubes, or take to a radiator shop for cleaning.
- Inspect each part for cracks or other damage that would render it unserviceable.
- Inspect the drain plug anode assembly and replace if more than 50% deteriorated.



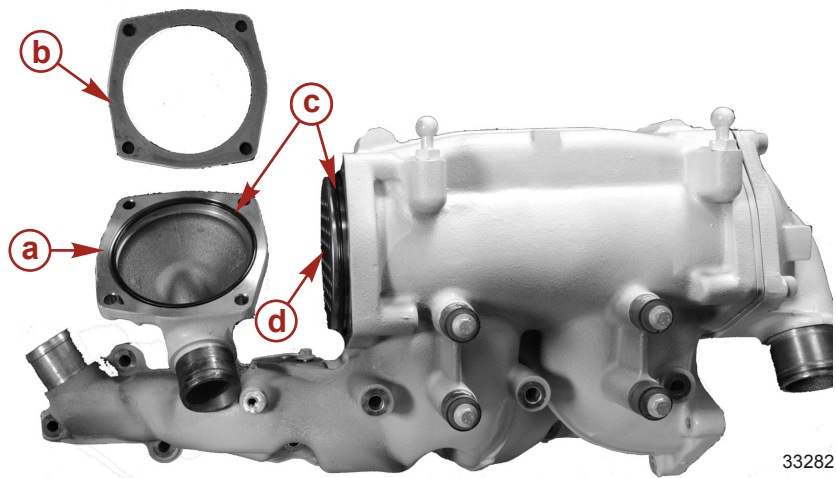
New drain plug anode assembly

- Clean and paint the exterior surfaces as required to prevent corrosion.

Assembly

IMPORTANT: Do not roll or twist O-rings during installation.

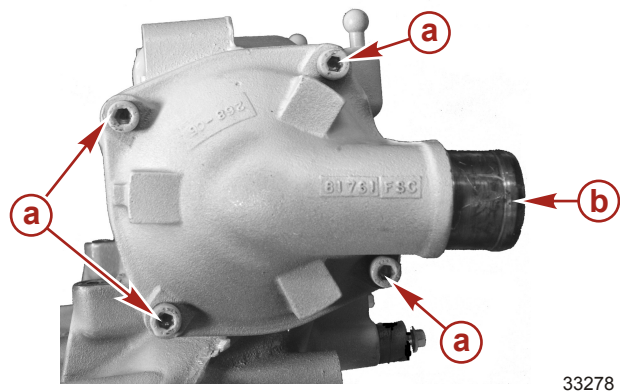
- 1. Install O-rings in the groove machined into the front cover and on the front of the aftercooler heat exchanger core flush against the front flange.



- a - Front cover
- b - Spacer
- c - O-ring
- d - Aftercooler heat exchanger core

NOTE: Note the orientation of the aftercooler heat exchanger core and spacer to properly align the screw holes.

- 2. Install the aftercooler heat exchanger core into the aftercooler housing.
- 3. Install the front cover. Tighten the four front cover screws evenly, in a cross pattern.

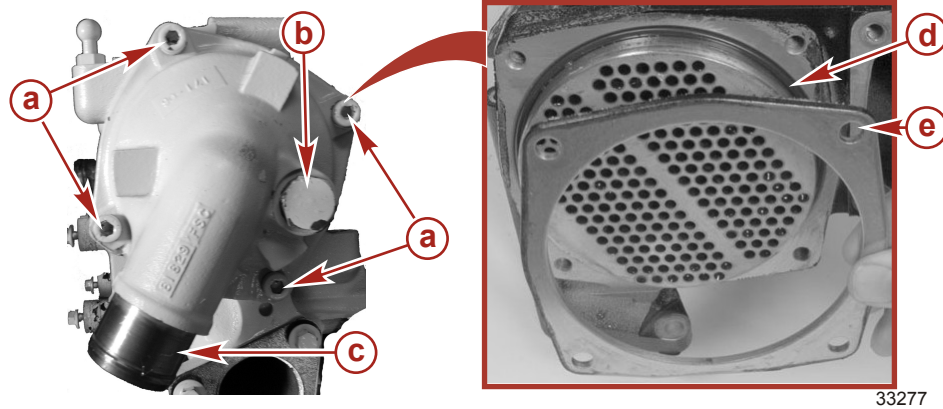


- a - Screw
- b - Seawater inlet

- 4. Tighten the front cover screws to the specified torque.

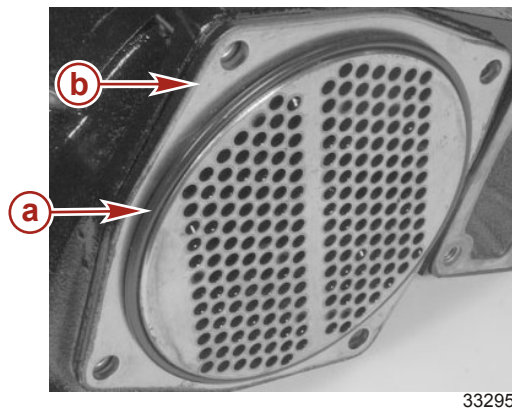
Description	Nm	lb-in.	lb-ft
Front cover screws	40	–	30

5. Install an O-ring on the front of the aftercooler heat exchanger core flush against the rear of the aftercooler housing.



- a** - Rear cover screws
- b** - Drain plug anode assembly
- c** - Seawater outlet
- d** - O-ring
- e** - Spacer

6. Install the spacer on the rear of the aftercooler housing.
7. Install a second O-ring around the aftercooler heat exchanger core flush against the spacer.

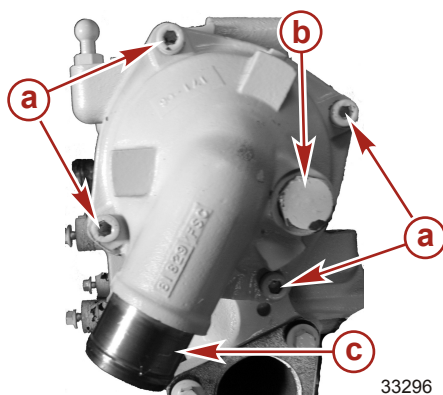


- a** - O-ring
- b** - Plate

8. Install the rear cover tightening the four rear cover screws evenly, in a cross pattern.
9. Tighten the rear cover screws to the specified torque.

Description	Nm	lb-in.	lb-ft
Front cover screws	40	–	30

10. Install a new drain plug anode assembly with a new sealing washer.

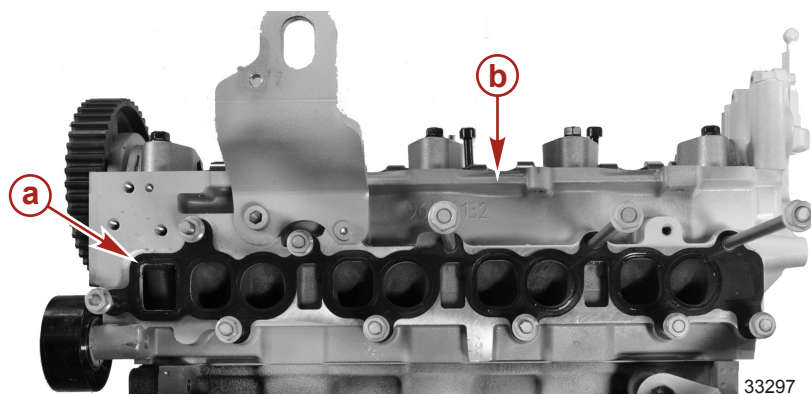


11. Tighten drain plug anode assembly to the specified torque.

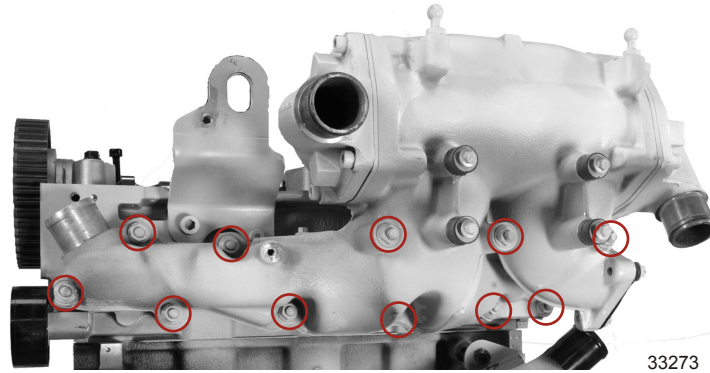
Description	Nm	lb-in.	lb-ft
Drain plug anode assembly	17	150	–

Installation

1. Place a new intake manifold gasket over the intake manifold aftercooler assembly studs flush against the cylinder head.



2. Install the intake manifold and aftercooler assembly and tighten the nuts in a crossing pattern working from the center studs out.

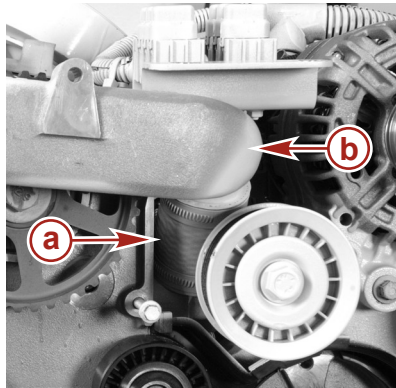


Intake manifold aftercooler assembly nuts

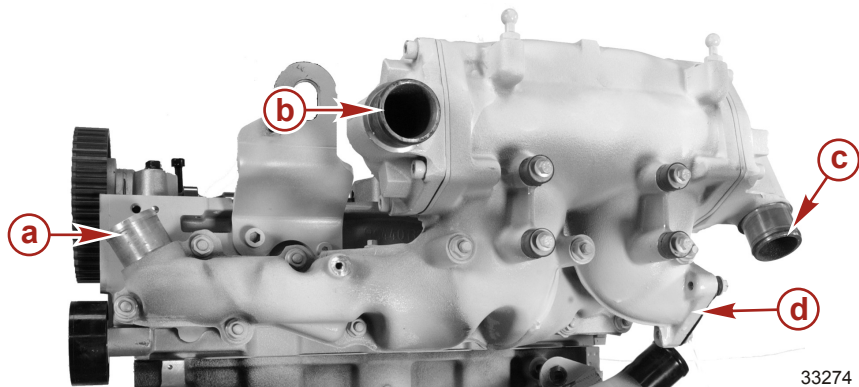
3. Tighten the intake manifold and aftercooler assembly nuts to the specified torque.

Description	Nm	lb-in.	lb-ft
Intake manifold and aftercooler assembly nuts	27.5	–	20

4. Install the coolant manifold to intake manifold coolant hose.



- a** - Hose
b - Coolant manifold



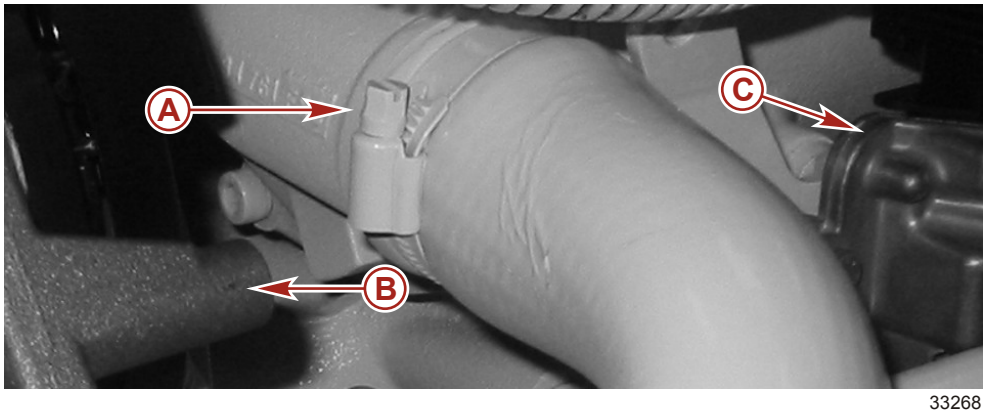
Intake manifold and aftercooler assembly hose connection points (surrounding components removed for clarity)

- a - Coolant outlet
- b - Seawater inlet
- c - Seawater outlet
- d - Air intake

5. Tighten the coolant manifold to intake manifold coolant hose clamp to the specified torque.

Description	Nm	lb-in.	lb-ft
Hose clamp	5.7	50	–

6. Install the intake manifold seawater inlet hose.

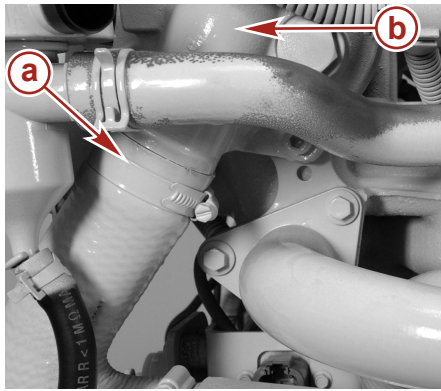


- a - Intake manifold seawater inlet
- b - Alternator
- c - ECM

7. Tighten the intake manifold seawater inlet hose clamp to the specified torque.

Description	Nm	lb-in.	lb-ft
Hose clamp	5.7	50	–

8. Install the intake manifold seawater outlet hose.



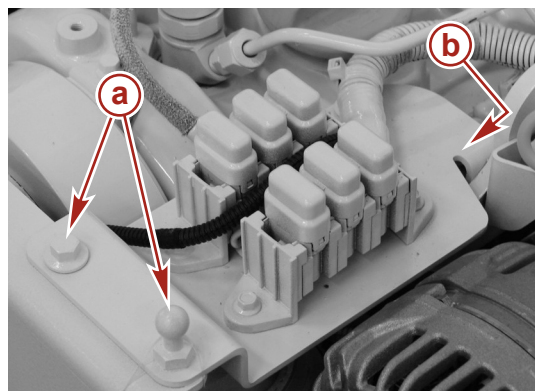
33270

- a** - Seawater outlet hose
b - Intake manifold and aftercooler assembly

9. Tighten the intake manifold seawater outlet hose clamp to the specified torque.

Description	Nm	lb-in.	lb-ft
Hose clamp	5.7	50	–

10. Install the intake manifold air pipe. See **Section 7A—Intake Manifold Air Pipe**.
 11. Install the MAP/IAT sensor and connect the electrical connector. See **Section 5G—Manifold Absolute Pressure and Intake Air Temperature Sensor**.
 12. Install the ECM bracket.
 13. Install and connect the electronic control module (ECM). See **Section 5G—Electronic Control Module (ECM)**.
 14. If applicable, install the fuel cooler. See **Section 6A—Fuel Cooler**.
 15. Install the alternator. See **Section 4B—Charging System**.
 16. Install the fasteners attaching the engine fuse panel.



33119

- a** - Screw and stud
b - Nut and bolt

17. Tighten the fasteners attaching the engine fuse panel to the specified torque.

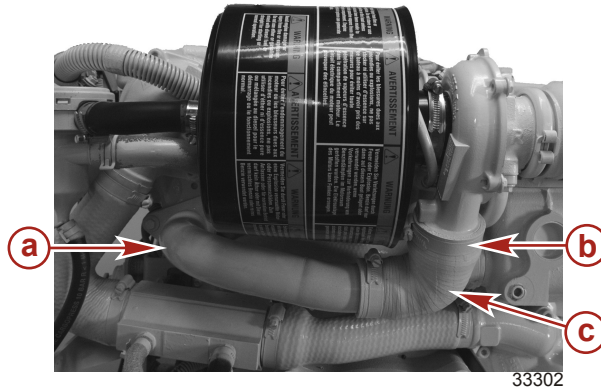
Description	Nm	lb-in.	lb-ft
Engine fuse panel screw	27.5	–	20
Engine fuse panel screw with ball head	27.5	–	20
Engine fuse panel nut and bolt	11	97	–

18. Fill the closed cooling system. See **Section 6A—Filling the Closed Cooling System**.
19. Install the engine cover.
20. Test run the engine. Check for any fluid or air intake leaks.

Air Intake Pipe

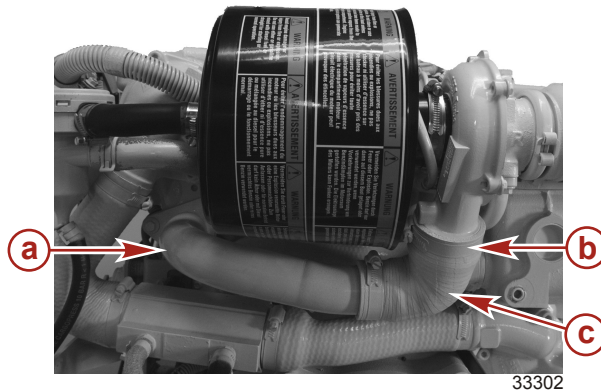
Removal

1. Remove the air filter assembly. See **Section 1B—Air Filter**.
2. Remove the three screws attaching the air intake pipe to the rear of the intake manifold and aftercooler assembly.



- a** - Air intake pipe
- b** - Clamp
- c** - Air intake pipe to turbocharger hose

3. Loosen the hose clamp attaching the air intake pipe to turbocharger hose to the turbocharger and remove the air intake pipe from the engine.



- a** - Air intake pipe
- b** - Clamp
- c** - Air intake pipe to turbocharger hose

4. Separate the air intake pipe and the air intake pipe to turbocharger hose.

Cleaning and Inspection

1. Clean the old gasket material from the intake manifold and aftercooler assembly and the mounting flange of the air intake pipe. Do not damage the sealing surfaces.

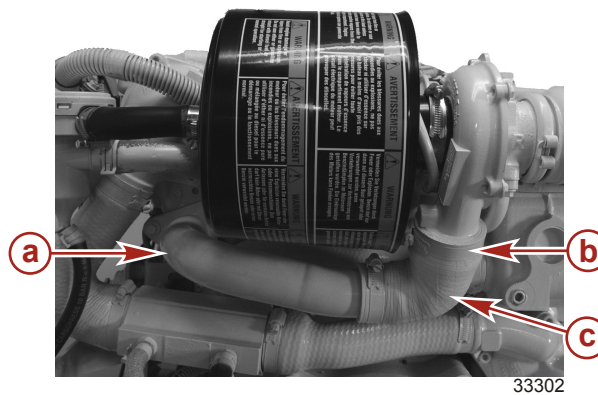
2. Inspect the air intake pipe for cracks or other damage that would render it unserviceable.
3. Inspect the air intake pipe to turbocharger hose for cracks or other damage that would render it unserviceable.
4. Clean and paint the exterior surface as necessary to prevent corrosion.

Installation

1. Connect the air intake pipe and the air intake pipe to turbocharger hose.
2. Tighten the hose clamp to specification to the specified torque.

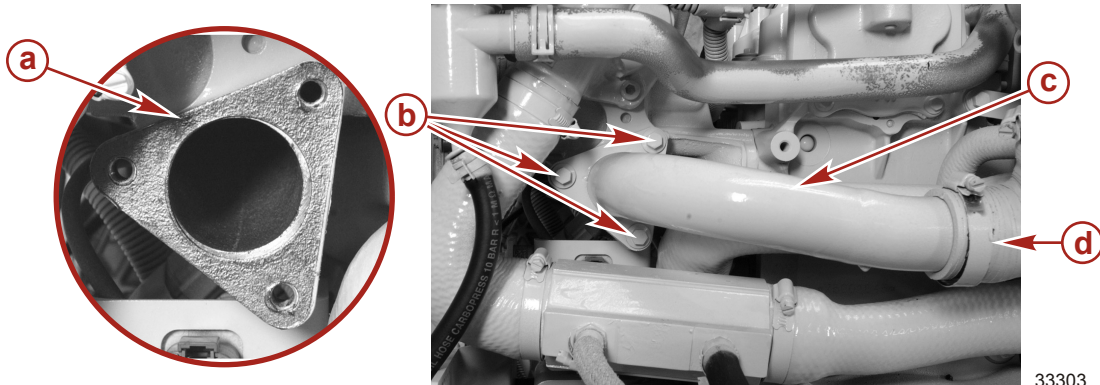
Description	Nm	lb-in.	lb-ft
Hose clamp	5.6	50	–

3. Attach the air intake pipe to turbocharger hose to the turbocharger. Leave the hose clamp loose to ease air intake pipe alignment with the intake manifold and aftercooler assembly.



- a** - Air intake pipe
b - Clamp
c - Air intake pipe to turbocharger hose

4. Install the air intake pipe and a new gasket to the rear of the intake manifold and aftercooler assembly.



- a** - Gasket
b - Screws
c - Air intake pipe
d - Hose

5. Tighten the air intake pipe to intake manifold and aftercooler assembly screws to the specified torque.

Description	Nm	lb-in.	lb-ft
Air intake pipe screws	24.5	–	18

6. Tighten the air intake pipe to turbocharger hose clamp to the specified torque.

Description	Nm	lb-in.	lb-ft
Hose clamp	5.6	50	–

7. Install the air filter assembly. See **Section 1B—Air Filter**.