# **3** SPECIAL EQUIPMENT

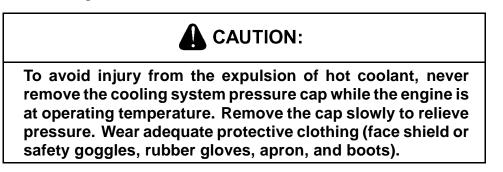
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# 3.1 AIR COMPRESSOR

The air compressor, with a power-steering pump attached, is driven by a gear on the camshaft. Perform the following procedures for removal and installation of the air compressor.

# 3.1.1 Air Compressor Removal

Remove the air compressor as follows:



- 1. Drain the coolant.
- 2. Remove the two bolts attaching the power steering pump to the air compressor. See Figure 3-1.

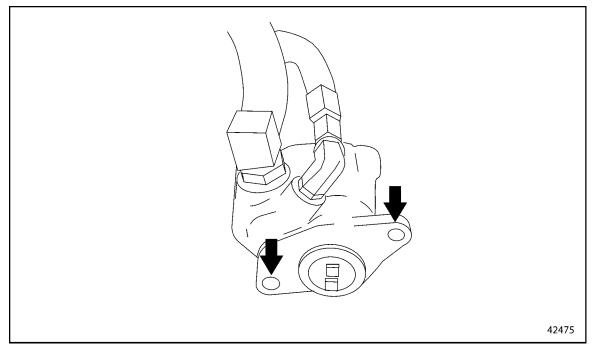
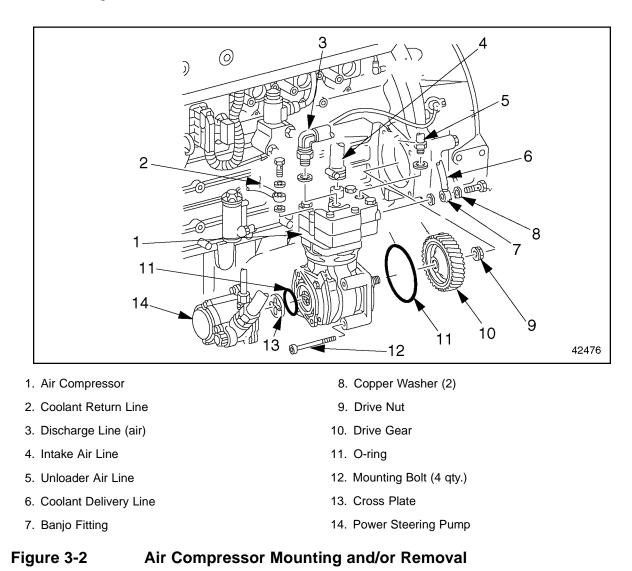


Figure 3-1Power Steering Pump

# NOTE:

Do not remove the power steering lines. Tie up the lines and the pump out of the way.

3. Remove the cross plate between the compressor and the power steering pump. See Figure 3-2.



4. Remove the coolant delivery line and coolant return line.

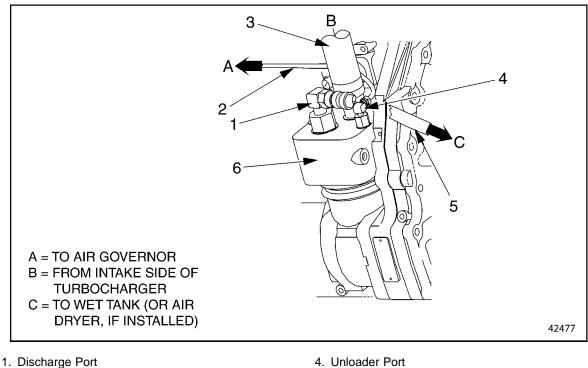
### NOTE:

The coolant delivery line is attached to the crank angle position sensor wire with a tie strap. Cut the tie strap and remove the coolant delivery line.

# 

To avoid injury from the sudden release of a high-pressure hose connection, wear a face shield or goggles.

5. Remove the three air lines. See Figure 3-3.



- 2. Unloader Air Line
- 3. Intake Air Line

- 5. Discharge Air Line
- 6. Air Compressor

#### Figure 3-3 **Air Line Attachments**

- Remove the discharge (compressed air) line. Check the fittings for damage and [a] replace if necessary. Check inside the discharge line for carbon deposits. If deposits are found, replace the discharge line.
- [b] Remove the unloader line. Check the fittings for damage and replace if necessary.
- [c] Loosen the hose clamp and remove the intake (suction) air line.
- 6. Remove the four mounting bolts attaching the air compressor to the cylinder block. See Figure 3-2.
- 7. Slide the drive gear away from the flywheel. Collect any oil that runs out and dispose of it properly.

# 3.1.1.1 Air Compressor Inspection

Inspect the air compressor as follows:

- 1. Inspect the O-rings on the fittings at the air system ports and replace if necessary. If the O-rings are damaged, also replace the fittings.
- 2. Replace the O-ring between the power steering pump and the air compressor.
- 3. Install the locking device (KM 904 589 03 63 00) on the air compressor at the end of the drive shaft, where it connects to the power steering pump. This locks the drive shaft to allow removal of the drive nut. See Figure 3-4.

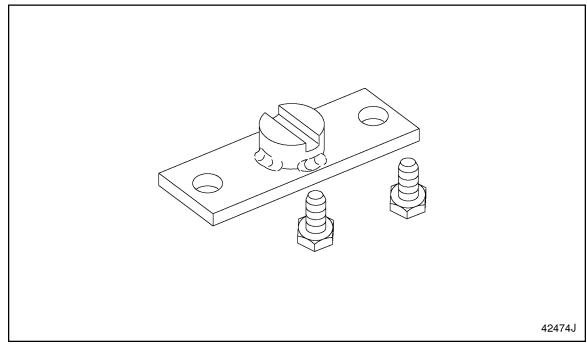
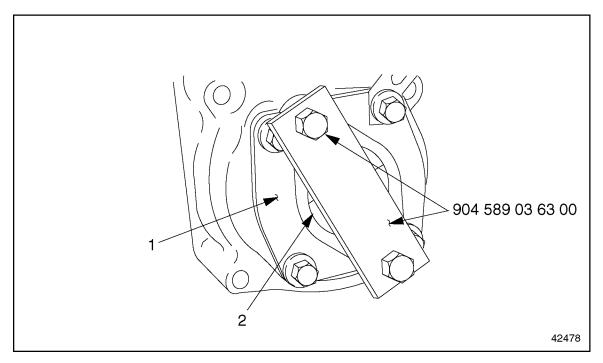


Figure 3-4 Air Compressor Locking Device (KM 904 589 03 63 00)

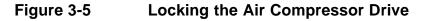
From Bulletin 4-MBE900-04

4. Install the two locking bolts on the locking device (KM 904 589 03 63 00) and tighten them until the air compressor drive is locked and incapable of movement. See Figure 3-5.

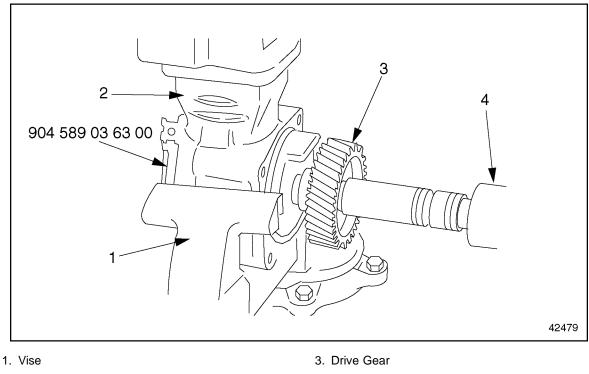


1. Air Compressor

2. End of Drive Shaft



5. Remove the drive gear from the air compressor. See Figure 3-6.



2. Air Compressor

4. Impact Wrench

### Figure 3-6 Pulling the Drive Gear

- [a] Place the air compressor in a vise. Make sure it is tightly secured and cannot slip or slide out of the vise.
- [b] Place an impact wrench on the drive gear nut and remove the drive nut.
- [c] Remove the drive gear from the air compressor with a gear puller, if necessary.
- 6. Inspect the drive gear for worn or broken teeth, spalling, and corrosion. Replace the drive gear if necessary.
- 7. Install the drive gear and drive nut on the drive shaft of the air compressor. Tighten the drive nut 270 N·m (200 lb·ft).
- 8. Remove the locking device from the air compressor and release the air compressor from the vise.

# 3.1.2 Air Compressor Installation

Install the air compressor as follows:

- 1. Install the air compressor.
- 2. Install the four air compressor mounting bolts. Tighten each bolt 40 N·m (30 lb·ft).
- 3. Install the three air lines. See Figure 3-3.

- [a] Install the discharge line. Make sure the O-ring is properly installed on the fitting. Tighten the fitting 100 N·m (74 lb·ft).
- [b] Install the unloader line. Make sure the O-ring is properly installed on the fitting.
- [c] Install the intake air line and tighten the hose clamp.
- 4. Install the two coolant lines.
  - [a] Pay particular attention to the coolant delivery line at the rear of the air compressor. It is difficult to line up the bolt and fitting correctly.

### NOTE:

If necessary to line up the banjo bolt, loosen the coolant line that attaches to the rear of the engine.

### NOTE:

Attach the coolant delivery line to the crank angle position sensor wire with a tie strap.

- [b] Tighten the banjo bolts on the coolant delivery and return lines 40 N·m (30 lb·ft).
- 5. Install the cross plate. Use grease to hold it in place while installing the power steering pump.
- 6. Install the two bolts attaching the power steering pump to the air compressor. Tighten the bolts 40 N·m (30 lb·ft). See Figure 3-1.
- 7. Fill the radiator with coolant.

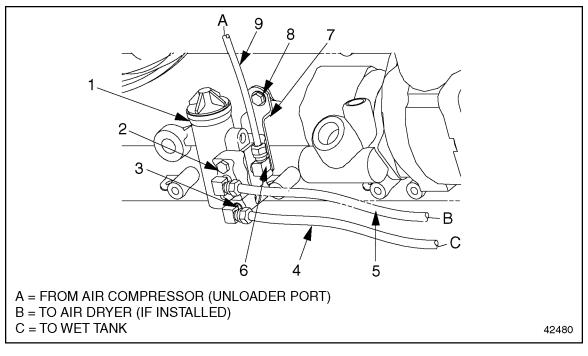
# 3.2 AIR GOVERNOR

The following sections describe the removal and installation of the air governor.

### 3.2.1 Air Governor Removal

Remove the air governor as follows:

- 1. Release system air pressure.
- 2. Remove and mark the three air line fittings. See Figure 3-7. Inspect all fittings for damage and replace if necessary.



- 1. Air Governor
- 2. Unloader Port, Air Dryer
- 3. Reservoir Port
- 4. Supply Air Line
- 5. Air Dryer Control Line

- 6. Unloader Port, Air Compressor
- 7. Mounting Bracket
- 8. Mounting Bolt, M8
- 9. Unloader Air Line

### Figure 3-7 Air Governor Removal and Installation

- 3. Remove the mounting bolt and remove the mounting bracket from the vehicle, with the air governor attached.
- 4. Remove the two bolts holding the air governor to the mounting bracket.

# 3.2.2 Air Governor Installation

Install the air governor as follows:

- 1. Install the air governor on the mounting bracket, using the two bolts, as removed.
- 2. Install the mounting bracket, with the air governor attached, on the engine. Tighten the M8 mounting bolt 16 N·m (12 lb·ft).
- 3. Coat each air line fitting with pipe thread sealant at the air governor port.

### NOTE:

Coat the surface between the fitting and port on the air governor. Do not put sealant on the surfaces between the fitting and the air line.

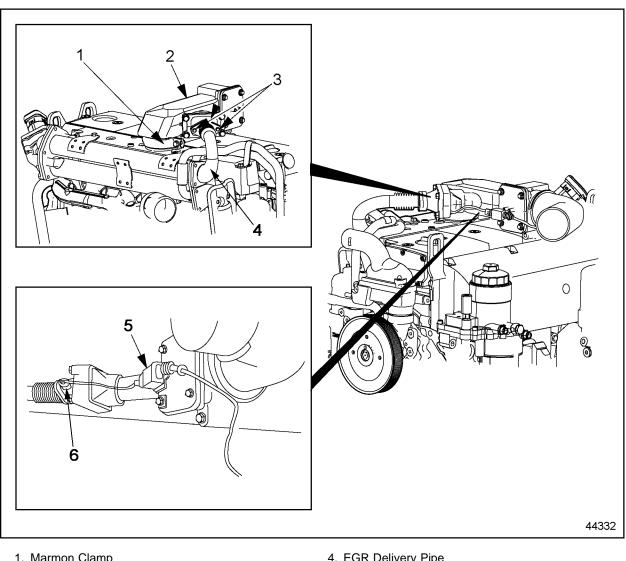
4. Install the three air line fittings, as removed. Make sure all fittings receive the proper torque, as listed in Table 3-1.

# **3.3 EGR CHARGE AIR INTAKE HOUSING**

# **3.3.1 EGR Charge Air Intake Housing Removal**

Remove the charge air intake housing as follows (see Figure 3-8 for component location):

- 1. Disconnect the electrical plug connector (5) of the temperature sensor (6).
- 2. Remove bolt securing the charge air intake housing to support bracket.
- 3. Remove two bolts (3) from the EGR delivery pipe (4).
- 4. Remove marmon clamp (1) from charge air intake housing (2).



5. Remove the charge air intake housing (2) and seal ring. Discard seal ring.

- 1. Marmon Clamp
- 2. Charge Air Intake Housing
- 3. EGR Delivery Pipe Bolts

- 4. EGR Delivery Pipe
- 5. Electrical Plug Connector
- 6. Temperature Sensor

#### Charge Air Intake Housing Removal and Installation Figure 3-8

#### EGR Charge Air Intake Housing Cleaning 3.3.1.1

Clean the EGR charge air intake housing as follows:

- 1. Clean sealing surface of the EGR/CA mixer housing and discard gasket.
- 2. Clean the sealing surface where the charge air intake housing meets with the air intake housing.

# 3.3.2 EGR Charge Air Intake Housing Installation

Install the EGR charge air intake housing as follows (see Figure 3-8 for component locations):

- 1. Lubricate new seal with lubricant (order number 000 989 11 60) and install on charge air intake housing (2).
- 2. Install marmon clamp (1) around charge air intake housing (2) and mount to air intake manifold and secure with bolt. Tighten bolt to 31-35 N·m (23-26 lb·ft).
- 3. Secure charge air intake housing (2) to support bracket with bolt. Tighten bolt to 31-35 N·m (23-26 lb·ft).
- 4. Using a new gasket, secure EGR delivery pipe (4) to charge air intake housing (2) with two bolts. Tighten bolts to 31-35 N·m (23-26 lb·ft).
- 5. Connect the electrical plug connector (5) to the temperature sensor (6).

3-14

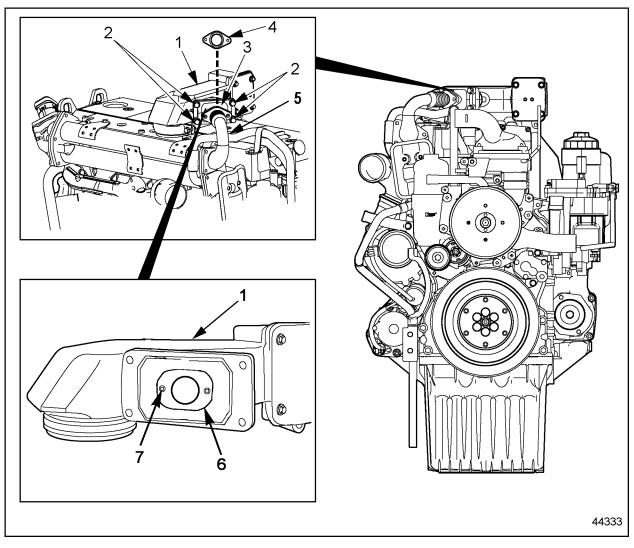
# 3.4 EGR/CA MIXER HOUSING

# 3.4.1 EGR/CA Mixer Housing Removal

Remove the EGR/CA mixer housing as follows (see Figure 3-9 for component locations):

- 1. Remove the charge air intake housing (1). Refer to section 3.3.1.
- Remove the EGR/CA mixer housing cover bolts (2) and remove the gasket and cover (3). Discard gasket.

3. Remove two hexagon socket-head head screws (7) securing the EGR/CA mixer tube (6) inside the charge air intake housing (1).



- 1. Charge Air Intake Housing
- 2. EGR/CA Mixer Housing Cover Bolts
- 3. EGR/CA Mixer Housing Cover
- 4. Delivery Pipe Gasket

3-16

- 5. Delivery Pipe
- 6. EGR/CA Mixer Tube
- 7. Hexagon Socket-head Screw

### Figure 3-9 EGR/CA Mixer Housing Removal and Installation

# 3.4.2 EGR/CA Mixer Housing Installation

Install the EGR/CA mixer housing as follows (see Figure 3-9 for component locations):

- 1. Install EGR/CA mixer tube (6) in charge air intake housing (1) with two hexagon socket-head screws (7). Tighten screws to 12–14 N·m (9–10 lb·ft).
- 2. Install charge air housing. Refer to section 3.3.2.

# 3.5 EGR COOLER

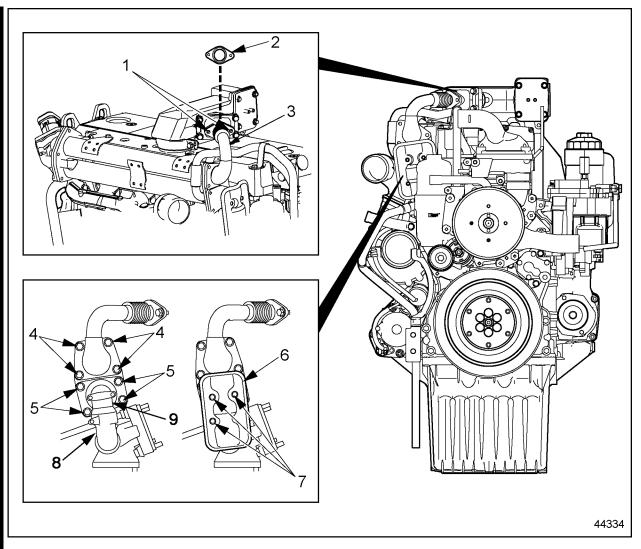
# 3.5.1 EGR Cooler Removal

Remove the EGR cooler as follows:

1. Drain the coolant.

# NOTICE:

No coolant must escape during disassembly of the coolant inlet line.



- 1. EGR Delivery Pipe Bolts
- 2. EGR Delivery Pipe Gasket
- 3. EGR Delivery Pipe
- 4. Bolts
- 5. Bolts

- 6. Heat Shield
- 7. Heat Shield Mounting bolts
- 8. EGR Exhaust Elbow
- 9. EGR Exhaust Housing

- - - - -

# Figure 3-10 EGR Cooler Removal and Installation

- 2. Remove the two bolts (1) from the EGR delivery pipe (3). See Figure 3-10.
- 3. Remove four bolts (4) from the EGR cooler upper flange. See Figure 3-10.

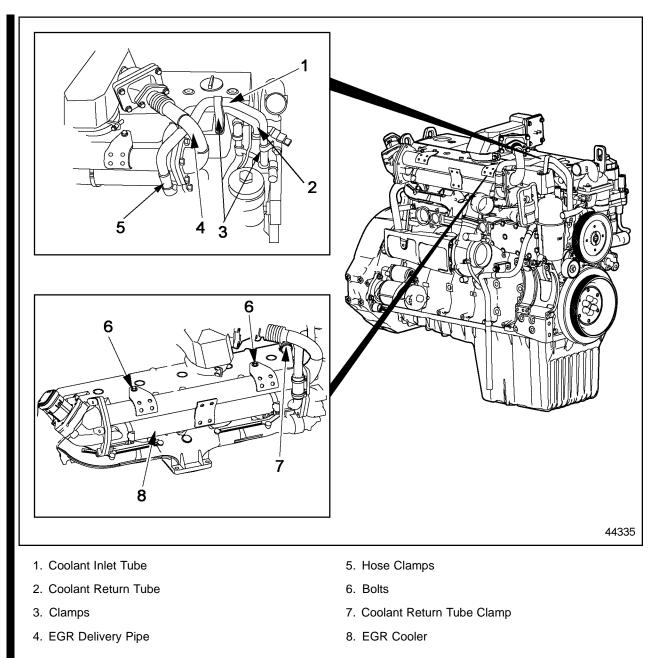
4. Remove EGR delivery pipe (3). See Figure 3-10.

### NOTE:

The EGR cooler end gasket is a one piece gasket. Whenever the EGR delivery tube is removed, the EGR exhaust elbow must also be removed to replace the gasket. If the EGR exhaust elbow is removed the EGR delivery tube must be removed in order to replace the gasket.

- 5. Remove three bolts (7) from heat shield (6) and remove shield. See Figure 3-10.
- 6. Remove four bolts (5) from the lower EGR cooler flange. Remove housing (9) and elbow (8). See Figure 3-10.

7. Remove elbow (8) from housing and inspect seal rings. If damaged replace seal rings. See Figure 3-10.



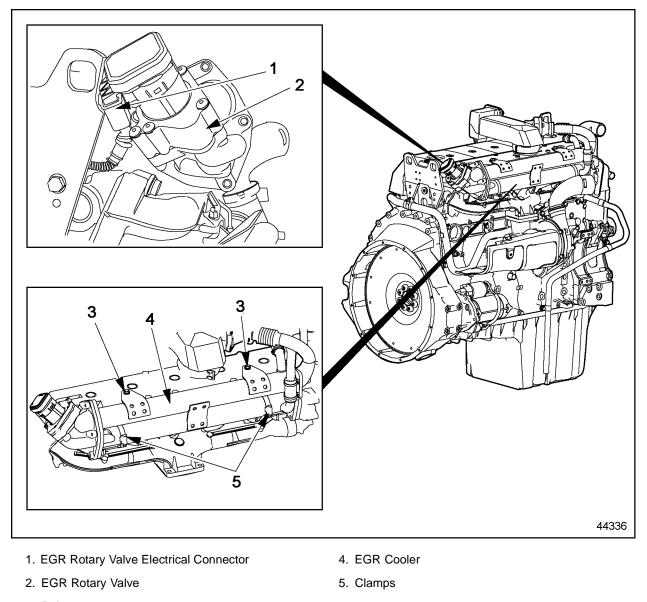
### Figure 3-11 Coolant Inlet Line and Related Components

- 8. Remove bolts from clamps (3) securing coolant inlet tube (1) to thermostat housing and air intake manifold. See Figure 3-11.
- 9. Loosen two hose clamps (5) from hose on coolant inlet tube (1).
- 10. Remove coolant inlet tube and O-ring. Discard O-ring.

- 11. Remove two bolts, hose and clamps securing EGR coolant return tube (2) to thermostat housing and EGR cooler (8). See Figure 3-11.
- 12. Remove EGR coolant return tube (2) and gasket. Discard gasket.
- 13. Remove electrical plug connector (1) from the EGR rotary valve (2). See Figure 3-12.
- 14. Remove two bolts (3) securing the EGR cooler (4). See Figure 3-12.

### NOTE:

On MBE 904, 906, 924 and 926 engines, the EGR cooler is secured with two brackets with two hose clamps.



3. Bolts

## Figure 3-12 EGR Rotary Valve and Related Components

- 15. Remove the hose clamps (5) on the EGR cooler (4). See Figure 3-12.
- 16. Remove the EGR cooler (4) with the EGR rotary valve (2) still attached. See Figure 3-12.
- 17. If required, remove two EGR cooler lower support brackets by removing two bolts per bracket.
- 18. Remove the EGR rotary valve (2) from the EGR cooler (4) by removing five nuts and gasket. Discard gasket. See Figure 3-12.

# 3.5.2 EGR Cooler Installation

Install the EGR cooler as follows (see Figure 3-12 for component location):

- 1. Install the EGR rotary valve (2) and new gasket on the EGR cooler (4) with five nuts. Tighten nuts to 31-35 N·m (23-26 lb·ft).
- 2. If removed, install two lower EGR cooler support brackets and secure with two bolts per bracket. Tighten bolts to 60-66 N·m (44-49 lb·ft).
- 3. Install the EGR cooler (4) on lower support brackets.
- 4. Secure EGR cooler (4) with two bolts (3). Tighten bolts to 31-35 N·m (23-26 lb·ft).
- 5. Install and tighten clamps (5) on the EGR cooler (4).
- 6. Install electrical plug connector (1) to the rotary valve (2). See Figure 3-12.
- Inspect the coolant return hose for any damage. Replace hose if required. Install the coolant return tube (2) in hose. Using a new gasket and two bolts secure to the thermostat housing. Tighten bolts to 31-35 N·m (23-26 lb·ft). See Figure 3-11.
- 8. Tighten hose clamps on coolant hose.
- 9. Install new seal ring on coolant inlet tube (1). See Figure 3-11.
- 10. Install coolant inlet tube (1) into hose (5) and secure coolant inlet tube with two bolts at clamps (3). Tighten bolts to 31-35 N·m (23-26 lb·ft). See Figure 3-11.
- 11. Install EGR exhaust elbow (8) with seal rings in EGR exhaust housing (9) and into end of exhaust manifold. See Figure 3-10.

### NOTE:

The EGR cooler end gasket is a one piece gasket. Whenever the EGR delivery tube is removed, the EGR exhaust elbow must also be removed to replace the gasket. If the EGR exhaust elbow is removed the EGR delivery tube must be removed in order to replace the gasket.

- 12. Using a new gasket, install the EGR exhaust housing (9) using four bolts (5). Tighten bolts to 31-35 N·m (23-26 lb·ft). See Figure 3-10.
- 13. Install heat shield (6) using three mounting bolts (7). Tighten bolts to 12-14 N·m (9-10 lb·ft). See Figure 3-10.
- 14. Loosely install EGR delivery pipe (3) at upper cooler flange with four bolts (1). See Figure 3-10.

- Install the EGR delivery pipe (3) using a new gasket (2) and two bolts (1). Tighten bolts to 31-35 N·m (23-26 lb·ft). See Figure 3-10.
- 16. Tighten EGR delivery pipe bolts (4) at lower flange. Tighten bolts to 31-35 N·m (23-26 lb·ft). See Figure 3-10.
- 17. Fill engine with fresh coolant to required levels.

# 3.5.2.1 Testing Engine for Leaks

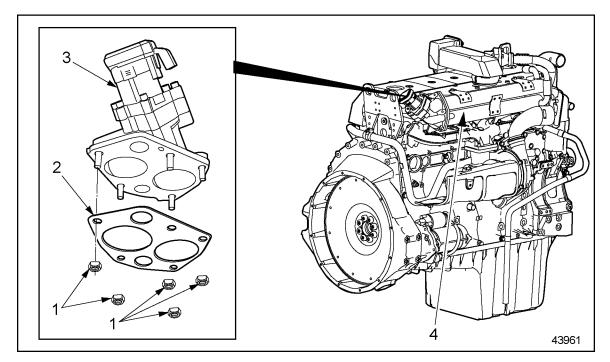
Perform the following steps to test the engine for coolant leaks:

- 1. Check the coolant level and top off if required.
- 2. Check for leaks with the engine running.
- 3. If any leaks are observed shut engine down and make necessary repairs.

#### EGR ROTARY VALVE 3.6

#### 3.6.1 **EGR Rotary Valve Removal**

Remove the EGR rotary valve as follows (see Figure 3-13 for component locations):



1. Nuts	3. EGR Rotary Valve
2. Gasket	4. EGR Cooler

### 2. Gasket

#### Figure 3-13 Exploded view of Rotary (EGR) Valve

- 1. Drain engine coolant.
- 2. Remove EGR cooler. Refer to section 3.5.1.
- 3. Remove five nuts (1) from EGR rotary valve (3) and remove from EGR cooler (4). Discard gasket (2). See Figure 3-13.

### NOTE:

The EGR rotary valve is not serviced and must be replaced as an assembly.

#### **EGR Rotary Valve Installation** 3.6.2

Install the EGR rotary valve as follows (See Figure 3-13 for component locations):

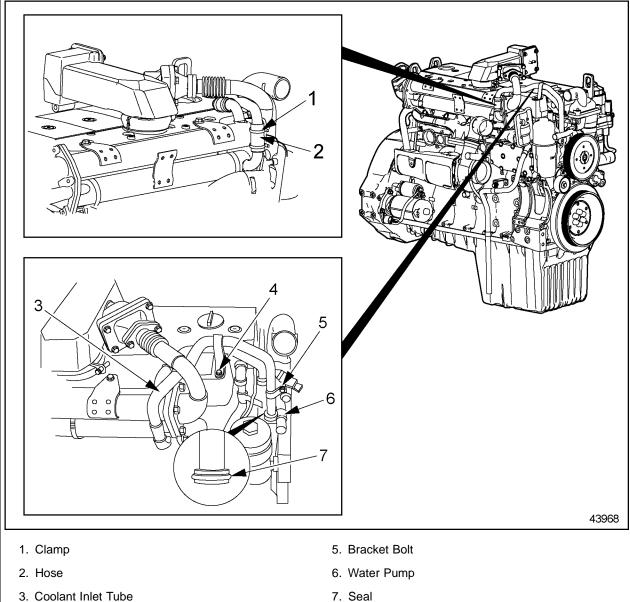
- Using a new gasket (2), install the EGR valve (3) to the cooler using the five nuts (1). 1. Tighten nuts to 31-35 N·m (23-26 lb·ft).
- Install EGR cooler. Refer to section 3.5.2. 2.

- 3. Fill engine with fresh coolant to required level.
- 4. Test engine for leaks. Refer to section 3.5.2.1.

#### EGR COOLANT INLET TUBE 3.7

#### 3.7.1 **EGR Coolant Inlet Tube Removal**

Remove the EGR coolant inlet tube as follows (see Figure 3-14 for componet locations):



- 3. Coolant Inlet Tube
- 4. Bracket Bolt

#### Figure 3-14 EGR Coolant Inlet Tube and Related Components

- Remove EGR delivery pipe. Refer to section 3.9.1. 1.
- Loosen the hose clamps (1) on the coolant hose (2). See Figure 3-14. 2.
- Remove the two bolts (4, 5) from the brackets securing the coolant inlet tube (3). 3.

4. Remove the coolant inlet tube (3) from the coolant hose (2) and the water pump (6). Remove and discard seal (7) from tube.

### 3.7.2 EGR Coolant Inlet Tube Installation

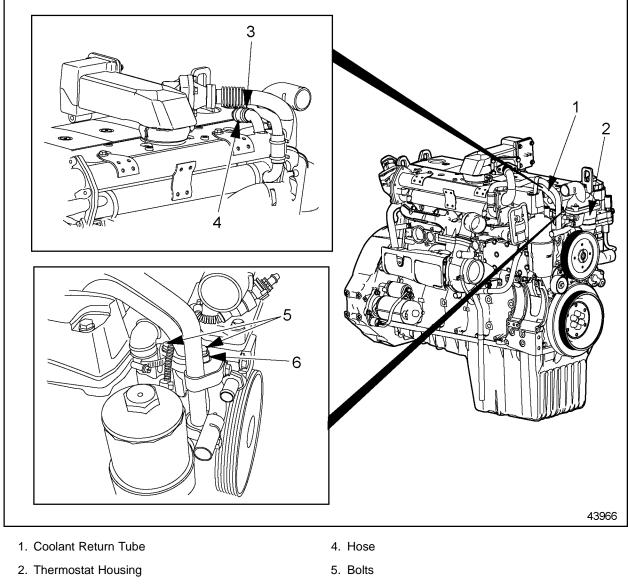
Install the EGR coolant inlet tube as follows (See Figure 3-14 for component locations):

- 1. Lubricate new coolant inlet tube seal (7) with lubricant (order number 000 989 11 60) and install on inlet tube.
- 2. Inspect the coolant hose (2) for damage and replace if required.
- 3. Install inlet tube in hose (2) and at water pump (6) and secure with bolts (4 and 5) at clamps. Tighten bolts to 31-35 N·m (23-26 lb·ft) and tighten hose clamps.
- 4. Install EGR delivery pipe. Refer to section 3.8.2.
- 5. Fill engine with fresh coolant to required level.
- 6. Test engine for leaks, refer to section 3.5.2.1 and perform the required steps.

# 3.8 EGR COOLANT RETURN TUBE

# 3.8.1 EGR Coolant Return Tube Removal

Remove the EGR coolant return tube as follows (see Figure 3-15 for component locations):



3. Clamp

6. Gasket

# Figure 3-15 EGR Coolant Return Tube and Related Components

- 1. Drain the engine coolant.
- 2. Remove EGR delivery pipe. Refer to section 3.9.1.
- 3. Remove the two bolts (5) attaching the coolant return tube (1) to the thermostat housing (2).

- 4. Loosen the hose clamp (3) on the coolant hose (4).
- 5. Remove coolant return tube (1) from the coolant hose (4) and thermostat housing (2). Discard gasket (6).

### 3.8.2 EGR Coolant Return Tube Installation

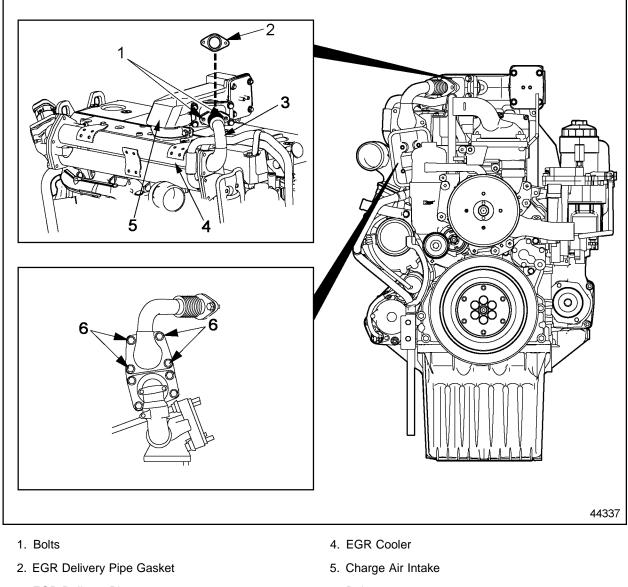
Install the EGR coolant return tube as follows (see Figure 3-15 for component locations):

- 1. Replace gasket (6) and inspect the coolant hose (4) for any damage. Replace hose if required. Install the coolant return tube (1) to the coolant hose (4) and at the thermostat housing (2).
- 2. Tighten the hose clamps (3) on the coolant hose (4).
- 3. Install and tighten the two bolts (5) attaching the coolant return tube (1) to the thermostat housing (2). Tighten bolts to 31-35 N·m (23-26 lb·ft).
- 4. Install EGR delivery pipe. Refer to section 3.9.2.
- 5. Fill engine with fresh coolant to required level.
- 6. Test engine for leaks, refer to section 3.5.2.1 and perform the required steps.

# **3.9 EGR DELIVERY PIPE**

# 3.9.1 EGR Delivery Pipe Removal

Remove the EGR delivery pipe as follows (see Figure 3-16 for component locations):



3. EGR Delivery Pipe

3-30

6. Bolts

# Figure 3-16 EGR Delivery Pipe and Related Components

1. Remove two bolts (1) and gasket (2) securing EGR delivery pipe (3) to charge air intake (5). Discard gasket.

### NOTE:

The EGR cooler end gasket is a one-piece gasket. Whenever the EGR delivery tube is removed, the EGR exhaust elbow must also be removed to replace the gasket. If the EGR exhaust elbow is removed the EGR delivery tube must be removed in order to replace the gasket

Remove EGR delivery pipe (3) and gasket from EGR cooler (4) by removing four bolts (6). Discard gasket.

# 3.9.2 EGR Delivery Pipe Installation

Install the EGR delivery pipe as follows (see Figure 3-16 for component locations):

### NOTE:

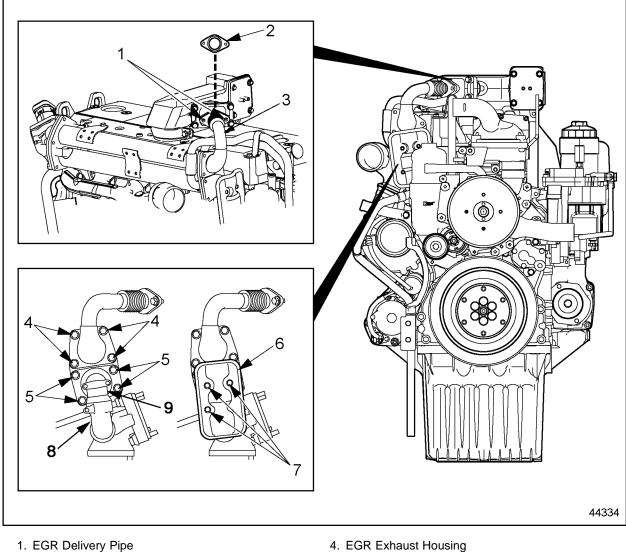
The EGR cooler end gasket is a one-piece gasket. Whenever the EGR delivery tube is removed, the EGR exhaust elbow must also be removed to replace the gasket. If the EGR exhaust elbow is removed the EGR delivery tube must be removed in order to replace the gasket.

- 1. Install a new gasket on the EGR delivery pipe (3) and loosely secure pipe to the EGR cooler (4) with four bolts (6).
- 2. Install a new gasket (2) between EGR delivery pipe (3) and charge air intake (5) and secure with two bolts (1). Tighten bolts to 31-35 N·m (23-26 lb·ft).
- 3. Tighten the four EGR delivery pipe bolts (6) at EGR cooler (4) to 31-35 N·m (23-26 lb·ft).

# 3.10 EGR EXHAUST ELBOW

#### EGR Exhaust Elbow Removal 3.10.1

Remove the EGR exhaust elbow as follows (see Figure 3-17 for component locations):



2. Heat Shield

- 5. Bolts

3. Bolts

6. EGR Exhaust Elbow

#### Figure 3-17 EGR Exhaust Elbow and Related Components

- 1. Remove three bolts (3) from heat shield (2) and remove shield. See Figure 3-17.
- 2. Remove four bolts (5) from the lower EGR cooler flange. Remove housing (4) and elbow (6). See Figure 3-17.

- 3. Remove elbow (6) from housing (4) and inspect seal rings. If damaged replace seal rings. See Figure 3-17.
- 4. Remove EGR delivery pipe. refer to section 3.9.1.

# 3.10.2 EGR Exhaust Elbow Installation

Install the EGR exhaust elbow as follows (see Figure 3-17 for component locations):

### NOTE:

The EGR cooler end gasket is a one-piece gasket. Whenever the EGR delivery tube is removed, the EGR exhaust elbow must also be removed to replace the gasket. If the EGR exhaust elbow is removed the EGR delivery tube must be removed in order to replace the gasket.

- 1. Install exhaust elbow (6) in housing (4).
- 2. Install a new gasket on the EGR exhaust housing (4) and secure to the EGR cooler with four bolts (5). Tighten bolts to 31-35 N·m (23-26 lb·ft).
- 3. Install EGR delivery pipe. refer to section 3.9.2.

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Page

# **3.A ADDITIONAL INFORMATION**

# Description

SPECIFICATIONS		
Air Compressor	3-35	
Air Governor	3-36	

# **SPECIFICATIONS**

Any specifications for special equipment are listed below.

# **Air Compressor**

The specifications for the air compressor torque values are listed in Table 3-1.

Description	N-m (lb-ft)
Air Compressor Mounting Bolts	40 (30)
Discharge Line Fitting	100 (74)
Coolant Line Banjo Bolts	40 (30)
Drive Nut	270 (200)
Power Steering Pump Mounting Bolts	40 (30)

## Table 3-1Air Compressor Torque Values

# Air Governor

The specifications for the air governor torque values are listed in Table 3-2. The list of approved pipe thread sealants are listed in Table 3-3.

Description	N-m (lb-ft)
Air Governor Mounting Bolt, M8	16 (12)

### Table 3-2Air Governor Torque Values

Protectant Material	Approved Brand
	Loctite 567
Pipe Thread Sealant (49–00094–108)	Henkel 790 Pipegrip
	Perma-Lok LH-150

 Table 3-3
 Approved Pipe Thread Sealants