Table of Contents

Description

See (See Variable Geometry Turbocharger (VGT), page 21) for complete description of the EVRT® electronically controlled turbocharger.

This engine is equipped with a EVRT® electronically controlled turbocharger. For the procedures in this manual, the term Variable Geometry Turbocharger (VGT) will be used.

Major VGT assembly components are not serviceable individually. When turbocharger issues arise, remove the VGT and perform an initial inspection.

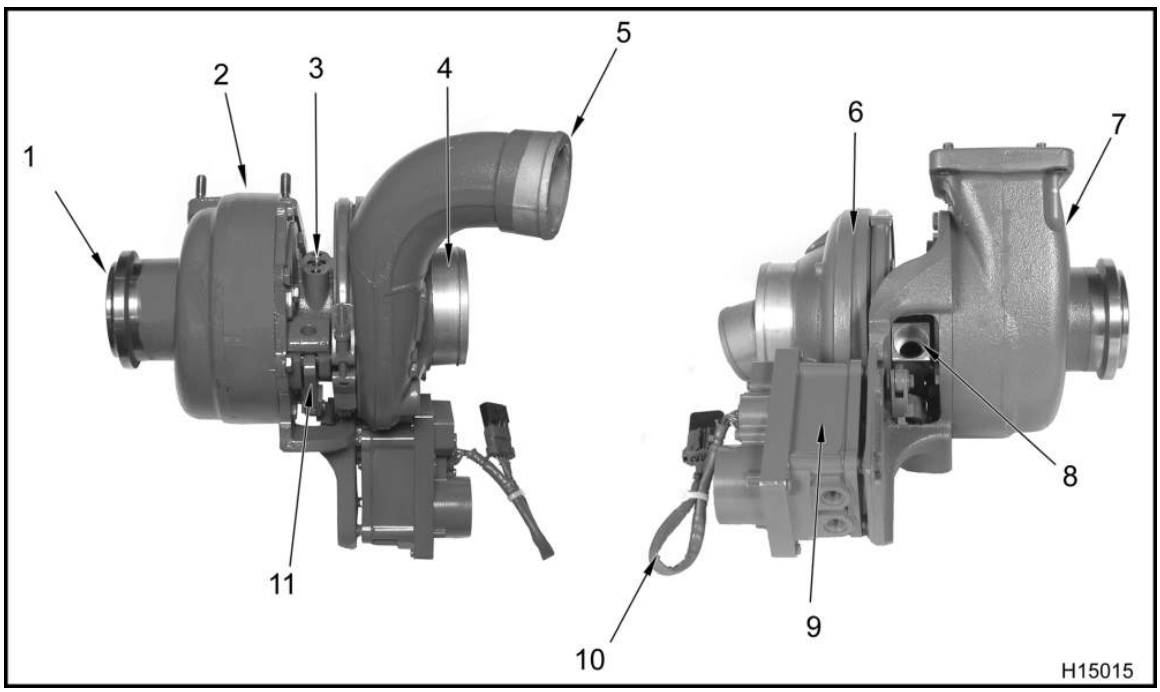

Figure 54 EVRT® Electronically Controlled Turbocharger component locations

1. Turbine outlet
2. Turbine inlet
3. Oil supply port
4. Compressor inlet
5. Compressor outlet
6. Compressor housing
7. Turbine housing
8. Oil drain port
9. Turbocharger control module
10. Electrical connector
11. VGT linkage

Removal

Variable Geometry Turbocharger (VGT) Assembly and Components

WARNING: To avoid serious personal injury, possible death, or damage to the engine or vehicle, read all safety instructions in the "Safety Information" section of this manual.

WARNING: To avoid serious personal injury, possible death, or damage to the engine or vehicle, make sure that the engine has cooled down sufficiently before attempting to remove VGT assembly.

WARNING: To avoid serious personal injury, possible death, or damage to the engine or vehicle, make sure to disconnect the battery cable from the battery. Failure to remove the battery ground cable could cause an electrical arc while removing the turbocharger.

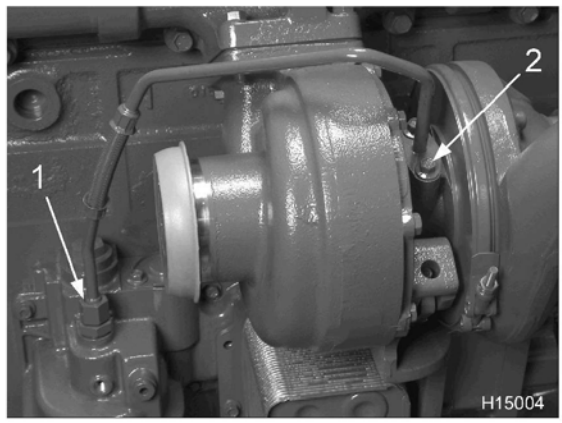

Figure 55 Oil inlet tube assembly

1. Nut
2. Bolt, M8 x 20 (2)

1. Remove turbo oil inlet tube assembly nut from fitting on top of oil filter header.
2. Remove two bolts (M8 x 20) from turbo oil inlet tube assembly. Remove tube assembly, and discard O-ring.

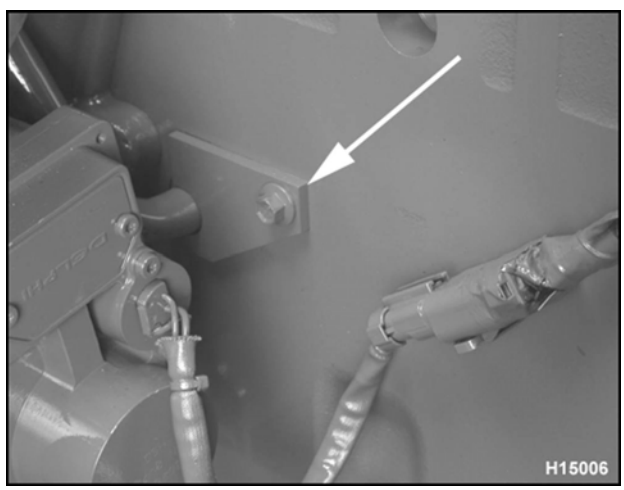

Figure 56 Oil drain tube bracket and bolt

3. Remove the bolt (M8 x 16) from the turbo oil drain tube bracket.
4. Disconnect electrical harness from VGT actuator.

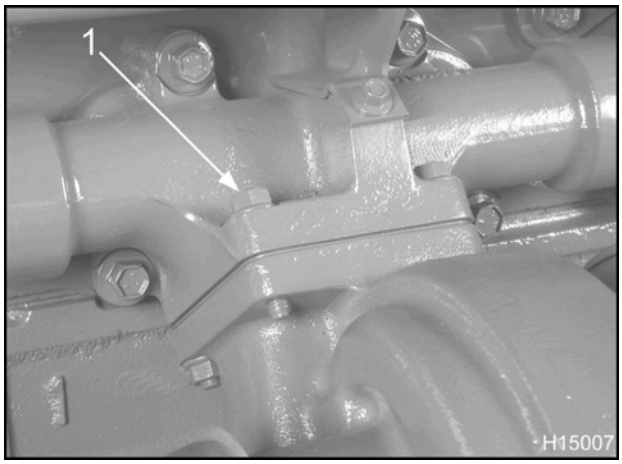

Figure 57 VGT mounting nuts

1. Nuts, M10 (4)

NOTE: To aid in the disassembly of the turbocharger, loosen four nuts (M10) between ⅛ and ¼ of a turn then tap each nut using a socket or flat punch and hammer. This will knock the “peaks” of the stud threads off the “ramps” of the special Spiralock® nuts, thus allowing the nuts to unthread with considerable ease.

5. Remove four nuts (M10) securing the VGT assembly to the exhaust manifold.
6. Remove VGT assembly and turbo oil drain tube as a combined unit. Discard turbo mounting gasket, oil drain tube O-rings, and mounting nuts.

Cleaning

Turbocharger and Related Parts

1. Use soap and water to clean piping between VGT and air cleaner assembly. Use filtered compressed air page 3 to dry all piping.
2. Use filtered compressed air page 3 to clean the air inlet piping and connecting hoses.
3. Use a suitable solvent and a nylon brush to clean the oil inlet tube and oil drain tube. Use filtered compressed air page 3 to dry the tubes. Replace any damaged tubes.
4. Clean off any remaining gasket material from the turbine housing and exhaust manifold mounting surfaces.

Inspection

Checking Turbine and Compressor

1. Position VGT on a workbench so that the shaft is horizontal.

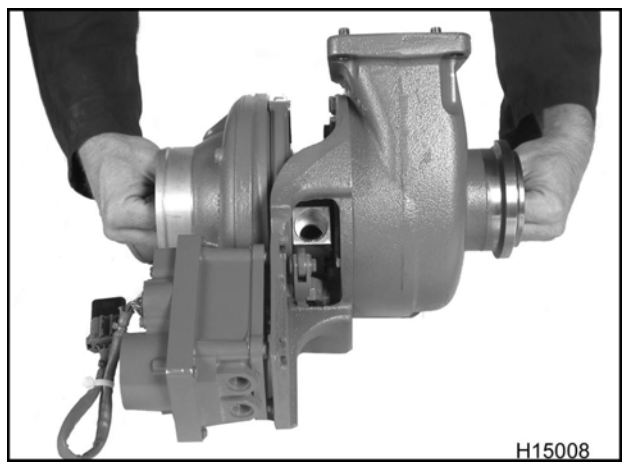

Figure 58 Checking shaft rotation

2. Turn shaft by hand and check for wheel rub within each housing.

   The wheels must rotate freely. If there is any rubbing or interference, replace the VGT assembly.

NOTE: Do not attempt to straighten bent blades.

3. Check the compressor impeller and turbine wheel. If there are deposits on the blades or any blades are bent, broken or eroded, replace the VGT assembly.

Checking Axial End Play

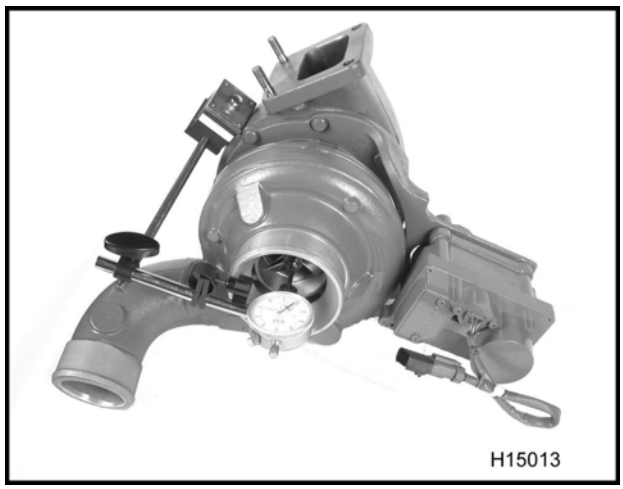

Figure 59 Setup for checking axial end play

1. Place VGT assembly onto a clean workbench.
2. Position dial indicator magnetic base onto a suitable location. Place tip of indicator onto the turbine shaft and zero the indicator needle with face graduations.
3. Move the shaft back and forth by hand. Record turbine shaft end play on dial indicator. If the reading exceeds specifications, replace the VGT assembly.
4. Orient VGT assembly so that actuator linkage can be easily accessed and viewed. Move the actuator shaft through its entire travel. The actuator shaft should rotate 90° and return under spring tension.

Installation

Variable Geometry Turbocharger (VGT) Assembly and Components

1. Place a new turbo mounting gasket onto turbocharger flange studs.
2. Place a new O-ring onto each end of the turbo oil drain tube and lubricate with clean engine oil.

CAUTION: To avoid serious personal injury, possible death, or damage to the engine or vehicle, exercise special care not to cut or damage oil drain tube O-rings.

3. Install oil drain tube into turbocharger side and then move turbocharger and oil drain tube into cylinder block as a unit.
4. Mount VGT onto exhaust manifold and thread two new nuts (M10) onto top studs and leave loose.

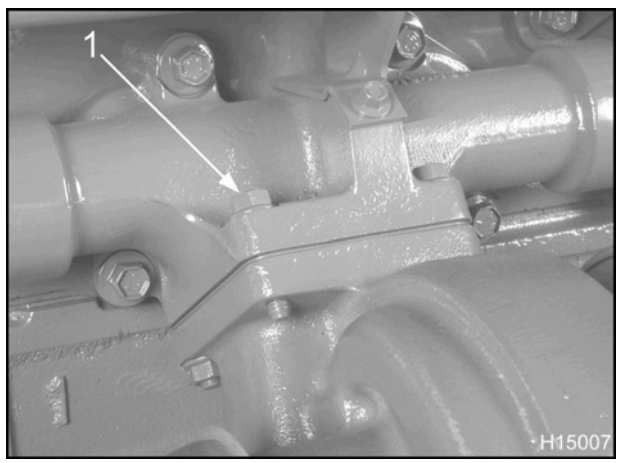

Figure 60 VGT mounting nuts

1. Nuts, M10 (4)

5. Install two new nuts (M10) to the bottom exhaust manifold studs. Tighten all four turbocharger mounting nuts making sure the oil drain tube is seated within the cylinder block drain port. Torque turbocharger mounting nuts to the special torque value (Table 6).

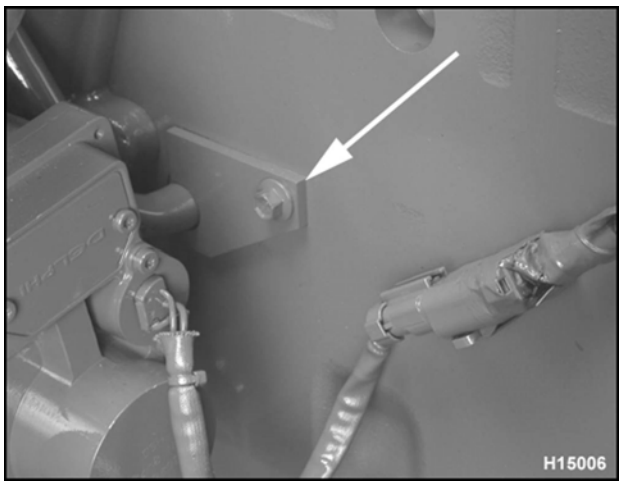

Figure 61 Oil drain tube bracket and bolt

6. Align oil drain tube bracket with bolt (M8 x 16) and hole and tighten bolt to the standard torque value (See General Torque Guidelines, page 409).
7. Place a new turbo oil inlet O-ring over oil inlet flange located on top of the VGT central housing.

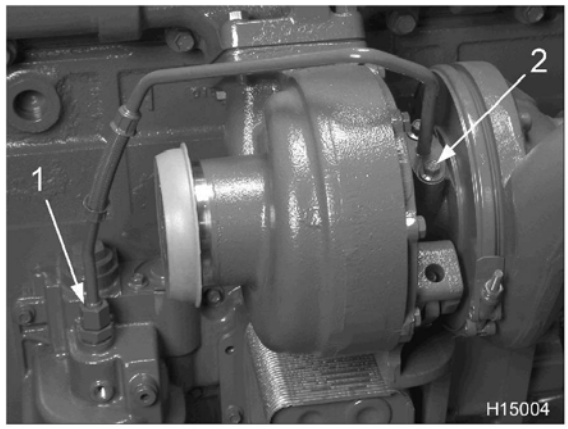

Figure 62 Oil inlet tube assembly

1. Nut
2. Bolt, M8 x 20 (2)

8. Thread two bolts (M8 x 20) through turbo oil inlet tube assembly at the top of the VGT. Do not tighten these bolts yet.
9. Thread oil inlet tube assembly nut onto fitting located on top of oil filter header.
10. Tighten two bolts (M8 x 20) at the top of the oil inlet tube assembly to the standard torque value (See General Torque Guidelines, page 409).
11. Tighten oil inlet tube assembly nut to the standard torque value (See General Torque Guidelines, page 409).
12. Connect electrical harness to VGT actuator.

SPECIFICATIONS

Table 5 VGT Specifications

Turbine shaft axial end play	0.05-0.13 mm (0.002-0.005 in)
Turbine shaft radial movement	0.52-0.74 mm (0.020-0.029 in)
VGT axial linkage shaft	Must strike open and closed stops in actuator, 90° rotation

Special Torque

Table 6 VGT Special Torques

Turbo mounting studs and nuts	71 N·m (52 lbf·ft)

SPECIAL SERVICE TOOLS

Table 7 VGT Special Service Tools

Dial indicator set	Obtain locally
Intake guard	JDG576

Table of Contents

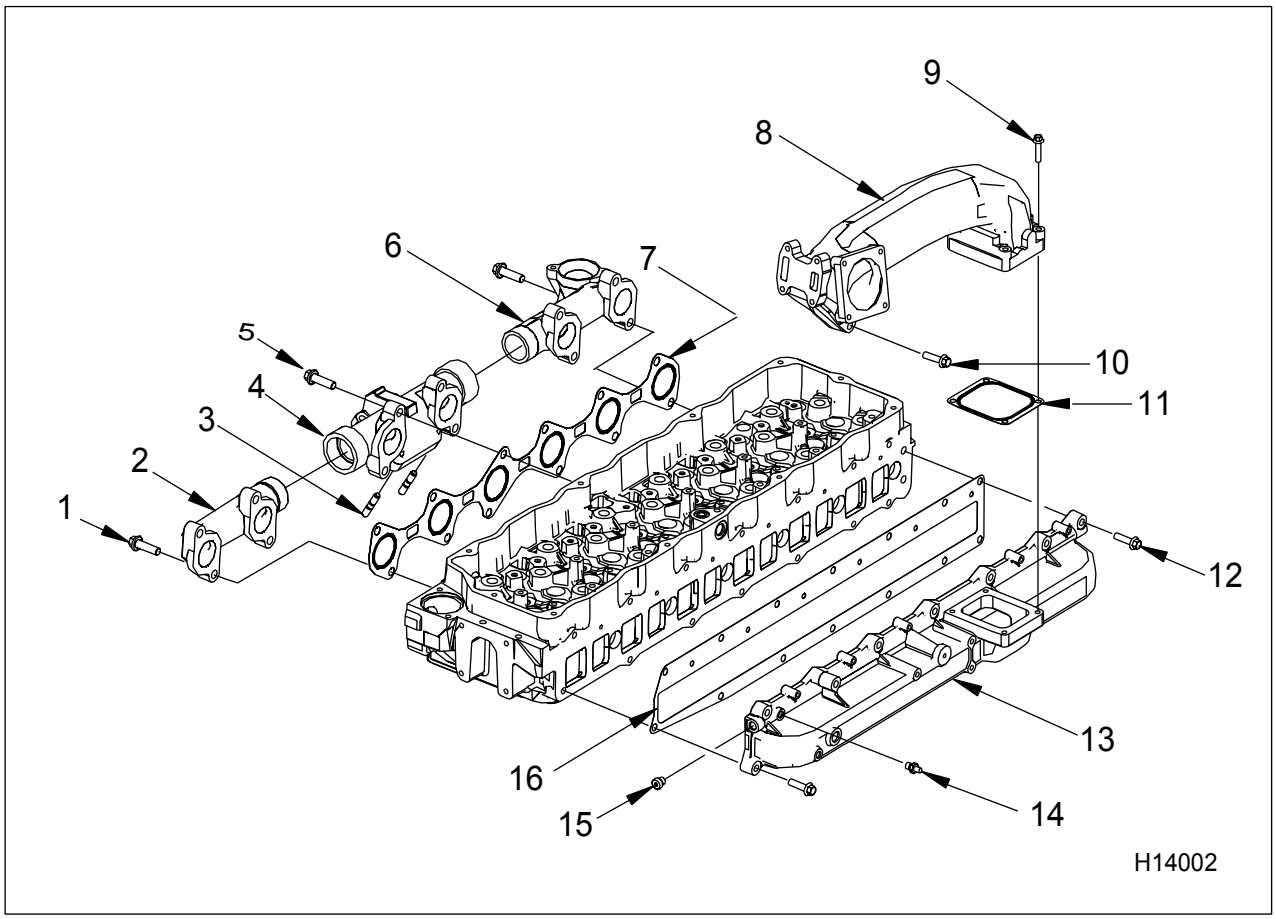

Figure 63 Intake manifold, inlet and EGR mixer, and exhaust manifold assemblies

1. Exhaust manifold flange head bolt, M12 x 35 (11)
2. Manifold, exhaust front
3. Stud, M10 (2)
4. Manifold, exhaust center (low or high mount turbo versions)
5. Exhaust manifold and EGR bracket flange head bolt, M12 x 120 (1)
6. Manifold, exhaust rear (short or long EGR cooler version)
7. Exhaust manifold gasket
8. Inlet and EGR mixer duct (heater optional)
9. EGR mixer flange bolt, M8 x 60 (4)
10. EGR mixer support bolt, M10 x 90
11. Intake manifold to mixer gasket
12. Intake manifold bolt, M10 x 35 (13)
13. Intake manifold
14. Fuel (Schrader) valve
15. Intake manifold plug (2)
16. Intake manifold gasket

Removal

WARNING: To avoid serious personal injury, possible death, or damage to the engine or vehicle, read all safety instructions in the "Safety Information" section of this manual.

WARNING: To avoid serious personal injury, possible death, or damage to the engine or vehicle, make sure the transmission is in neutral, parking brake is set, and wheels are blocked before doing diagnostic or service procedures on engine or vehicle.

NOTE: For information regarding the removal or installation of adjacent components, refer to the following service procedures located in other sections of this manual:

- VGT turbo
- EGR valve
- Fuel filter assembly
- Crankcase breather
- Oil fill tube assembly

Exhaust Manifold

1. Disconnect the EBP tubing nut at exhaust manifold.

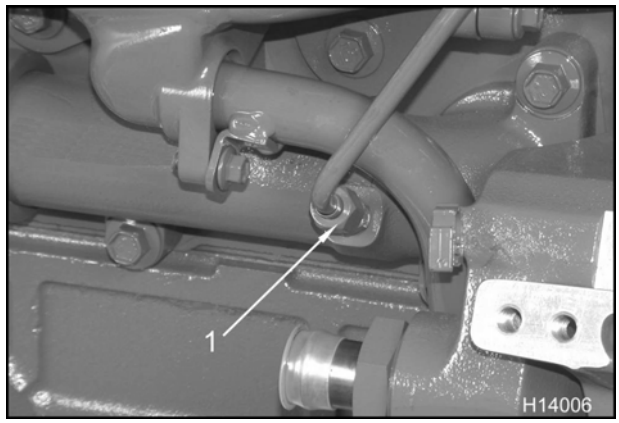

Figure 64 EBP tubing nut

1. EBP tubing nut

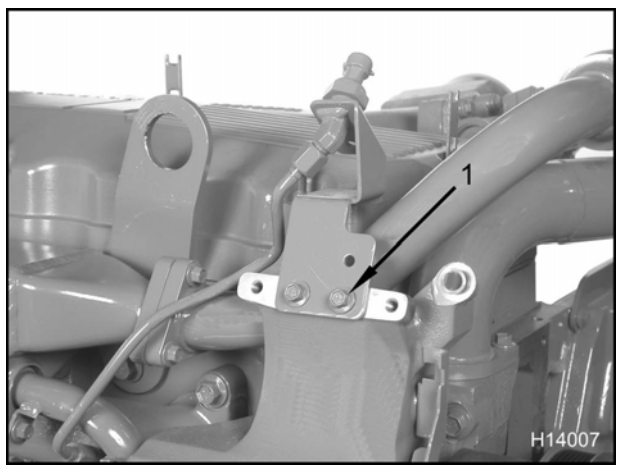

Figure 65 Removing EBP tubing bracket

1. EBP tubing bracket bolts (2)

2. Remove EBP tubing bracket bolts at water housing (Freon® compressor bracket).
3. Lift the EBP tubing and bracket assembly from the engine.

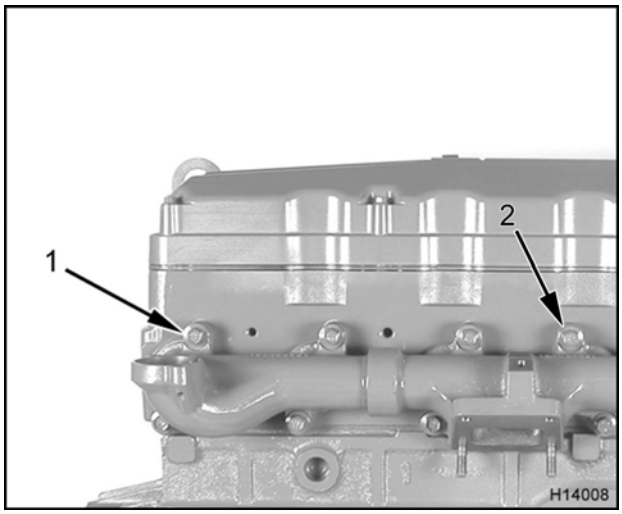

Figure 66 Exhaust manifold mounting bolts

1. Exhaust manifold mounting bolts, M12 x 35 (11)
2. Exhaust manifold mounting bolt, M12 x 120

4. Remove 11 mounting bolts (M12 x 35) and one mounting bolt (M12 x 120) securing the three-piece exhaust manifold to the cylinder head.

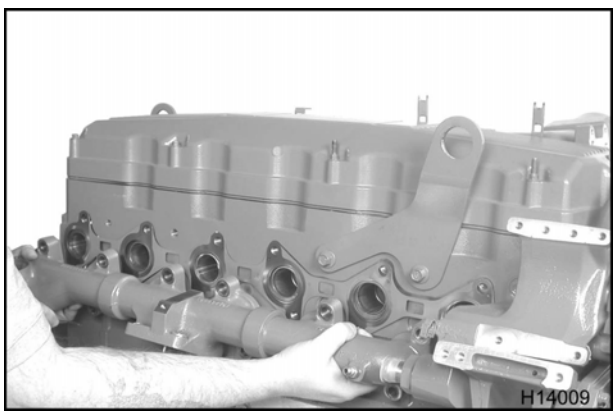

Figure 67 Removing exhaust manifold

5. Remove exhaust manifold from the engine and discard the one piece gasket.

Inlet and EGR Mixer Duct

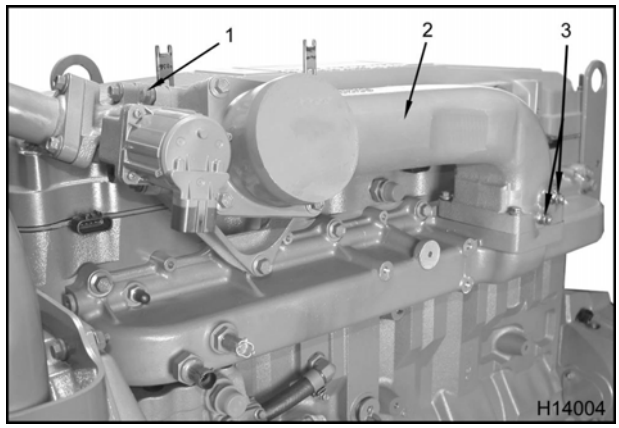

Figure 68 Inlet and EGR mixer duct related components

1. EGR valve mounting bolts (4)
2. Inlet and EGR mixing duct
3. Inlet air heater cable connections (if equipped)

1. Remove four EGR valve mounting bolts at the EGR valve to mixer duct connection.
2. Remove EGR valve gasket and discard.
3. Disconnect the intake air heater cables (if equipped with inlet air heater option).

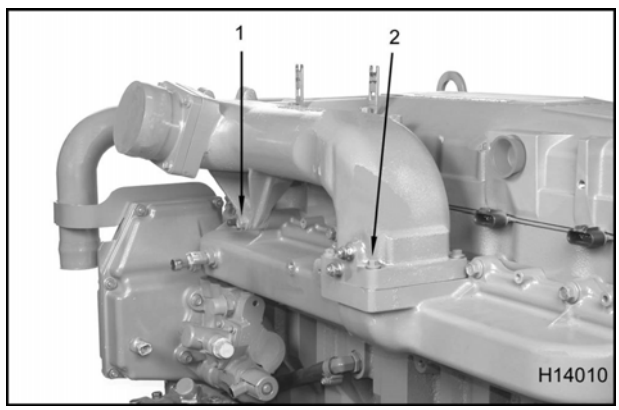

Figure 69 Inlet and EGR mixer duct bolts

1. Inlet and EGR mixer support bolt, M10 x 90
2. Inlet mixer bolts, M8 x 60 (4)

4. Remove the inlet and EGR mixer duct bolts.

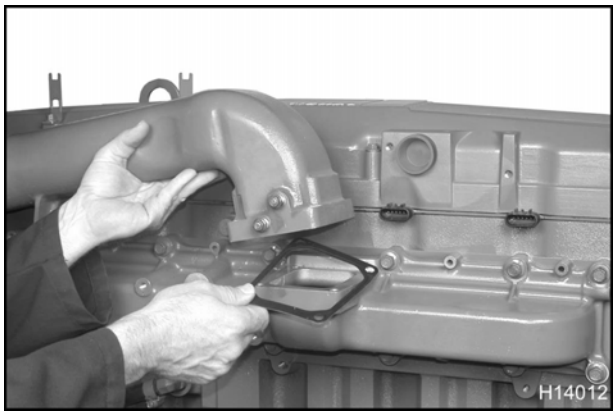

Figure 70 Inlet and EGR mixer duct gasket

5. Lift inlet and EGR mixer duct away from the intake manifold. Remove gasket and discard.

Intake Manifold

1. Disconnect wire from MAP and MAT sensor connectors.
2. Disconnect injector harness anchor points.
3. Pull out wiring harness and connectors.
4. Disconnect the high-pressure oil hose at pump.

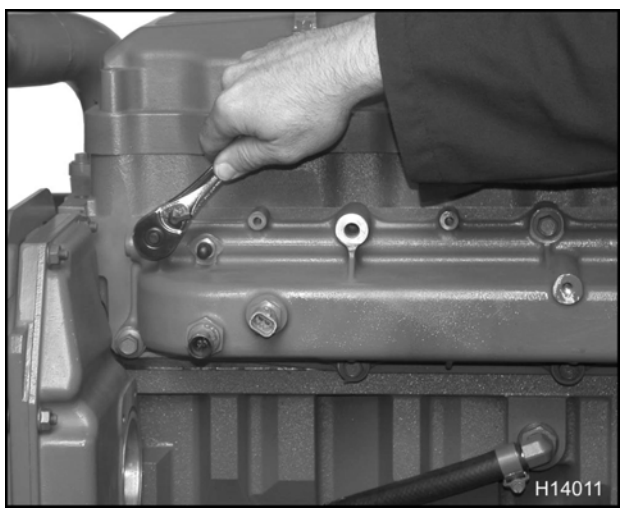

Figure 71 Intake manifold mounting bolts

5. Remove 13 intake manifold mounting bolts (M10 x 35).
6. Remove intake manifold and gasket from the engine. Discard gasket.

Cleaning and Inspection

Exhaust Manifold

1. Clean exhaust manifold thoroughly with a suitable non-caustic solvent. Scrape off excess scale and rust from manifold surfaces.
2. After cleaning, blow dry using filtered compressed air page 3.
3. Check manifold for cracks and damage. Replace manifold as necessary.
4. Check for warpage as follows:
   a. Install exhaust manifold without the gasket to a cleaned cylinder head mating surface. Torque 12 mounting bolts (M12 x 35) to the special torque value (Table 9).

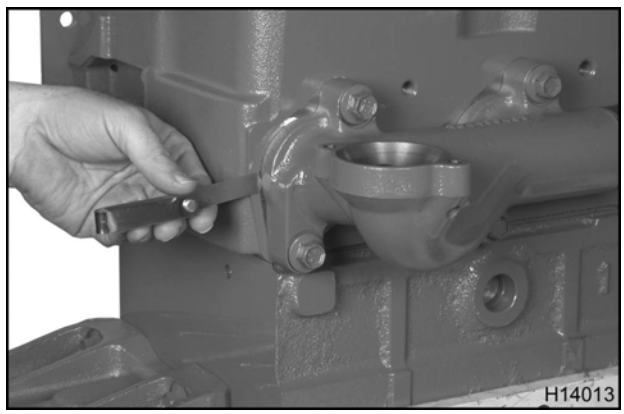

Figure 72 Checking exhaust manifold for cracks and warpage

   b. Use a 0.25 mm (0.010 in) feeler gauge to measure the gap between the mating surfaces of the manifold and engine. If the feeler gauge passes through the gap, the manifold must be resurfaced.

      NOTE: A maximum of 0.64 mm (0.025 in) of material can be ground off to correct warpage.

   c. Remove 12 bolts (M12 x 35) and manifold.
   d. If the warpage cannot be corrected by grinding manifold mating surface, replace manifold.

Intake Manifold

CAUTION: To avoid engine damage, do not attempt to grind or machine the intake manifold to compensate for a warped condition.

1. Clean inlet manifold thoroughly with a suitable non-caustic solvent.
2. After cleaning, blow dry using filtered compressed air page 3.
3. Check manifold for cracks and damage. Replace intake manifold as necessary.

Installation

Exhaust Manifold

CAUTION: To avoid engine damage, make sure exhaust manifold gasket and exhaust manifold are aligned before tightening bolts to the specified torque value.

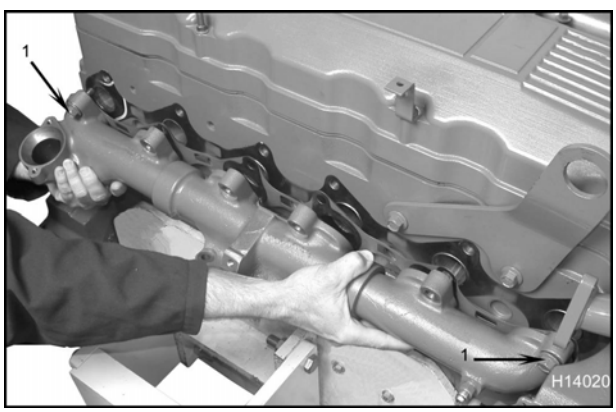

Figure 73 Installing exhaust manifold

1. Bolts installed holding gasket

1. Apply anti-seize compound to all 11 bolt (M12 x 35) threads and one bolt (M12 x 120) used with the EGR cooler bracket.
2. Insert an exhaust manifold bolt (M12 x 35) at each end of the assembled exhaust manifold. Place the exhaust manifold gasket over these two bolts. This will ensure a proper alignment of the exhaust manifold and gasket.

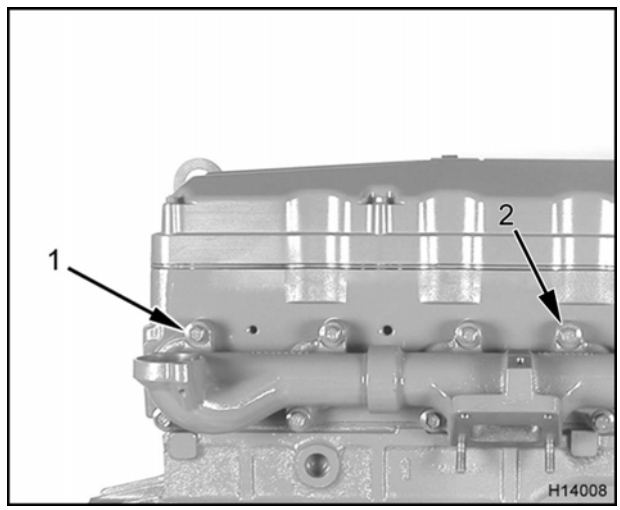

Figure 74 Exhaust manifold mounting bolts

1. Exhaust manifold mounting bolts, M12 x 35 (11)
2. Exhaust manifold mounting bolt, M12 x 120

3. Install assembled exhaust manifold with a new gasket to cylinder head.

NOTE: Refer to the EGR Cooler and Tubing Section for instructions assembling the EGR cooler.

4. Torque the exhaust manifold bolts in the following three step sequence.

Exhaust Manifold Torque Sequence

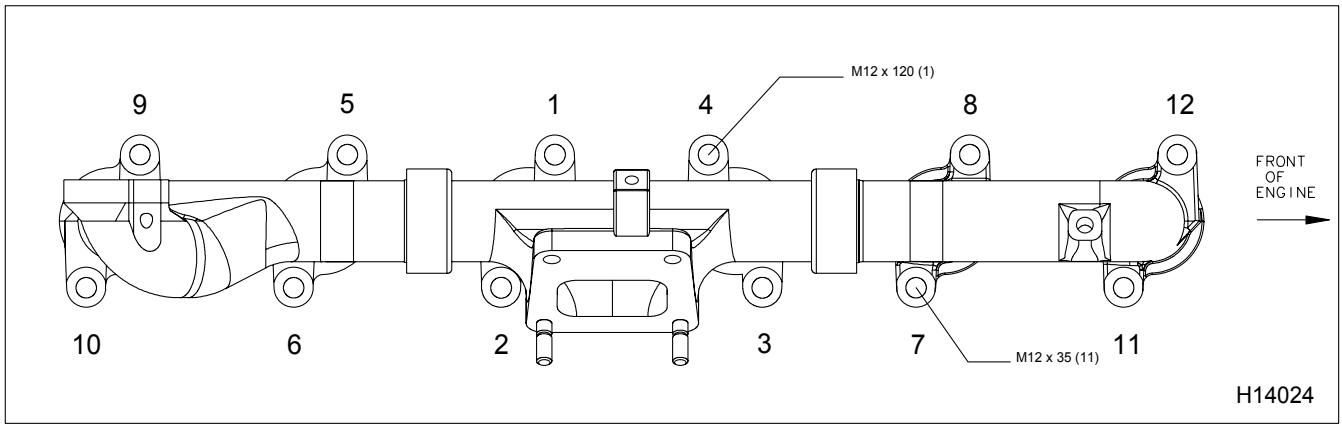

Figure 75 Exhaust manifold torque sequence

a. Torque all bolts in sequence 1 through 12 to 27 N·m (20 lbf·ft).

b. Torque all bolts in sequence 1 through 12 to 54 N·m (40 lbf·ft).

c.

CAUTION: To avoid engine damage, make sure that the EGR cooler bracket bolt (M12 x 120) has a final torque value of 116 N·m (85 lbf·ft). This applies only to this bolt (number 4 in the sequence).

Torque all bolts in sequence 1 through 12 to 109 N·m (80 lbf·ft).

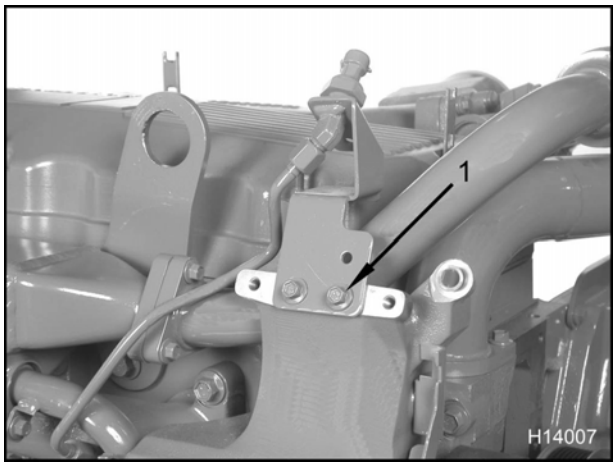

Figure 76 Installing EBP tubing bracket

1. EBP tubing bracket bolts, M8 x 20 (2)

5. Install EBP tubing bracket assembly and bolts onto the water supply housing (Freon® compressor bracket) and tighten.

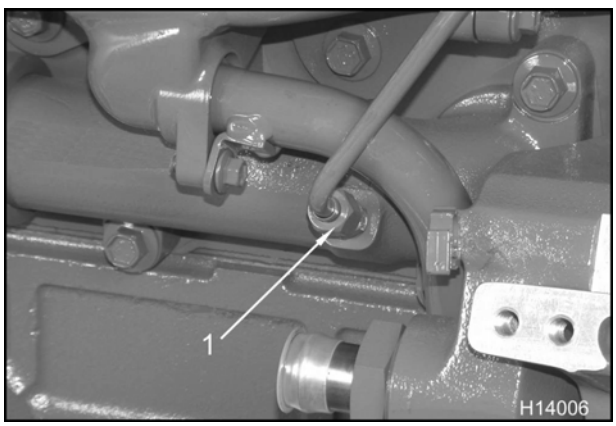

Figure 77 Installing EBP tubing nut

1. EBP tubing nut

6. Torque tubing nut to the standard torque value (See General Torque Guidelines, page 409).
7. Torque EBP tubing bracket bolts to the standard torque value (See General Torque Guidelines, page 409).
8. Install the EBP sensor connector.

Intake Manifold

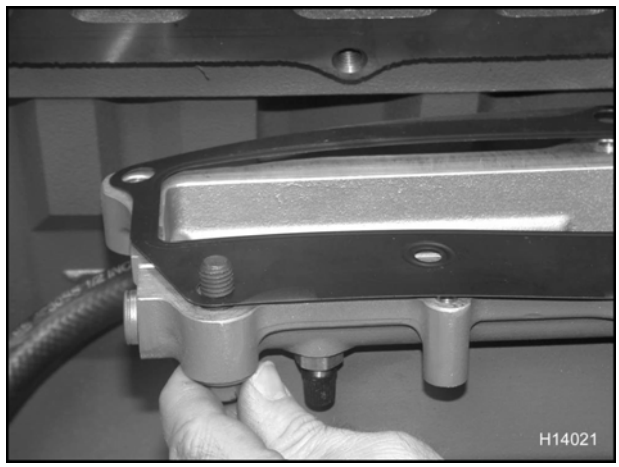

Figure 78 Aligning intake gasket to manifold

1. Insert an intake manifold bolt (M10 x 35) into each end of the intake manifold (both top holes). Place intake manifold gasket over these two bolts to ensure proper alignment between the manifold and gasket.
2. Install the intake manifold and gasket to the cylinder head by starting the two top end bolts by hand.

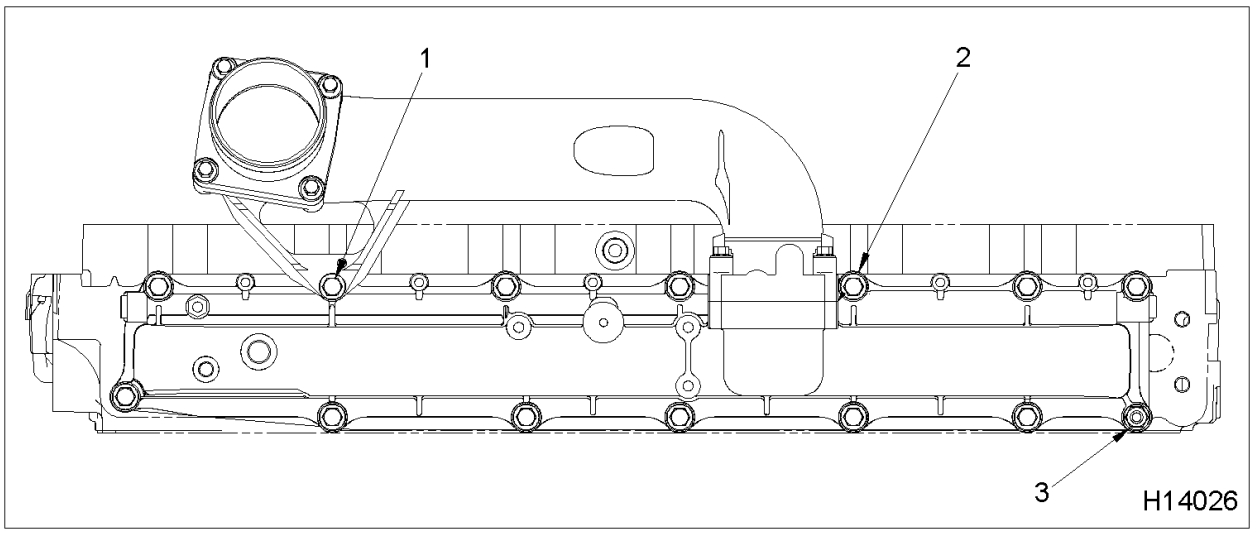

Figure 79 Intake manifold and inlet duct bolt configuration

1. Inlet and EGR mixer support bolt, M10 x 90
2. Bolt, M10 x 35 (12)
3. Bolt / Stud, M10 x 35 / 20

3. Place bolt / stud, (M10 x 35 / 20) into the rear most bolt hole along the bottom finger tight.
4. Install the remaining short intake manifold mounting bolts (M10 x 35) finger tight, in their correct positions. One bolt hole should remain open for later installation of the inlet and EGR mixer support and bolt.
5. Connect injectors and anchor harness.
6. Connect harness to MAP and MAT sensors.

Inlet and EGR Mixer Duct

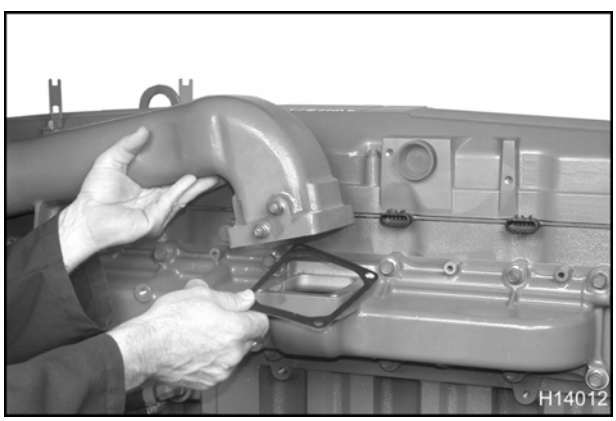

Figure 80 Inlet and EGR mixer gasket

1. Install inlet and EGR mixer with new gasket.

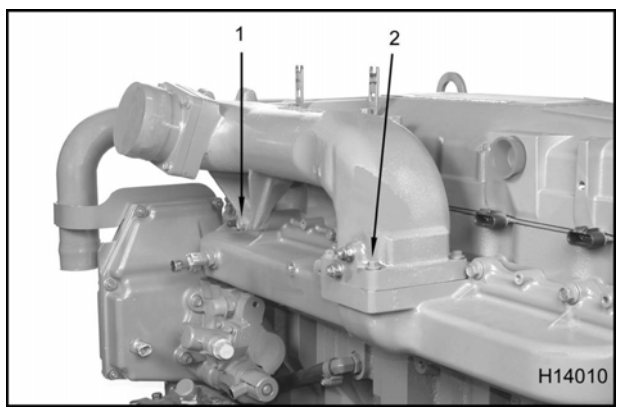

Figure 81 Mounting the inlet and EGR mixer

1. Inlet and EGR mixer support bolt, M10 x 90
2. Inlet mixer bolts, M8 x 60 (4)

2. Install four bolts (M8 x 60) that hold the inlet and EGR mixer to the intake manifold, but do not tighten.
3. Thread the inlet and EGR mixer duct support bolt (M10 x 90) finger tight.

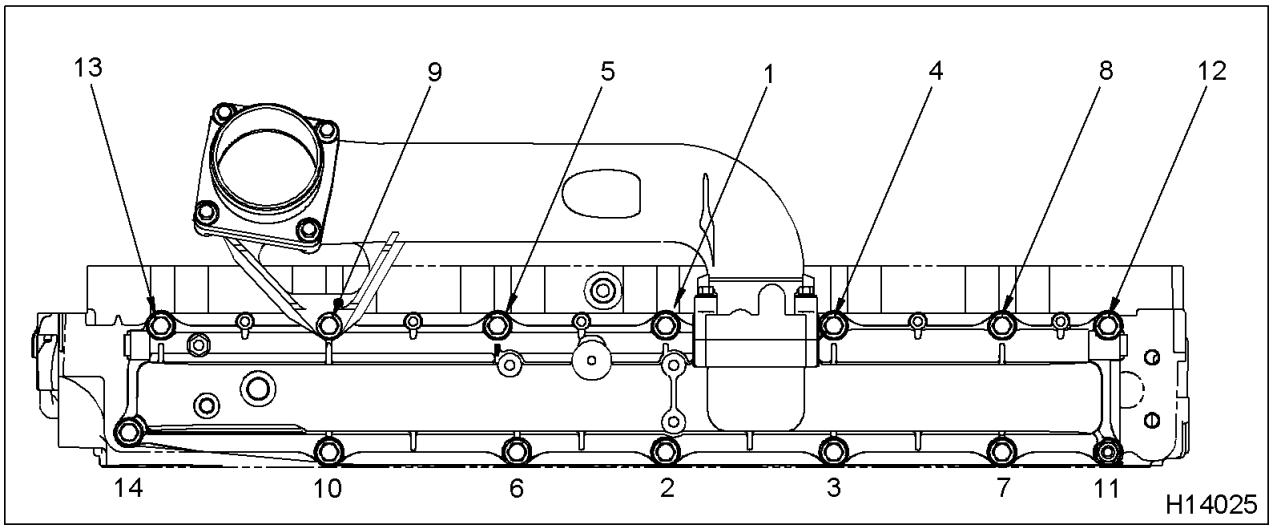

Figure 82 Intake manifold torque sequence

4. Torque intake manifold bolts including the inlet and EGR mixer support bolt (M10 x 90) to the standard torque value (See General Torque Guidelines, page 409) and in the recommended sequence.

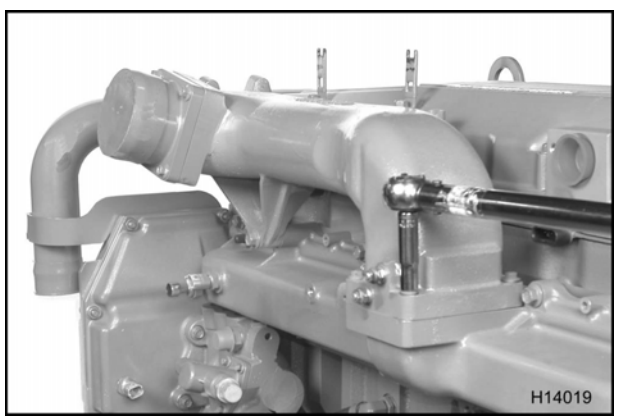

Figure 83 Torque the inlet and EGR mixer bolts

5. Torque four inlet mixer bolts (M8 x 60) to the standard torque value (See General Torque Guidelines, page 409).
6. Install fuel assembly valve if removed, and tighten to the special torque value (Table 9).
7. Install Intake plug assemblies, if removed (M12) and tighten to the special torque value (Table 9).

SPECIFICATIONS

Table 8 Exhaust Manifold Specifications

Allowable warpage (max.)	0.10 mm (0.004 in) overall
Flange thickness (min.)	21.59 mm (0.850 in)

Special Torque

Table 9 Intake Manifold, Inlet and EGR Mixer, and Exhaust Manifold Special Torques

Exhaust manifold mounting torque and sequence.	See “Exhaust manifold torque sequence” page 82.
Fuel assembly valve	15 N·m (132 lbf·in)
Intake manifold mounting bolts	40 N·m (30 lbf·ft)
Intake plug assembly	25 N·m (18 lbf·ft)

Table of Contents

Description

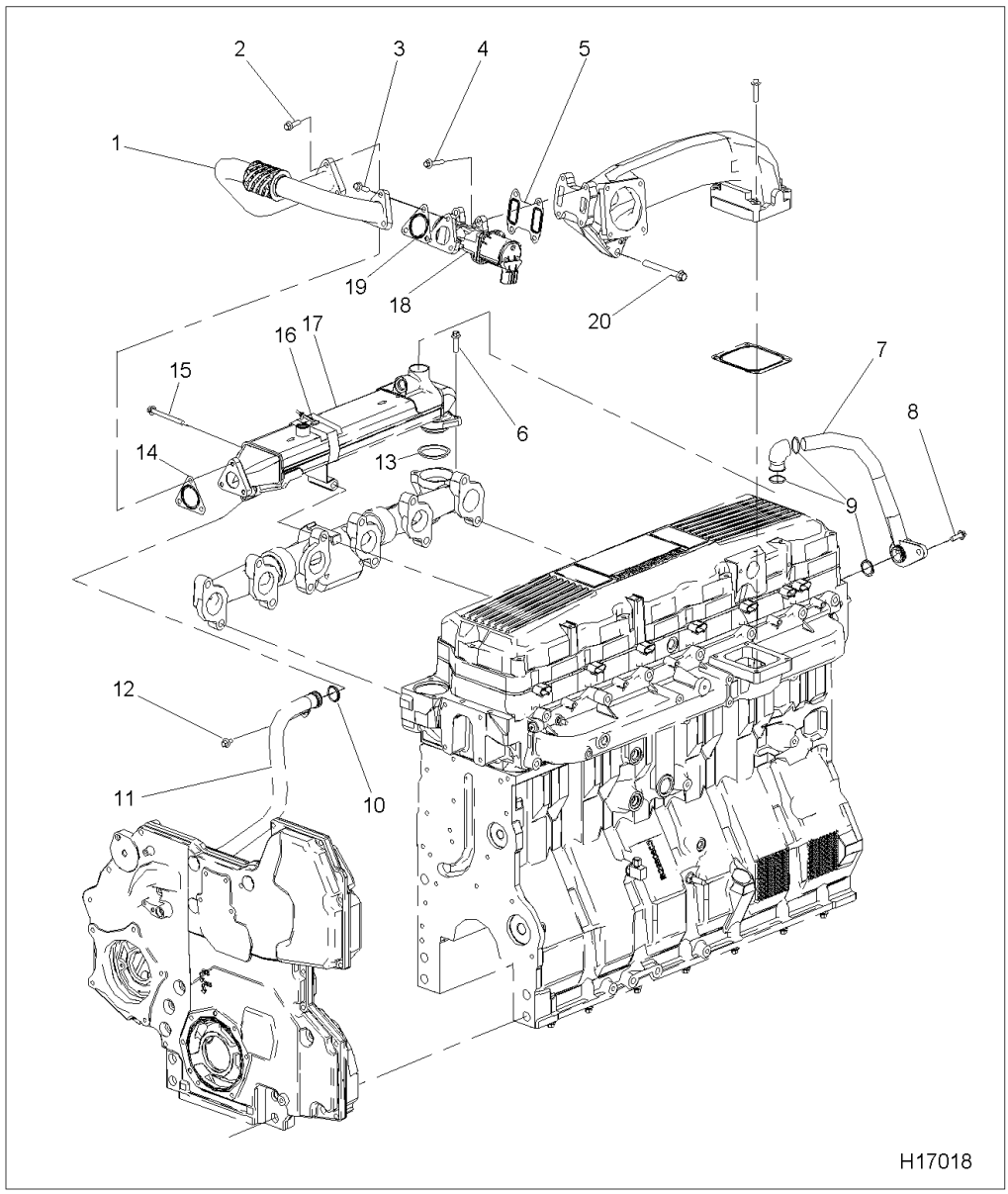

Figure 84 EGR system

1. EGR tube assembly
2. Bolt, M8 x 25 (3)
3. Bolt, M8 x 25 (3)
4. Bolt, M8 x 35 (4)
5. Gasket
6. Bolt, M8 x 30 (2)
7. EGR cooler return tube
8. Bolt, M8 x 25
9. O-ring
10. O-ring (2)
11. EGR cooler supply tube
12. EGR cooler supply tube retaining bolt, M8 x 16
13. Gasket, hot side
14. Gasket, cool side
15. Bolt, M12 x 120
16. EGR cooler bracket clamp
17. EGR cooler assembly
18. EGR valve assembly
19. Gasket
20. Bolt, M10 x 90

NOTE: The following table matches the engine and horsepower combinations with the appropriate EGR cooler length.

Table 10 EGR Cooler – Engine Applications

EGR Cooler Length (inches)	Engine Application	Rated Brake Horsepower (bhp)
11.5	DT 466	225 and below
17.0	DT 466	245 and above
	DT and HT 570	295 and below
21.0	DT and HT 570	300 and above

Removal

EGR System Components

WARNING: To avoid serious personal injury, possible death, or damage to the engine or vehicle, read all safety instructions in the "Safety Information" section of this manual.

WARNING: To avoid serious personal injury, possible death, or damage to the engine or vehicle, make sure the transmission is in neutral, parking brake is set, and wheels are blocked before doing diagnostic or service procedures on engine or vehicle.

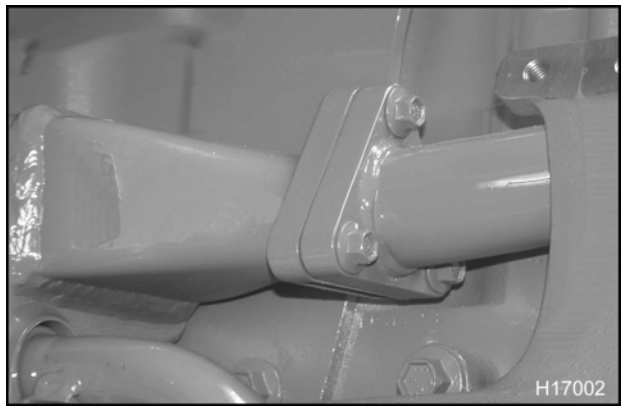

Figure 85 EGR tube assembly at EGR cooler

1. Remove three bolts (M8 x 25) from the EGR tube assembly at the EGR cooler assembly.

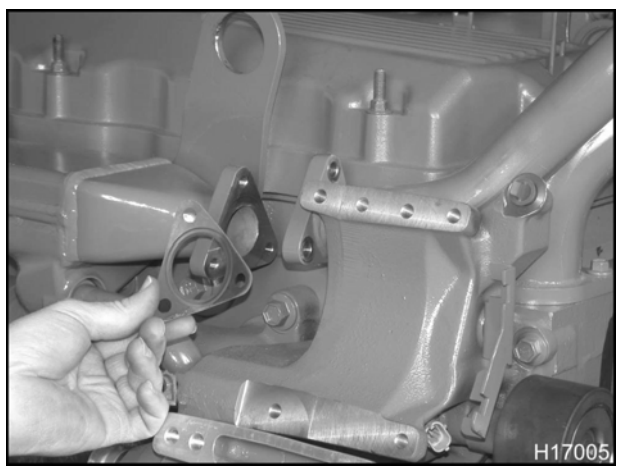

Figure 86 Removing the gasket

2. Pull tube assembly away and discard gasket.

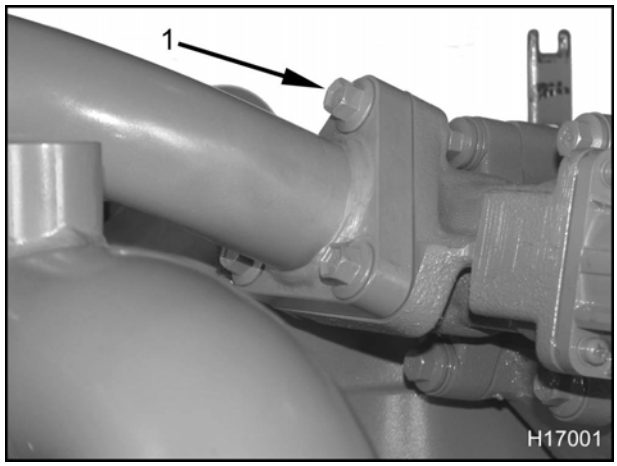

Figure 87 Exhaust gas crossover at EGR valve

1. Bolt, M8 x 25 (3)

3. Remove three bolts (M8 x 25) securing the exhaust gas crossover at the EGR valve assembly.

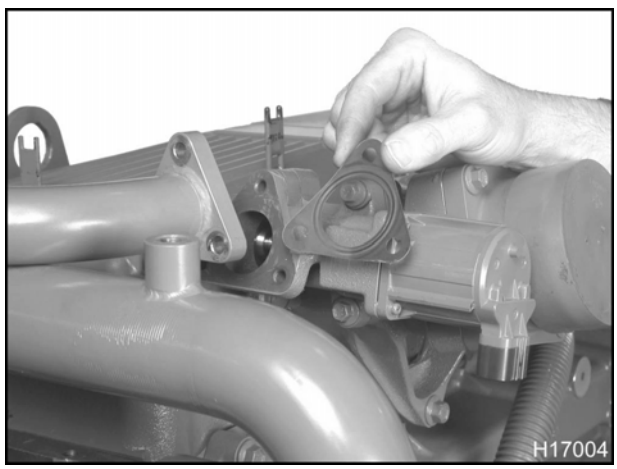

Figure 88 Removing the exhaust gas crossover gasket

1. Bolt, M8 x 25 (3)

4. Remove exhaust gas crossover and discard gasket.
5. Disconnect wiring harness connector at EGR valve assembly.

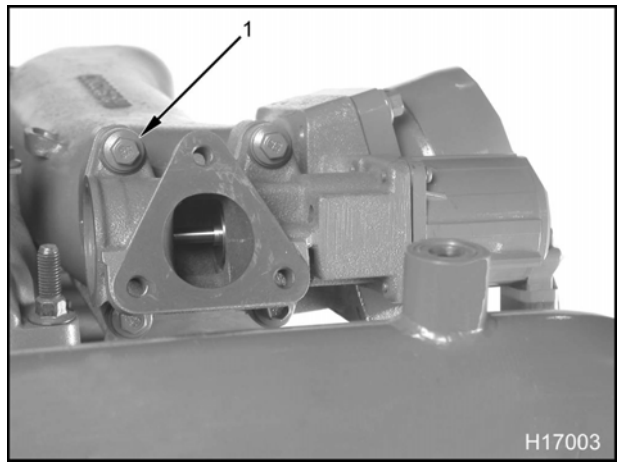

Figure 89 EGR valve retaining bolts

1. Bolt, M8 x 35 (4)

6. Remove four bolts (M8 x 35) securing the EGR valve assembly to the EGR mixer duct.

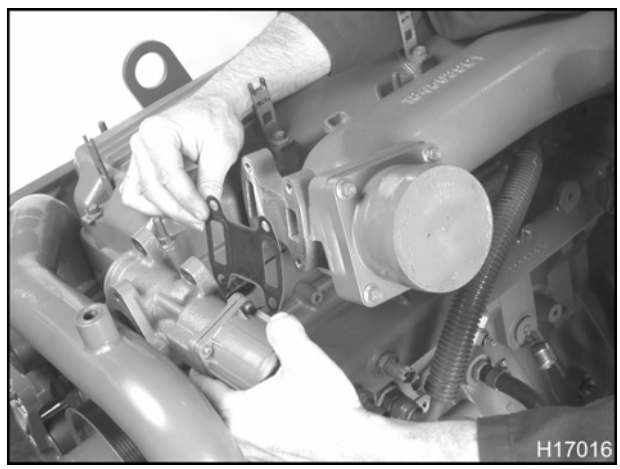

Figure 90 Removing the EGR valve to EGR mixer gasket

7. Remove and discard gasket between EGR valve assembly and EGR mixer.

NOTE: Do not attempt to remove the EGR cooler supply tube from the engine until the EGR cooler assembly has been removed. The EGR cooler supply tube is trapped between the EGR cooler and the rear half of the front cover.

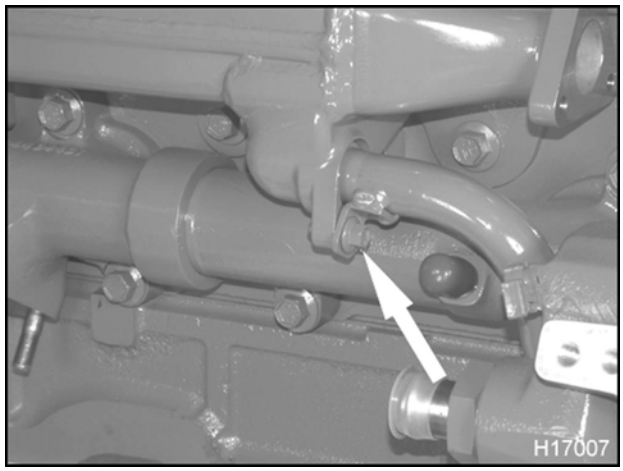

Figure 91 EGR cooler supply tube assembly retaining bolt

8. Remove the EGR cooler supply tube assembly retaining bolt (M8 x 16).

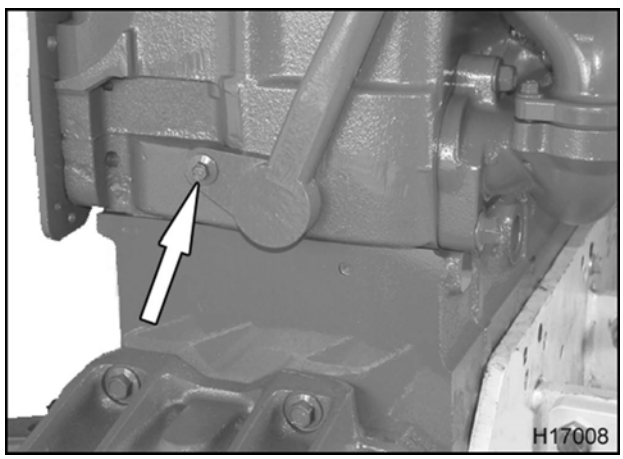

Figure 92 EGR cooler return tube assembly retaining bolt

9. Remove the EGR cooler return tube assembly retaining bolt (M8 x 25).

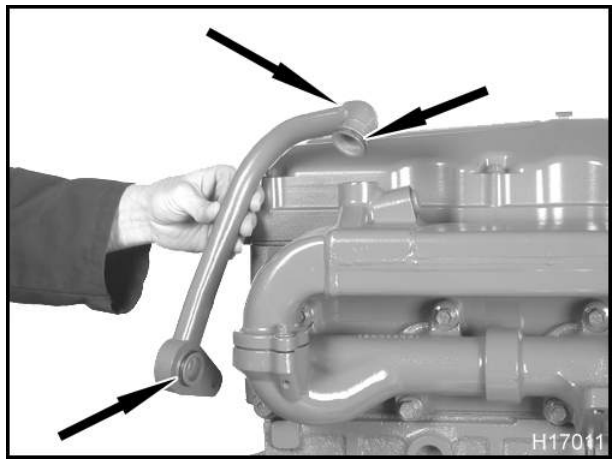

Figure 93 EGR cooler return tube O-rings

10. Remove the EGR cooler return tube assembly from engine and discard all O-rings.

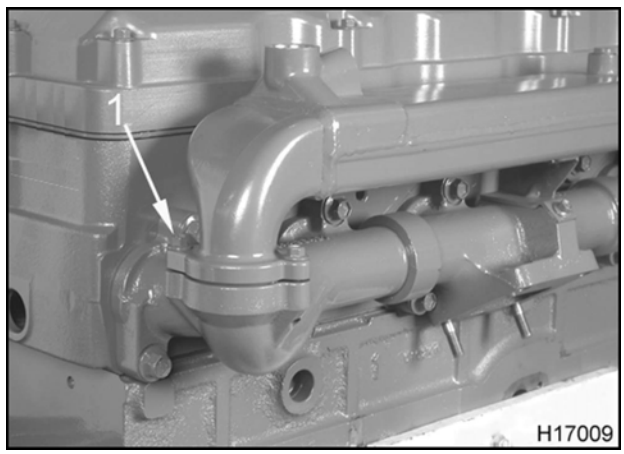

Figure 94 EGR cooler retaining bolts at exhaust manifold

1. Bolt, M8 x 30 (2)

11. Remove two bolts (M8 x 30) retaining the EGR cooler to the exhaust manifold.

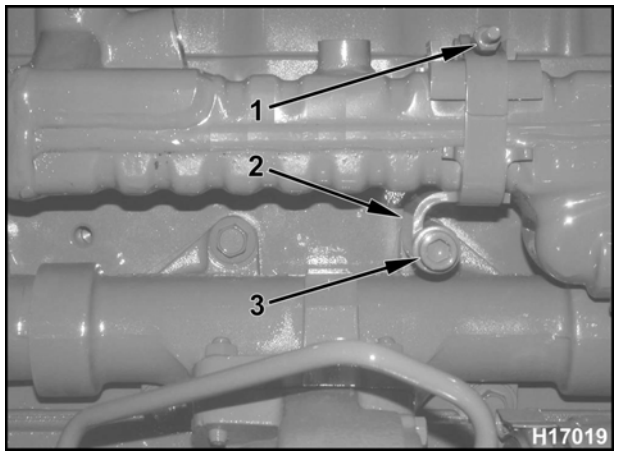

Figure 95 EGR cooler mounting bracket hardware

1. EGR cooler bracket clamp
2. EGR cooler mounting bracket
3. Bolt, M12 x 120

12. Remove the EGR cooler bracket clamp.

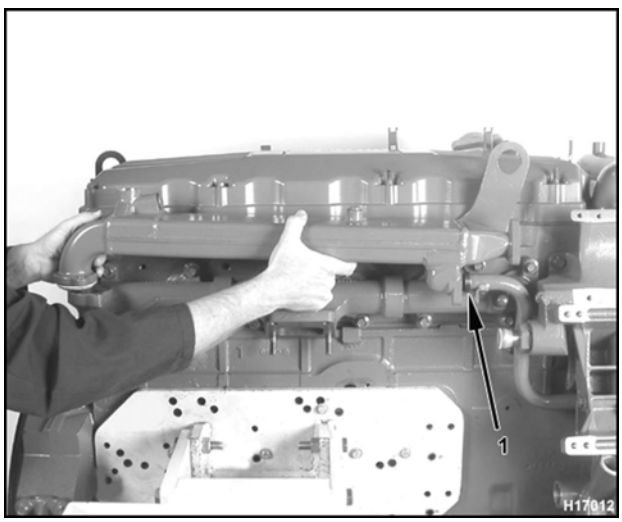

Figure 96 Removing the EGR cooler assembly

1. O-ring gasket

13. Remove the EGR cooler assembly by pulling out from EGR cooler supply tube and discard O-ring gasket.

14. Discard gasket between EGR cooler assembly and exhaust manifold.

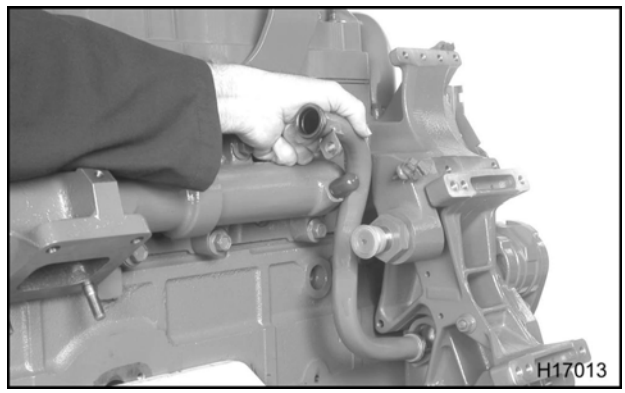

Figure 97 EGR cooler supply tube

15. Remove EGR cooler supply tubing from rear half of front cover. Discard O-ring from end of tube.

Cleaning

EGR System Components

1. Clean off any gasket material and carbon deposits between the EGR cooler and exhaust manifold mating surfaces.
2. Clean mating surfaces between EGR cooler and exhaust gas crossover.
3. Clean mating surfaces between exhaust gas crossover and EGR valve.
4. Clean mating surfaces between EGR valve and intake mixer duct.

Inspection

EGR Cooler

1. Bolt EGR cooler pressure test plates (Table 12) to each end of the EGR cooler assembly.
2. Connect air pressure to EGR cooler pressure test plate and regulate pressure to not more than 207 kPa (30 psi).

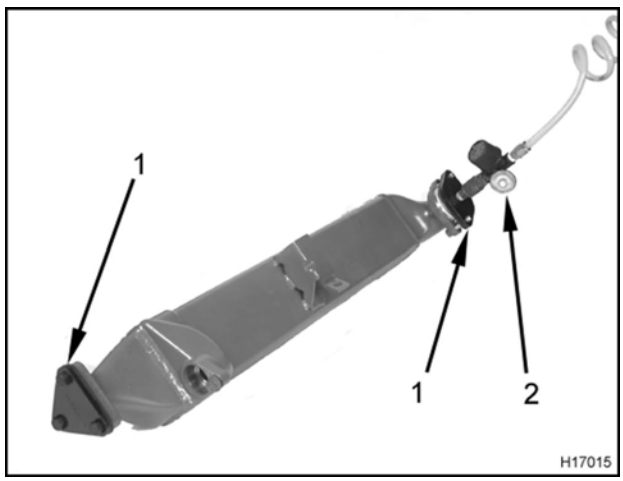

Figure 98 EGR cooler pressure test

1. EGR cooler pressure test plates (2)
2. Air pressure regulator

3. Submerge assembly into a tank of water. Watch for air bubbles coming out of the coolant ports. Discard EGR cooler if any air bubbles are produced from any ports.

Installation

EGR System Components

NOTE: Assemble the following parts in order, but do not torque any bolts until all components have been installed and bolts threaded finger tight.

1. Install new O-rings onto each end of the EGR cooler supply tube.

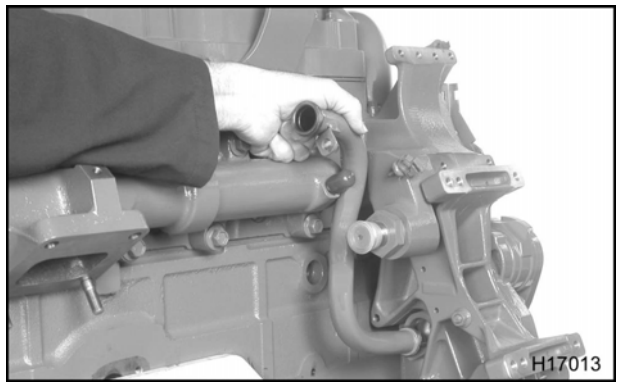

Figure 99 EGR cooler supply tube

2. Install the EGR cooler supply tube into the open port in rear half of front cover.
3. Install a new gasket between the EGR cooler assembly and exhaust manifold.

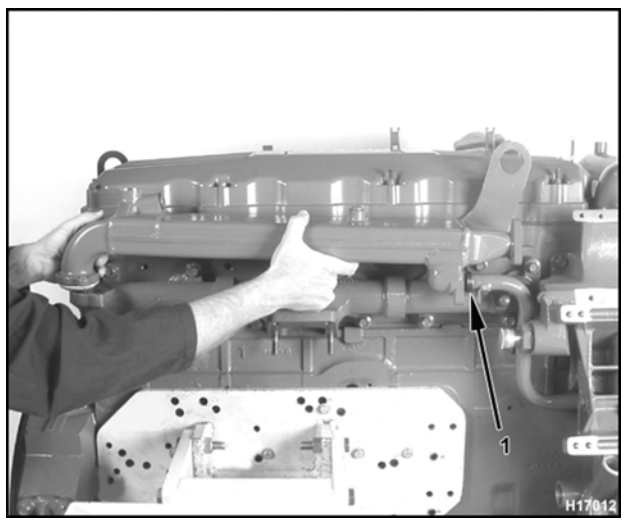

Figure 100 Installing the EGR cooler assembly

1. O-ring gasket

4. Install EGR cooler assembly by pushing in towards the EGR cooler supply tube. Make sure EGR cooler supply tube fully engages the EGR cooler assembly. The cooler tube should be trapped between the EGR cooler and the rear half of the front cover.

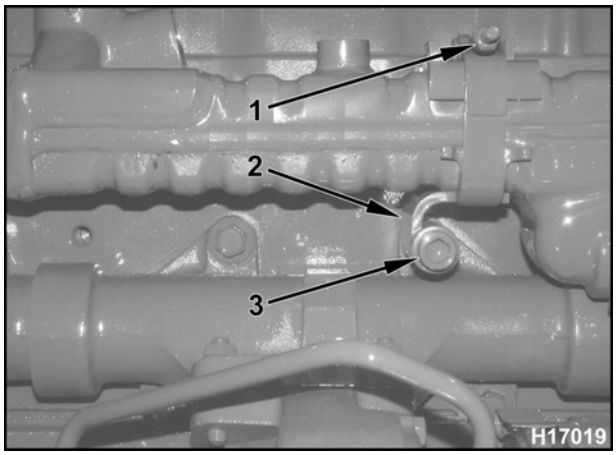

Figure 101 EGR cooler support bracket retaining bolt

1. EGR cooler bracket clamp
2. EGR cooler mounting bracket
3. Bolt, M12 x 120

5. Install the EGR cooler into the mounting bracket and close EGR cooler bracket clamp.

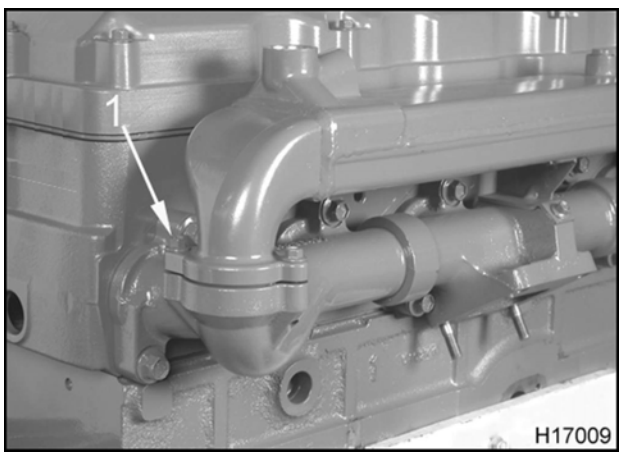

Figure 102 EGR cooler retaining bolts at exhaust manifold

1. Bolt, M8 x 30 (2)

6. Install two EGR cooler retaining bolts (M8 x 30). Thread bolts finger tight at the exhaust manifold.

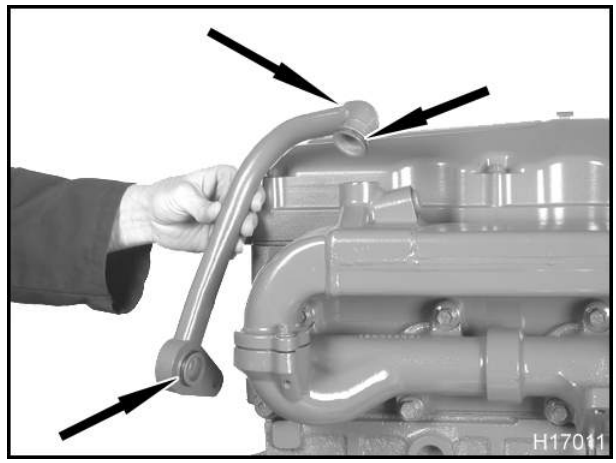

Figure 103 EGR cooler return tube O-rings

7. Install new O-rings onto each end of the EGR cooler return tube.

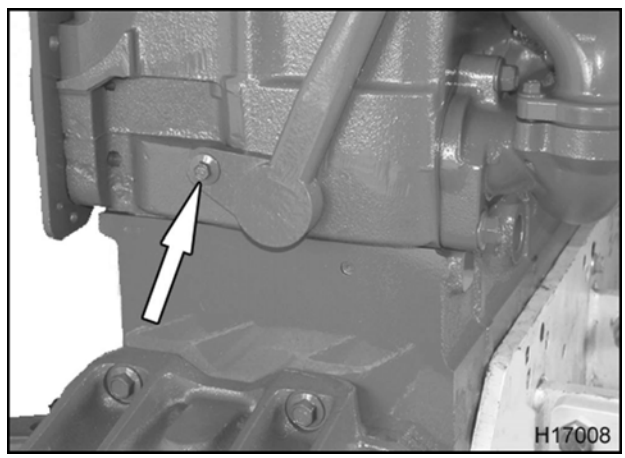

Figure 104 EGR cooler return tube assembly retaining bolt

8. Position the EGR cooler return tube assembly into place and install retaining bolt (M8 x 25) finger tight.

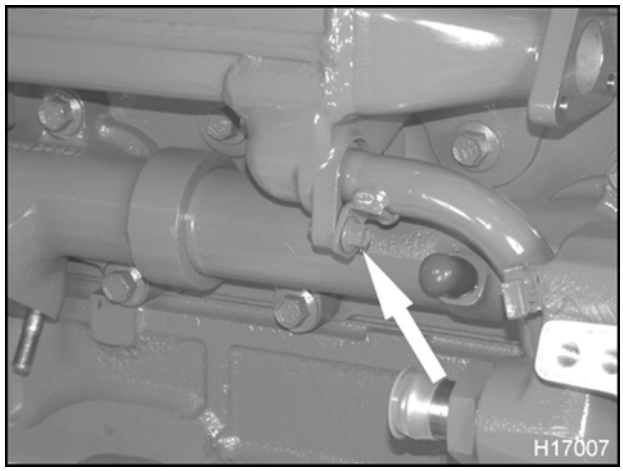

Figure 105 EGR cooler supply tube assembly retaining bolt

9. Install the EGR cooler supply tube assembly retaining bolt (M8 x 16) finger tight.

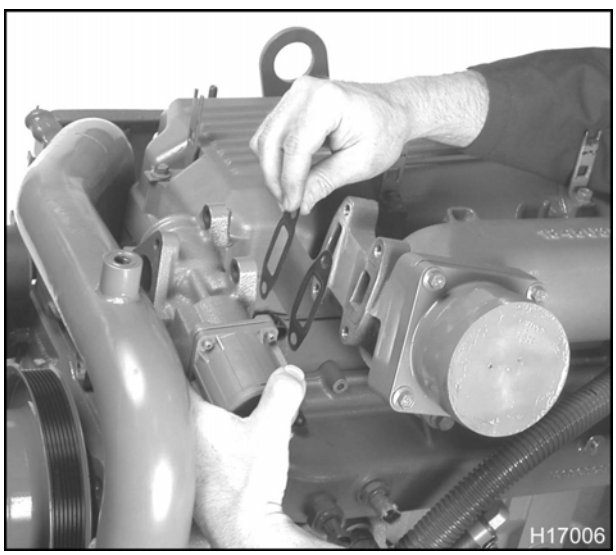

Figure 106 EGR valve gasket at EGR mixer duct

10. Place a new gasket between the EGR mixer duct and EGR valve assembly.

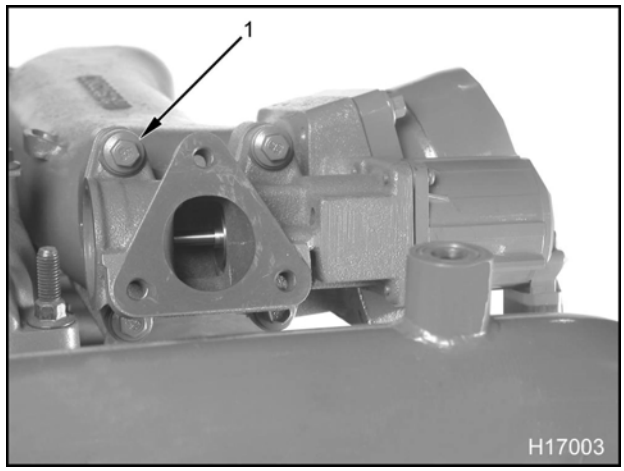

Figure 107 EGR valve mounting bolts

1. Bolt, M8 x 35 (4)

11. Secure EGR valve assembly with four bolts (M8 x 35) finger tight.

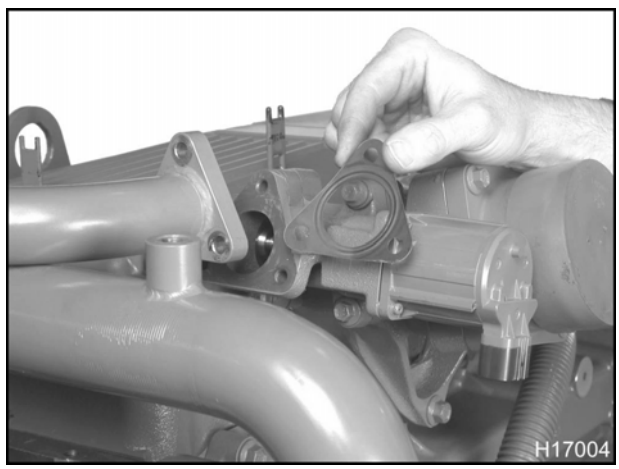

Figure 108 Exhaust gas crossover at EGR valve

12. Position a new gasket between the exhaust gas crossover and EGR valve assembly.

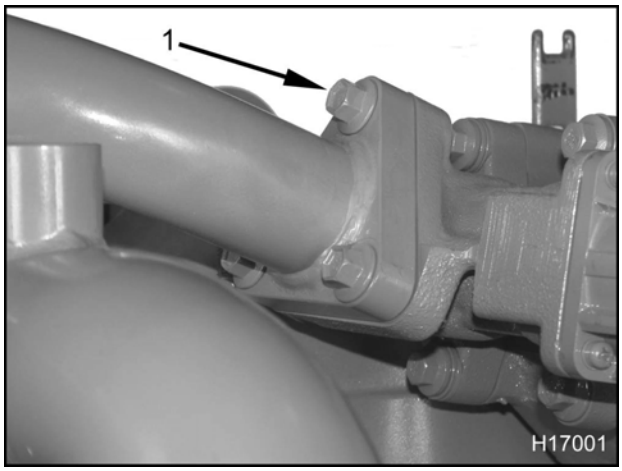

Figure 109 Exhaust gas crossover at EGR valve

1. Bolt, M8 x 25 (3)

13. Install three exhaust gas crossover bolts (M8 x 25) finger tight.

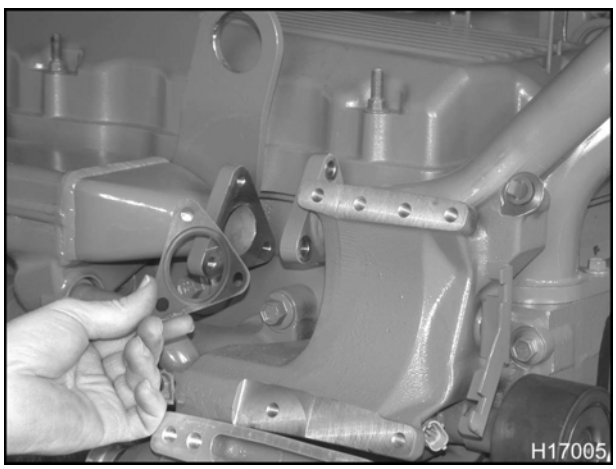

Figure 110 Installing a new gasket

14. Position a new gasket between the exhaust gas crossover and EGR cooler.

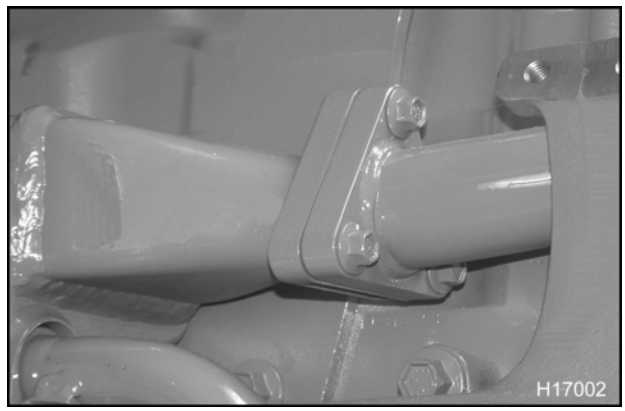

Figure 111 EGR tube assembly at EGR cooler

15. Install three bolts (M8 x 25) finger tight to join the EGR tube assembly at the EGR cooler assembly.
16. Torque all system component bolts to the standard torque value (See General Torque Guidelines, page 409) in the following order, unless otherwise noted:
    a. EGR cooler at exhaust manifold, special torque value (Table 11)
    b. EGR tube assembly at EGR cooler
    c. EGR valve mounting bolts
    d. Exhaust gas crossover at EGR valve
    e. EGR cooler return tube assembly retaining bolt
    f. EGR cooler supply tube assembly retaining bolt
    g. EGR cooler support bracket retaining bolt

Special Torque

Table 11 EGR Cooler Special Torques

EGR cooler bracket clamp	8 N·m (72 lbf·in)
EGR cooler bracket bolt, M12 x 120	116 N·m (85 lbf·ft)

SPECIAL SERVICE TOOLS

Table 12 EGR System Special Service Tools

EGR cooler pressure test plates	ZTSE4636