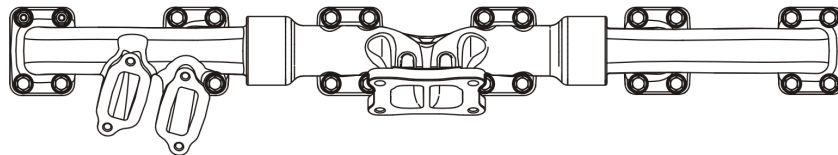


Date	Group	No.	Page
3.2007	<b>251</b>	<b>38</b>	1(35)

Exhaust Manifold  
Replacement  
D16F

## Exhaust Manifold, Replacement



W2005712

This information covers the replacement procedure for the exhaust manifold and gaskets on the Volvo D16F engine.

### Contents

- “Special Tools” page 2
- “Exhaust Manifold, Replacement” page 3

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

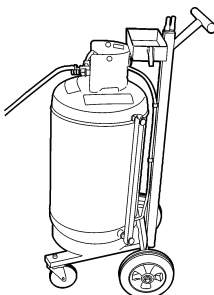
## Special Tools

For special tool ordering instructions, refer to Tools Information, group 08.

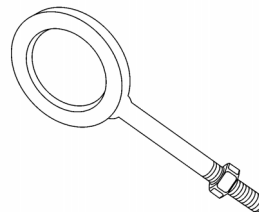


W0001795

**9996049**  
Drain Hose



**DBT2V700**  
Coolant Extractor



W0002266

**85108575**  
Turbocharger Lift Tool

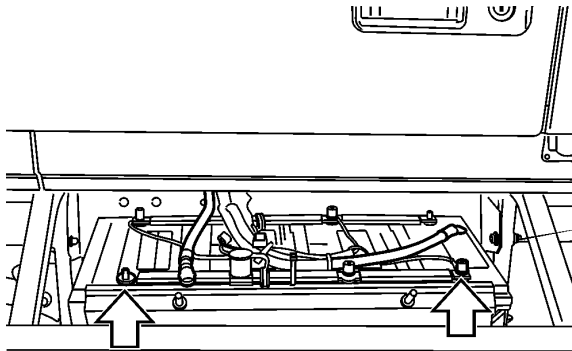
## 2515-03-02-01 Exhaust Manifold, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing these procedures. If you are not properly trained and certified in these procedures, ask your supervisor for training before you perform the procedures.

*Special tools: 9996049, DBT2V700, 85108575*

### Removal

- 1**  
Apply the parking brake and place the shift lever in neutral.
- 2**  
Remove all cables from ground (negative) battery terminals to prevent personal injury from electrical shock.

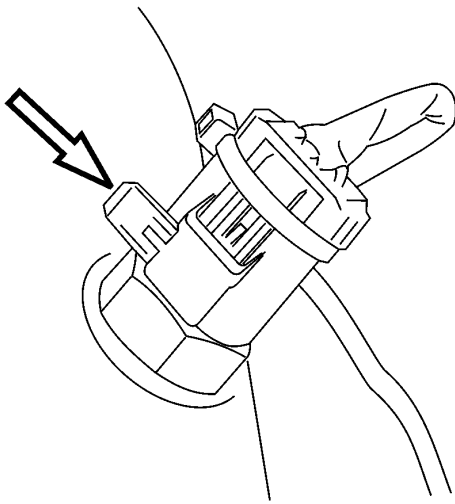


W2003815

- 3**  
Connect the coolant extractor to the drain fitting at the bottom of the radiator and drain the coolant.  
**Note:** An alternate method is to connect the drain hose to the drain fitting and drain the coolant into a suitable container.

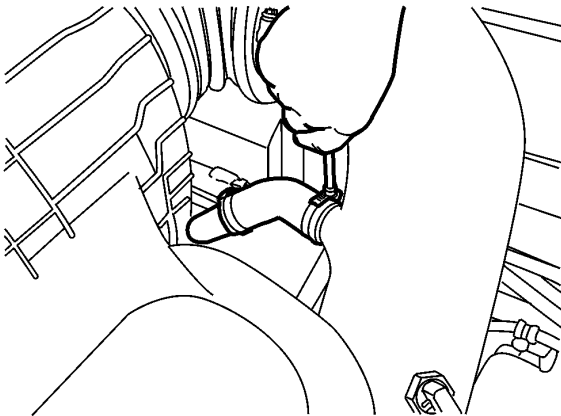
DBT2V700, 9996049

- 4**  
Remove inner splash guard as an assembly.  
**Note:** Some models may be equipped with fender extenders, attached to the inner splash guard. Remove these as an assembly.



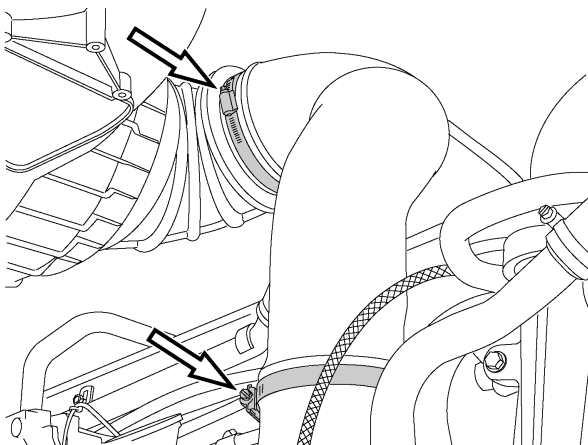
W2004720

- 5**  
Disconnect the air temperature sensor connector from the sensor. Cut the tie strap and disengage the lock tab. Remove the clamp securing the harness to the main fresh air pipe.



W2004719

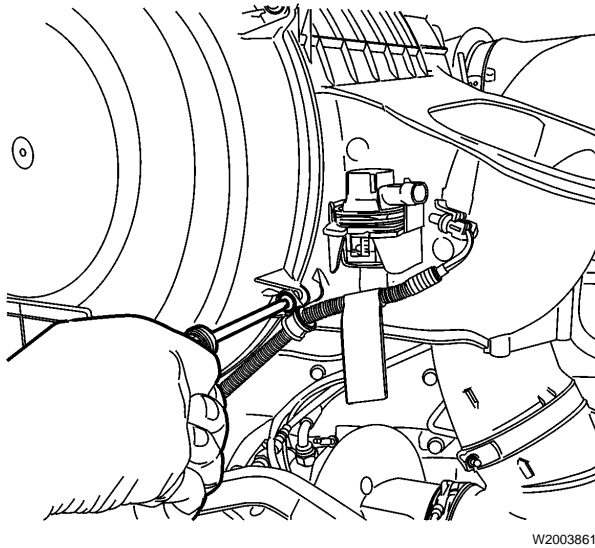
- 6**  
Loosen the air compressor fresh air pipe coupling hose clamp at the main fresh air pipe. Separate the hose from the pipe.



W2006005

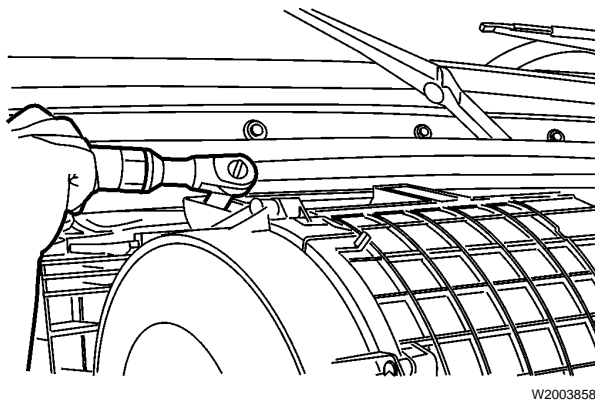
- 7**  
Loosen the clamps securing the main fresh air pipe to the air filter housing and to the turbocharger inlet elbow. Remove the main fresh air pipe.





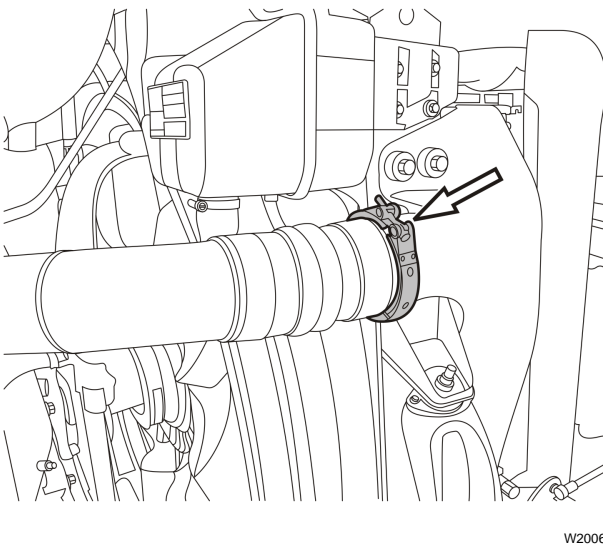
**8**

Disconnect the air restriction gauge harness connector and remove the clamps securing the wiring harness to the air filter housing.



**9**

Remove the fasteners securing the air filter housing to the cab and remove the housing.



**10**

Remove the charge air inlet pipe from between the turbocharger and the charge air cooler.

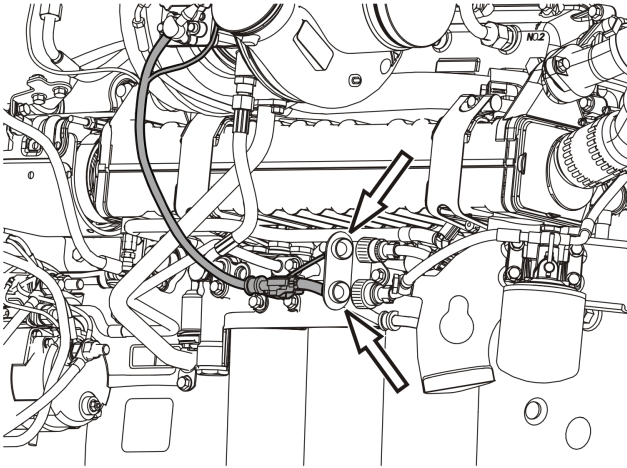
**Note:** Disconnect the Discharge Recirculation Valve (DRV) air line. Loosen the clamp and disconnect the recirculation hose from the inlet elbow.

**11**

Remove the turbocharger inlet elbow.

**12**

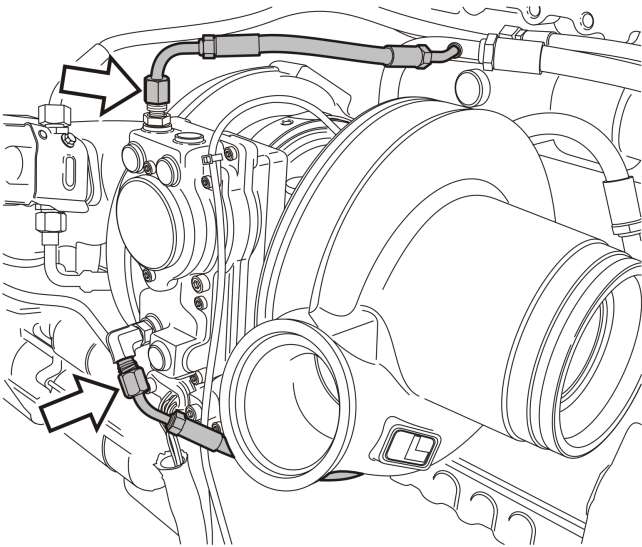
Cut the tie straps securing the turbocharger actuator and speed sensor wiring harnesses. Disconnect and remove the connectors mounted in bracket at the oil filter housing.



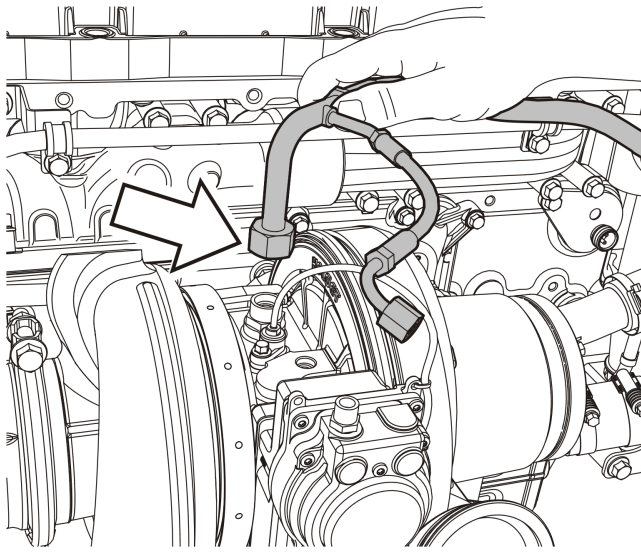
W2005620

**13**

Disconnect the coolant supply and return lines from the turbocharger actuator.



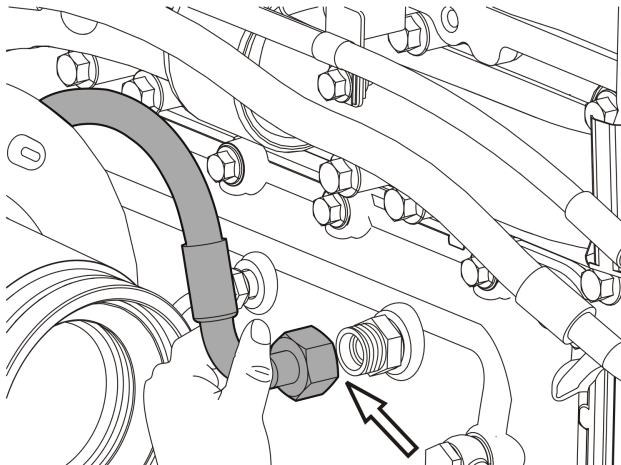
W2005621



W2005622

**14**

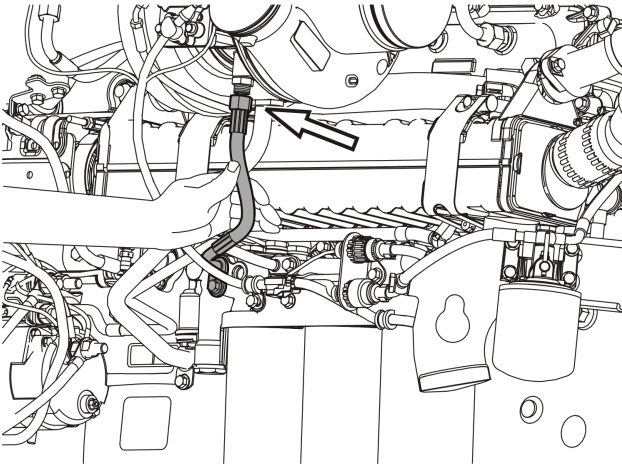
Disconnect the coolant line from the top of the turbocharger.



W2005623

**15**

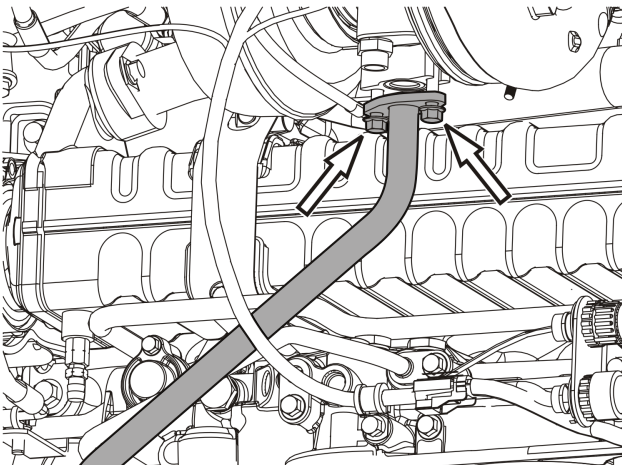
Disconnect the turbocharger coolant line from the oil cooler cover.



W2005624

**16**

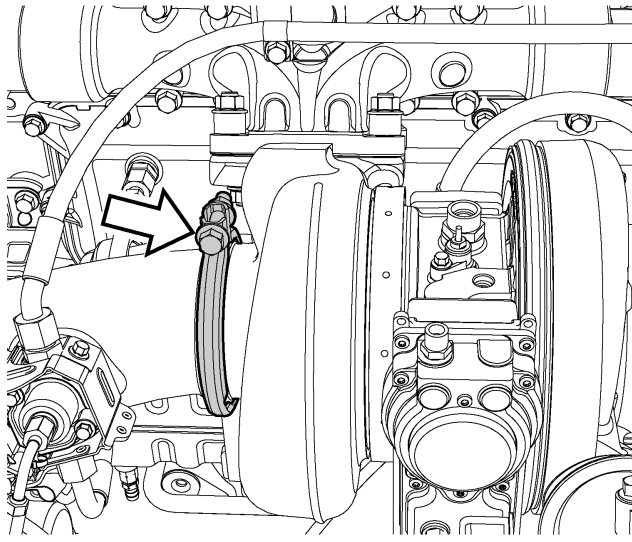
Disconnect the oil supply line from the bottom of the turbocharger.



W2005628

**17**

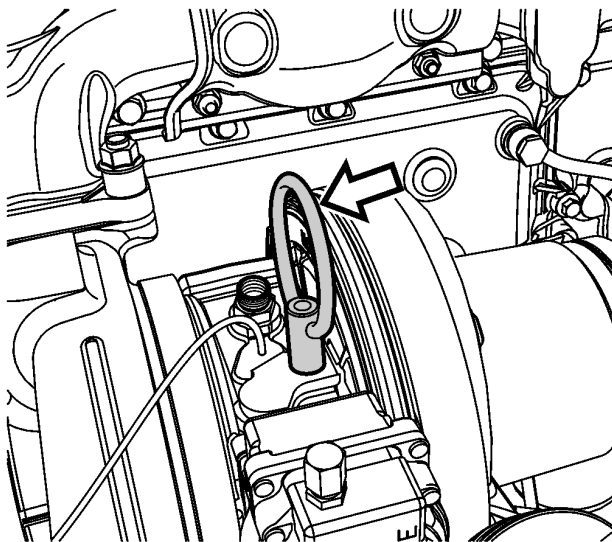
Remove the fasteners securing the oil drain pipe to the bottom of the turbocharger and spacer block. Remove the spacer block. Separate the gasket and O-ring from the spacer block and discard.



W2006108

**18**

Loosen the diffuser-to-turbocharger clamp and slide the diffuser away from the turbocharger.

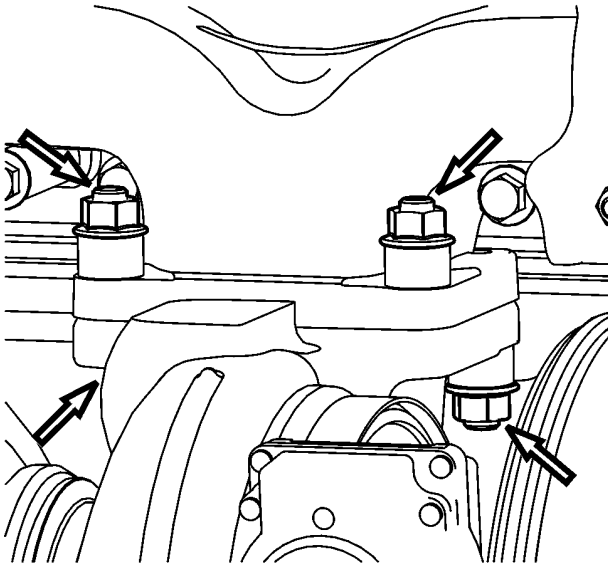


W2005042

**19**

Remove the plug at the top of the turbocharger and install the turbocharger lifting tool.

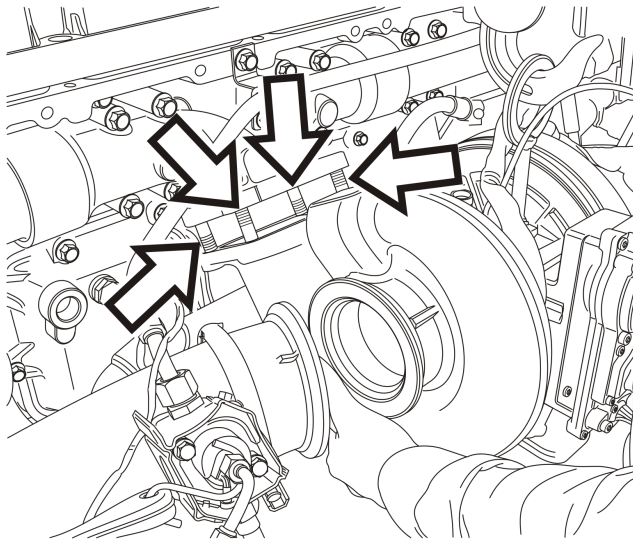
85108575



W2005011

**20**

Support the weight of the turbocharger using a mobile floor crane such as OTC 16-1815 or equivalent. Remove the turbocharger mounting nuts and spacers.



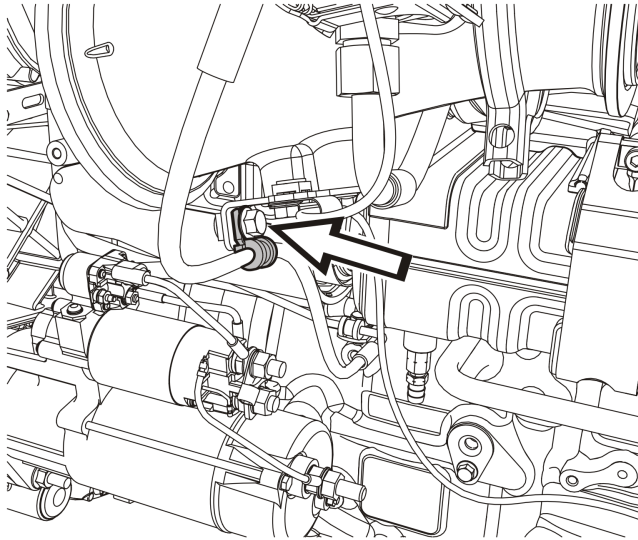
W2005629

**21**

With the aid of an assistant, lower the turbocharger away from the exhaust manifold studs and remove it from the engine.

**22**

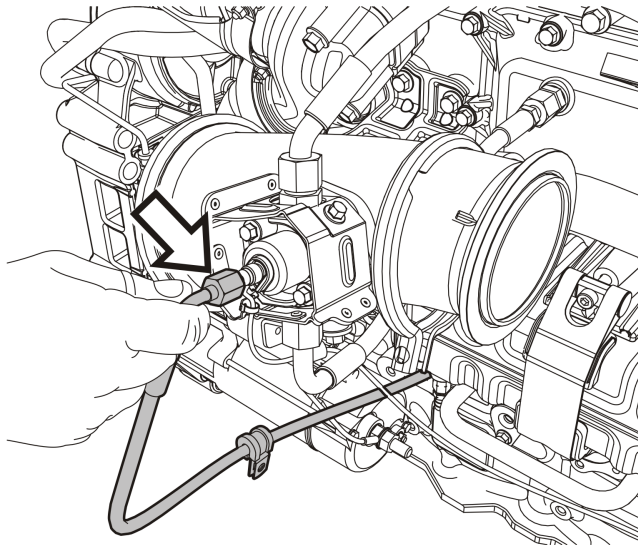
Place the turbocharger on a suitable support. Plug the turbocharger oil lines and outlet openings to prevent contamination. Install covers on the intake and exhaust openings of the turbocharger to prevent foreign material from entering.



W2005657

**23**

Remove the aftertreatment fuel injector line clamp at the bottom of the diffuser.

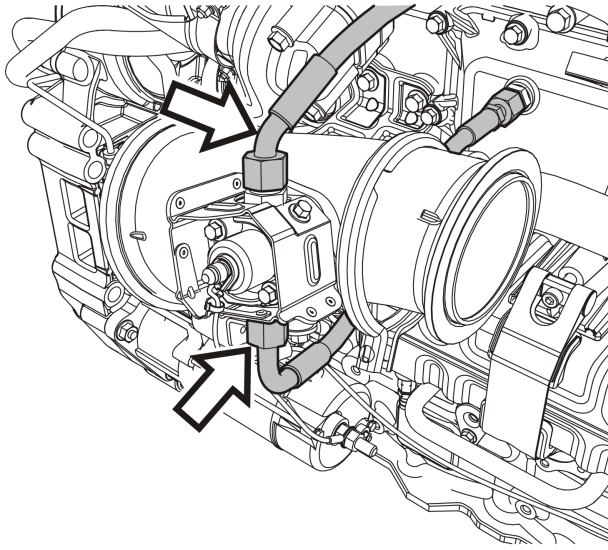


W2005656

**24**

Remove the fuel line from the aftertreatment fuel injector.





W2005655

**25**

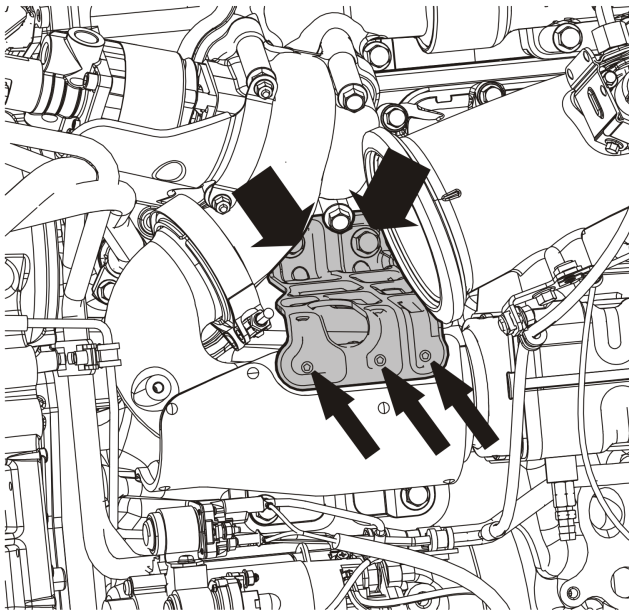
Remove the supply and return coolant lines from the aftertreatment fuel injector.

**26**

Remove the diffuser-to-exhaust pipe clamp and move the diffuser away from the EGR cooler for easier access to cooler connections.

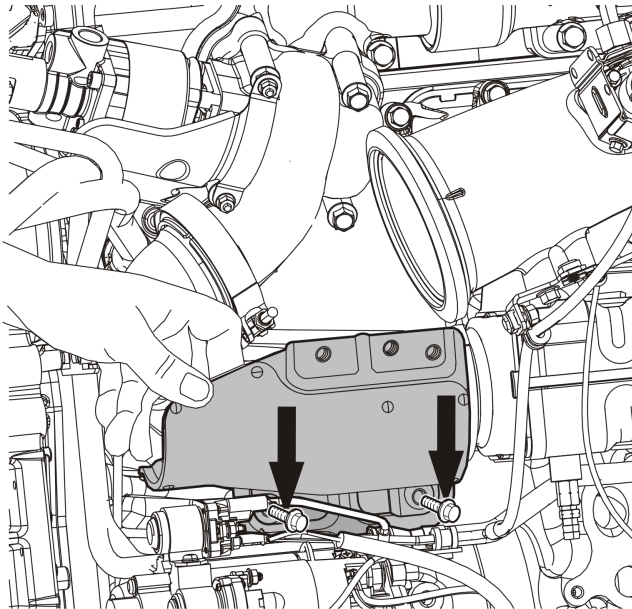
**27**

Remove the fasteners securing the upper portion of the EGR hot pipe shield and remove the shield.



W2005686

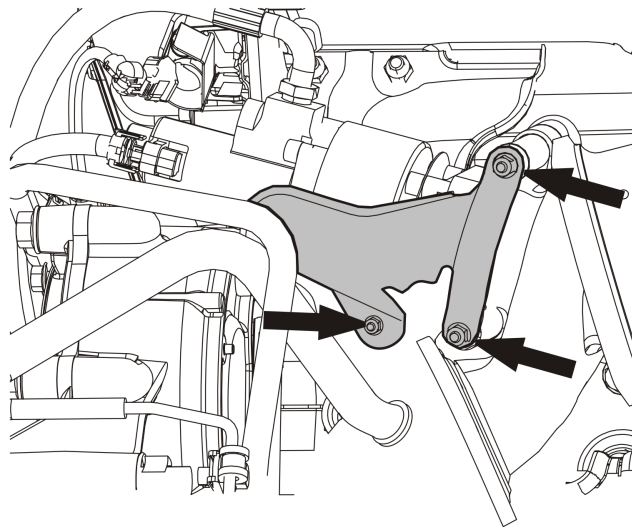




W2005687

**28**

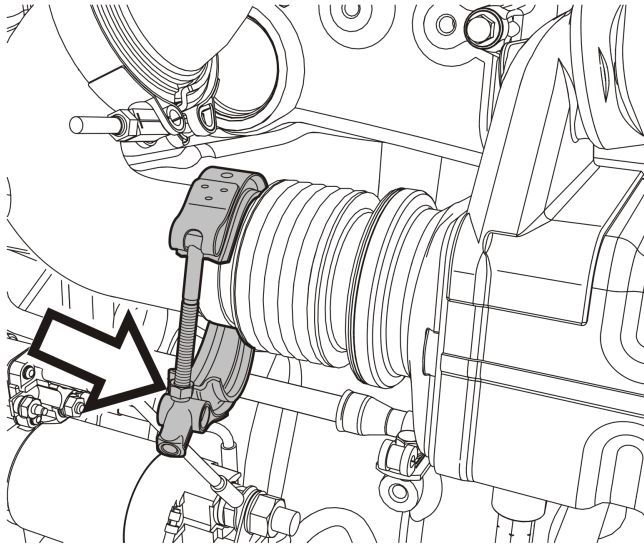
Remove the fasteners securing the lower portion of the EGR hot pipe shield and remove the shield.



W2005685

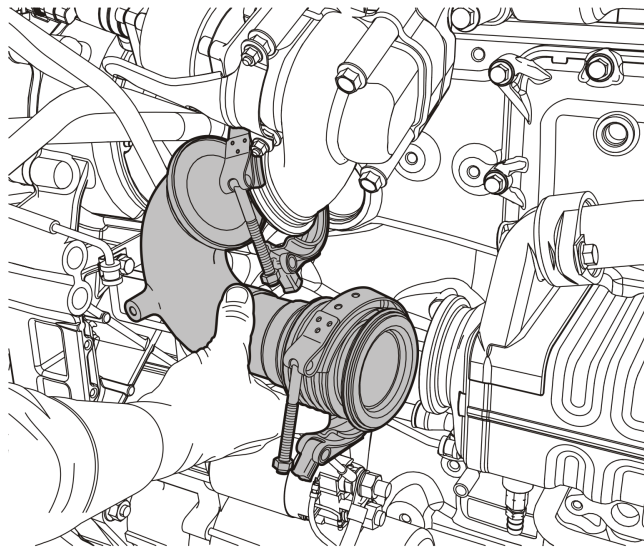
**29**

Remove the fasteners securing the EGR valve heat shield and remove the shield.



**30**

Loosen the EGR valve hot pipe V-clamps. Free the EGR hot pipe clamps from the flanges at the EGR valve and at the EGR cooler.

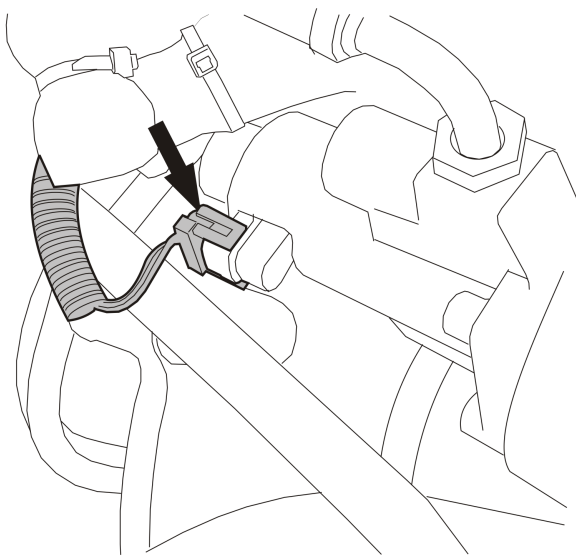


**31**

Remove the EGR hot pipe from between the EGR valve and the EGR cooler. Remove and discard the gaskets.

**32**

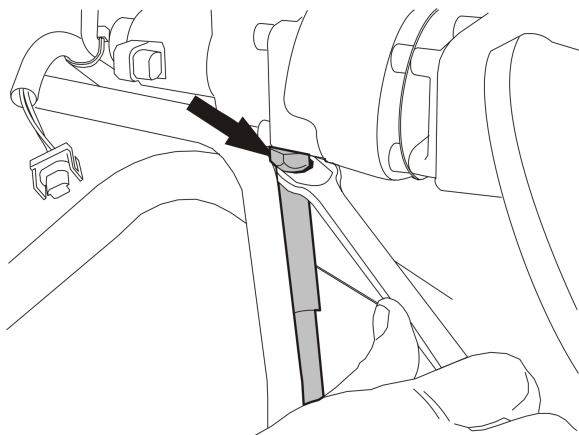
Remove the electrical connector from the EGR valve.



W2005689

**33**

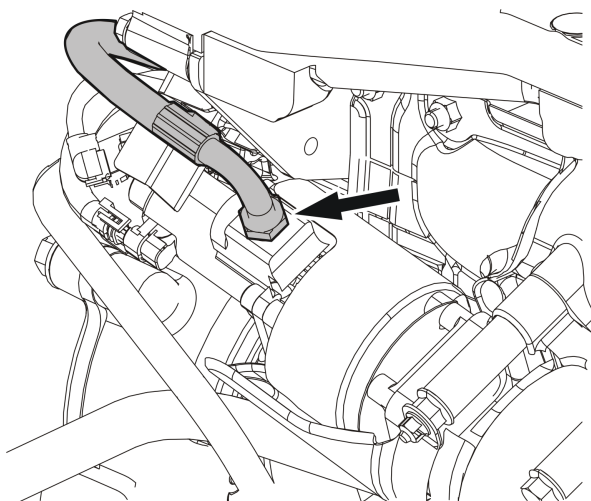
Loosen the EGR valve supply and return oil lines.



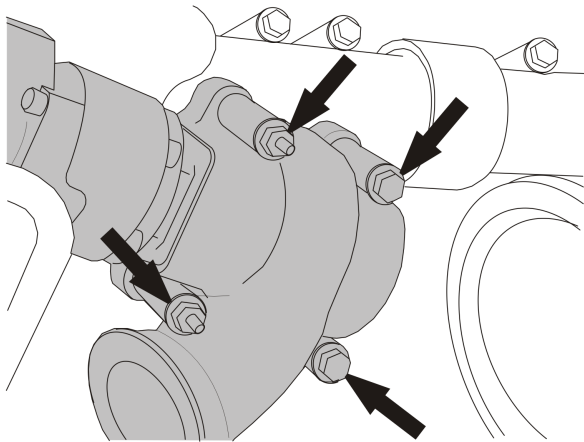
W2005692

**34**

Remove the EGR valve return oil line.



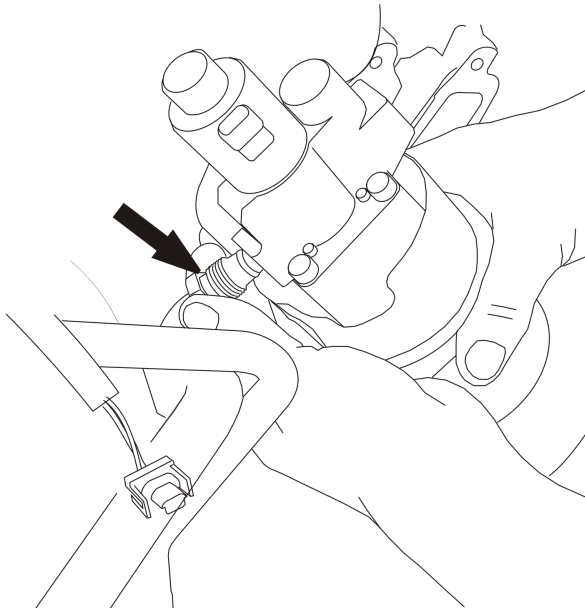
W2005690



W2005693

**35**

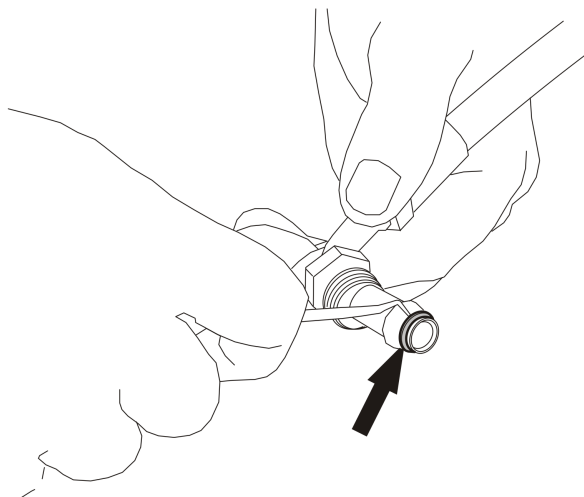
Remove the EGR valve mounting bolts and move the valve away from exhaust manifold, with supply oil line still connected.



W2005694

**36**

Remove the EGR valve supply oil line from the valve.



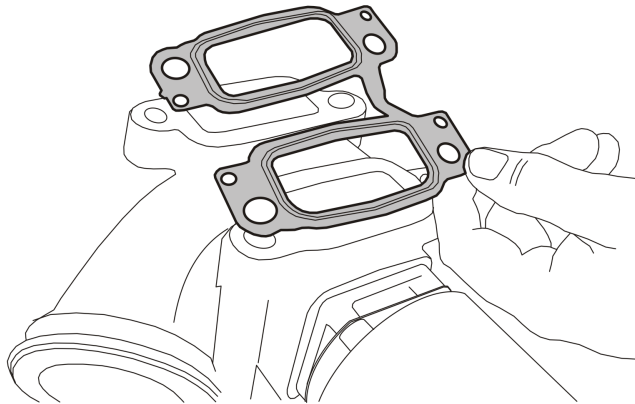
W2005691

**37**

Replace the O-rings on the EGR valve oil line supply and return oil line fittings. Lubricate the new O-rings with engine oil.

**38**

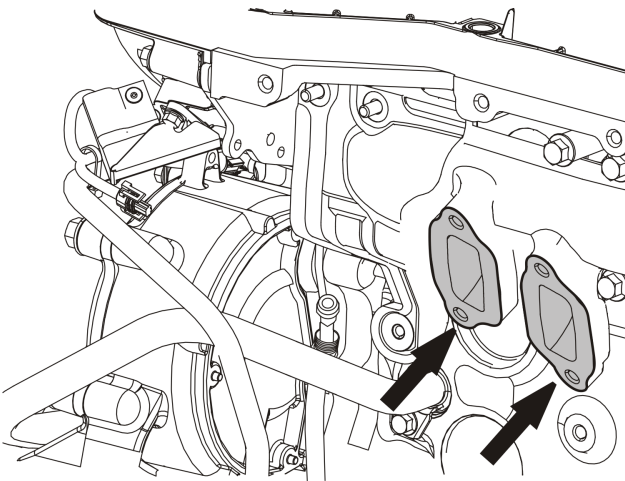
Remove and discard the EGR valve gasket.



W2005696

**39**

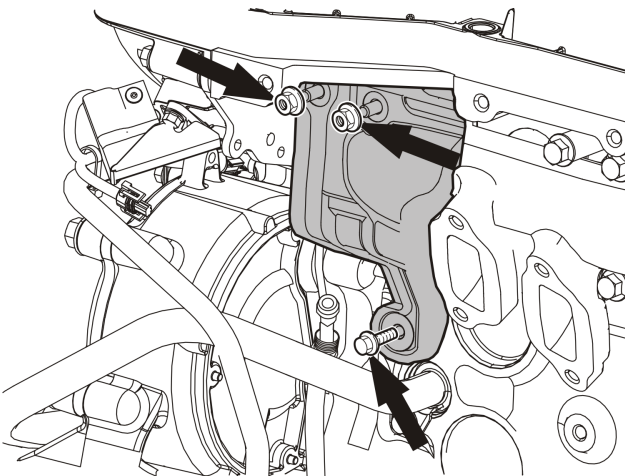
If the exhaust manifold is being reused, clean the EGR valve mounting surface. If the EGR valve is being reused, clean the valve mounting surface.



W2005697

**40**

Remove the fasteners securing the EGR valve heat shield to the exhaust manifold and cylinder block. Remove the heat shield.



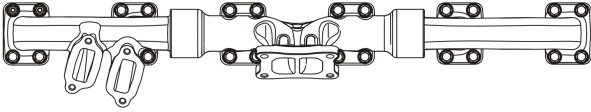
W2005707

**41**

Loosen and remove the exhaust manifold mounting bolts, spacers and remove the exhaust manifold.

**Note:** The exhaust manifold for this engine is a three-piece manifold with sealed slip joints. When removing the manifold, keep it assembled.

**Note:** Inspect the cylinder head around the exhaust ports for indications of leaking exhaust manifold slip joints.



W2005712

**42**

Remove and discard the exhaust manifold gaskets.

## Installation

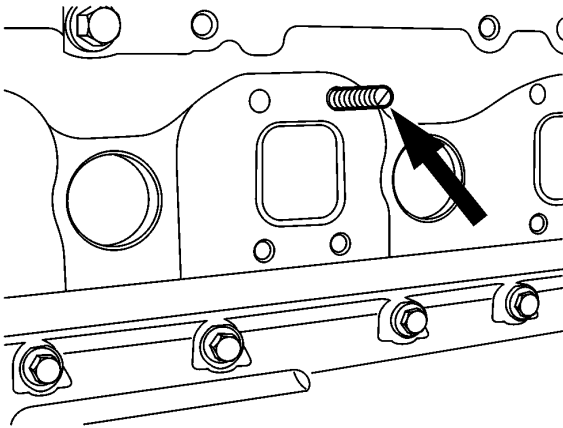
**1**

Clean the exhaust manifold and cylinder head mounting surfaces.

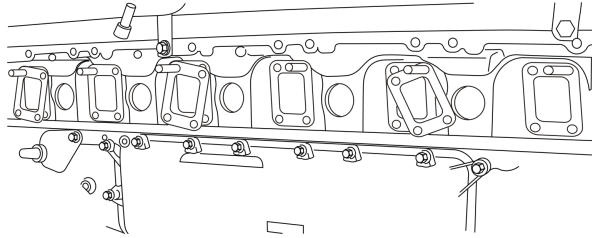
**2**

Temporarily install a locating stud at each exhaust manifold flange location on the cylinder head.

**Note:** This is done to hold the manifold while positioning the manifold gaskets for installation of the bolts and spacers.



W2004629



W2005711

### 3

Install new exhaust manifold gaskets over the locating studs.

**Note:** The gaskets are marked "MANIFOLD SIDE" to aid in installation. Make sure to place this side of the gasket toward the exhaust manifold. The graphite fiber side of the gasket faces the cylinder head.

### 4

Position the exhaust manifold against the cylinder head over the locating studs.

### 5

Install the mounting bolts and spacers.

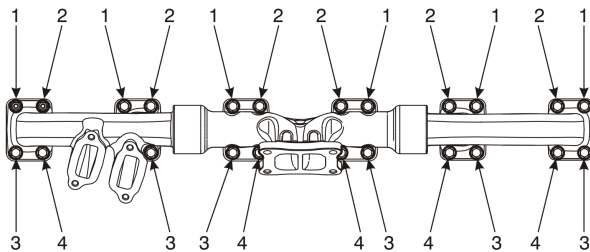
**Note:** Make sure the spacers are seated properly in the manifold step bore at each bolt hole location.

**Note:** Lift the exhaust manifold gaskets in place while installing the bolts and spacers. Remove the locating studs as needed to install the remaining bolts and spacers.

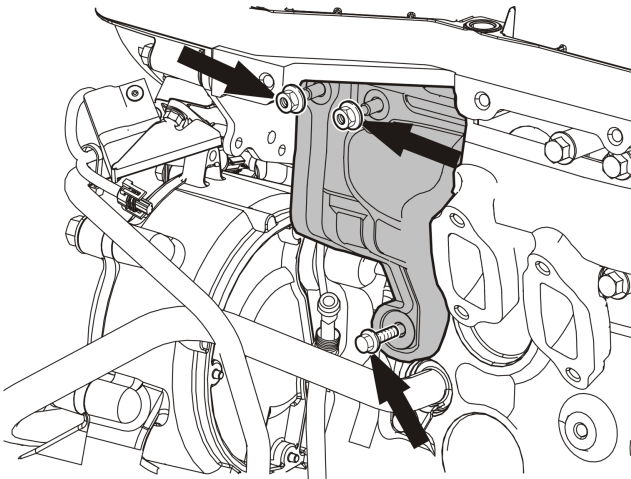
### 6

Tighten the exhaust manifold bolts using the following sequence:

- 1 Bolts 1 — 10 Nm (7 ft-lb) maximum
- 2 Bolts 2 — 10 Nm (7 ft-lb) maximum
- 3 Bolts 3 —  $52 \pm 4$  Nm ( $38 \pm 3$  ft-lb)
- 4 Bolts 2 —  $52 \pm 4$  Nm ( $38 \pm 3$  ft-lb)
- 5 Bolts 4 —  $52 \pm 4$  Nm ( $38 \pm 3$  ft-lb)
- 6 Bolts 1 —  $52 \pm 4$  Nm ( $38 \pm 3$  ft-lb)



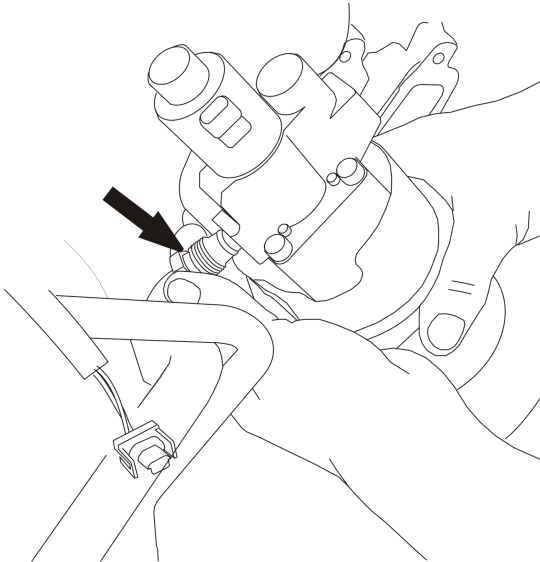
W2005710



W2005707

**7**

Place the exhaust manifold heat shield into position over the exhaust manifold and cylinder block. Install the fasteners and tighten to secure the shield.



W2005694

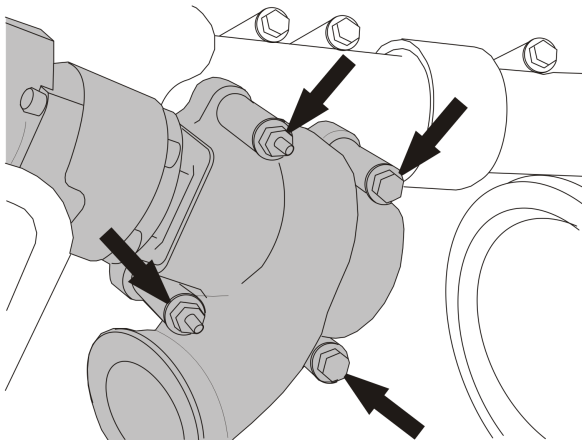
**8**

Install the oil supply line to the bottom of the EGR valve. Leave the fitting finger tight.

**9**

Position the EGR valve to the exhaust manifold and slip a new gasket between the valve and the manifold. Install the EGR valve bolts to hold the valve and gasket in place.



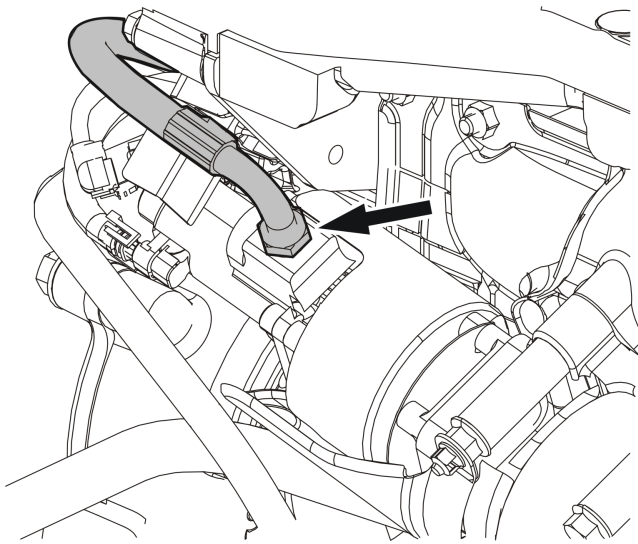


W2005693

**10**

Tighten the EGR valve bolts to 61 Nm (45 ft-lb).

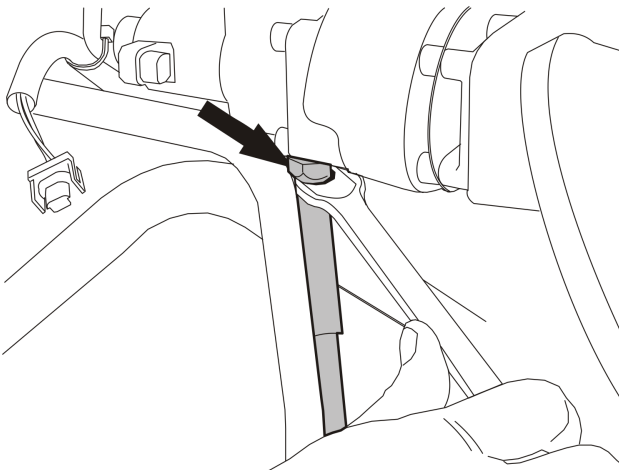
61 Nm (45 ft-lb)



W2005690

**11**

Install the EGR valve return oil line and tighten to specification.

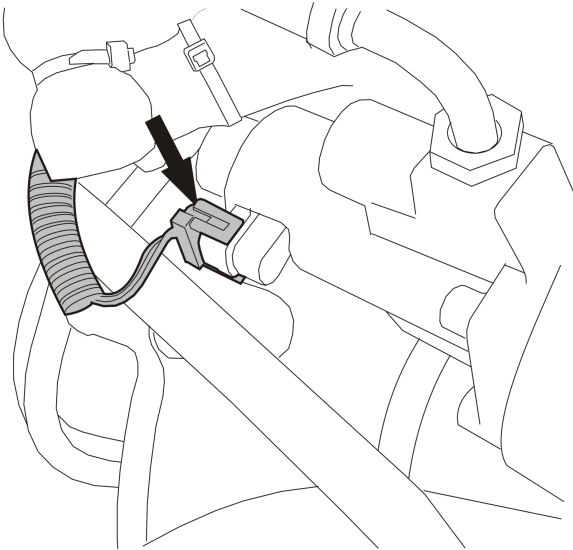


W2005692

**12**

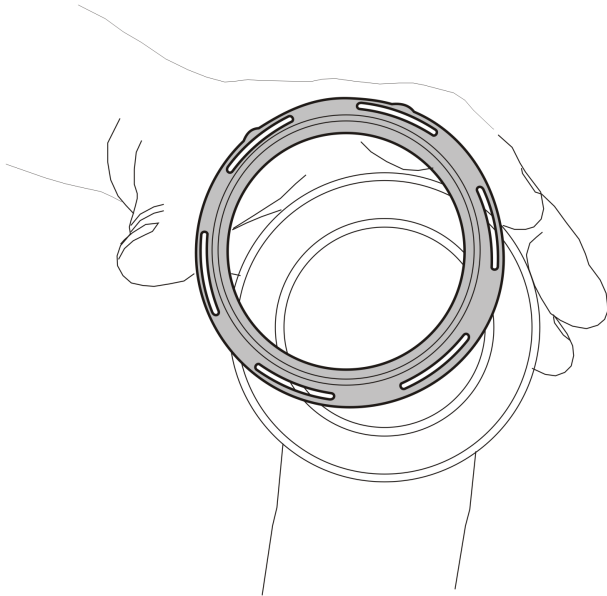
Tighten the EGR valve oil supply line to specification.

- 13**  
Install the EGR valve electrical connector.



W2005689

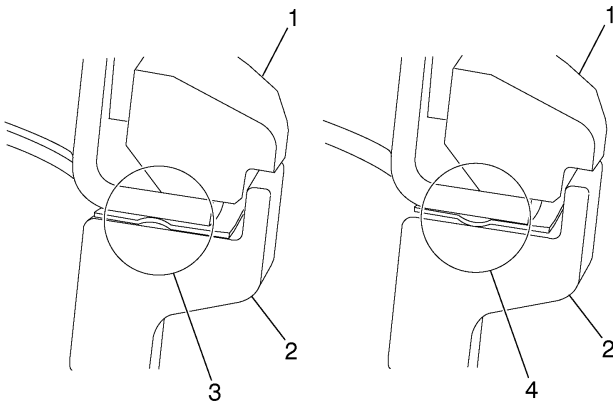
- 14**  
Install new gaskets onto the EGR valve end of the hot pipe and into the inlet flange of the EGR cooler.



W2005688

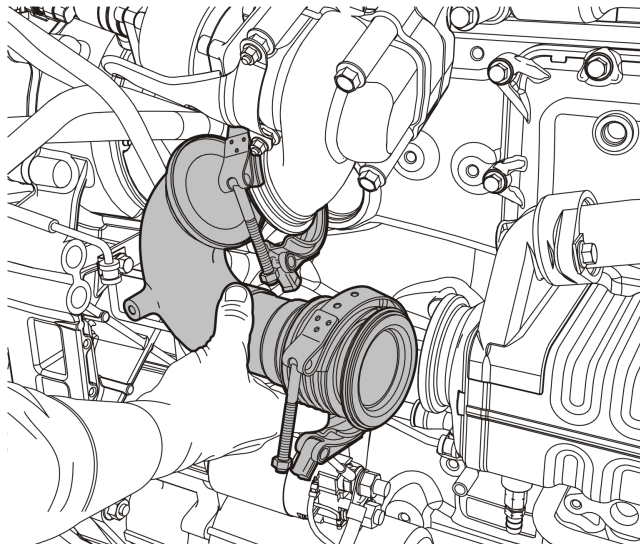
**15**

Make sure the gaskets lay flat against the flanges correctly and are assembled with the bead of the gasket facing the EGR pipe as shown.



W2006165

- 1 EGR Pipe Floating Flange
- 2 EGR Cooler Flange
- 3 Gasket Assembled Correctly
- 4 Gasket Assembled Incorrectly



W2005641

**16**

Inspect and lubricate the V-clamps. Hook the upper V-clamp over the EGR valve flange. Place the lower V-clamp over the bellows on the hot pipe.

**Note:** The V-band clamps can be reused if there is no noticeable wear or damage.

**Note:** Gaskets are one time use only. Do not reuse gaskets.

**17**

Lubricate both the flange on the EGR cooler inlet and the flange on the EGR hot pipe. Lubricate the V-band clamps and T-bolt threads. Lubricating the flanges and clamps aids in V-clamp installation.

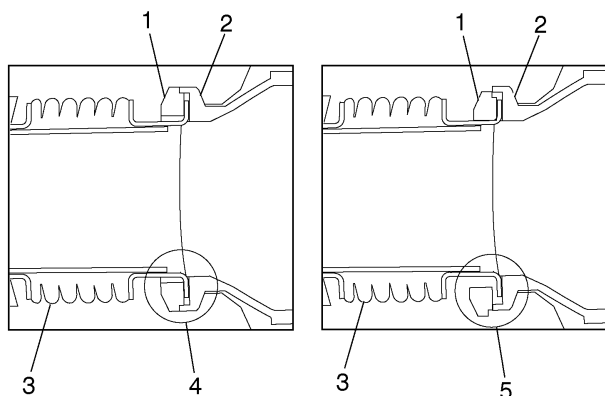
### 18

Position the EGR hot pipe between the EGR valve and the EGR cooler. Make sure the flange engages properly. While holding the hot pipe in position, slide the upper V-clamp over the flange and tighten until snug. Slide the floating flange into the groove of the EGR cooler flange. Slide the lower V-clamp over the flange of the EGR cooler and tighten the clamp until enough pressure prevents the floating flange from falling out of the EGR cooler flange.

### 19

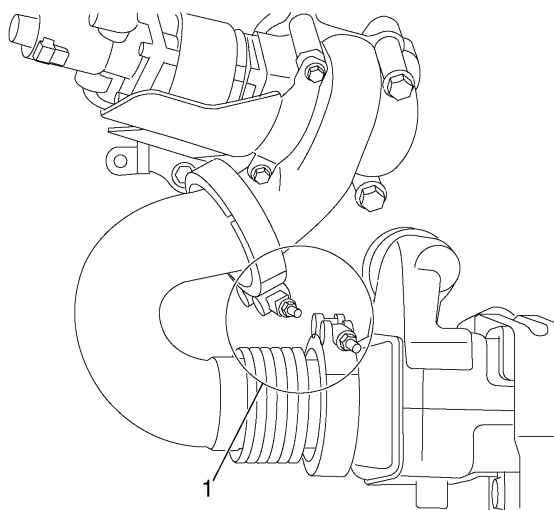
Visually inspect the flange through the gap in the V-band clamp to make sure it is properly seated in the EGR cooler flange. The floating flange must be concentric with the EGR cooler flange.

**Note:** If the floating flange is not properly seated in the EGR cooler flange, the gasket will not be compressed and the seal will leak.



W2006163

- 1 EGR Pipe Floating Flange
- 2 EGR Cooler Flange
- 3 EGR Pipe
- 4 Flange Assembled Correctly
- 5 Flange Assembled Incorrectly



W2006164

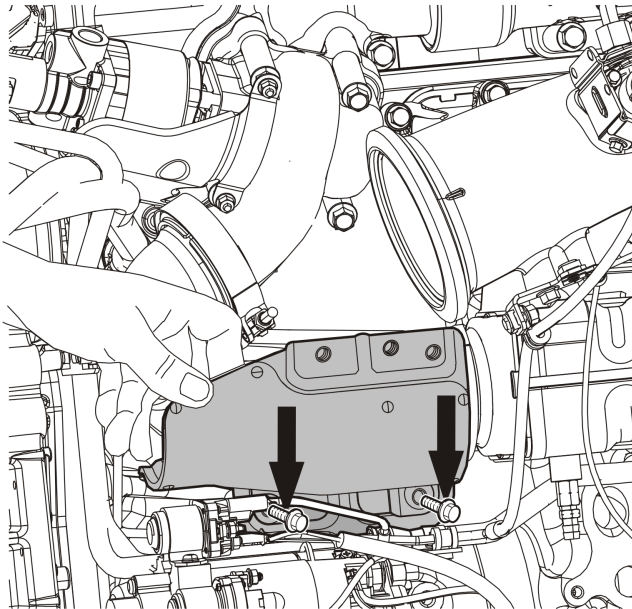
- 1 EGR Pipe Clamp Position

### 20

Position the V-clamps as shown so that the T-bolts clear both heat shields. Apply anti-seize to the threads of the T-bolts. Tighten to  $20 \pm 4$  Nm ( $15 \pm 3$  ft-lb).

**Note:** After reaching the specified torque, inspect the V-clamps to make sure that no portion of the clamp has "bottomed out."

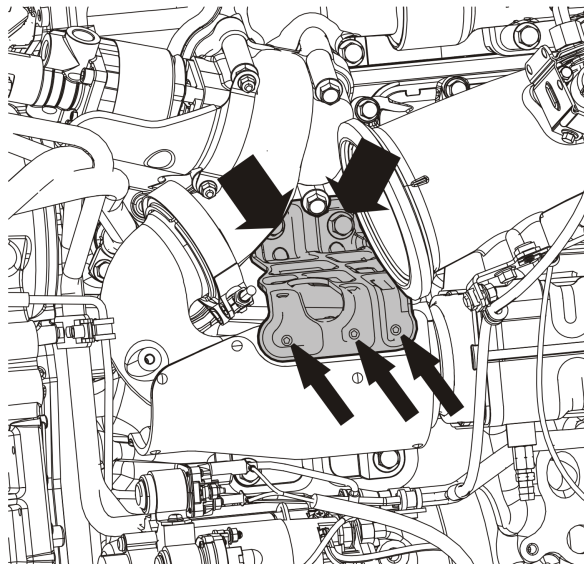
$20 \pm 4$  Nm ( $15 \pm 3$  ft-lb)



W2005687

**21**

Position the lower EGR hot pipe heat shield over the pipe and secure with bolts. Do not tighten at this time.



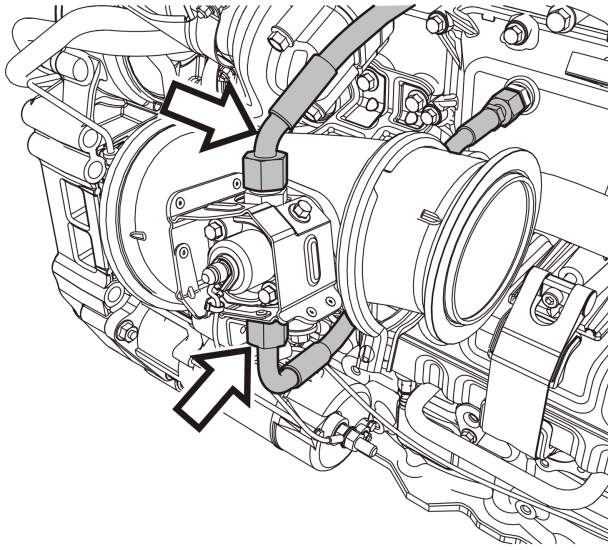
W2005686

**22**

Position the upper EGR hot pipe heat shield and install the fasteners to secure the shield. Tighten all fasteners to specification.

**23**

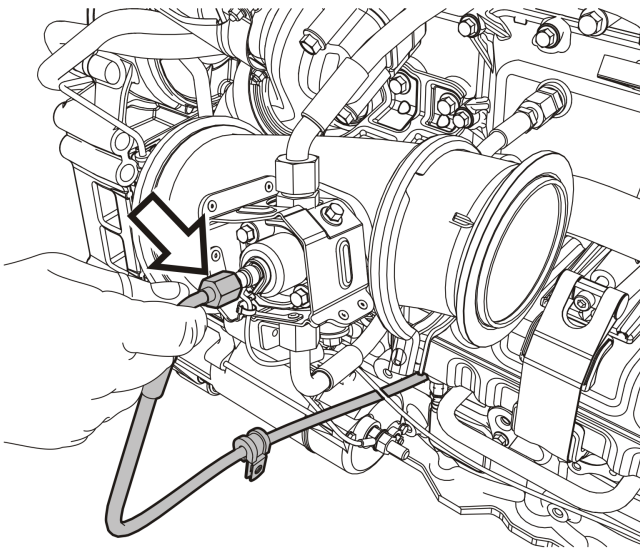
Position the diffuser to the exhaust pipe and loosely install the V-band clamp.



W2005655

**24**

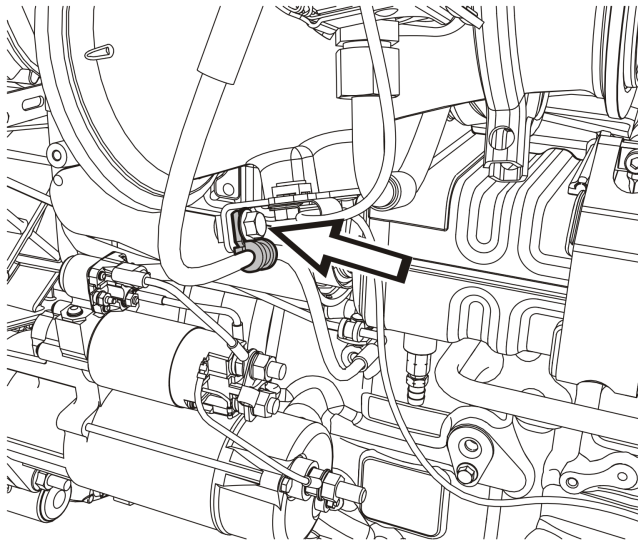
Install the coolant supply and return lines to the aftertreatment fuel injector.



W2005656

**25**

Install the fuel line onto the aftertreatment fuel injector.



W2005657

**26**

Install the aftertreatment fuel injector fuel line clamp and fastener to the bottom of the diffuser.

**27**

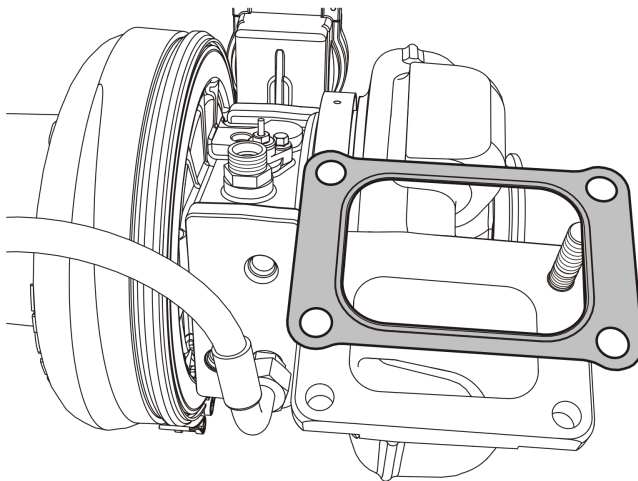
Clean the contact surface of the exhaust manifold and the turbocharger.

**28**

Remove the plugs from the turbocharger oil lines. Remove from the turbocharger intake and exhaust openings.

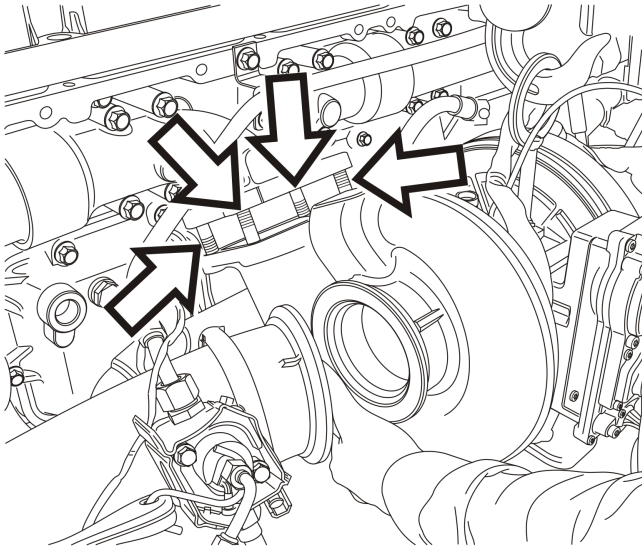
**29**

Install a new gasket onto the studs of the turbocharger.



W2005636





W2005629

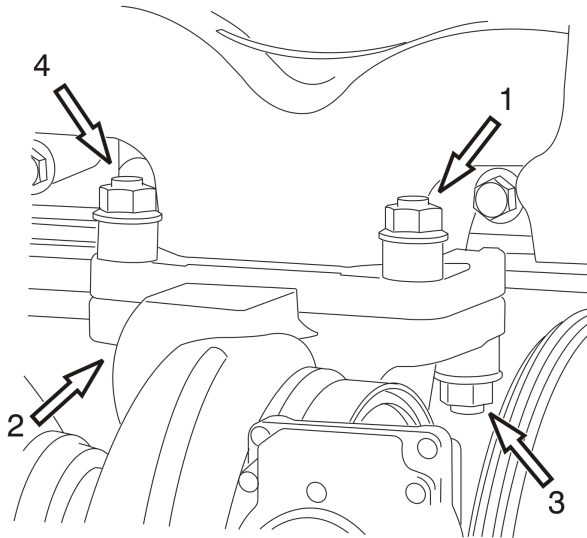
**30**

Attach the turbocharger to a mobile floor crane such as OTC 16-1815 or equivalent. With the aid of an assistant, position the turbocharger against the exhaust manifold, aligning the studs with the holes.

**31**

Install the turbocharger flange nuts and spacers and tighten to 135 Nm (100 ft-lb). The nuts should be tightened in the sequence shown.

135 Nm (100 ft-lb)



W2005206

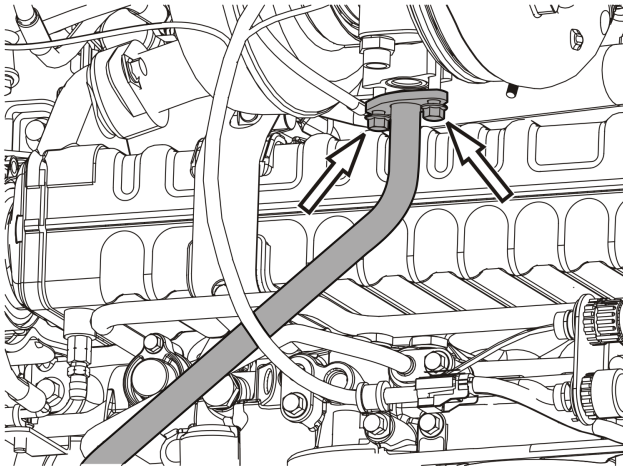
**32**

Remove the hoist and turbocharger lifting tool. Install the plug in the threaded hole at the top of the turbocharger.

**33**

Clean the contact surface of the turbocharger, spacer block and oil drain pipe.



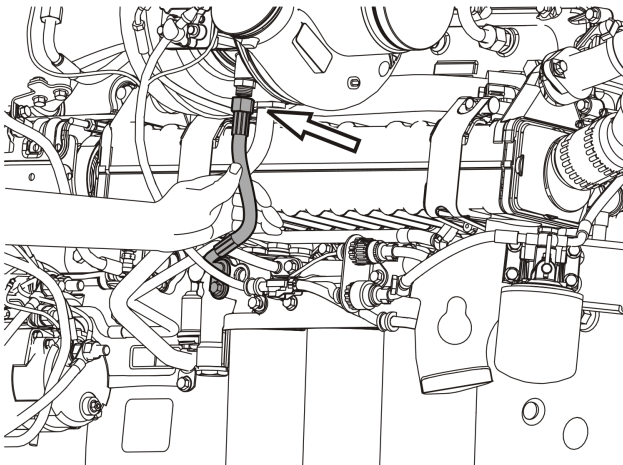


W2005628

**34**

Position a new O-ring and gasket on the spacer block and install the turbocharger oil drain pipe and spacer block to the bottom of the turbocharger. Tighten the fasteners to  $24 \pm 4$  Nm ( $18 \pm 3$  ft-lb).

$24 \pm 4$  Nm ( $18 \pm 3$  ft-lb)



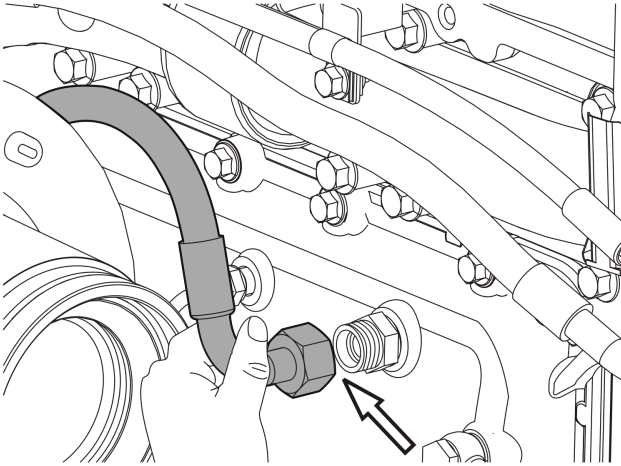
W2005624

**35**

Install the turbocharger oil supply line to the bottom fitting of the turbocharger and tighten the fitting.

**36**

Install the turbocharger coolant line to the fitting on the oil cooler cover and tighten to secure.

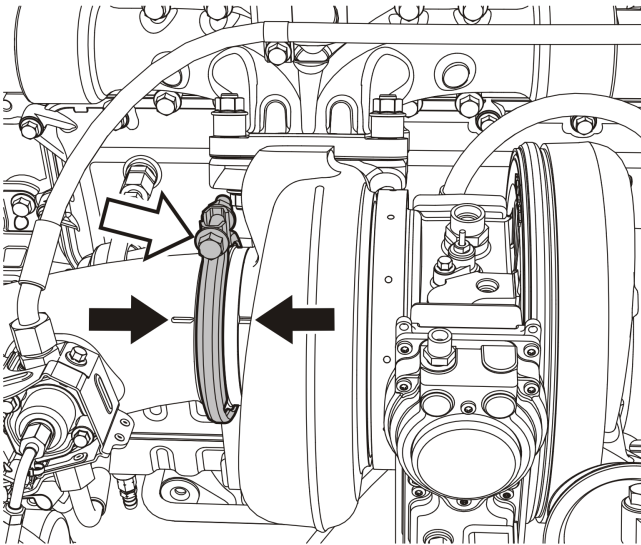


W2005623

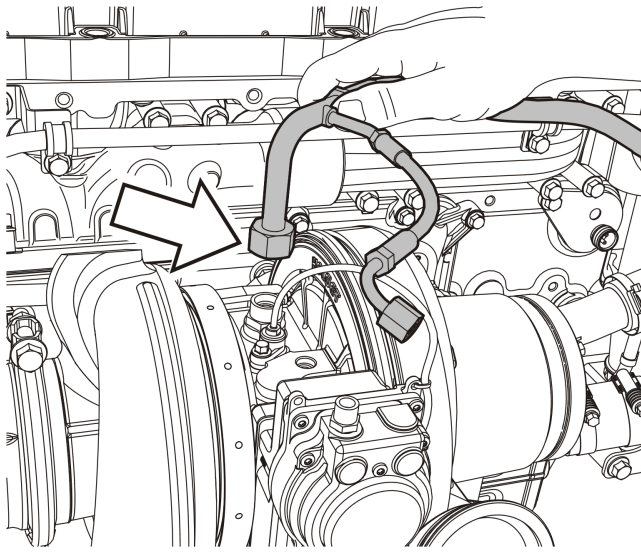
**37**

Position the diffuser against the turbocharger and install a new V-band clamp. Align the cast marks on the diffuser with the mark on the turbocharger and tighten the clamp to secure. Tighten the diffuser-to-exhaust pipe clamp.

**Note:** The diffuser V-band clamp is a one time use clamp.



W2005626

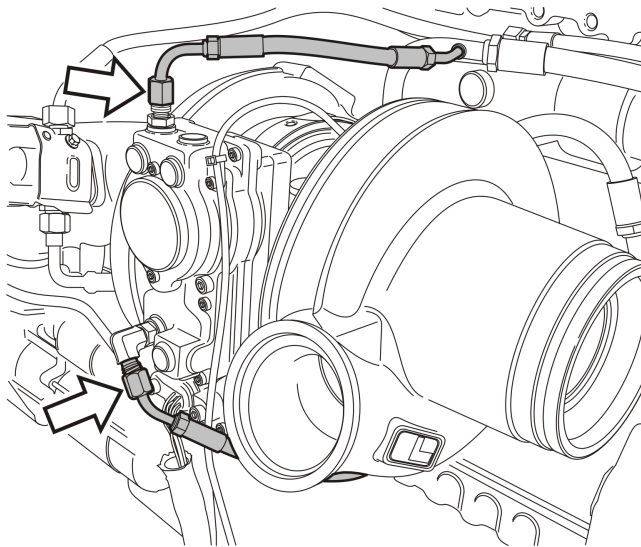


W2005622

**38**

Install the coolant line to the top of the turbocharger and tighten the fitting to secure.

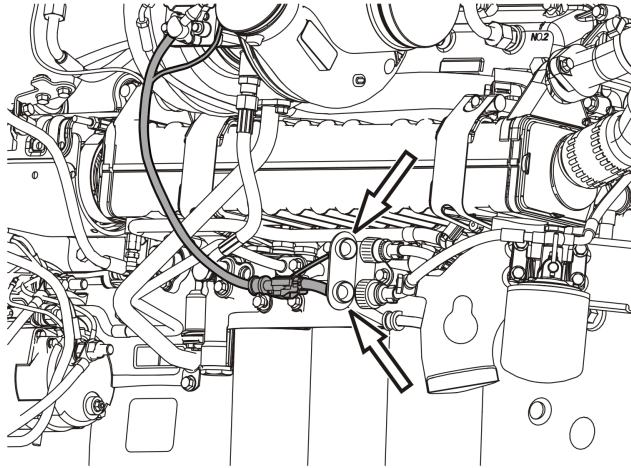
**Note:** This coolant line also connects to the turbocharger actuator.



W2005621

**39**

Install the turbocharger actuator coolant lines to the fittings and tighten to secure.



W2005620

**40**

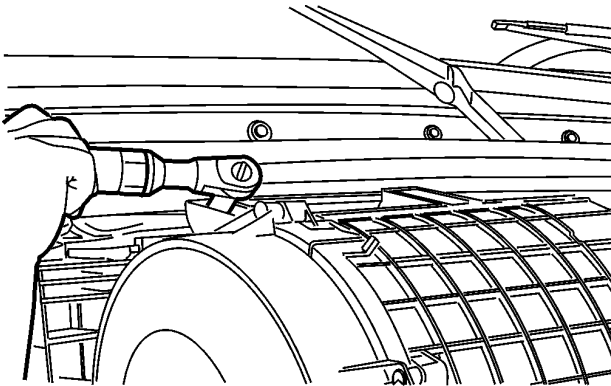
Connect the turbocharger actuator and turbocharger wheel speed sensor wiring harnesses. Make sure the connectors are oriented with the flat side toward the flat in the bracket. Install the cable clamp on the oil filter housing. Secure the wiring harness to itself and to the turbocharger oil drain pipe using tie straps.

**41**

Install the inlet elbow to the turbocharger. Do not tighten clamp.

**42**

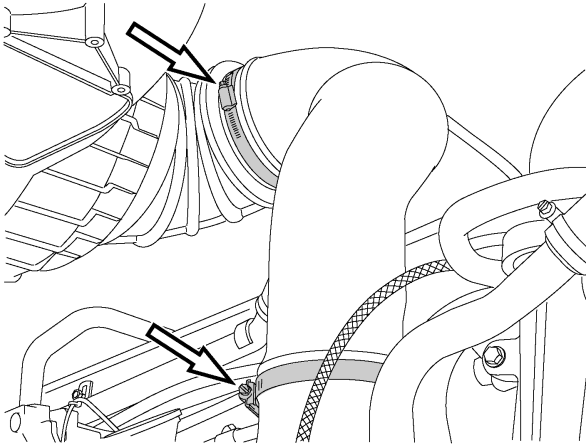
Position the air filter housing against the cab, install the bolts and tighten to secure.



W2003858

**43**

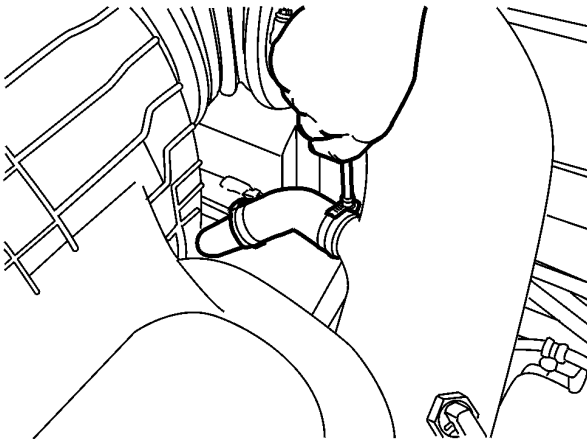
Install the main fresh air pipe to the air filter housing and the turbocharger inlet elbow. Tighten the clamps to secure.



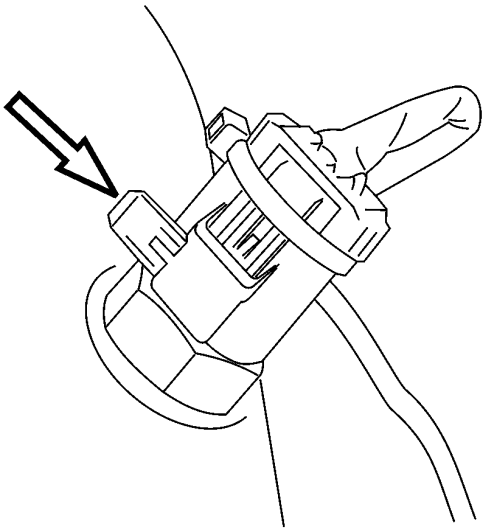
W2006005

**44**

Install the air compressor fresh air coupling hose to the main fresh air pipe, position the clamp and tighten to secure.



W2004719



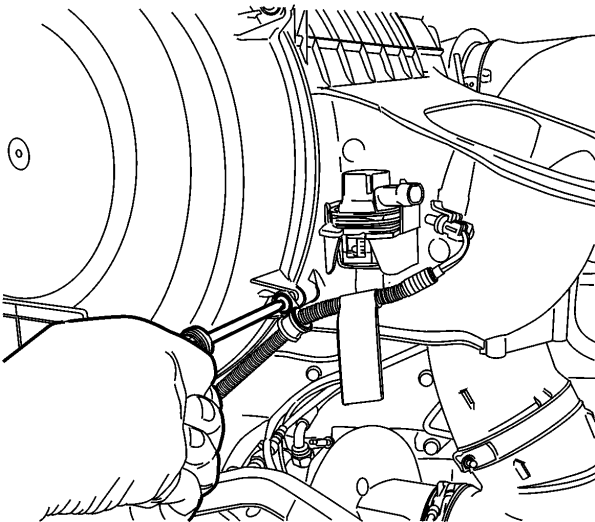
W2004720

**45**

Install the air temperature sensor connector to the sensor. Insert the connector lock tab, push in place and secure with a tie strap. Install the clamp and fastener to secure the harness to the main fresh air pipe.

**46**

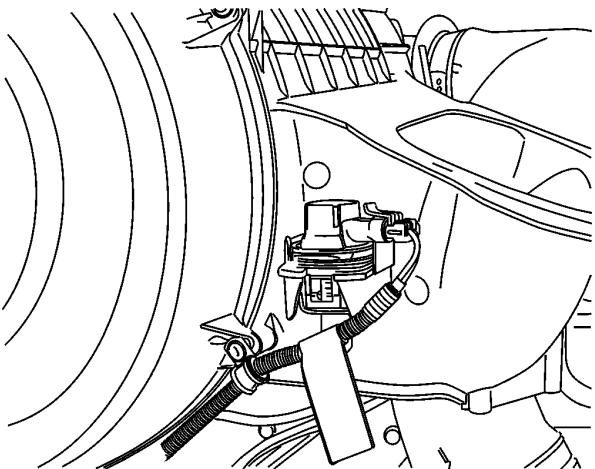
Install the air filter restriction gauge wiring harness to the air filter housing and tighten the clamps to secure.



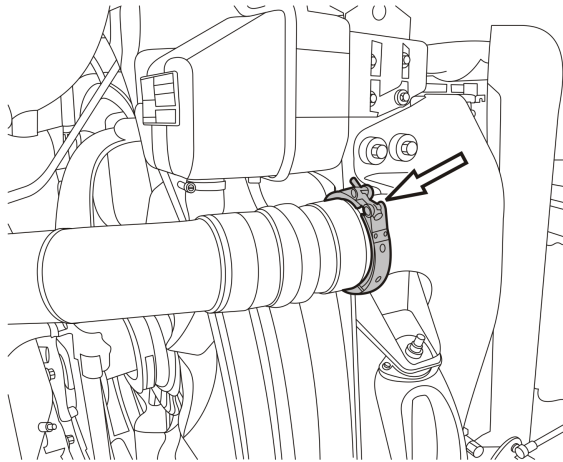
W2003861

**47**

Connect the air filter restriction gauge electrical harness connector.



W2004249



W2006040

**48**

Inspect the O-rings at each end of the charge air inlet pipe for damage, replace if needed. Install the charge air inlet pipe assembly between the turbocharger and charge air cooler.

**Note:** Connect the DRV air line. Connect the recirculation hose to the inlet elbow, position the clamp and tighten to secure.

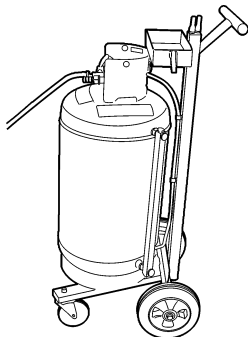
**49**

Check the engine oil level and replenish as needed with the recommended oil.

**50**

Fill the cooling system with the recommended coolant using the coolant extractor.

DBT2V700



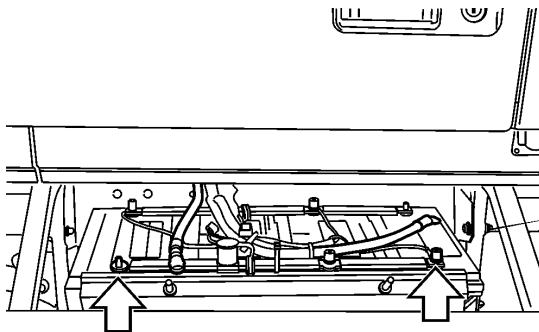
W2004191

**51**

Install the inner splash guard assembly.

**52**

Install all previously removed cables to the ground (negative) battery terminals.



W2003815

**53**

Start the engine, check for leaks and proper operation. After shutdown, replenish fluids as necessary.