

# DETROIT DIESEL



## SERIES 60<sup>®</sup> Service Information

NUMBER: 7-60-02 S.M. REF.: 6.6 ENGINE: 60 DATE: December 2002

**SUBJECT: EXHAUST GAS RECIRCULATION (EGR) SYSTEM RELEASED FOR THE SERIES 60 2002 ENGINE**

### INTRODUCTION

Detroit Diesel has released an Exhaust Gas Recirculation (EGR) system designed to provide reduced emissions meeting the NO<sub>x</sub> Emission Standards for October 2002.

### DETAILS AND REASON

The EGR system consists of the following components:

- S-Pipe

- EGR Valve and Actuator Assembly (The EGR Valve and Actuator Assembly are not servicable)

- EGR Cooler

- Delivery Pipe

- Mixer (Introduces exhaust into the fresh air intake stream)

- Delta-P Sensor Measurement System

- Variable Nozzle Turbocharger (VNT)

- Variable Pressure Output Device (VPOD) (Modulates Air Pressure to VNT and EGR Valve  
(The VPOD assembly is not servicable)

### Component Procedures

#### **NOTE:**

VNT Turbochargers are not repairable. Repair work on the VNT is limited to its replacement.

The variable nozzle turbine (VNT) turbocharger uses a high pressure, pneumatic actuator to regulate and control the Exhaust Gas Recirculation (EGR) system. There is no wastegate with this system. The VNT actuator is mounted on a bracket attached to the turbocharger and receives air pressure from the engine mounted Variable Pressure Output Device (VPOD). The VNT actuator connects via a rod end to a pin joint of the turbine external arm. Rotation of the external arm simultaneously rotates several pivoting nozzle vanes positioned inside the turbine housing at the outer periphery of the turbine wheel, adjusting turbocharger speed and boost in accordance with the DDEC engine management control.

---

A second actuator is the EGR valve actuator that controls the variable position of the EGR valve. The EGR valve outlet is connected to the EGR cooler and recirculates a fraction of the engine exhaust gases to the intake manifold for purposes of engine emission control.

The Delta-P (Differential Pressure) sensor uses the differential pressure created by using a fixed orifice and pressure ports on either side of the fixed orifice to determine the actual EGR flow rate. The Delta-P sensor is the feedback loop to the ECM so the ECM can:

1. Increase or decrease EGR flow via the VPODs.
2. Determine if the EGR system is functioning properly.

The EGR temperature sensor is used in conjunction with the Delta-P sensor to determine flow rate and warn the operator of EGR system malfunctions.

**For Series 60 engines with Exhaust Gas Recirculation (EGR) systems install the VNT turbocharger as follows:**

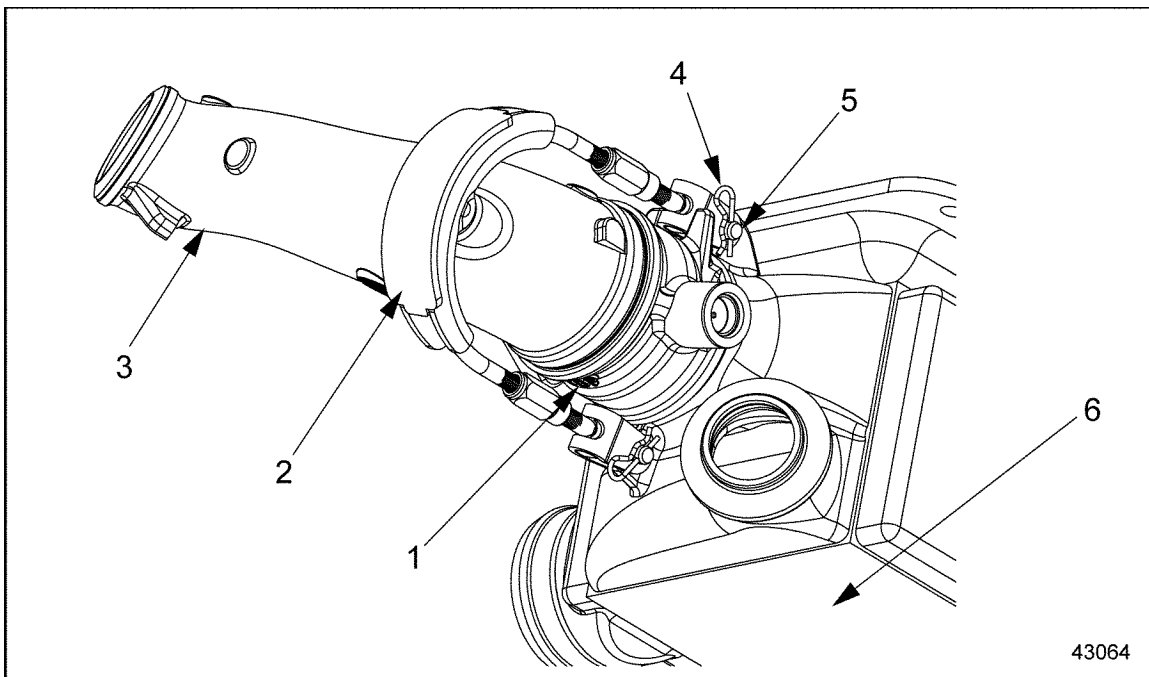
1. Place base gasket over studs on exhaust manifold.
  2. Place turbocharger over studs.
  3. Install four M10 nuts and washers and torque to 49 N·m (36 lb·ft).
  4. Connect air line to VNT actuator and torque to 20 N·m (14 lb·ft).
-

**CAUTION:**

To avoid injury from hot surfaces, allow engine to cool before removing any component. Wear protective gloves.

For Series 60 engines equipped with EGR systems remove EGR Cooler as follows:

1. Remove two bolts and seal ring from water pump outlet elbow. Discard seal ring.
2. Remove water pump outlet elbow from hose on EGR water inlet.
3. Remove hose and clamps from EGR Cooler water inlet.
4. Slide clamp onto hose of oil cooler water inlet.
5. Remove turnbuckle clamp, S-Pipe and EGR Valve assembly from EGR Cooler inlet. See Figure 1.

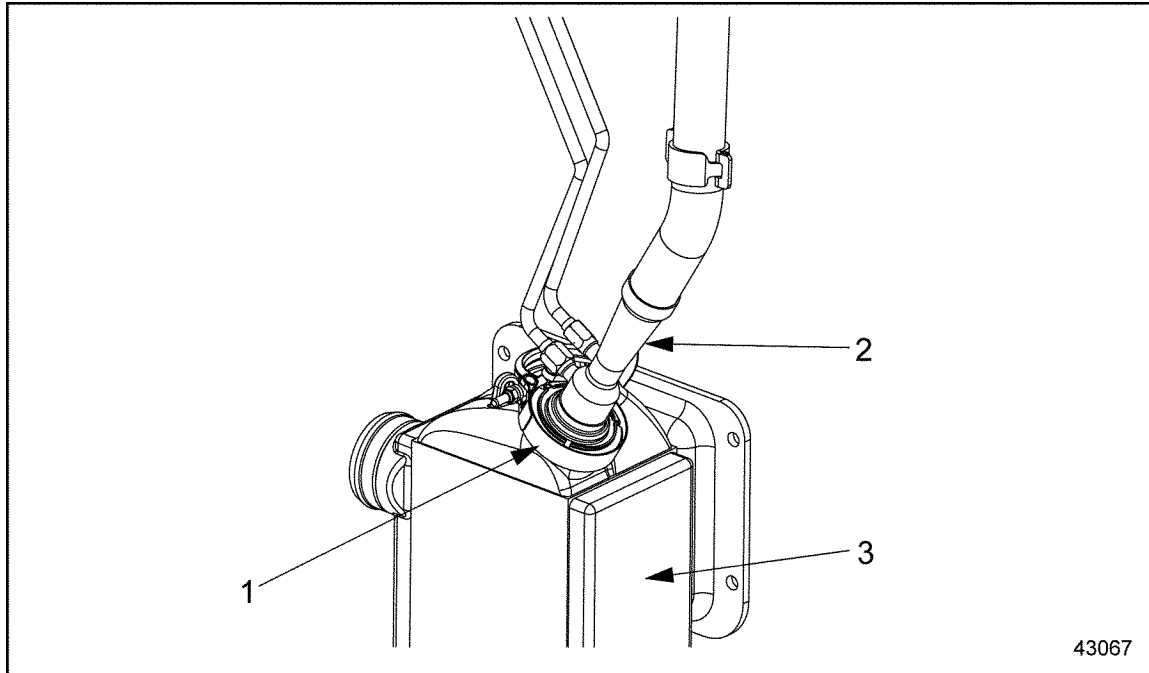


1. EGR Valve Assembly
2. Turnbuckle Clamp
3. S-Pipe

4. Clip Pin
5. Clevis Pin
6. EGR Cooler

**Figure 1 EGR Cooler and Related Parts**

6. Remove Delivery Pipe clamp from EGR Cooler outlet. See Figure 2.



- 1. Clamp
- 2. Delivery Pipe

3. EGR Cooler

**Figure 2 EGR Cooler and Delivery Pipe**

**⚠ CAUTION:**

**To avoid injury when removing or installing a heavy engine component, ensure the component is properly supported and securely attached to an adequate lifting device to prevent the component from falling.**

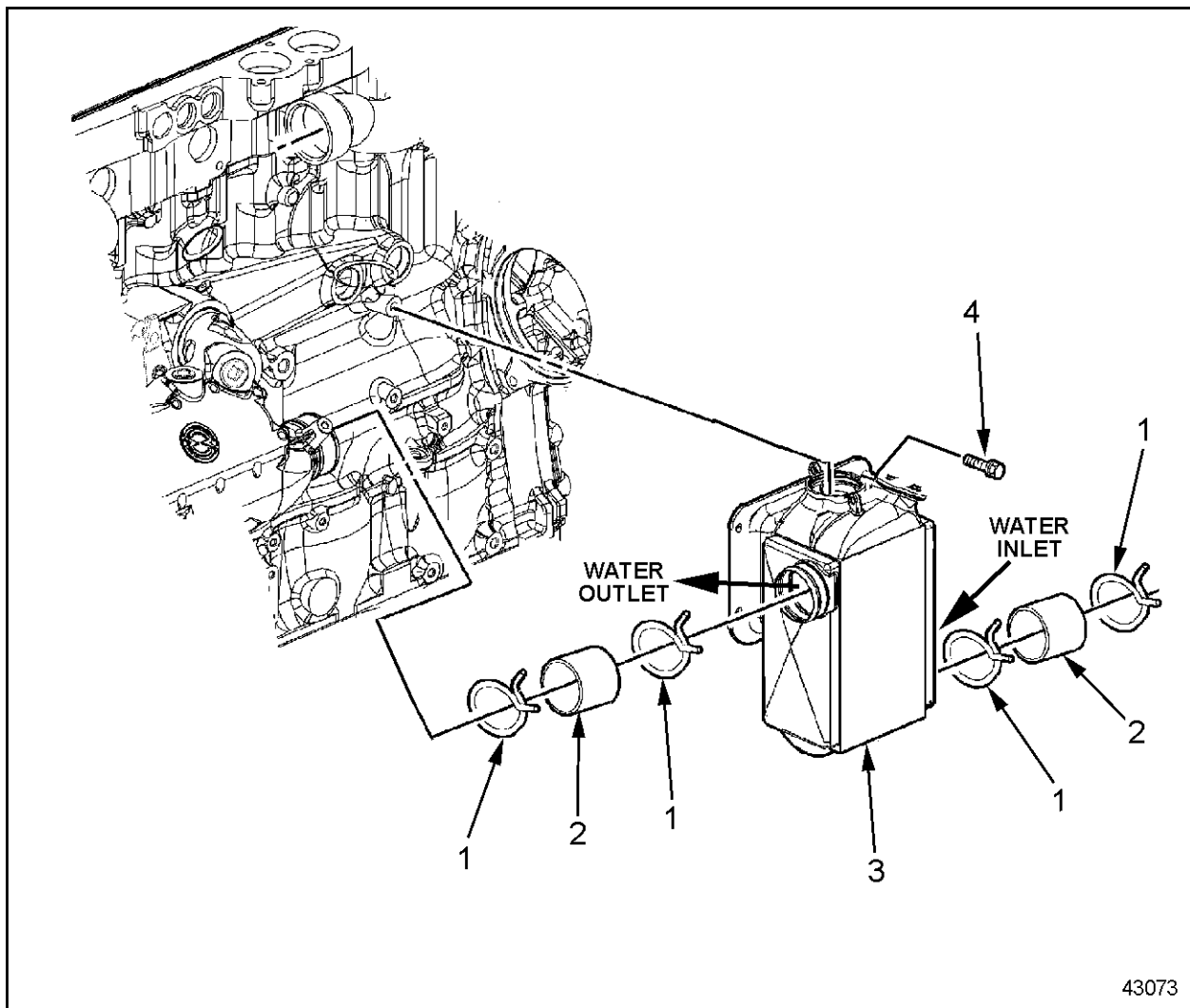
- 7. Remove four bolts attaching EGR Cooler backplate to engine block.
- 8. Remove hose and clamp from oil cooler water inlet.

Series 60 engines equipped with EGR systems have a EGR Cooler which cools the exhaust gas prior to introduction in the Intake Manifold.

**Install the EGR Cooler as follows:**

- 1. Install hose and clamps over oil cooler water inlet.

2. Insert EGR Cooler water outlet into hose on oil cooler inlet.
3. Align EGR Cooler back plate holes with four bosses on cylinder block.
4. Thread four M10 bolts through back plate and into cylinder block.
5. Tighten bolts to 46-52 N·m (34-38 lb·ft).
6. Install hose and clamps onto EGR Cooler water inlet. See Figure 3.



1. Clamp
2. Hose

3. EGR Cooler
4. Bolt

**Figure 3 EGR Cooler and Related Parts**

- 
7. Insert water pump outlet elbow into hose on EGR water inlet.
  8. Install new seal ring and water pump elbow on water pump with two M10 bolts torque bolts to 58-73 N·m (43-54 lb·ft).

**For Series 60 Engines equipped with EGR systems remove S-Pipe, EGR Valve and Actuator Assembly as follows:**



**CAUTION:**

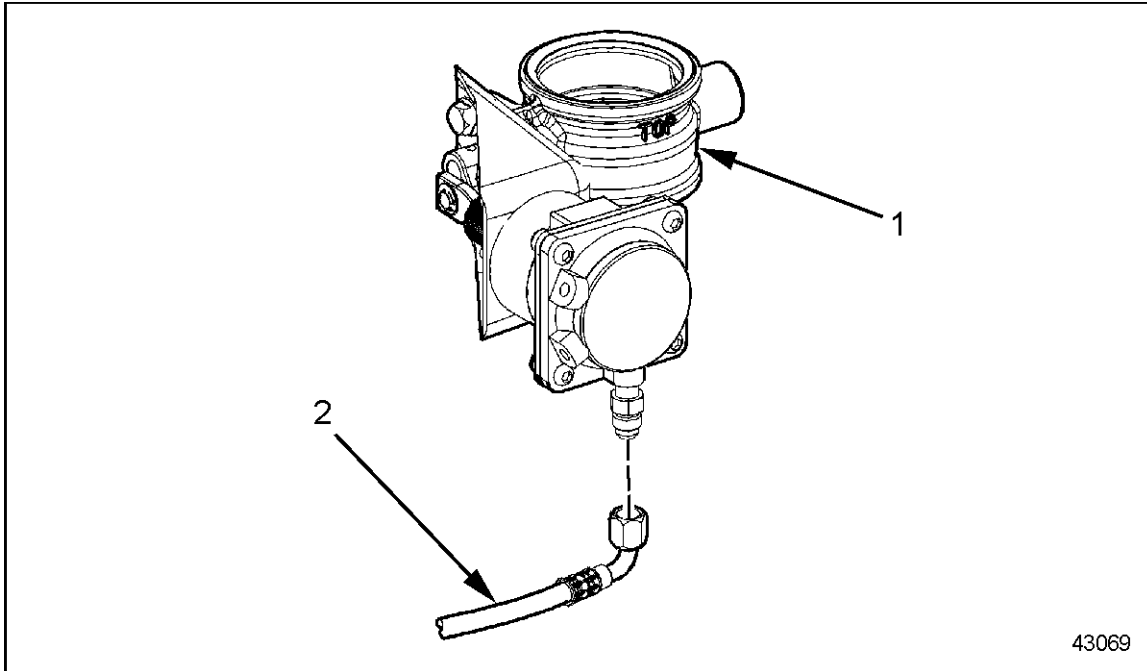
**To avoid injury from hot surfaces, allow engine to cool before removing any component. Wear protective gloves.**

**NOTICE**

EGR Valve and Actuator are not servicable remove and install as assemblies.

1. Remove nut, spherical washer and crab on M8 stud securing S-pipe to exhaust manifold.
  2. Loosen turnbuckles.
  3. Remove clevis and clip pins securing turnbuckle clamp to EGR Cooler, remove turnbuckle clamp and S-Pipe.
-

4. Remove airline fitting from valve actuator and remove EGR Valve. See Figure 4.



1. EGR Valve and Actuator Assembly

2. Air Line Tube

**Figure 4 EGR Valve and Actuator Assembly**

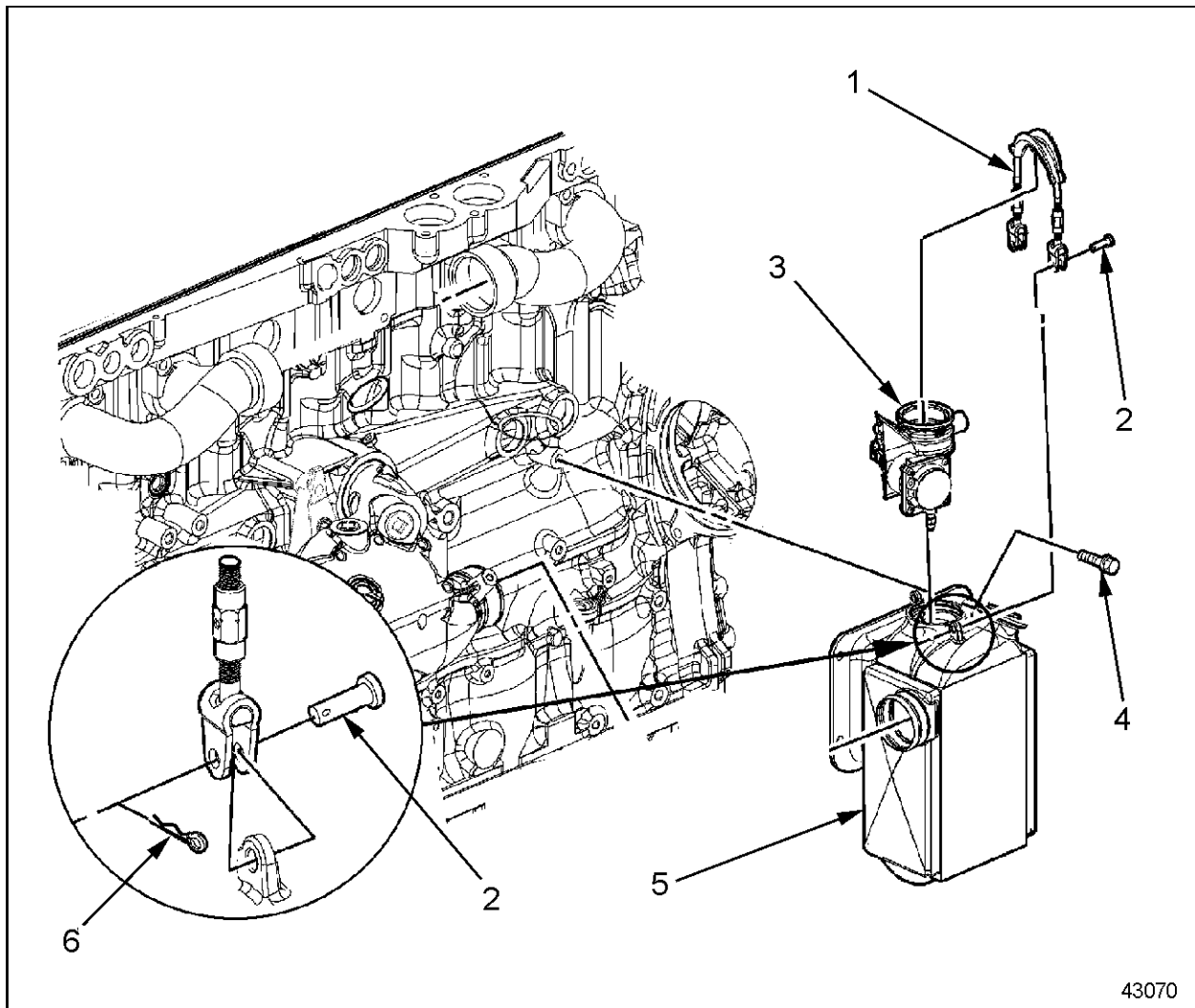
---

Exhaust gas flows from the exhaust manifold through the S-pipe and EGR valve to the cooler. This system includes three spherical slip joints to allow motion between the exhaust manifold and cooler due to assembly variation, vibration and thermal growth. The three joints are coated with a special material that allows for relative movement between parts while still maintaining a seal and minimizing wear.

**Install the S-Pipe as follows:**

1. If the exhaust manifold stud has not been installed use the following procedure:
  - [a] Apply antiseize to threads on the M8 stud and install in the threaded hole near the EGR port on the bottom of the exhaust manifold.
  - [b] Torque to 25-30 N·m (18-22 lb·ft).
2. Install exhaust manifold on the engine. Refer to Section 7.2.
3. Loosely install crab, spherical washer and nut on the M8 stud. See Figure 7.

4. Install the turnbuckle clamp on the cooler using clevis and clip pins. The turnbuckles on either side of the clamp should be extended; each turnbuckle nut should be engaged by a few threads. See Figure 5.



- |                                    |               |
|------------------------------------|---------------|
| 1. Turnbuckle Clamp                | 4. Bolt       |
| 2. Clevis Pin                      | 5. EGR Cooler |
| 3. EGR Valve and Actuator Assembly | 6. Clip Pin   |

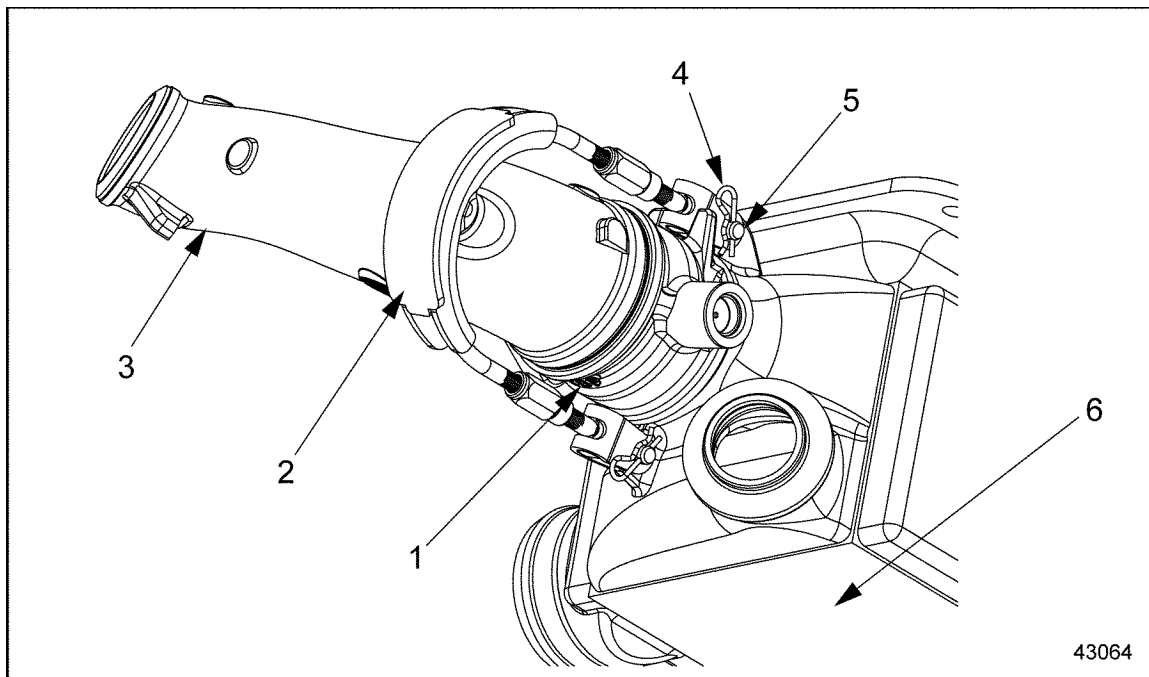
**Figure 5 Turnbuckle Clamp Assembly**

5. Slide and rotate the S-pipe into position with hold down tabs under the crab. See Figure 7.

**NOTICE:**

Inspect spherical sealing surfaces for scratches. Replace hardware if deeply scratched or galled.

6. Slide and rotate the EGR valve into position between the S-pipe and cooler. See Figure 6



1. EGR Valve Assembly
2. Turnbuckle Clamp
3. S-Pipe

4. Clip Pin
5. Clevis Pin
6. EGR Cooler

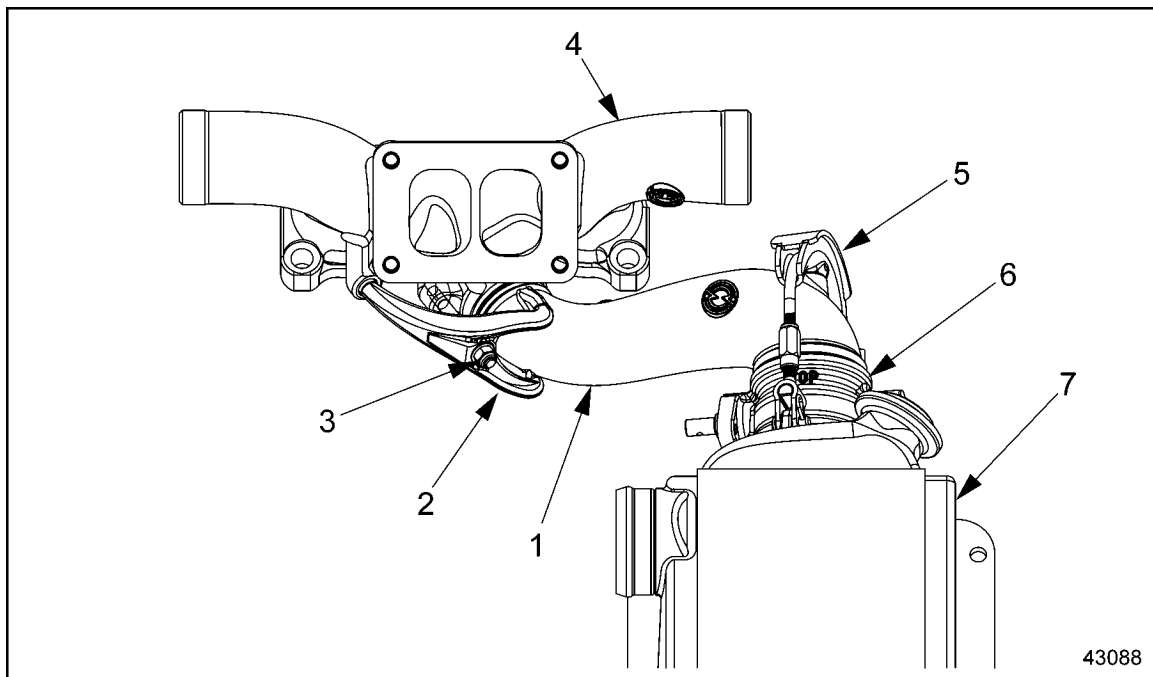
**Figure 6 EGR Cooler and Related Parts**

**NOTE:**

The valve **TOP** is indicated on the casting.

7. Rotate the turnbuckle clamp up and over the S-pipe so that the clamp's saddle rests in the bowl on top of the S-pipe.
8. Tighten the nuts on the turnbuckle by hand, making sure that both turnbuckle nuts are tightened equally. If one side is tightened more than the other, the EGR valve will be pulled out of alignment, and the exhaust gas path will not be sealed. Leave the nuts finger tight.

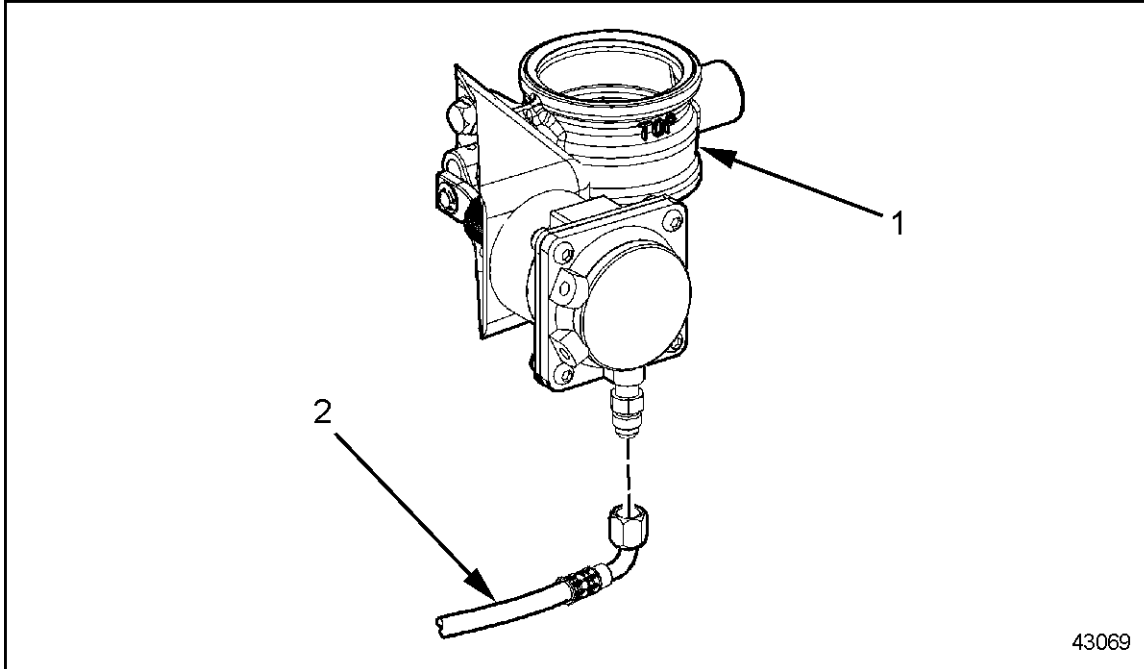
9. Finger tighten the nut on the crab at the other end of the S-Pipe.
10. Shift the S-pipe back and forth to ensure that the spherical joints are properly seated and the parts are aligned. When the manifold, S-pipe, EGR valve and EGR cooler are in alignment, the crab nut and turnbuckle clamp can be tightened.
11. Torque the crab nut to 25-30 N·m (18-22 lb·ft).
12. Tighten the turnbuckle clamp, turning each nut equally. Stop tightening the clamp when the torque on the outer nut, reaches 25-30 N·m (18-22 lb·ft). See Figure 7.



- |                             |                     |
|-----------------------------|---------------------|
| 1. S-Pipe                   | 5. Turnbuckle Clamp |
| 2. Crab                     | 6. EGR Valve        |
| 3. Nut and Spherical Washer | 7. EGR Cooler       |
| 4. Exhaust Manifold         |                     |

**Figure 7 EGR Assembly and Related Parts**

13. Install air line to fitting on EGR valve actuator and torque to 19-22 N·m (14-16 lb·ft). See Figure 8 .



1. EGR Valve Assembly

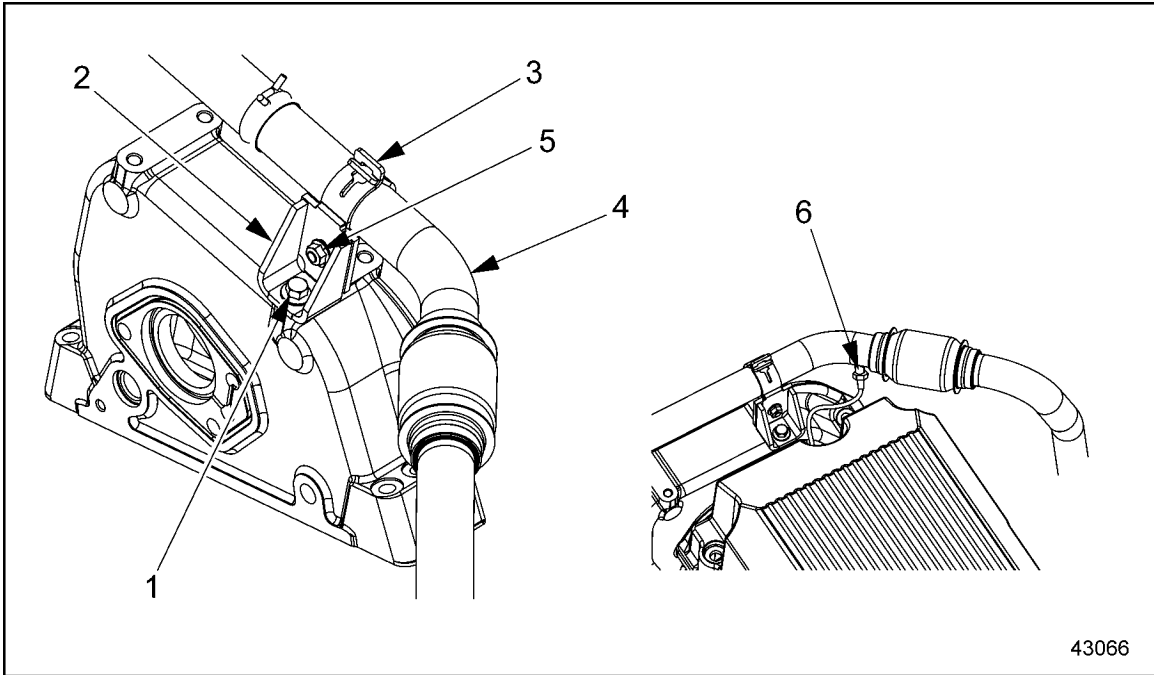
2. Airline Tube

**Figure 8 EGR Valve Assembly with Airline Tube**

**For Series 60 engines equipped with EGR systems remove Delivery Pipe as follows:**

**⚠ CAUTION:**  
**To avoid injury from hot surfaces, allow engine to cool before removing any component. Wear protective gloves.**

1. Remove bolt from L-bracket on top of camshaft gear cover and nut from P-clip. See Figure 9 .

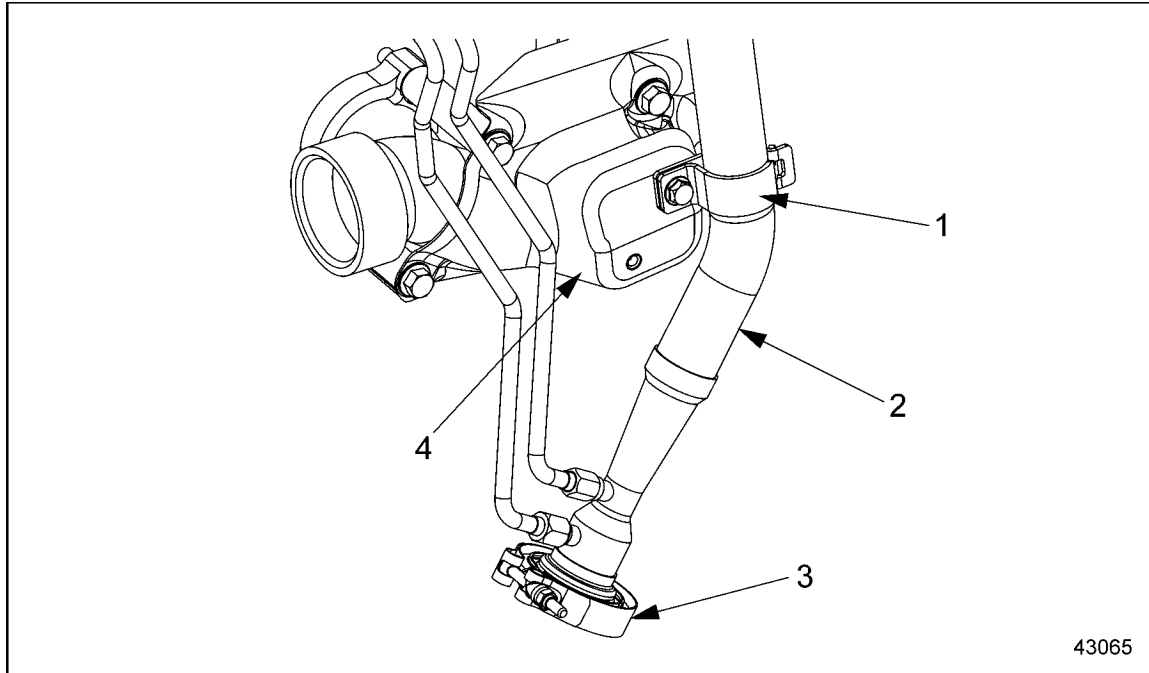


- |              |                           |
|--------------|---------------------------|
| 1. Bolt      | 4. Delivery Pipe          |
| 2. L-Bracket | 5. Nut                    |
| 3. P-Clip    | 6. EGR Temperature Sensor |

**Figure 9 Delivery Pipe and Related Parts**

2. Remove EGR temperature sensor from delivery pipe. See Figure 9.

3. Remove bolt securing P-Clip to heat shield on exhaust manifold. See Figure 10.



1. P-clip

2. Delivery Pipe

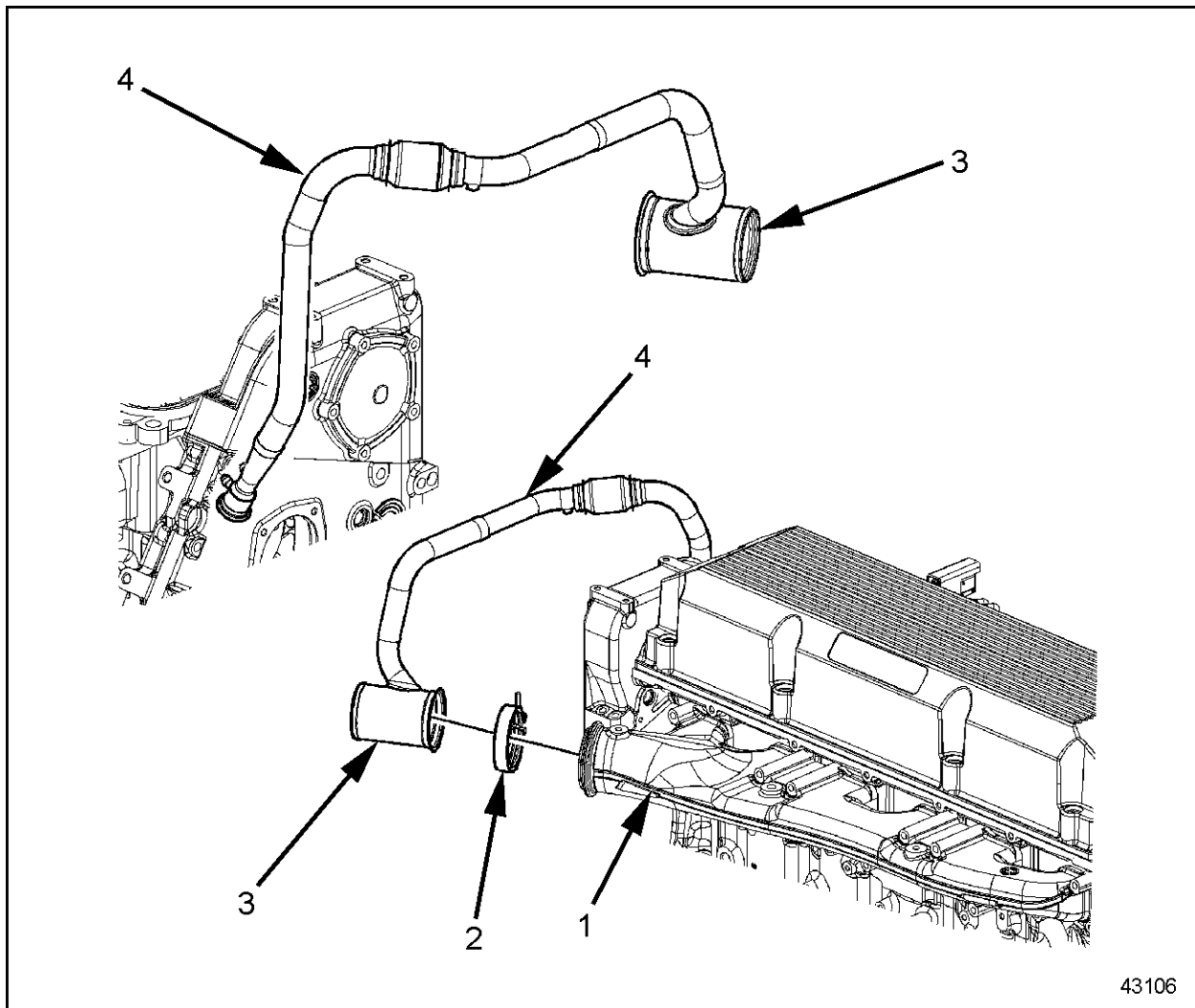
3. Clamp

4. Heat Shield

**Figure 10 Delivery Pipe and Related Parts**

4. Remove clamp at delivery tube (small end) to cooler outlet flange.
5. Disconnect Delta-P tubes at delivery pipe.

6. Remove clamp at mixer end (large end) of delivery pipe to intake manifold. See Figure 11.



1. Intake Manifold
2. Mixer Clamp

3. Mixer
4. Delivery Pipe

**Figure 11 Delivery Pipe and Related Parts**

The EGR Delivery Pipe provides a flow path from the cooler to the Intake Manifold.

**For Series 60 Engines equipped with EGR systems install the delivery pipe as follows:**

1. Loosely install the mixer end of the pipe (large diameter tube) to the intake manifold with band clamp. See Figure .

2. Loosely install the flow meter end of the pipe (small end) to the cooler outlet flange with band clamp. See Figure 2.
3. Loosely install the gusseted L-bracket to the top of the camshaft gear cover. See Figure 9.
4. Loosely attach the delivery pipe to the gusseted L-bracket with a P-clip. See Figure 9.
5. Loosely attach the delivery pipe to the forward exhaust manifold heat shield with a P-clip. See Figure 10.

**Notice:**

On some models the delivery tube is clipped to a bracket on the alternator. Ensure correct alignment before torquing.

6. Tighten the the delivery tube to mixer clamp to 12 N·m (105 lb·in.).
7. Tighten the clamp at the delivery tube to cooler to 12 N·m (105 lb·in).
8. Tighten the L-bracket bolt in the camshaft gear cover to 58-73 N·m (43-54 lb·ft).

**Notice:**

The camshaft gear cover is aluminum. Over tightening the bolt can strip threads in the camshaft gear cover.

9. Tighten the bolt connecting the P-clip to the gusseted L-bracket to 30-38 N·m (22-28 lb·ft).
10. Tighten the bolt into the heat shield to 30-38 N·m (22-28 lb·ft).

**For Series 60 engines equipped with EGR systems remove Delta-P Sensor Rate Measurement System as follows:**



**CAUTION:**

**To avoid injury from hot surfaces, allow engine to cool before removing any component. Wear protective gloves.**

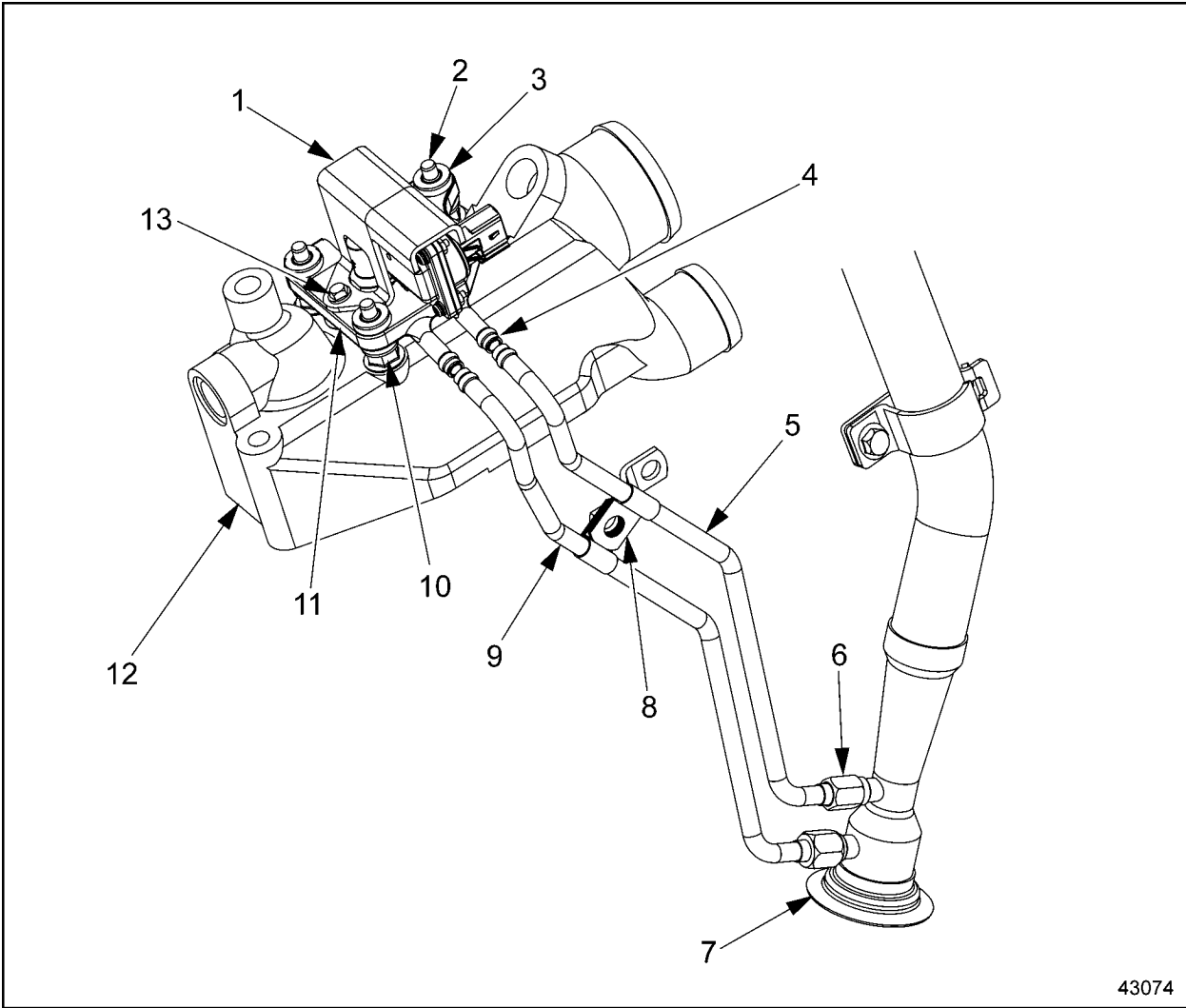
1. Remove four hose clamps at Delta-P sensor. See Figure 12.
2. Remove bolt and P-clips securing the Delta-P tubes.
3. Remove Delta-P tubes from ports on Delta-P Sensor and Delivery tube.
4. Remove two bolts securing Delta-P Sensor to bracket.

- 
5. Remove three nuts and six isolators securing Delta-P sensor mount to thermostat housing.  
See Figure 12.

EGR Rate Measurement system provides DDEC with measurements resulting in EGR flow rate prediction. The Rate Measurement system consists of a Venturi with pressure differential sensor and exhaust gas temperature sensor. Pressure differential between Venturi inlet and throat, along with exhaust gas temperature are converted to mass flow rate in DDEC. The Venturi is a component of the delivery pipe.

**Install the EGR Rate Measurement System as follows:**

1. Install the Delta-P sensor mount over the thermostat housing. Rubber isolators should be installed on both sides of the mount in each of the three mounting holes. Tighten nuts over the mounting studs until the nuts come to a hard stop. Torque the nuts to 23-27 N·m (17-20 lb·ft).
  2. Install the Delta-P sensor to the bracket with two bolts torque to 30–38 N·m (22–28 lb·ft).
  3. Install a hose connector with a clamp on each end to both ports on the sensor bracket.
  4. Loosely install two Delta-P tubes to the delivery pipe. The tube ends should line up with the hose connections on the Delta-P sensor bracket.
  5. Loosely clip the Delta-P tubes to the exhaust manifold assembly using clips.
  6. Tighten the Delta-P tube nuts to 24-30 N·m (18-22 lb·ft).
  7. Tighten the clip bolt to 30-38 N·m (22-28 lb·ft).
  8. Tighten the four hose clamps until snug.
-



43074

- |                   |                        |
|-------------------|------------------------|
| 1. Delta-P Sensor | 8. Clip                |
| 2. Stud           | 9. Delta-P Tube        |
| 3. Isolator       | 10. Nut                |
| 4. Hose Clamp     | 11. Bracket            |
| 5. Delta-P Tube   | 12. Thermostat Housing |
| 6. Nut            | 13. Bolt               |
| 7. Delivery Pipe  |                        |

**Figure 12 Delta-P Sensor and Related Parts**

---

The Variable Pressure Output Device (VPOD) modulates air pressure to the VNT and EGR Valve.

**Remove the VPOD as follows:**



**CAUTION:**

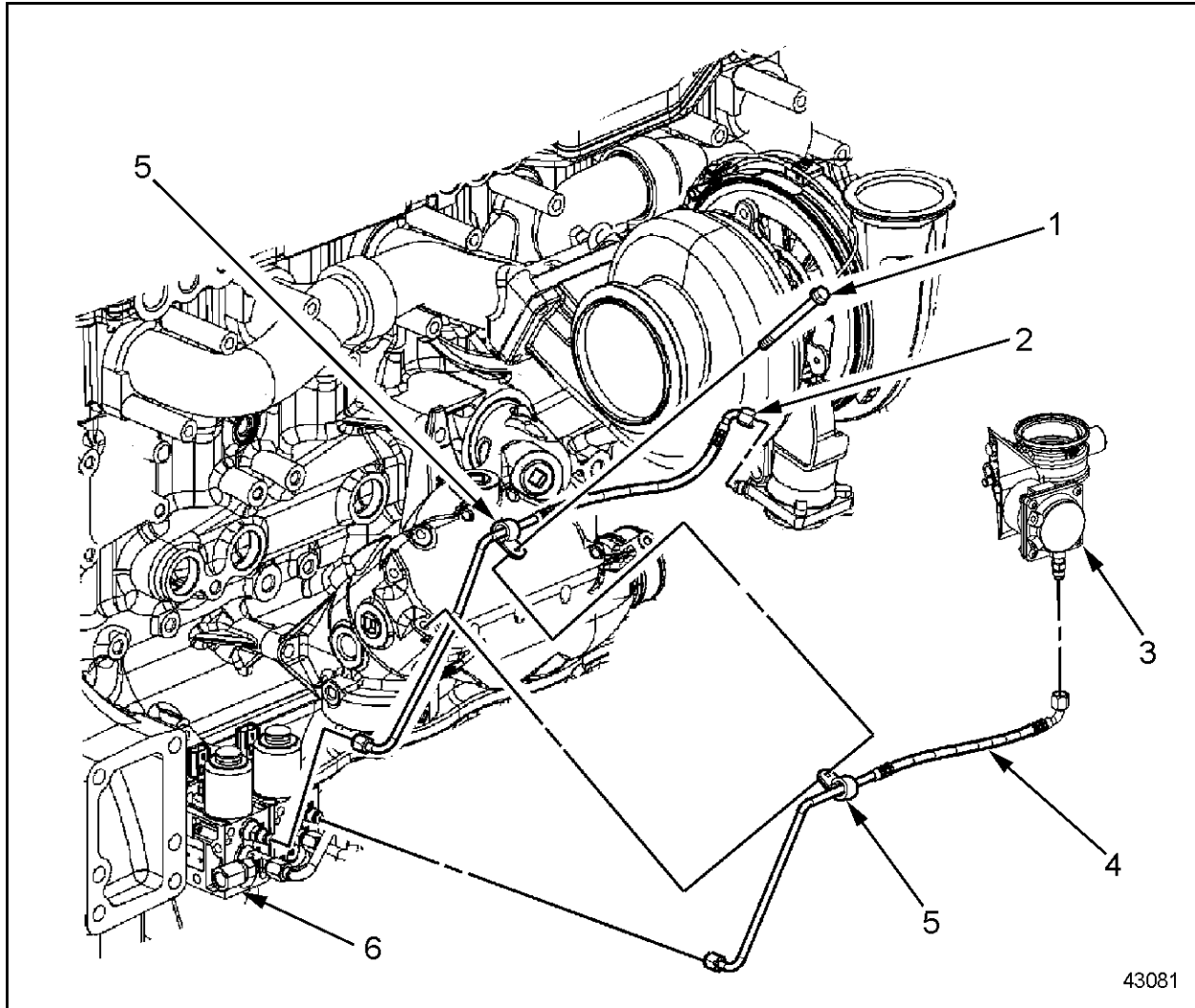
**To avoid injury from hot surfaces, allow engine to cool before removing any component. Wear protective gloves.**

1. Remove airlines from VPOD. See Figure 13.
2. Unplug harness connections. See Figure 14.
3. Remove two bolts and one stud holding VPOD assembly and bracket to engine block. See Figure 14.

**Install Variable Pressure Output Device (VPOD) as follows:**

1. Align VPOD assembly and bracket to threaded holes in engine block, install two bolts and one stud. Torque the M10 bolt and M10 stud to 58-73 N·m (43-54 lb·ft). Torque the M8 bolt to 30-38 N·m (22-28 lb·ft).

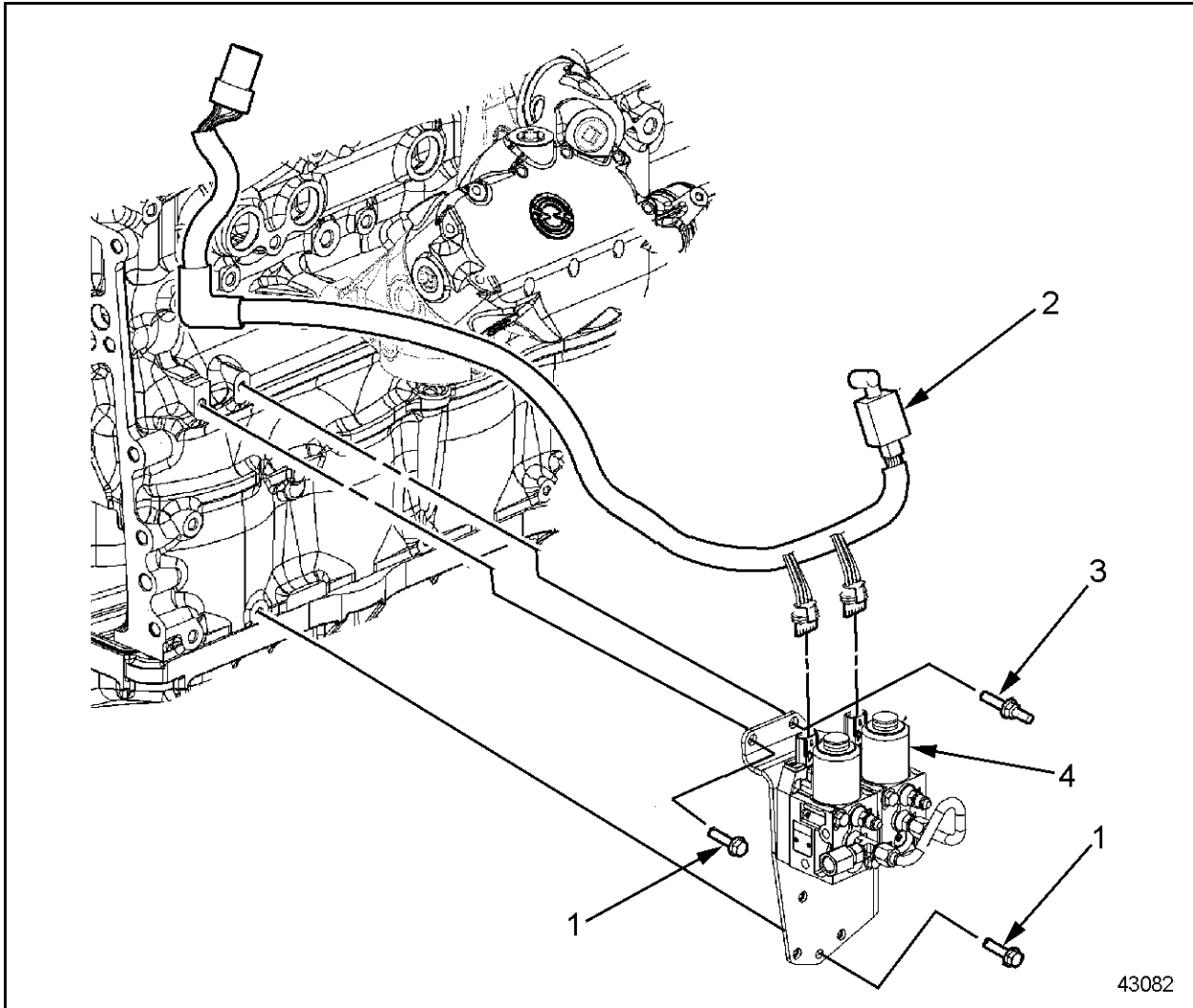
2. Connect airlines to VPOD and tighten. See Figure 13.



- |                                    |                       |
|------------------------------------|-----------------------|
| 1. Bolt                            | 4. Airline Connection |
| 2. Airline Connection              | 5. Clamp              |
| 3. EGR Valve and Actuator Assembly | 6. VPOD Assembly      |

**Figure 13 VPOD Airlines and Related Parts**

3. Plug harness connections into VPOD assembly. See Figure 14.



- 1. Bolt
- 2. Sensor Harness

- 3. Stud
- 4. VPOD Assembly

**Figure 14 VPOD Assembly**

**NOTE:**

The VPOD assembly is not serviced remove and replace only.

---

## ADDITIONAL SERVICE INFORMATION

Additional service information is available in the Detroit Diesel *Series 60 Service Manual*, 6SE483. The next revision to this manual will include the revised information. As a convenience to holders of the *Series 60 Service Manual*, information in service manual format is attached. The page(s) may be inserted into the manual.

### NOTE:

Manual insert pages are numbered for insertion into the current *Series 60 Service Manual* dated April 2002. Service manuals are available from authorized Detroit Diesel distributors. If this bulletin was obtained from the Internet, service manual page(s) are available by returning to the screen "SIB Index", selecting attachment pages, and printing the page(s).

**DETROIT DIESEL**  
CORPORATION



13400 Outer Drive, West / Detroit, Michigan 48239-4001  
Telephone: 313-592-5000  
[www.detroitdiesel.com](http://www.detroitdiesel.com)