3. Inspect manifold for leakage.
   [a] Check the three-piece manifold for fretting near the slip joints.
   [b] If there is exhaust manifold leakage refer to section 7.2.5.

4. Inspect #1 location manifold mounting bolt for damage. See Figure 7-9.
   [a] Check for broken or stressed bolt.
   [b] If bolt is excessively stretched, or if threads are excessively damaged, and complete manifold assembly replacement is required, three new exhaust manifold kits having center sections with reduced bolt hole boss at the #1 location, see Figure 7-9, are available. The new kits (23512896 - high mount, 23512897 middle mount, and 23513470 - low mount) also include bolts, studs, spacers, and special graphite-composition gaskets required for complete manifold replacement.
[c] If bolt is excessively stretched, or if threads are excessively damaged, and if the exhaust manifold assembly is reusable, rework the center section reducing the height of the cast-in bolt hole boss, #1 location, on the center section, see Figure 7-9, by grinding it down to 22 mm (0.87 in.). An isolating washer will be installed in this location. Glass bead inner and outer diameters of the slip joints.

**Figure 7-9** Exhaust Manifolds Showing Location of Stressed Bolt and Bolt Torque Sequence
5. Check one-piece, water-cooled exhaust manifold for cracks or obvious signs of coolant leakage and replace, if necessary.

6. Inspect exhaust pipe hangers for cracks. Replace as required. Refer to OEM guidelines for proper replacement procedure.

7. Inspect the flexible exhaust connection to ensure there is adequate flexibility to permit engine movement without stressing the turbocharger and exhaust manifold. Refer to OEM guidelines for proper flexibility specifications.

8. Ensure the exhaust pipe is adequately supported. Refer to OEM guidelines to verify that the exhaust pipe is adequately supported.

### 7.2.4 Installation of Three-Piece Exhaust Manifold

Install the exhaust manifold as follows:

1. If disassembled, reassemble the three pieces of the exhaust manifold.

2. Install four exhaust manifold guide studs, J 36107, into the cylinder head to hold the three exhaust manifold gaskets in the correct position, and facilitate manifold installation. For the modified bolt boss on the reusable center section, include one P.N. 23511667 exhaust manifold spacer under the bolts.

**NOTE:**
The bolt tightening pattern on cylinders 1, 2, and 3 reverses between middle-mount and high-mount exhaust manifolds. The exhaust gasket can be positioned either way. Ensure the guide studs and gaskets are positioned correctly for the manifold being installed.

3. Install the exhaust gaskets to the guide studs.

4. Install the assembled manifold to the guide studs.

5. Install eight of the bolts and spacers to the vacant holes. Finger-tighten the bolts.

6. Remove the four guide studs.

7. Install the remaining four manifold bolts and spacers to the holes from which the studs were removed.
8. Torque the bolts to 58-73 N·m (43-54 lb·ft) using the tightening sequence. See Figure 7-9. For a wrapped exhaust manifold see Figure 7-10.

![Wrapped Manifold Bolt Torque Sequence](image)

**Figure 7-10** Wrapped Manifold Bolt Torque Sequence

9. Install the turbocharger assembly. Refer to section 6.6.7 (diesel) or refer to section 6.7.5 (gas).

10. Install any other equipment that was removed for this procedure.
Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

- Always start and operate an engine in a well ventilated area.
- If operating an engine in an enclosed area, vent the exhaust to the outside.
- Do not modify or tamper with the exhaust system or emission control system.

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

11. Start the engine and check for exhaust leaks.

12. Refer to section 11.3.6 for verification of proper exhaust manifold installation.
7.2.5 Installation of Exhaust Manifold Slip Joint Seal Kit

To install the exhaust manifold slip joint seal kit preform the following steps: (See Figure 7-11).

1. Remove the rear exhaust manifold heat shield.
2. Install seal onto manifold slip joint, ensure split line of seal is located vertically. See Figure 7-12.

**WARNING:**

**PERSONAL INJURY**

To avoid injury from hot surfaces, wear protective gloves, or allow engine to cool before removing any component.
NOTICE:
When installing covers ensure the large lip of cover is located toward the turbocharger, and the area where the lip is removed is located toward the cylinder head. Do Not Align the split lines of the cover and seal.

3. Install covers onto seal, ensure split line of cover is located horizontally. See Figure 7-12.

![Diagram of installed covers and seal](image)

**Figure 7-12 Location of Installed Covers and Seal**

**NOTE:**
Cover and seal fit tightly under the thermostat housing and may require a screwdriver on top of the cover to compress the seal, which will allow for proper installation of cover.

4. Install clamp onto covers and seal. Ensure the nut on the clamp when installed is accessible and is clear of the rear exhaust manifold heat shield location.

5. Tighten the clamp until the cover split lines touch.

6. Reinstall the exhaust manifold rear heat shield and gently pry the heat shield away from the rear seal cover.

7. Repeat steps 2 through 5 for each exhaust manifold slip joint.
7.2.6 Installation of One-Piece Water-Cooled Exhaust Manifold

Install the one-piece water-cooled exhaust manifold as follows: (See Figure 7-13).

1. Bracket, Upper Manifold Support
2. Bolt
3. Stud
4. Exhaust Manifold
5. Spacer
6. Bolt
7. Turbo Mounting Flange (part of exhaust manifold)
8. Bracket, Turbo Mounting

Figure 7-13 One-Piece Water-Cooled Exhaust Manifold and Related Parts

1. Install six exhaust manifold guide studs, J 36107, into the cylinder head to hold the six exhaust manifold gaskets in the correct position and facilitate manifold installation.
2. Install the exhaust gaskets (3) to the guide studs.
3. Install the manifold to the guide studs.
4. Install twelve of the bolts and spacers to the vacant holes. Finger-tighten the bolts.
5. Remove the six guide studs.
6. Install the remaining manifold bolts to the holes from which the studs were removed.
7. Torque the bolts to 58-73 N·m (43-54 lb·ft) using the tightening sequence. See Figure 7-14.

![Figure 7-14 One-Piece Water-Cooled Exhaust Manifold Bolt Torque Sequence](image)

8. Install coolant inlet and outlet elbows to the exhaust manifold and attach coolant lines.
9. Install the turbocharger assembly. Refer to section 6.6.7 (diesel) or refer to section 6.7.5 (gas).
10. Install any other equipment that was removed for this procedure.
11. Refer to section 7.2.4 for the exhaust caution before proceeding. Start the engine and check for exhaust or coolant leaks.
12. Refer to section 11.3.6 for verification of proper exhaust manifold installation.