7.1 EXHAUST MANIFOLD

The following procedures describe the removal and installation of the exhaust manifold.

7.1.1 Exhaust Manifold Removal

Remove exhaust manifold as follows:

1. Disconnect the air cleaner pipe from the turbocharger.
2. Remove the turbo compressor outlet pipe from the turbocharger and the charge air cooler. On 6-cylinder engines, remove the mounting bracket for the charge air pipe. See Figure 7-1.

**NOTE:**
The 4-cylinder engine is shown; the 6-cylinder engine is similar.

![Exhaust Manifold Removal Diagram](image)

**A = MAXIMUM SHAFT LENGTH: 47.5 mm (1.87 in.)**

1. Gasket
2. Oil Supply Line
3. Exhaust Manifold
4. Turbo Compressor Outlet Pipe
5. Exhaust Manifold Bolt
6. Turbocharger Heat Shield
7. Oil Return Hose
8. Exhaust Brake Cylinder
9. Exhaust Brake Air Line
10. Exhaust Pipe

**Figure 7-1 Exhaust Manifold Removal**

3. Remove the turbocharger oil supply and return lines.
[a]  Remove the turbocharger oil supply line from the turbocharger and the oil filter.

[b]  Remove the oil return line from the cylinder block and the turbocharger. Collect any oil that runs out.

[c]  Plug all holes with a clean shop towel (turbocharger, oil filter, and cylinder block).

4. Disconnect the air line from the exhaust brake cylinder. Remove the exhaust pipe from the exhaust brake valve housing.

5. Using the exhaust manifold socket set (J-46379), remove the exhaust manifold and turbocharger, as an assembly, from the engine. See Figure 7-2.

**Figure 7-2**  Exhaust Manifold Socket Set (J-46379)

**NOTE:**
In most cases, the long socket can be used. Use the shorter socket when necessary to gain access.

6. Remove and discard the gaskets.

7. Remove the turbocharger from the exhaust manifold and discard nuts. Cap any holes in the turbocharger to prevent dust or dirt from entering.

8. Measure the shank length of the exhaust manifold bolts. If they exceed 47.5 mm (1.87 in.), replace the bolts.

**7.1.2  Exhaust Manifold Installation**

Install the exhaust manifold as follows:
1. Using new nuts, install the turbocharger on the exhaust manifold using the torque values listed in Table 7-1.

<table>
<thead>
<tr>
<th>Description</th>
<th>Part</th>
<th>Torque Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbocharger to Exhaust Manifold Nuts</td>
<td>4-Cylinder Engines</td>
<td>30 N·m (22 lb·ft)</td>
</tr>
<tr>
<td></td>
<td>6-Cylinder Engines</td>
<td>50 N·m (37 lb·ft)</td>
</tr>
<tr>
<td>Turbocharger Oil Supply Line</td>
<td>M6 Bolt</td>
<td>10 N·m (7 lb·ft)</td>
</tr>
<tr>
<td></td>
<td>M8 Bolt</td>
<td>40 N·m (30 lb·ft)</td>
</tr>
</tbody>
</table>

Table 7-1  Turbocharger Torque Values

2. Position the new gaskets on the engine exhaust ports.

**NOTE:**

MBE 900 engines require that the joining strip on the exhaust manifold gaskets be installed toward the bottom of the exhaust manifold due to interference with engine brackets.

3. Install the exhaust manifold and turbocharger assembly on the engine. Using the exhaust manifold socket set (J-46379), tighten the bolts in three stages as listed in Table 7-2.

<table>
<thead>
<tr>
<th>Size</th>
<th>Tightening Stage</th>
<th>Torque Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>M10</td>
<td>Stage 1</td>
<td>10 N·m (7 lb·ft)</td>
</tr>
<tr>
<td></td>
<td>Stage 2</td>
<td>55 N·m (41 lb·ft)</td>
</tr>
<tr>
<td></td>
<td>Stage 3</td>
<td>additional 90 degrees</td>
</tr>
</tbody>
</table>

Table 7-2  Tightening Stages for Exhaust Manifold Bolts

**NOTE:**

Clean the sealing surfaces of the exhaust pipe before installing.

4. Connect the air line at the exhaust brake cylinder. Install the exhaust pipe at the exhaust brake valve housing.

5. Install the turbocharger oil supply and return lines. The torque values are listed in Table 7-1.

[a] Fill the turbocharger housing with oil at the opening for the oil supply line.

**NOTE:**

Do not attempt to add oil at the air intake opening.

[b] Turn the turbocharger wheel several times to coat the bearings with oil.

[c] Install the turbocharger oil supply line at the turbocharger and the oil filter.

[d] Install the oil return line at the turbocharger and the cylinder block.
6. Install the turbo compressor outlet pipe at the turbocharger and the charge air cooler. On 6-cylinder engines, install the turbo compressor outlet pipe bracket.

7. Connect the air cleaner pipe at the turbocharger and the air cleaner.

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**WARNING:**

**PERSONAL INJURY**

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.

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**WARNING:**

**PERSONAL INJURY**

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.

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8. Start the engine and make sure there is oil pressure. Shut down the engine and check for leaks.
7.2 EXHAUST BRAKE ASSEMBLY

To increase braking performance, the engine can be equipped with an exhaust brake on the turbocharger in conjunction with constant-throttle valves on the cylinder head. The exhaust back-pressure is used by the exhaust brake to increase braking performance.

7.2.1 Exhaust Brake Assembly Removal

Remove the exhaust brake assembly as follows:

1. Remove the four hex head bolts that fasten the heat shield to the exhaust brake valve housing and turbocharger. Remove the heat shield. See Figure 7-3 for the 4-cylinder engine and Figure 7-4 for the 6-cylinder engine.

![Figure 7-3 Exhaust Brake Assembly Removal, 4-Cylinder Engines](image)

1. **Exhaust Brake Valve Housing**
2. **Turbocharger**
3. **Heat Shield**
4. **Exhaust Brake Cylinder**
5. **Exhaust Brake Air Line**
6. **Exhaust Pipe**