

# EXHAUST SYSTEM

## TABLE OF CONTENTS

|                                             | page |                                       | page |
|---------------------------------------------|------|---------------------------------------|------|
| <b>EXHAUST SYSTEM</b>                       |      | <b>INSTALLATION</b> .....             | 10   |
| DESCRIPTION                                 |      | <b>MUFFLER - 5.9L DIESEL</b>          |      |
| DESCRIPTION - 5.9/8.0L .....                | 2    | REMOVAL .....                         | 11   |
| DESCRIPTION—5.9L DIESEL .....               | 3    | INSTALLATION .....                    | 11   |
| <b>DIAGNOSIS AND TESTING</b>                |      | <b>TAILPIPE - 3.9L/5.2L/5.9L</b>      |      |
| DIAGNOSIS AND TESTING - GAS ENGINE ...      | 4    | REMOVAL .....                         | 11   |
| DIAGNOSIS AND TESTING - DIESEL              |      | INSPECTION .....                      | 11   |
| ENGINE .....                                | 4    | INSTALLATION .....                    | 11   |
| <b>SPECIFICATIONS</b>                       |      | <b>TAILPIPE - 5.9L HD/8.0L</b>        |      |
| TORQUE .....                                | 5    | REMOVAL .....                         | 12   |
| <b>CATALYTIC CONVERTER - 3.9L/5.2L/5.9L</b> |      | INSPECTION .....                      | 12   |
| DESCRIPTION .....                           | 5    | INSTALLATION .....                    | 12   |
| OPERATION .....                             | 5    | <b>TAILPIPE - 5.9L DIESEL</b>         |      |
| REMOVAL .....                               | 5    | REMOVAL .....                         | 12   |
| INSPECTION .....                            | 6    | INSPECTION .....                      | 12   |
| INSTALLATION .....                          | 6    | INSTALLATION .....                    | 13   |
| <b>CATALYTIC CONVERTER - 5.9L HD/8.0L</b>   |      | <b>RESONATOR</b>                      |      |
| DESCRIPTION .....                           | 6    | REMOVAL .....                         | 13   |
| OPERATION .....                             | 6    | INSTALLATION .....                    | 13   |
| REMOVAL .....                               | 6    | <b>TURBOCHARGER SYSTEM</b>            |      |
| INSPECTION .....                            | 6    | DIAGNOSIS AND TESTING -               |      |
| INSTALLATION .....                          | 7    | TURBOCHARGER BOOST PRESSURE .....     | 13   |
| <b>EXHAUST PIPE - 3.9L/5.2L/5.9L</b>        |      | <b>TURBOCHARGER</b>                   |      |
| REMOVAL .....                               | 7    | DESCRIPTION .....                     | 14   |
| INSPECTION .....                            | 7    | OPERATION .....                       | 14   |
| INSTALLATION .....                          | 7    | REMOVAL .....                         | 15   |
| <b>EXHAUST PIPE - 5.9L HD/8.0L</b>          |      | CLEANING .....                        | 16   |
| REMOVAL .....                               | 7    | INSPECTION .....                      | 16   |
| INSPECTION .....                            | 8    | INSTALLATION .....                    | 17   |
| INSTALLATION .....                          | 8    | <b>CHARGE AIR COOLER AND PLUMBING</b> |      |
| <b>EXHAUST PIPE - 5.9L DIESEL</b>           |      | DESCRIPTION .....                     | 18   |
| REMOVAL .....                               | 9    | OPERATION .....                       | 18   |
| INSPECTION .....                            | 9    | DIAGNOSIS AND TESTING - CHARGE AIR    |      |
| INSTALLATION .....                          | 9    | COOLER SYSTEM - LEAKS .....           | 18   |
| <b>HEAT SHIELDS</b>                         |      | REMOVAL .....                         | 18   |
| DESCRIPTION .....                           | 10   | CLEANING .....                        | 19   |
| REMOVAL .....                               | 10   | INSPECTION .....                      | 19   |
| INSTALLATION .....                          | 10   | INSTALLATION .....                    | 20   |
| <b>MUFFLER - 3.9L/5.2L/5.9L/8.0L</b>        |      |                                       |      |
| REMOVAL .....                               | 10   |                                       |      |

## EXHAUST SYSTEM

### DESCRIPTION

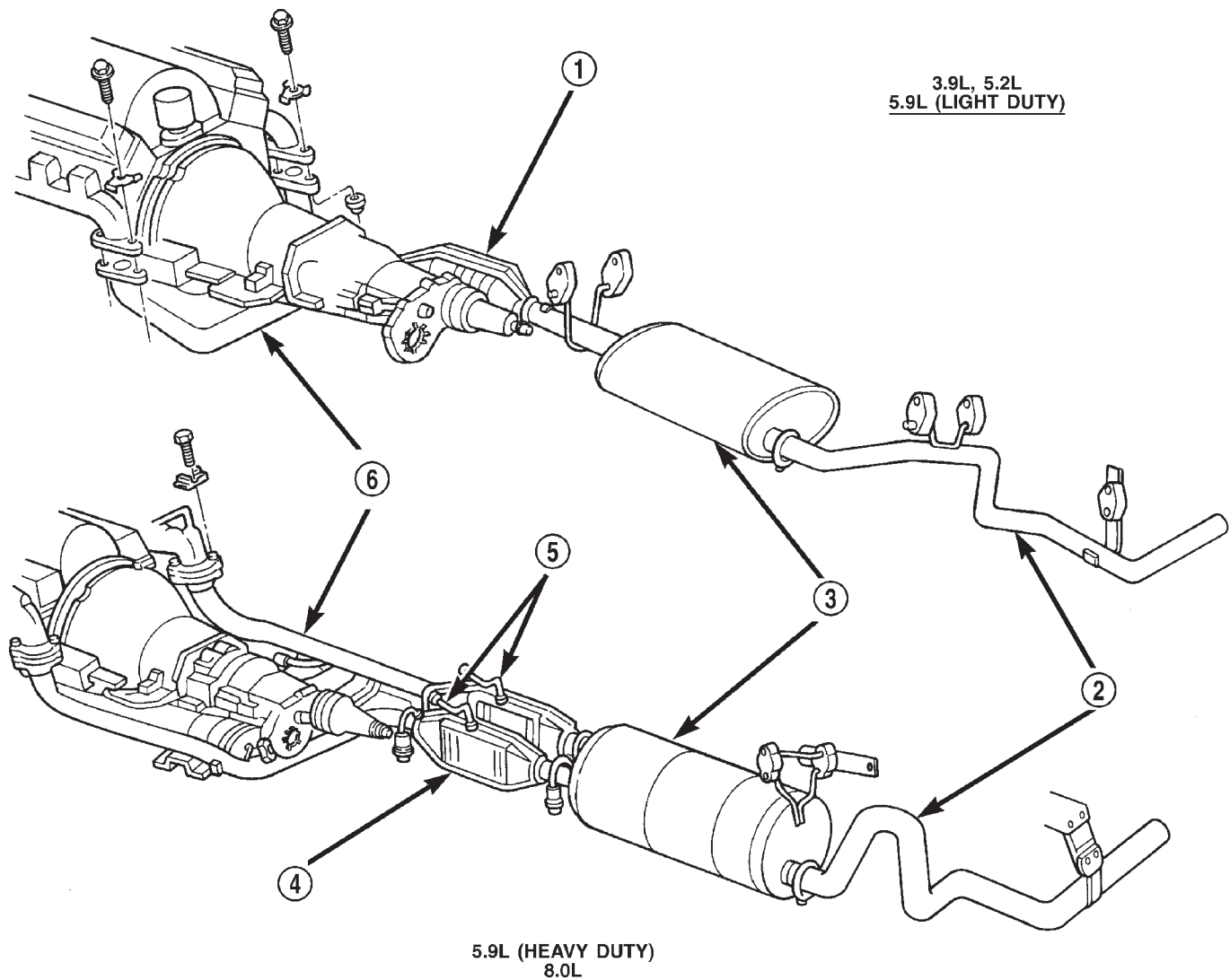
#### DESCRIPTION - 5.9/8.0L

**CAUTION:** Avoid application of rust prevention compounds or undercoating materials to exhaust system floor pan exhaust heat shields. Light overspray near the edges is permitted. Application of coating will result in excessive floor pan temperatures and objectionable fumes.

The federal gasoline engine exhaust system (Fig. 1) consists of engine exhaust manifolds, exhaust pipes, catalytic converter(s), extension pipe (if needed), exhaust heat shields, muffler and exhaust tailpipe.

The California emission vehicles exhaust system also contains the above components as well as mini catalytic converters added to the exhaust pipe (Fig. 2).

The exhaust system must be properly aligned to prevent stress, leakage and body contact. Minimum clearance between any exhaust component and the body or frame is 25.4 mm (1.0 in.). If the system contacts any body panel, it may amplify objectionable noises from the engine or body.



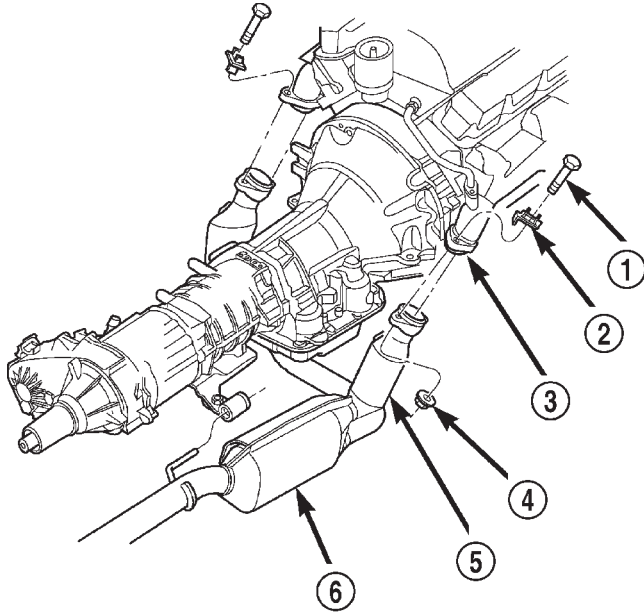
80a62501

**Fig. 1 Exhaust System Gasoline Engines—Federal Emissions (Typical)**

- 1 - CATALYTIC CONVERTER
- 2 - TAILPIPE
- 3 - MUFFLER

- 4 - CATALYTIC CONVERTERS
- 5 - AIR INDUCTION LINES
- 6 - EXHAUST PIPE

## EXHAUST SYSTEM (Continued)



80bfe1e1

**Fig. 2 Catalytic Converter with Pipes and Mini Catalytic Converters**

- 1 - BOLT
- 2 - RETAINER
- 3 - EXHAUST MANIFOLD
- 4 - NUT
- 5 - MINI CATALYTIC CONVERTER
- 6 - CATALYTIC CONVERTER WITH PIPES

**DESCRIPTION—5.9L DIESEL**

**CAUTION:** Avoid application of rust prevention compounds or undercoating materials to exhaust system floor pan exhaust heat shields. Light overspray near the edges is permitted. Application of coating will result in excessive floor pan temperatures and objectionable fumes.

The diesel engine exhaust system consists of an engine exhaust manifold, turbocharger, exhaust pipe, resonator, extension pipe (if needed), muffler and exhaust tailpipe.

The exhaust system must be properly aligned to prevent stress, leakage and body contact. The exhaust components should be kept a minimum of 25.4 mm (1.0 in.) away from the body and frame. If the system contacts any body panel, it may amplify objectionable noises from the engine or body.

**11 - 4 EXHAUST SYSTEM**

BR/BE

## EXHAUST SYSTEM (Continued)

## DIAGNOSIS AND TESTING

**DIAGNOSIS AND TESTING - GAS ENGINE***EXHAUST SYSTEM DIAGNOSIS CHART*

| CONDITION                                                                                                                                                                                                                | POSSIBLE CAUSE                                                                                                                                                                                                                                                                                                                                                                                                                       | CORRECTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EXCESSIVE EXHAUST NOISE OR LEAKING EXHAUST GASES                                                                                                                                                                         | <ol style="list-style-type: none"> <li>1. Leaks at pipe joints.</li> <li>2. Rusted or blown out muffler.</li> <li>3. Broken or rusted out exhaust pipe.</li> <li>4. Exhaust pipe leaking at manifold flange.</li> <li>5. Exhaust manifold cracked or broken.</li> <li>6. Leak between exhaust manifold and cylinder head.</li> <li>7. Catalytic converter rusted or blown out.</li> <li>8. Restriction in exhaust system.</li> </ol> | <ol style="list-style-type: none"> <li>1. Tighten clamps/bolts at leaking joints.</li> <li>2. Replace muffler. Inspect exhaust system.</li> <li>3. Replace exhaust pipe.</li> <li>4. Tighten/replace flange attaching nuts/bolts.</li> <li>5. Replace exhaust manifold.</li> <li>6. Tighten exhaust manifold to cylinder head bolts.</li> <li>7. Replace catalytic converter assy.</li> <li>8. Remove restriction, if possible. Replace restricted part if necessary.</li> </ol> |
| <p>caution:</p> <p>When servicing and replacing exhaust system components, disconnect the oxygen sensor connector(s). Allowing the exhaust to hang by the oxygen sensor wires will damage the harness and/or sensor.</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

**DIAGNOSIS AND TESTING - DIESEL ENGINE***EXHAUST SYSTEM DIAGNOSIS CHART*

| CONDITION                                        | POSSIBLE CAUSE                                                                                                                                                                                                                                                                                                                                                                                                                    | CORRECTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EXCESSIVE EXHAUST NOISE OR LEAKING EXHAUST GASES | <ol style="list-style-type: none"> <li>1. Leaks at pipe joints.</li> <li>2. Rusted or blown out muffler.</li> <li>3. Broken or rusted out exhaust pipe.</li> <li>4. Exhaust pipe leaking at manifold flange.</li> <li>5. Exhaust manifold cracked or broken.</li> <li>6. Leak between exhaust manifold and cylinder head.</li> <li>7. Turbocharger mounting flange cracked.</li> <li>8. Restriction in exhaust system.</li> </ol> | <ol style="list-style-type: none"> <li>1. Tighten clamps/bolts at leaking joints.</li> <li>2. Replace muffler. Inspect exhaust system.</li> <li>3. Replace exhaust pipe.</li> <li>4. Tighten/replace flange attaching nuts/bolts.</li> <li>5. Replace exhaust manifold.</li> <li>6. Tighten exhaust manifold to cylinder head bolts.</li> <li>7. Remove turbocharger and inspect. (Refer to 11 - EXHAUST SYSTEM/ TURBOCHARGER SYSTEM/ TURBOCHARGER - REMOVAL).</li> <li>8. Remove restriction, if possible. Replace restricted part if necessary.</li> </ol> |

## EXHAUST SYSTEM (Continued)

## SPECIFICATIONS

## TORQUE

| DESCRIPTION                                                | N·m | Ft.<br>Lbs. | In.<br>Lbs. |
|------------------------------------------------------------|-----|-------------|-------------|
| Adjusting Strap—Bolt                                       | 23  | —           | 200         |
| Air Heater Power Supply—Nuts                               | 14  | —           | 124         |
| Air Inlet Housing—Bolts                                    | 24  | 18          | —           |
| Cab Heater Supply/Return Line—Nuts                         | 24  | 18          | —           |
| Exhaust Clamp—Nuts                                         | 48  | 35          | —           |
| Exhaust Manifold to Cylinder Head—Bolts<br>(Diesel Engine) | 43  | 32          | —           |
| Exhaust Manifold to Cylinder Head—Bolts<br>(5.9L)          | 31  | 23          | —           |
| Exhaust Manifold to Cylinder Head—Bolts<br>(8.0L)          | 22  | —           | 195         |
| Exhaust Pipe to Manifold—Bolts                             | 31  | 23          | —           |
| Generator Mounting—Bolts                                   | 41  | 30          | —           |
| Charge Air Cooler Mounting—Bolts                           | 2   | —           | 17          |
| Charge Air Cooler Duct—Nuts                                | 8   | —           | 72          |
| Heat Shield—Nuts and Bolts                                 | 11  | —           | 100         |
| Turbocharger Mounting—Nuts                                 | 32  | 24          | —           |
| Turbocharger Oil Drain Tube—Bolts                          | 24  | 18          | —           |
| Turbocharger Oil Supply Line—Fitting                       | 15  | —           | 133         |
| Turbocharger V-Band Clamp—Nut                              | 9   | —           | 75          |

CATALYTIC CONVERTER -  
3.9L/5.2L/5.9L

## DESCRIPTION

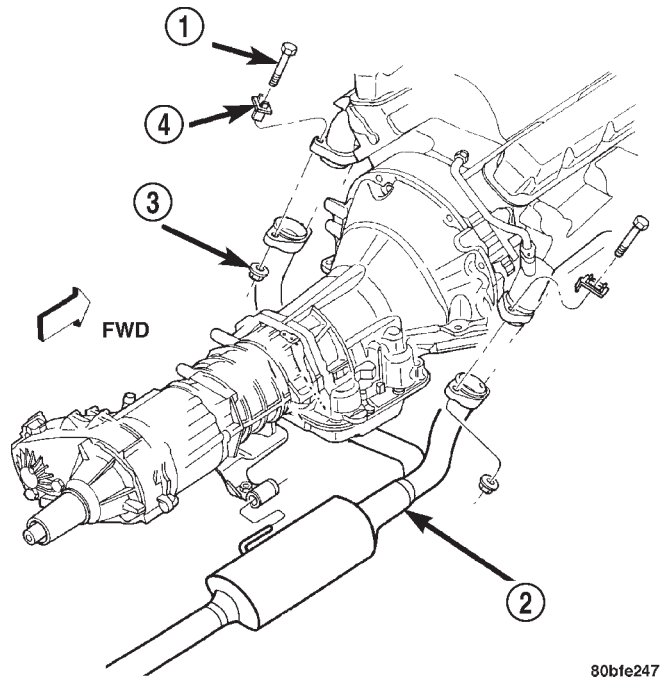
The stainless steel catalytic converter is located under the vehicle, integral to the exhaust pipe(s).

## OPERATION

The catalytic converter captures and burns any unburned fuel mixture exiting the combustion chambers during the exhaust stroke of the engine. This process aids in reducing emissions output.

## REMOVAL

- (1) Raise and support vehicle.
- (2) Saturate the bolts and nuts with heat valve lubricant. Allow 5 minutes for penetration.
- (3) Remove clamps and nuts (Fig. 3) (Fig. 4).

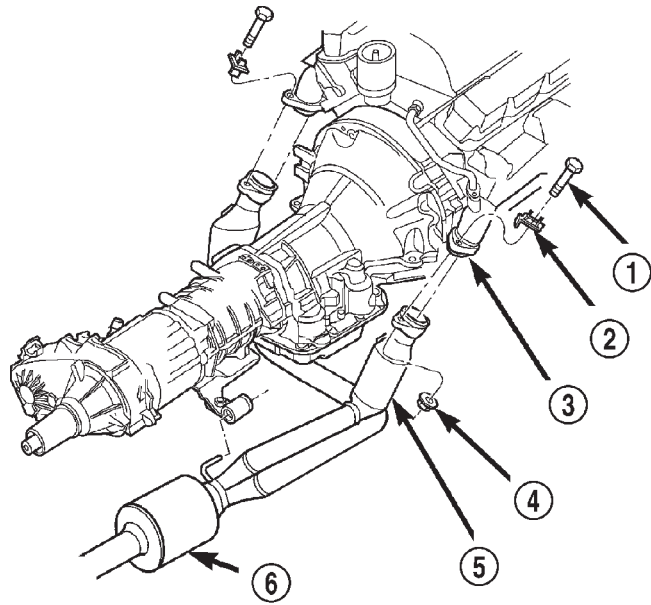


**Fig. 3 Catalytic Converter and Exhaust Pipe 3.9L, 5.2L and 5.9L Light Duty ( Federal )**

- 1 - BOLT  
2 - EXHAUST PIPE W/CONVERTER  
3 - NUT  
4 - RETAINER

- (4) Remove the catalytic converter.

## CATALYTIC CONVERTER - 3.9L/5.2L/5.9L (Continued)



80bfe248

**Fig. 4 Catalytic Converter and Exhaust Pipe 3.9L, 5.2L and 5.9L Light Duty ( California )**

- 1 - BOLT
- 2 - RETAINER
- 3 - EXHAUST MANIFOLD
- 4 - NUT
- 5 - MINI CATALYTIC CONVERTER
- 6 - CATALYTIC CONVERTER WITH PIPES

## INSPECTION

Look at the stainless steel body of the converter, inspect for bulging or other distortion that could be a result of overheating. If the converter has a heat shield attached make sure it is not bent or loose.

If you suspect internal damage to the catalyst, tapping the bottom of the catalyst with a rubber mallet may indicate a damaged core.

## INSTALLATION

- (1) Assemble converter and clamps loosely in place.
- (2) Install the exhaust pipe onto exhaust manifolds, tighten 31 N·m (23 ft. lbs.).
- (3) Tighten all clamp nuts to 48 N·m (35 ft. lbs.) torque.
- (4) Lower the vehicle.
- (5) Start the engine and inspect for exhaust leaks and exhaust system contact with the body panels. A minimum of 25.4 mm (1.0 in.) is required between exhaust system components and body/frame parts. Adjust the alignment, if needed.

## CATALYTIC CONVERTER - 5.9L HD/8.0L

## DESCRIPTION

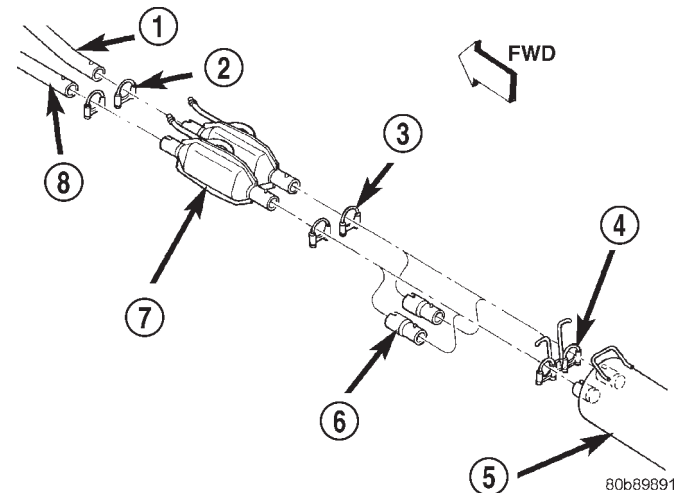
The stainless steel catalytic converter is located under the vehicle, attached to the exhaust pipe(s).

## OPERATION

The catalytic converter captures and burns any unburned fuel mixture exiting the combustion chambers during the exhaust stroke of the engine. This process aids in reducing emissions output.

## REMOVAL

- (1) Raise and support vehicle.
- (2) Saturate the bolts and nuts with heat valve lubricant. Allow 5 minutes for penetration.
- (3) Remove clamps and nuts (Fig. 5) (Fig. 6).



**Fig. 5 Catalytic Converter 5.9L Heavy Duty**

- 1 - DOWN PIPE RIGHT
- 2 - CLAMP
- 3 - CLAMP
- 4 - HANGER ASSY. DUAL CLAMP
- 5 - MUFFLER
- 6 - EXTENSION PIPE
- 7 - CATALYTIC CONVERTER
- 8 - DOWN PIPE LEFT

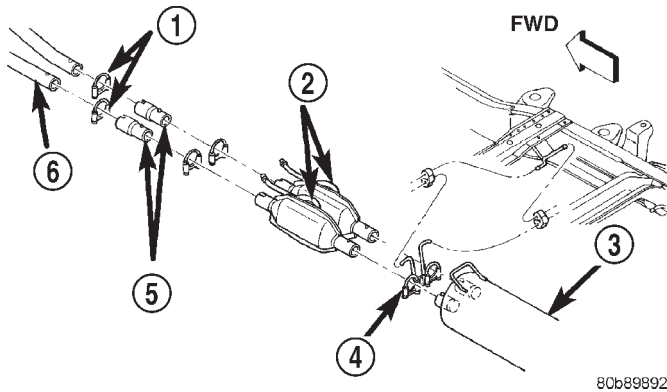
- (4) Remove the catalytic converter.

## INSPECTION

Look at the stainless steel body of the converter, inspect for bulging or other distortion that could be a result of overheating. If the converter has a heat shield attached make sure it is not bent or loose.

If you suspect internal damage to the catalyst, tapping the bottom of the catalyst with a rubber mallet may indicate a damaged core.

## CATALYTIC CONVERTER - 5.9L HD/8.0L (Continued)

**Fig. 6 Catalytic Converter 8.0L**

- 1 - CLAMPS
- 2 - CATALYTIC CONVERTERS
- 3 - MUFFLER
- 4 - HANGER ASSY. DUAL CLAMP
- 5 - EXTENSION PIPES
- 6 - DOWN PIPE

**INSTALLATION**

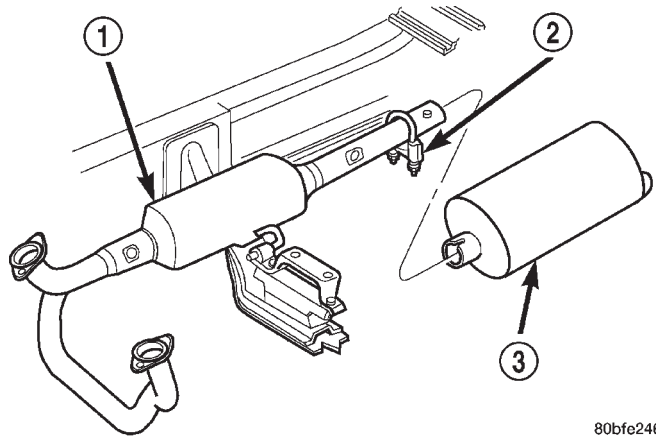
- (1) Assemble converter and clamps loosely in place.
- (2) Tighten all clamp nuts to 48 N·m (35 ft. lbs.) torque.
- (3) Lower the vehicle.
- (4) Start the engine and inspect for exhaust leaks and exhaust system contact with the body panels. A minimum of 25.4 mm (1.0 in.) is required between exhaust system components and body/frame parts. Adjust the alignment, if needed.

**EXHAUST PIPE - 3.9L/5.2L/5.9L****REMOVAL**

- (1) Raise and support the vehicle.
- (2) Saturate the bolts and nuts with heat valve lubricant. Allow 5 minutes for penetration.
- (3) Remove exhaust pipe to manifold bolts, retainers and nuts (Fig. 7).
- (4) Remove the clamp nuts (Fig. 7).
- (5) Remove the exhaust pipe.

**INSPECTION**

Discard rusted clamps, broken or worn supports and attaching parts. Replace a component with original equipment parts, or equivalent. This will assure proper alignment with other parts in the system and provide acceptable exhaust noise levels.

**Fig. 7 Exhaust Pipe 3.9L, 5.2L, 5.9L Light Duty**

- 1 - EXHAUST PIPE WITH CATALYTIC CONVERTER
- 2 - CLAMP
- 3 - MUFFLER

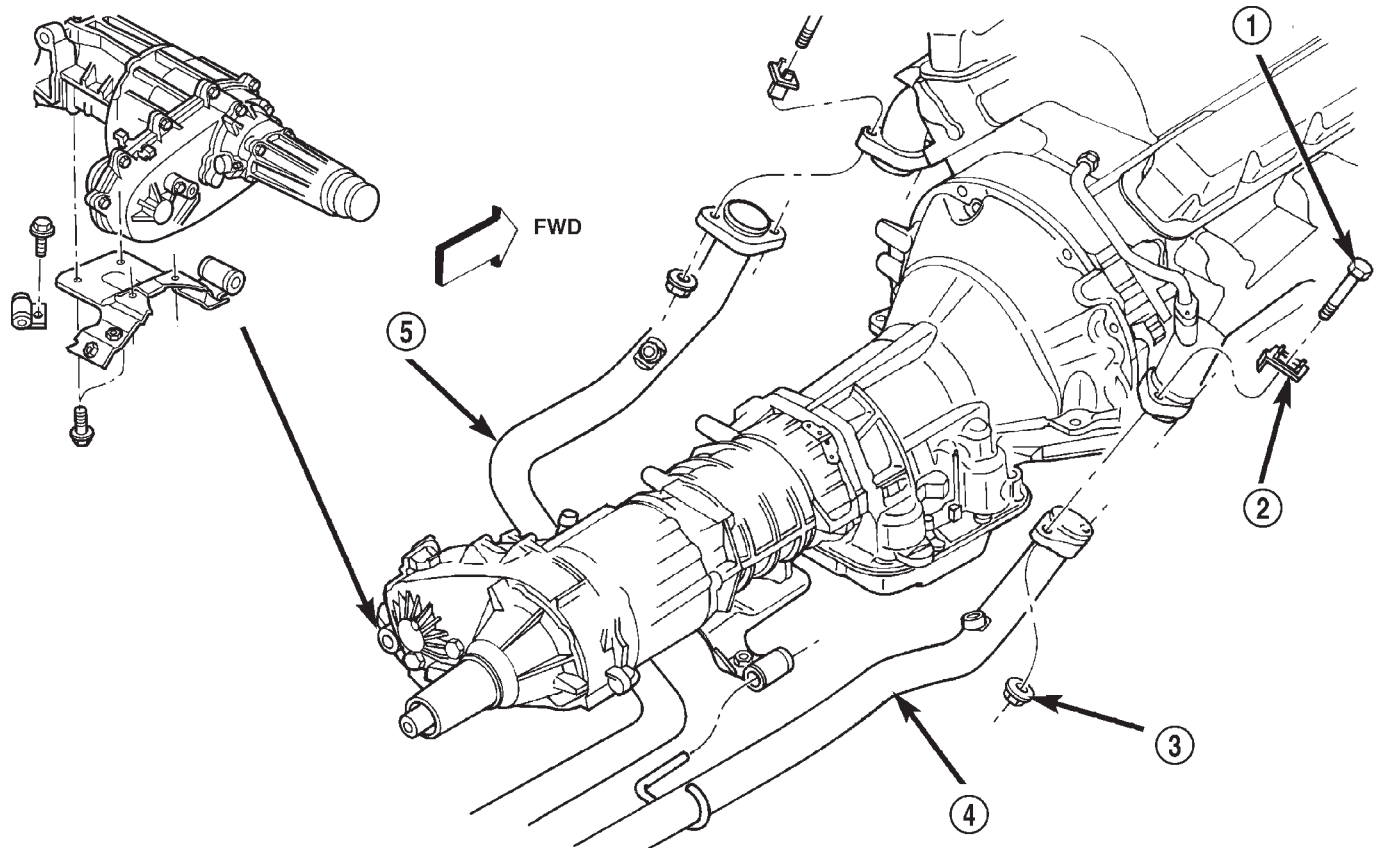
**INSTALLATION**

- (1) Position the exhaust pipe for proper clearance with the frame and underbody parts. A minimum clearance of 25.4 mm (1.0 in.) is required.
- (2) Position the exhaust pipe to manifold. Install the bolts, retainers and nuts. Tighten the nuts to 31 N·m (23 ft. lbs.) torque.
- (3) Tighten the clamp nuts to 48 N·m (35 ft. lbs.) torque.
- (4) Lower the vehicle.
- (5) Start the engine and inspect for exhaust leaks and exhaust system contact with the body panels. Adjust the alignment, if needed.

**EXHAUST PIPE - 5.9L HD/8.0L****REMOVAL**

- (1) Raise and support the vehicle.
- (2) Saturate the bolts and nuts with heat valve lubricant. Allow 5 minutes for penetration.
- (3) Remove exhaust pipe to manifold bolts, retainers and nuts (Fig. 8).
- (4) Remove the clamp nuts (Fig. 9) (Fig. 10).
- (5) Disconnect the exhaust pipe from the support hangers on the 5.9L (Heavy Duty) and the 8.0L engines (Fig. 8).
- (6) Remove the exhaust pipe.

## EXHAUST PIPE - 5.9L HD/8.0L (Continued)



80be47bb

**Fig. 8 Exhaust Pipe 8.0L and 5.9L Heavy Duty**

- 1 - BOLT  
2 - RETAINER  
3 - NUT

- 4 - DOWN PIPE  
5 - DOWN PIPE

**INSPECTION**

Discard rusted clamps, broken or worn supports and attaching parts. Replace a component with original equipment parts, or equivalent. This will assure proper alignment with other parts in the system and provide acceptable exhaust noise levels.

**INSTALLATION**

(1) Connect the exhaust pipe support hangers on the (Fig. 8).

(2) Position the exhaust pipe for proper clearance with the frame and underbody parts. A minimum clearance of 25.4 mm (1.0 in.) is required.

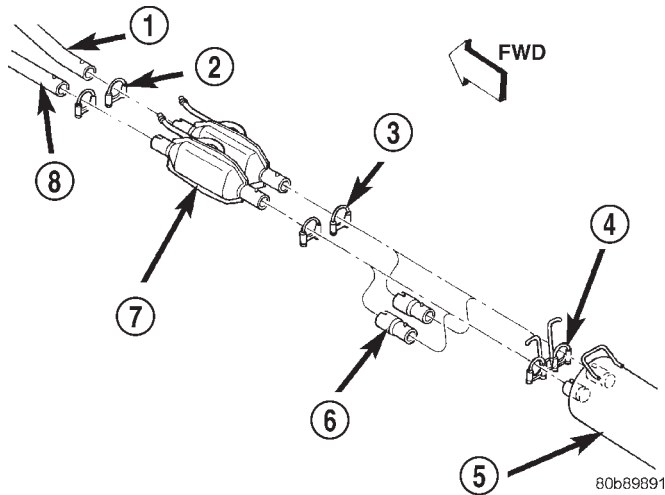
(3) Position the exhaust pipe to manifold. Install the bolts, retainers and nuts. Tighten the nuts to 31 N·m (23 ft. lbs.) torque.

(4) Tighten the clamp nuts to 48 N·m (35 ft. lbs.) torque.

(5) Lower the vehicle.

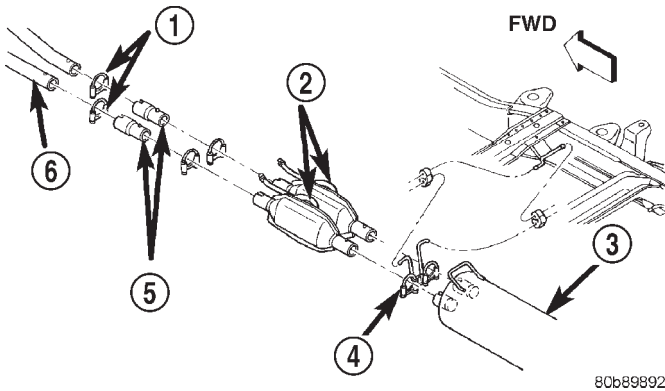
(6) Start the engine and inspect for exhaust leaks and exhaust system contact with the body panels. Adjust the alignment, if needed.

## EXHAUST PIPE - 5.9L HD/8.0L (Continued)



**Fig. 9 Catalytic Converter and Clamp Location 5.9L Heavy Duty**

- 1 - DOWN PIPE RIGHT
- 2 - CLAMP
- 3 - CLAMP
- 4 - HANGER ASSY. DUAL CLAMP
- 5 - MUFFLER
- 6 - EXTENSION PIPE
- 7 - CATALYTIC CONVERTER
- 8 - DOWN PIPE LEFT



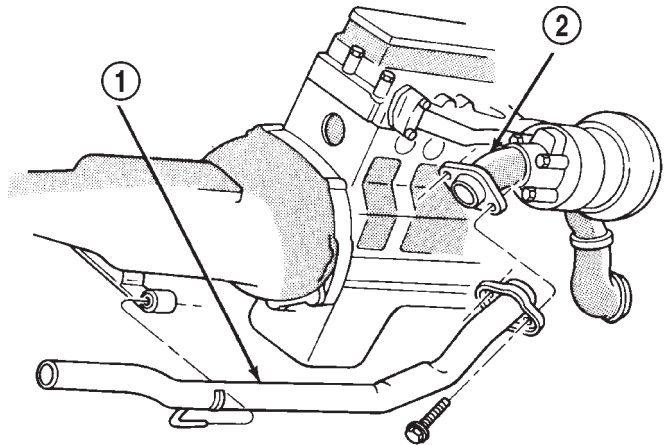
**Fig. 10 Catalytic Converter and Clamp Location 8.0L**

- 1 - CLAMPS
- 2 - CATALYTIC CONVERTERS
- 3 - MUFFLER
- 4 - HANGER ASSY. DUAL CLAMP
- 5 - EXTENSION PIPES
- 6 - DOWN PIPE

## EXHAUST PIPE - 5.9L DIESEL

## REMOVAL

- (1) Disconnect the battery negative cables.
- (2) Raise and support the vehicle on a hoist.
- (3) Saturate the bolts and nuts with heat valve lubricant. Allow 5 minutes for penetration.
- (4) Remove the exhaust pipe-to-extension pipe clamp. Separate the exhaust pipe and extension pipe.
- (5) Remove the exhaust pipe-to-turbocharger elbow bolts (Fig. 11).
- (6) Remove the exhaust pipe from the transmission support (Fig. 11).



**Fig. 11 Exhaust Pipe Removal/Installation**

- 1 - EXHAUST PIPE
- 2 - TURBOCHARGER EXHAUST PIPE

## INSPECTION

Discard rusted clamps, broken or worn supports and attaching parts. Replace a component with original equipment parts, or equivalent. This will assure proper alignment with other parts in the system and provide acceptable exhaust noise levels.

## INSTALLATION

- (1) Install the exhaust pipe into the transmission support and onto the turbocharger flange (Fig. 11).
- (2) Install the exhaust pipe-to-turbocharger elbow bolts and tighten to 31 N·m (23 ft. lbs.) torque.
- (3) Install the extension pipe and clamp to the exhaust pipe using a new clamp and tighten the clamp nuts to 48 N·m (35 ft. lbs.) torque.
- (4) Lower the vehicle.
- (5) Connect the battery negative cables.
- (6) Start the engine and inspect for exhaust leaks and exhaust system contact with the body panels. A minimum of 25.4 mm (1.0 in.) is required. Adjust the alignment, if needed.

## HEAT SHIELDS

### DESCRIPTION

There are two types of heat shields used. One is stamped steel the other is molded foil sheets. The shields attach to the vehicle around the exhaust system to prevent heat from the exhaust system from entering the passenger area and other areas where the heat can cause damage to other components.

### REMOVAL

- (1) Raise and support the vehicle.
- (2) Remove the nuts or bolts holding the exhaust heat shield to the floor pan, crossmember or bracket.
- (3) Slide the shield out around the exhaust system.

### INSTALLATION

- (1) Position the exhaust heat shield to the floor pan, crossmember or bracket and install the nuts or bolts.
- (2) Tighten the nuts and bolts 11 N·m (100 in. lbs.).
- (3) Lower the vehicle.

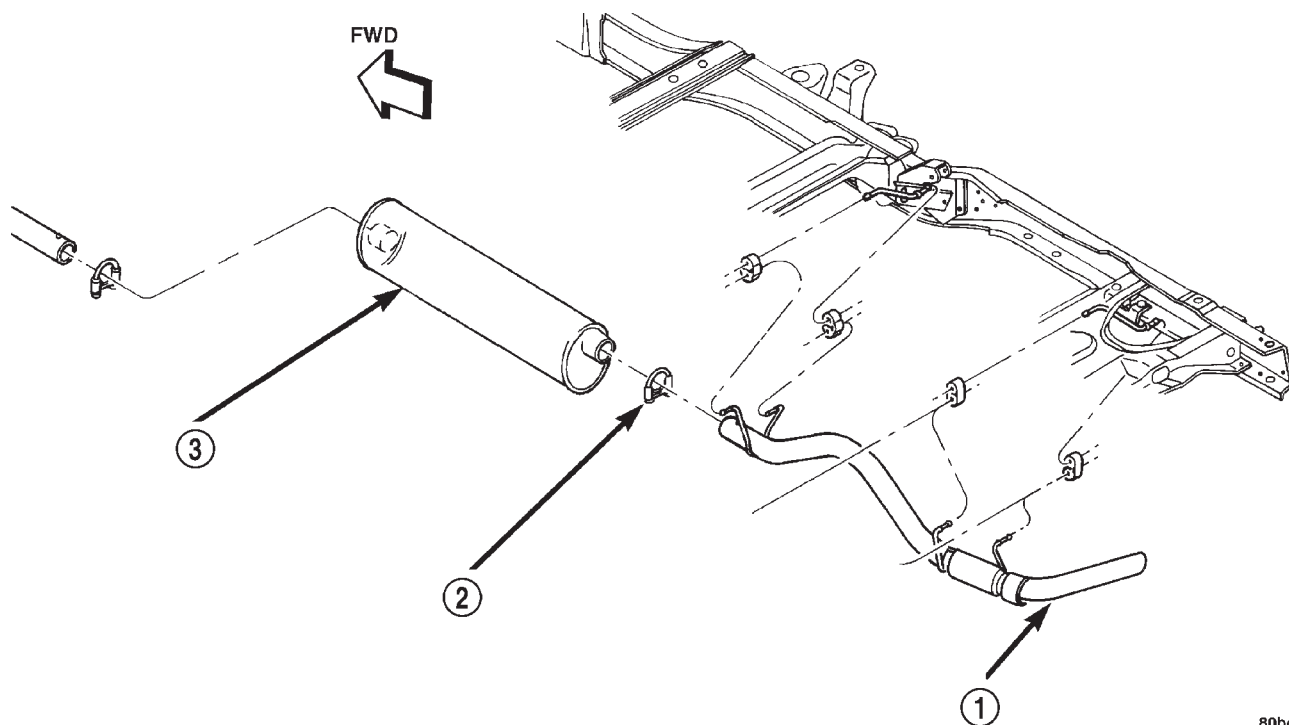
## MUFFLER - 3.9L/5.2L/5.9L/8.0L

### REMOVAL

- (1) Raise and support the vehicle.
- (2) Saturate the clamp nuts with heat valve lubricant. Allow 5 minutes for penetration.
- (3) Disconnect the muffler hanger (Fig. 12) (Fig. 13).
- (4) Remove clamps and nuts (Fig. 12) (Fig. 13).
- (5) Remove the muffler.

### INSTALLATION

- (1) Assemble muffler and clamps loosely to permit proper alignment of all parts.
- (2) Connect the muffler hanger.
- (3) Tighten the clamp nuts to 48 N·m (35 ft. lbs.) torque.
- (4) Lower the vehicle.
- (5) Start the engine and inspect for exhaust leaks and exhaust system contact with the body panels. A minimum of 25.4 mm (1.0 in.) is required between exhaust system components and body/frame parts. Adjust the alignment, if needed.



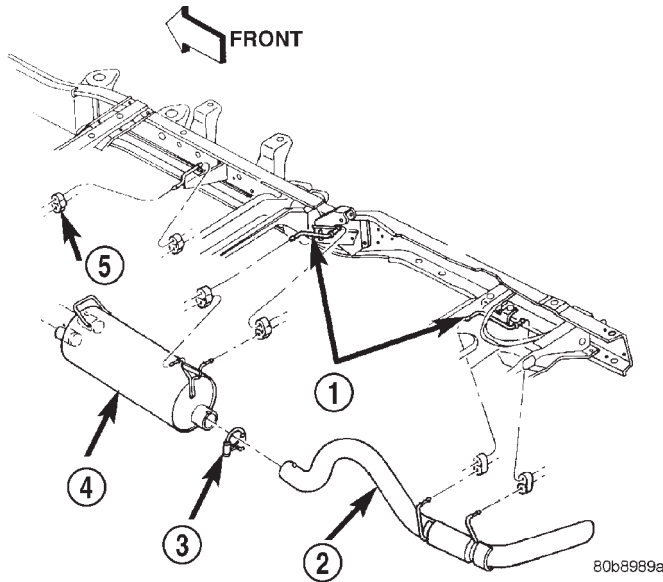
80be47bc

**Fig. 12 Muffler for 3.9L, 5.2L and 5.9L-Light Duty Engines**

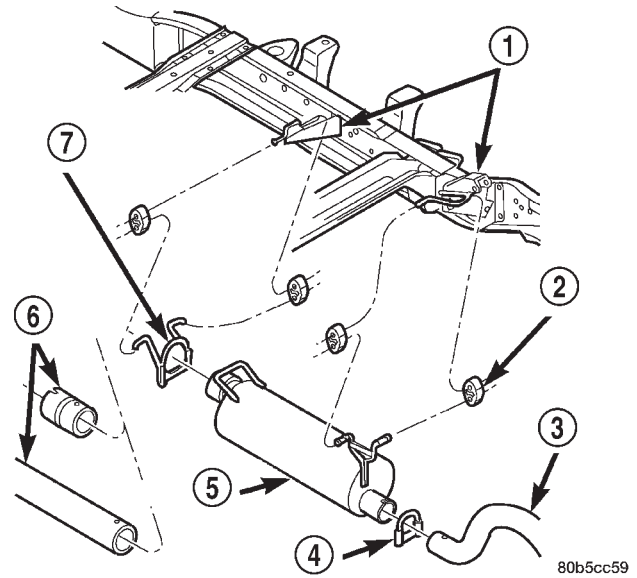
1 - TAILPIPE  
2 - CLAMP

3 - MUFFLER LIGHT DUTY

## MUFFLER - 3.9L/5.2L/5.9L/8.0L (Continued)

**Fig. 13 Muffler for 5.9L Heavy Duty and 8.0L**

- 1 - HANGER
- 2 - TAILPIPE
- 3 - CLAMP
- 4 - MUFFLER
- 5 - INSULATOR

**Fig. 14 Muffler Removal/Installation**

- 1 - HANGER BRACKETS
- 2 - ISOLATOR
- 3 - TAILPIPE
- 4 - CLAMP
- 5 - MUFFLER
- 6 - EXTENSION PIPE
- 7 - HANGER W/CLAMP

## MUFFLER - 5.9L DIESEL

**REMOVAL**

- (1) Disconnect the battery negative cables.
- (2) Raise and support the vehicle.
- (3) Remove the muffler to tail pipe and extension pipe clamps (Fig. 14).
- (4) Disconnect the muffler from the hanger isolators (Fig. 14).
- (5) Disconnect the muffler from the tailpipe.
- (6) Disconnect the muffler from the extension pipe and remove from the vehicle..

**INSTALLATION**

- (1) Install the muffler hanger rods into the isolators (Fig. 14).
- (2) Install the muffler into the extension pipe.
- (3) Install the muffler into the tail pipe.
- (4) Install the exhaust clamps, align the exhaust system, and tighten the exhaust clamps to 48 N·m (35 ft. lbs.) torque.
- (5) Lower the vehicle.
- (6) Connect the battery negative cables.
- (7) Start the engine and inspect for exhaust leaks and exhaust system contact with the body panels. A minimum of 25.4 mm (1.0 in.) is required between exhaust system components and body/frame parts. Adjust the alignment, if needed.

## TAILPIPE - 3.9L/5.2L/5.9L

**REMOVAL**

- (1) Raise and support the vehicle.
- (2) Saturate the clamp nuts with heat valve lubricant. Allow 5 minutes for penetration.
- (3) Disconnect the exhaust tailpipe support hanger.
- (4) Remove clamps and nuts.
- (5) Remove the exhaust tailpipe.

**INSPECTION**

Discard rusted clamps, broken or worn supports and attaching parts. Replace a component with original equipment parts, or equivalent. This will assure proper alignment with other parts in the system and provide acceptable exhaust noise levels.

**INSTALLATION**

- (1) Loosely assemble exhaust tailpipe to permit proper alignment of all parts.
- (2) Connect the support hangers.
- (3) Position the exhaust tailpipe for proper clearance with the underbody parts.
- (4) Tighten all clamp nuts to 48 N·m (35 ft. lbs.) torque.
- (5) Lower the vehicle.

## TAILPIPE - 3.9L/5.2L/5.9L (Continued)

(6) Start the engine and inspect for exhaust leaks and exhaust system contact with the body panels. A minimum of 25.4 mm (1.0 in.) is required between the exhaust system components and body/frame parts. Adjust the alignment, if needed.

## TAILPIPE - 5.9L HD/8.0L

## REMOVAL

- (1) Raise and support the vehicle.
- (2) Saturate the clamp nuts with Mopar® Rust Penetrant. Allow 5 minutes for penetration.
- (3) Disconnect the exhaust tailpipe support hangers (Fig. 15).
- (4) Remove clamps and nuts.
- (5) Remove the exhaust tailpipe.

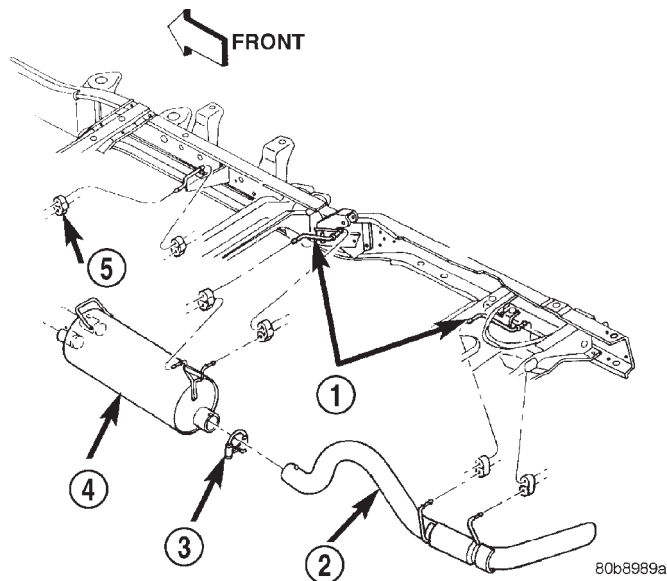


Fig. 15 TAILPIPE 8.0L AND 5.9L HEAVY DUTY

- 1 - HANGER
- 2 - TAILPIPE
- 3 - CLAMP
- 4 - MUFFLER
- 5 - INSULATOR

## INSPECTION

Discard rusted clamps, broken or worn supports and attaching parts. Replace a component with original equipment parts, or equivalent. This will assure proper alignment with other parts in the system and provide acceptable exhaust noise levels.

## INSTALLATION

- (1) Loosely assemble exhaust tailpipe to permit proper alignment of all parts (Fig. 15).
- (2) Connect the support hangers (Fig. 15).
- (3) Position the exhaust tailpipe for proper clearance with the underbody parts.

(4) Tighten all clamp nuts to 48 N·m (35 ft. lbs.) torque.

(5) Lower the vehicle.

(6) Start the engine and inspect for exhaust leaks and exhaust system contact with the body panels. A minimum of 25.4 mm (1.0 in.) is required between the exhaust system components and body/frame parts. Adjust the alignment, if needed.

## TAILPIPE - 5.9L DIESEL

## REMOVAL

- (1) Disconnect the battery negative cables.
- (2) Raise and support the vehicle.
- (3) Saturate the clamp nuts with heat valve lubricant. Allow 5 minutes for penetration.
- (4) Disconnect the exhaust tailpipe support hanger isolators (Fig. 16).
- (5) Remove the muffler-to-tailpipe clamps (Fig. 16).
- (6) Remove the tailpipe from the vehicle.

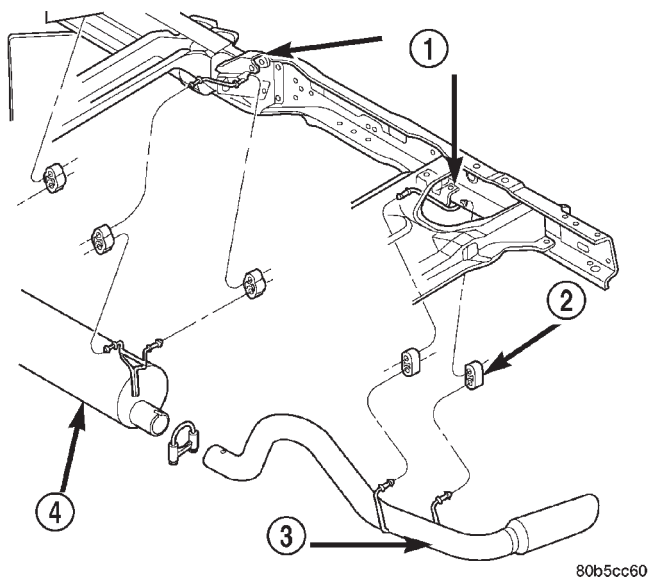


Fig. 16 Tailpipe Removal/Installation

- 1 - HANGER BRACKETS
- 2 - ISOLATOR
- 3 - TAILPIPE
- 4 - MUFFLER

## INSPECTION

Discard rusted clamps, broken or worn supports and attaching parts. Replace a component with original equipment parts, or equivalent. This will assure proper alignment with other parts in the system and provide acceptable exhaust noise levels.

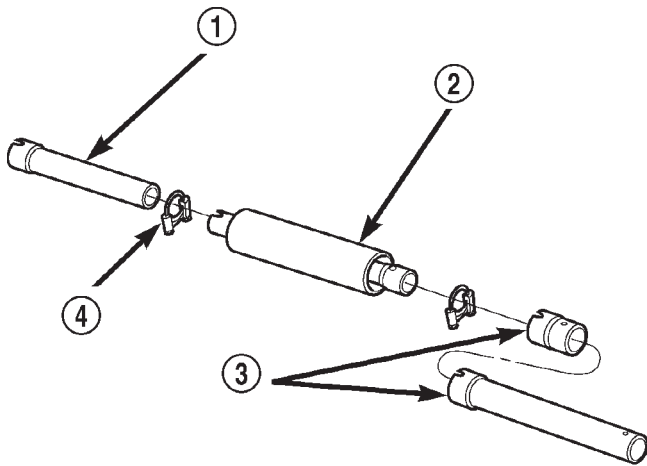
## TAILPIPE - 5.9L DIESEL (Continued)

**INSTALLATION**

- (1) Install the tailpipe into the muffler.
- (2) Install the tailpipe hanger rods into the isolators (Fig. 16).
- (3) Install the exhaust clamp, align the exhaust system, and tighten the clamp 48 N·m (35 ft. lbs.) torque.
- (4) Lower the vehicle.
- (5) Connect the battery negative cables.
- (6) Start the engine and inspect for exhaust leaks and exhaust system contact with the body panels. Adjust the alignment, if needed.

**RESONATOR****REMOVAL**

- (1) Disconnect the battery negative cables.
- (2) Raise vehicle on hoist.
- (3) Remove the exhaust clamps from the resonator to extension pipes (Fig. 17).
- (4) Separate the resonator from the front and rear extension pipes (Fig. 17) and remove the resonator from the vehicle.



80b5cc61

**Fig. 17 Resonator Removal/Installation**

- 1 - EXTENSION PIPE
- 2 - RESONATOR
- 3 - EXTENSION PIPE
- 4 - CLAMP

**INSTALLATION**

- (1) Assemble the resonator to the front and rear extension pipes (Fig. 17).
- (2) Install new exhaust clamps, align the exhaust system, and tighten the exhaust clamps to 48 N·m (35 ft. lbs.) torque.
- (3) Lower the vehicle.

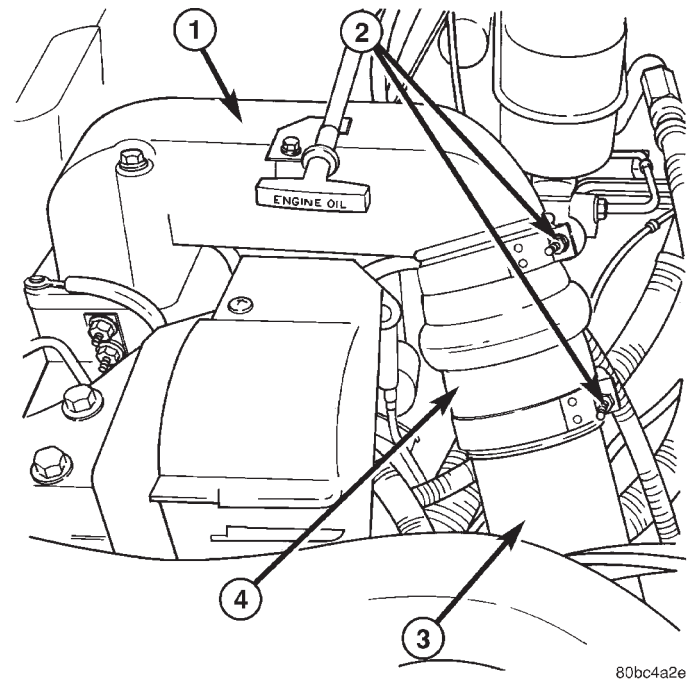
- (4) Connect the battery negative cables.
- (5) Start the engine and inspect for exhaust leaks.

**TURBOCHARGER SYSTEM****DIAGNOSIS AND TESTING - TURBOCHARGER BOOST PRESSURE**

**NOTE:** This diagnostic procedure is to be used with the DRBIII® while test driving the vehicle under normal load and driving conditions.

Low turbocharger boost pressure can cause poor engine performance and driveability concerns. The following procedure will test the turbocharger boost pressure.

- (1) Loosen clamps holding air inlet duct rubber sleeve to the intake manifold and air inlet duct. Remove rubber sleeve (Fig. 18).



80bc4a2e

**Fig. 18 INTAKE MANIFOLD TO AIR INLET DUCT RUBBER SLEEVE**

- 1 - INTAKE MANIFOLD AIR INLET
- 2 - CLAMPS
- 3 - AIR INLET DUCT
- 4 - AIR INLET DUCT RUBBER SLEEVE

- (2) Position Special Tool 8462 onto air inlet duct and intake manifold. Using the existing clamps tighten to 8 N·m (72 in. lbs.).

- (3) Install the 3447.5 kpa 500 psi (gray) Pressure Transducer (part of OT-CH8520 Transducer Kit) into Special Tool 8462.

## TURBOCHARGER SYSTEM (Continued)

(4) Connect the DRBIII® to the pressure transducer following the instructions supplied with the DRB III®.

(5) Enter DRBIII® into pressure reading mode and test drive vehicle.

(6) The turbocharger boost pressure must be between 110 - 138 kpa (16 - 20 psi.). If pressure readings are lower than 110 kpa (16 psi.) inspect for the following:

- Restricted air inlet system
- Leak in the charge air cooler system (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM/CHARGE AIR COOLER AND PLUMBING - DIAGNOSIS AND TESTING)
- Turbocharger wastegate broken or misadjusted
- Turbocharger damaged (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM/TURBOCHARGER - INSPECTION)

## TURBOCHARGER

## DESCRIPTION

The turbocharger is an exhaust-driven supercharger which increases the pressure and density of the air entering the engine. With the increase of air entering the engine, more fuel can be injected into the cylinders, which creates more power during combustion.

The turbocharger assembly consists of four (4) major component systems (Fig. 19) (Fig. 20) :

- Turbine section
- Compressor section
- Bearing housing
- Wastegate

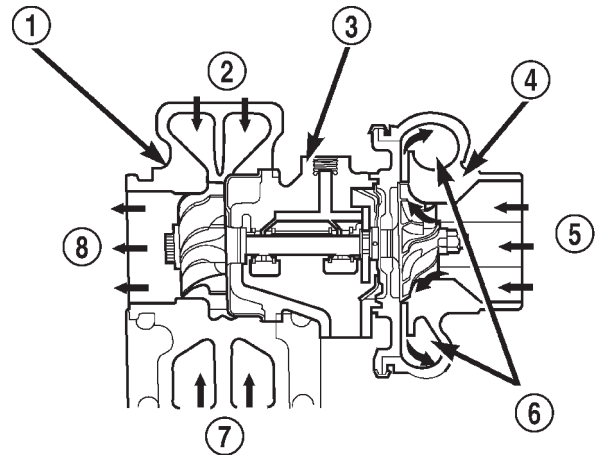
## OPERATION

Exhaust gas pressure and energy drive the turbine, which in turn drives a centrifugal compressor that compresses the inlet air, and forces the air into the engine through the charge air cooler and plumbing. Since heat is a by-product of this compression, the air must pass through a charge air cooler to cool the incoming air and maintain power and efficiency.

**Increasing air flow to the engine provides:**

- Improved engine performance
- Lower exhaust smoke density
- Improved operating economy
- Altitude compensation
- Noise reduction.

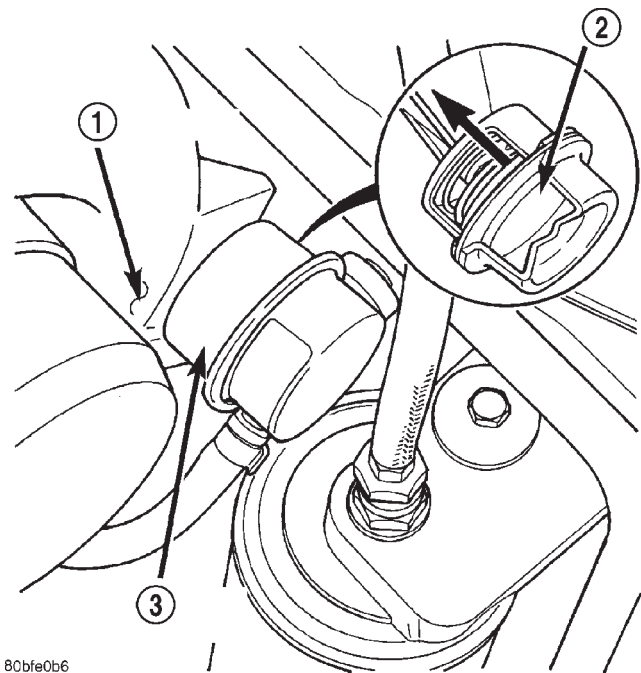
The turbocharger also uses a wastegate (Fig. 21) , which regulates intake manifold air pressure and prevents over boosting at high engine speeds. When the wastegate valve is closed, all of the exhaust gases flow through the turbine wheel. As the intake manifold pressure increases, the wastegate actuator opens



80b5cc50

**Fig. 19 Turbocharger Operation**

- 1 - TURBINE SECTION
- 2 - EXHAUST GAS
- 3 - BEARING HOUSING
- 4 - COMPRESSOR SECTION
- 5 - INLET AIR
- 6 - COMPRESSED AIR TO ENGINE
- 7 - EXHAUST GAS
- 8 - EXHAUST GAS TO EXHAUST PIPE



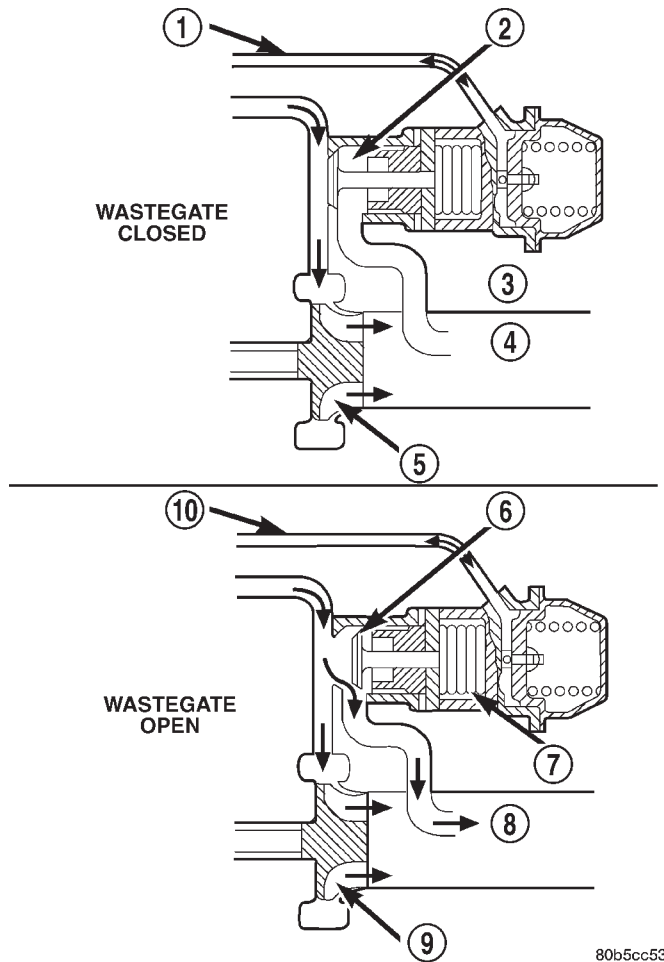
80bre0b6

**Fig. 20 Turbocharger Wastegate Actuator**

- 1 - TURBOCHARGER
- 2 - DIAPHRAGM
- 3 - WASTE GATE ACTUATOR

the valve, diverting some of the exhaust gases away from the turbine wheel. This limits turbine shaft speed and air output from the impeller.

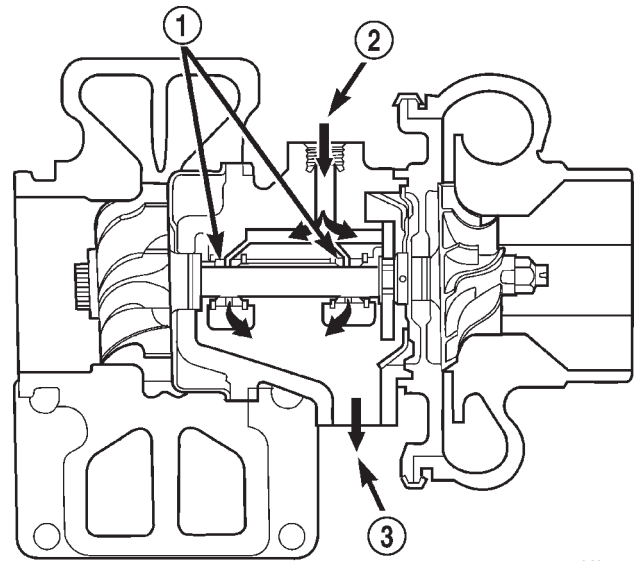
## TURBOCHARGER (Continued)

**Fig. 21 Wastegate Operation**

- 1 - SIGNAL LINE
- 2 - EXHAUST BYPASS VALVE
- 3 - WASTEGATE
- 4 - EXHAUST
- 5 - TURBINE
- 6 - EXHAUST BYPASS VALVE
- 7 - WASTEGATE
- 8 - EXHAUST
- 9 - TURBINE
- 10 - SIGNAL LINE

The turbocharger is lubricated by engine oil that is pressurized, cooled, and filtered. The oil is delivered to the turbocharger by a supply line that is tapped into the oil filter head. The oil travels into the bearing housing, where it lubricates the shaft and bearings (Fig. 22). A return pipe at the bottom of the bearing housing, routes the engine oil back to the crankcase.

The most common turbocharger failure is bearing failure related to repeated hot shutdowns with inadequate "cool-down" periods. A sudden engine shut down after prolonged operation will result in the transfer of heat from the turbine section of the turbocharger to the bearing housing. This causes the oil



80b5cc57

**Fig. 22 Turbocharger Oil Supply and Drain**

- 1 - BEARINGS
- 2 - OIL SUPPLY (FROM FILTER HEAD)
- 3 - OIL RETURN (TO SUMP)

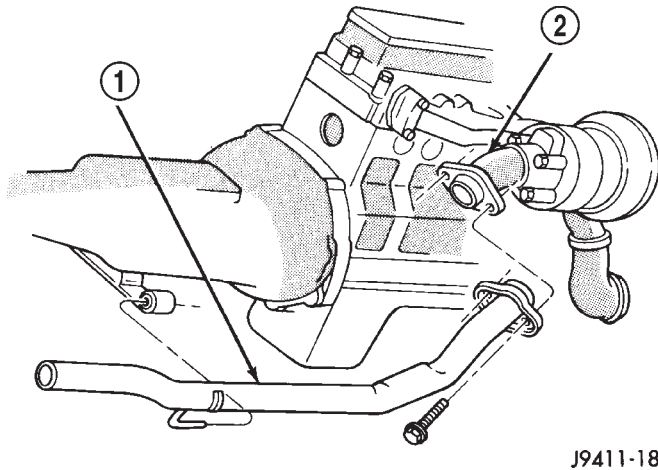
to overheat and break down, which causes bearing and shaft damage the next time the vehicle is started.

Letting the engine idle after extended operation allows the turbine housing to cool to normal operating temperature. The following chart should be used as a guide in determining the amount of engine idle time required to sufficiently cool down the turbocharger before shut down, depending upon the type of driving and the amount of cargo.

**REMOVAL**

- (1) Disconnect the battery negative cables.
- (2) Raise vehicle on hoist.
- (3) Disconnect the exhaust pipe from the turbocharger elbow (Fig. 23).
- (4) Lower vehicle.
- (5) Disconnect the turbocharger air inlet hose (Fig. 24).
- (6) Disconnect the turbocharger oil supply line and the oil drain tube from the turbocharger (Fig. 25).
- (7) Disconnect the charge air cooler inlet pipe from the turbocharger (Fig. 25).
- (8) Remove the turbocharger and gasket from the exhaust manifold.
- (9) If the turbocharger is not to be installed immediately, cover the opening to prevent material from entering into the manifold.
- (10) If replacing the turbocharger, transfer the discharge elbow and clamp to the new assembly.
- (11) Clean and inspect the sealing surface.

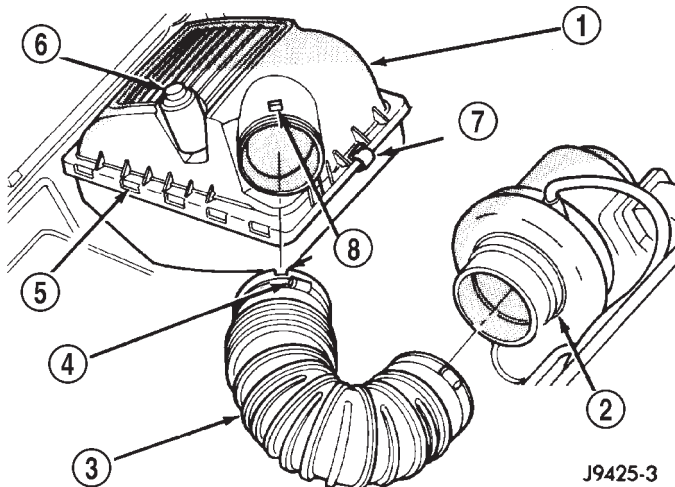
## TURBOCHARGER (Continued)



J9411-18

**Fig. 23 Exhaust Pipe Removal/Installation**

- 1 - EXHAUST PIPE  
2 - TURBOCHARGER EXHAUST PIPE



J9425-3

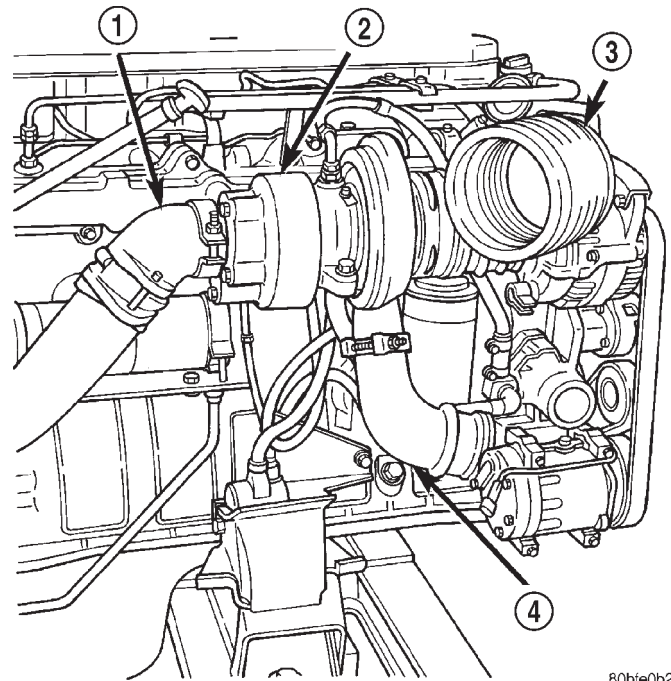
**Fig. 24 Turbocharger Air Inlet Hose**

- 1 - AIR FILTER HOUSING COVER  
2 - TURBOCHARGER  
3 - AIR INLET TUBE  
4 - HOSE CLAMP  
5 - HINGE TABS  
6 - FILTER MINDER  
7 - CLIPS (4)  
8 - TUBE ALIGNMENT NOTCHES

**CAUTION:** The turbocharger is only serviced as an assembly. Do not attempt to repair the turbocharger as turbocharger and/or engine damage can result.

**CLEANING**

Clean the turbocharger and exhaust manifold mounting surfaces with a suitable scraper.



80b1e0b2

**Fig. 25 Oil Supply Line and Charge Air Cooler Inlet Duct**

- 1 - EXHAUST PIPE  
2 - TURBOCHARGER  
3 - AIR INLET TUBE  
4 - COOLER INLET DUCT

**INSPECTION**

Visually inspect the turbocharger and exhaust manifold gasket surfaces. Replace stripped or eroded mounting studs.

(1) Visually inspect the turbocharger for cracks. The following cracks are NOT acceptable:

- Cracks in the turbine and compressor housing that go completely through.
- Cracks in the mounting flange that are longer than 15 mm (0.6 in.).
- Cracks in the mounting flange that intersect bolt through-holes.
- Two (2) Cracks in the mounting flange that are closer than 6.4 mm (0.25 in.) together.

(2) Visually inspect the impeller and compressor wheel fins for nicks, cracks, or chips. Note: Some impellers may have a factory placed paint mark which, after normal operation, appears to be a crack. Remove this mark with a suitable solvent to verify that it is not a crack.

(3) Visually inspect the turbocharger compressor housing for an impeller rubbing condition (Fig. 26). Replace the turbocharger if the condition exists.

(4) Measure the turbocharger axial end play:

- (a) Install a dial indicator as shown in (Fig. 27). Zero the indicator at one end of travel.

## TURBOCHARGER (Continued)

(b) Move the impeller shaft fore and aft and record the measurement. Allowable end play is 0.038 mm (0.0015 in.) MIN. and 0.089 mm (0.0035 in.) MAX. If the recorded measurement falls outside these parameters, replace the turbocharger assembly.

(5) Measure the turbocharger bearing radial clearance:

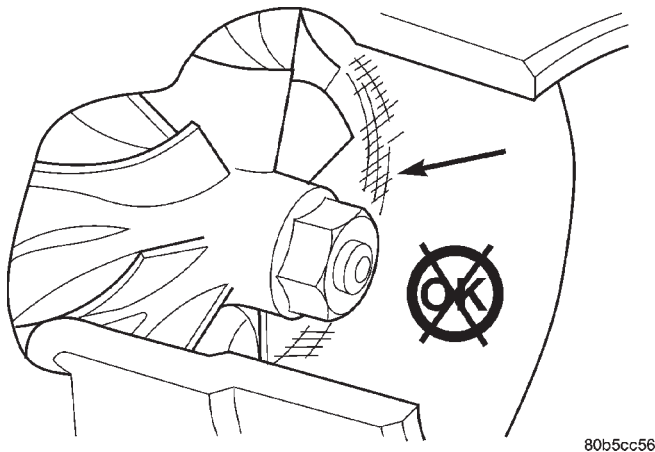
(a) Insert a narrow blade or wire style feeler gauge between the compressor wheel and the housing (Fig. 28).

(b) Gently push the compressor wheel toward the housing and record the clearance.

(c) With the feeler gauge in the same location, gently push the compressor wheel away from the housing and again record the clearance.

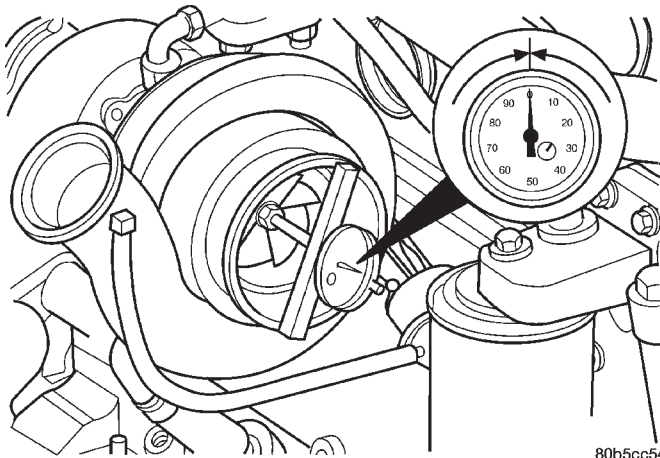
(d) Subtract the smaller clearance from the larger clearance. This is the radial bearing clearance.

(e) Allowable radial bearing clearance is 0.326 mm (0.0128 in.) MIN. and 0.496 mm (0.0195 in.) MAX. If the recorded measurement falls outside these specifications, replace the turbocharger assy.



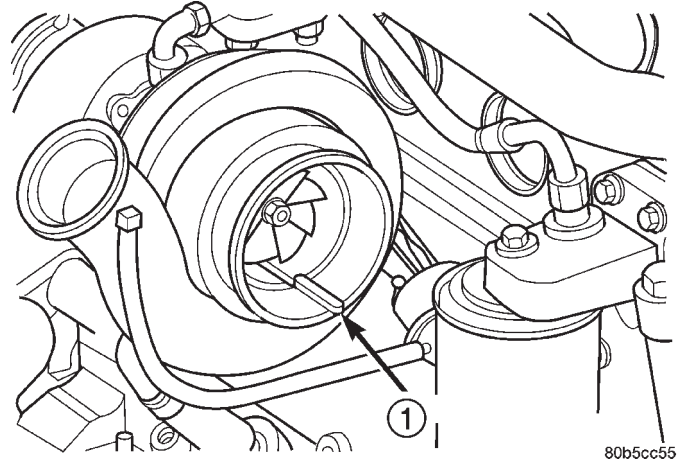
80b5cc56

**Fig. 26 Inspect Compressor Housing for Impeller Rubbing Condition**



80b5cc54

**Fig. 27 Measure Turbocharger Axial End Play**



80b5cc55

**Fig. 28 Measure Turbocharger Bearing Radial Clearance**

1 - FEELER GAUGE

## INSTALLATION

(1) Install the turbocharger. Apply anti-seize to the studs and then tighten the turbocharger mounting nuts to 32 N·m (24 ft. lbs.) torque.

(2) Install the oil drain tube and oil supply line to the turbocharger (Fig. 25). Tighten the drain tube bolts to 24 N·m (18 ft. lbs.) torque.

(3) **Pre-lube the turbocharger.** Pour 50 to 60 cc (2 to 3 oz.) clean engine oil in the oil supply line fitting. Carefully rotate the turbocharger impeller by hand to distribute the oil thoroughly.

(4) Install and tighten the oil supply line fitting nut to 20 N·m (133 in. lbs.) torque.

(5) Position the charge air cooler inlet pipe to the turbocharger. With the clamp in position, tighten the clamp nut to 11 N·m (95 in. lbs.) torque.

(6) Position the air inlet hose to the turbocharger (Fig. 24). Tighten the clamp to 11 N·m (95 in. lbs.) torque.

(7) Raise vehicle on hoist.

(8) Connect the exhaust pipe to the turbocharger (Fig. 23) and tighten the bolts to 34 N·m (25 ft. lbs.) torque.

(9) Lower the vehicle.

(10) Connect the battery negative cables.

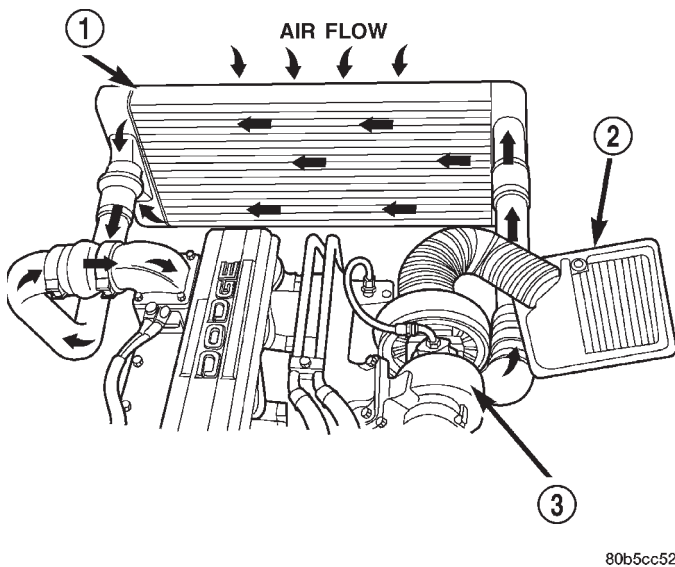
(11) Start the engine to check for leaks.

## CHARGE AIR COOLER AND PLUMBING

### DESCRIPTION

The charge air system (Fig. 29) consists of the charge air cooler piping, charge air cooler and intake air grid heater.

The charge air cooler is a heat exchanger that uses air flow from vehicle motion to dissipate heat from the intake air. As the turbocharger increases air pressure, the air temperature increases. Lowering the intake air temperature increases engine efficiency and power.



80b5cc52

**Fig. 29 Intake Air Circulation**

- 1 - CHARGE AIR COOLER
- 2 - AIRFILTER
- 3 - TURBOCHARGER

### OPERATION

Intake air is drawn through the air cleaner and into the turbocharger compressor housing. Pressurized air from the turbocharger then flows forward through the charge air cooler located in front of the radiator. From the charge air cooler the air flows back into the intake manifold.

### DIAGNOSIS AND TESTING - CHARGE AIR COOLER SYSTEM - LEAKS

Low turbocharger boost pressure and low engine performance can be caused by leaks in the charge air cooler or its plumbing. The following procedure outlines how to check for leaks in the charge air cooler system.

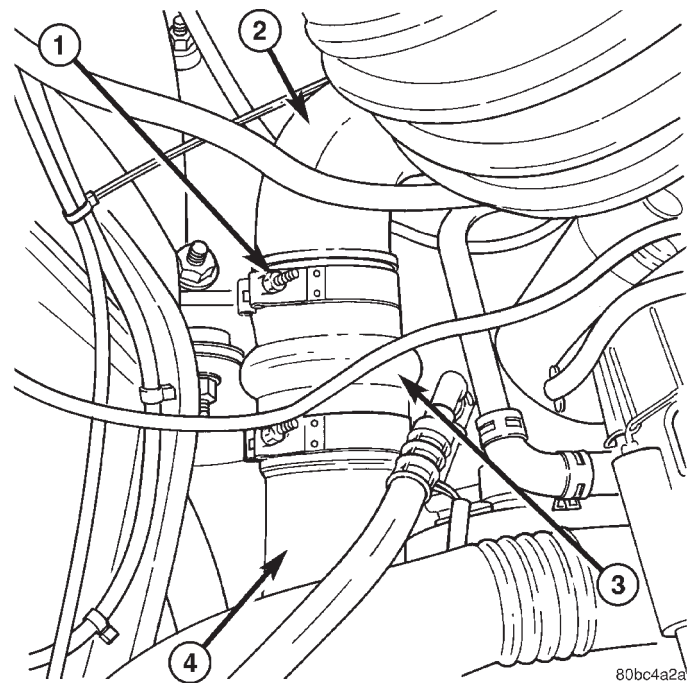
(1) Loosen clamp and remove turbocharger to air inlet duct rubber sleeve from turbocharger (Fig. 30).

(2) Insert Special Tool 8442 Adapter into the rubber sleeve. Tighten existing clamp to 8 N·m (72 in.lbs.).

**CAUTION: Do not apply more than 138 kpa (20 psi) air pressure to the charge air cooler system, sever damage to the charge air cooler system may occur.**

(3) Connect regulated air supply to air fitting on Special Tool 8442 Adapter. Set air pressure to a Maximum of 138 kpa (20 psi).

(4) Using soapy water check the air inlet ducts, rubber sleeves, charge air cooler and intake manifold for leaks.



80bc4a2a

**Fig. 30 AIR INLET DUCT RUBBER SLEEVE**

- 1 - CLAMP
- 2 - TURBOCHARGER
- 3 - AIR DUCT RUBBER SLEEVE
- 4 - AIR INLET DUCT

### REMOVAL

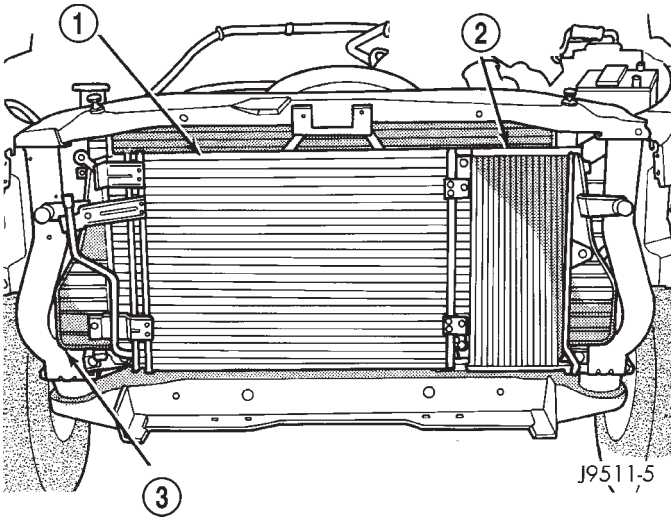
**WARNING: IF THE ENGINE WAS JUST TURNED OFF, THE AIR INTAKE SYSTEM TUBES MAY BE HOT.**

- (1) Disconnect the battery negative cables.
- (2) Remove the front bumper (Refer to 13 - FRAMES & BUMPERS/BUMPERS/Front BUMPER - REMOVAL).
- (3) Remove the front support bracket.

## CHARGE AIR COOLER AND PLUMBING (Continued)

(4) Discharge the A/C system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE) and remove the A/C condenser (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C CONDENSER - REMOVAL) (Fig. 31) (if A/C equipped).

(5) Remove the transmission auxiliary cooler (Fig. 31) (Refer to 7 - COOLING/TRANSMISSION/TRANS COOLER - REMOVAL).



**Fig. 31 Condenser and Transmission Auxiliary Cooler**

- 1 - A/C CONDENSOR
- 2 - TRANSMISSION COOLER
- 3 - INTERCOOLER

(6) Remove the boost tubes from the charge air cooler (Fig. 32).

(7) Remove the charge air cooler bolts. Pivot the charge air cooler forward and up to remove.

## CLEANING

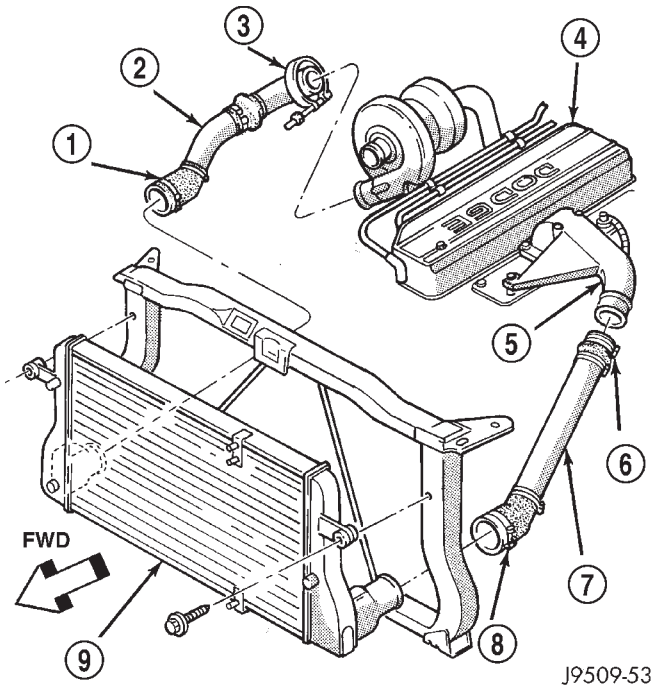
**CAUTION:** Do not use caustic cleaners to clean the charge air cooler. Damage to the charge air cooler will result.

**NOTE:** If internal debris cannot be removed from the cooler, the charge air cooler **MUST** be replaced.

(1) If the engine experiences a turbocharger failure or any other situation where oil or debris get into the charge air cooler, the charge air cooler must be cleaned internally.

(2) Position the charge air cooler so the inlet and outlet tubes are vertical.

(3) Flush the cooler internally with solvent in the direction opposite of normal air flow.



**Fig. 32 Air Intake System Tubes**

- 1 - CLAMP
- 2 - INTERCOOLER INLET DUCT
- 3 - CLAMP
- 4 - VALVE COVER
- 5 - AIR INLET HOUSING
- 6 - CLAMP
- 7 - INTERCOOLER OUTLET DUCT
- 8 - CLAMP
- 9 - INTERCOOLER

(4) Shake the cooler and lightly tap on the end tanks with a rubber mallet to dislodge trapped debris.

(5) Continue flushing until all debris or oil are removed.

(6) Rinse the cooler with hot soapy water to remove any remaining solvent.

(7) Rinse thoroughly with clean water and blow dry with compressed air.

## INSPECTION

Visually inspect the charge air cooler for cracks, holes, or damage. Inspect the tubes, fins, and welds for tears, breaks, or other damage. Replace the charge air cooler if damage is found.

Pressure test the charge air cooler, using Charge Air Cooler Tester Kit #3824556. This kit is available through Cummins® Service Products. Instructions are provided with the kit.

**CHARGE AIR COOLER AND PLUMBING (Continued)**

**INSTALLATION**

(1) Position the charge air cooler. Install the bolts and tighten to 2 N·m (17 in. lbs.) torque.

(2) Install the air intake system tubes to the charge air cooler. With the clamps in position, tighten the clamps to 11 N·m (95 in. lbs.) torque.

(3) Install the transmission auxiliary cooler (if equipped) (Refer to 7 - COOLING/TRANSMISSION/TRANS COOLER - INSTALLATION).

(4) Install the A/C condenser (if A/C equipped) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C CONDENSER - INSTALLATION).

Recharge A/C system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(5) Install the front support bracket. Install and tighten the bolts.

(6) Install the front bumper (Refer to 13 - FRAMES & BUMPERS/BUMPERS/FRONT BUMPER - INSTALLATION).

(7) Connect the battery negative cables.

(8) Start engine and check for boost system leaks.