

# EXHAUST SYSTEM AND INTAKE MANIFOLD

## CONTENTS

	page		page
<b>GENERAL INFORMATION</b>		EXHAUST PIPE .....	4
CATALYTIC CONVERTER .....	1	EXHAUST PIPE—DIESEL .....	11
EXHAUST HEAT SHIELDS .....	2	EXHAUST TAILPIPE .....	6
EXHAUST SYSTEM .....	1	EXHAUST TAILPIPE—DIESEL .....	12
<b>DESCRIPTION AND OPERATION</b>		HEAT SHIELDS—DIESEL .....	13
ENGINE EXHAUST MANIFOLD—V-6 and V-8		INTAKE MANIFOLD COVER—AIR INTAKE	
ENGINES .....	3	HEATER (DIESEL) .....	14
EXHAUST MANIFOLD—V-10 ENGINE .....	3	INTAKE MANIFOLD V-10 .....	8
INTAKE MANIFOLD—V-10 ENGINE .....	3	INTAKE MANIFOLD—V-6 and V-8 ENGINES ...	6
INTAKE MANIFOLD—V-6 and V-8 ENGINES ...	3	MUFFLERS .....	5
INTERCOOLER—CHARGE AIR COOLER .....	3	MUFFLER—DIESEL .....	12
TURBOCHARGER—5.9L DIESEL ENGINE .....	3	TURBOCHARGER .....	16
<b>DIAGNOSIS AND TESTING</b>		<b>CLEANING AND INSPECTION</b>	
INTAKE MANIFOLD DIAGNOSIS .....	3	CATALYTIC CONVERTER .....	19
<b>REMOVAL AND INSTALLATION</b>		CHARGE AIR COOLER .....	19
CATALYTIC CONVERTERS .....	5	EXHAUST MANIFOLD .....	18
CATALYTIC CONVERTER—DIESEL .....	12	EXHAUST PIPE .....	18
CHARGE AIR COOLER—DIESEL .....	17	INTAKE MANIFOLD .....	18
ENGINE EXHAUST MANIFOLD—V-6 and V-8		<b>ADJUSTMENTS</b>	
ENGINES .....	10	WASTEGATE ADJUSTMENT .....	19
EXHAUST HEAT SHIELDS .....	6	<b>SPECIFICATIONS</b>	
EXHAUST MANIFOLD V-10 .....	11	TORQUE SPECIFICATIONS .....	21
EXHAUST MANIFOLD—DIESEL .....	13	TURBOCHARGER SPECIFICATIONS .....	21

## GENERAL INFORMATION

### EXHAUST SYSTEM

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

The diesel engine exhaust system consists of an engine exhaust manifold, turbocharger, exhaust pipe, catalytic converter, extension pipe (if needed), muffler and exhaust tailpipe (Fig. 2).

The engine exhaust manifolds on gasoline engines are equipped with ball flange outlets to assure a tight seal and strain free connections.

The exhaust system must be properly aligned to prevent stress, leakage and body contact. If the system contacts any body panel, it may amplify objectionable noises from the engine or body.

When inspecting an exhaust system, critically inspect for cracked or loose joints, stripped screw or bolt threads, corrosion damage and worn, cracked or

broken hangers. Replace all components that are badly corroded or damaged. DO NOT attempt to repair.

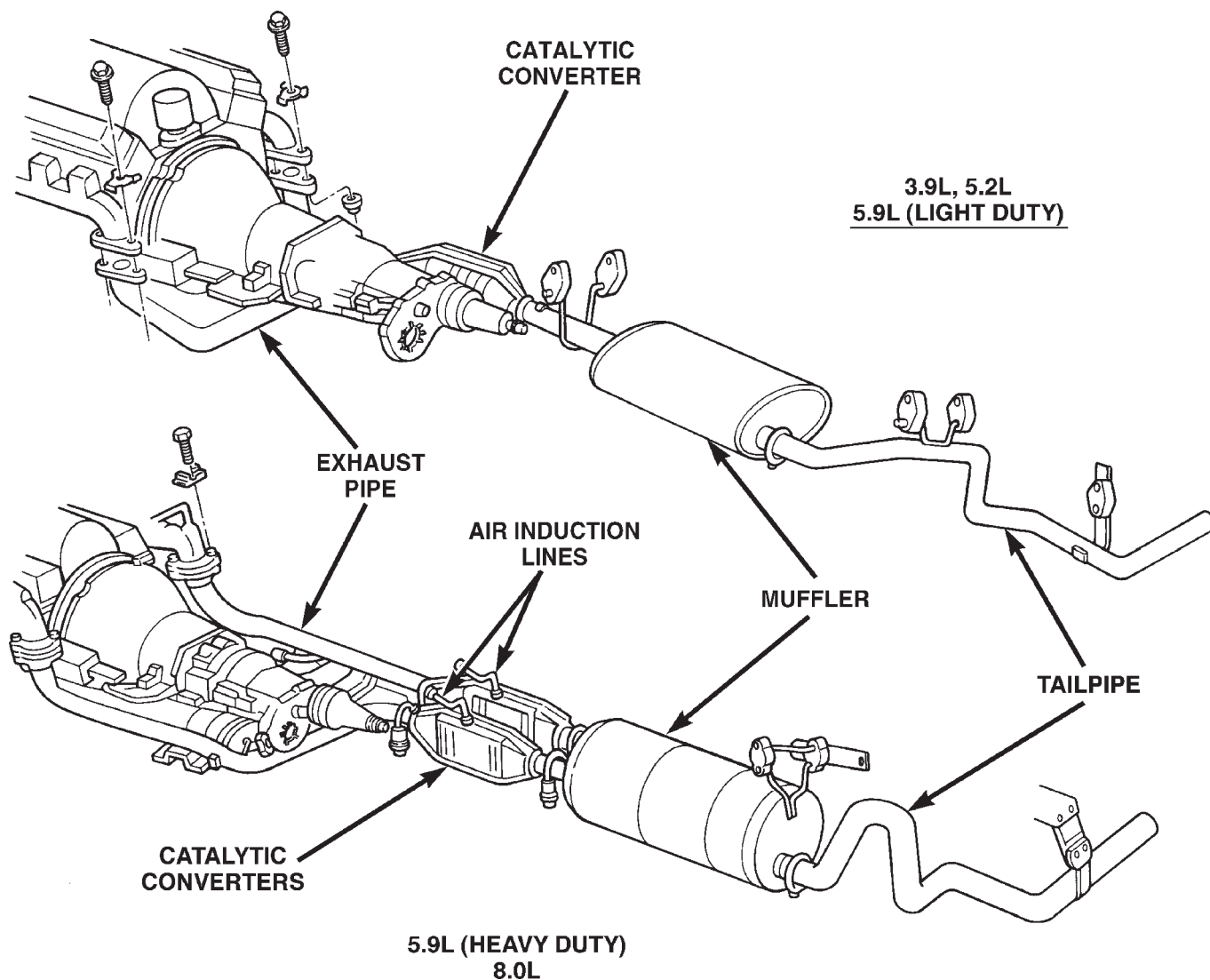
When replacement is required, use original equipment parts (or their equivalent). This will assure proper alignment and provide acceptable exhaust noise levels.

**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.

### CATALYTIC CONVERTER

There is no regularly scheduled maintenance on any Mopar® stainless steel catalytic converter body. Excessive heat can result in bulging or other distortion, but excessive heat will not be the fault of the

## GENERAL INFORMATION (Continued)



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

converter. If unburned fuel enters the converter, overheating may occur. If a converter is heat-damaged, correct the cause of the damage at the same time the converter is replaced. Also, inspect all other components of the exhaust system for heat damage.

Unleaded gasoline must be used in gas engines to avoid contaminating the catalyst core.

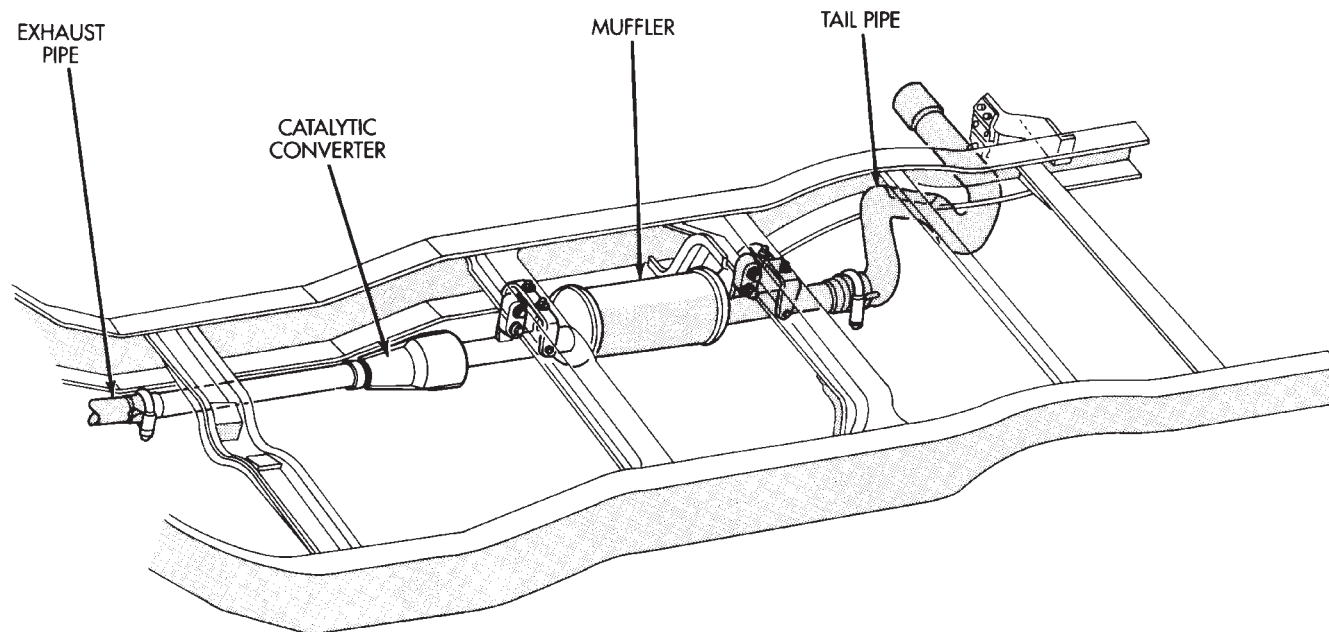
**EXHAUST HEAT SHIELDS**

Exhaust heat shields are needed to protect both the vehicle and the environment from the high temperatures developed by the catalytic converter. The combustion reaction facilitated by the catalyst releases additional heat in the exhaust system. Under severe operating conditions, the temperature

increases in the area of the reactor. Such conditions can exist when the engine misfires or otherwise does not operate at peak efficiency. DO NOT remove spark plug wires from plugs or by any other means short out cylinders. Failure of the catalytic converter can occur due to a temperature increase caused by unburned fuel passing through the converter.

DO NOT allow the engine to operate at fast idle for extended periods (over 5 minutes). This condition may result in excessive temperatures in the exhaust system and on the floor pan.

## GENERAL INFORMATION (Continued)



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**Fig. 2 Exhaust System—Diesel Engines (Typical)****DESCRIPTION AND OPERATION****TURBOCHARGER—5.9L DIESEL ENGINE**

A turbocharger is used to force more air into the engine cylinders. Exhaust gas energy is used to turn the turbine wheel and shaft. At the other end of the shaft is the compressor wheel. The compressor wheel draws air in and forces it into the engine cylinders through the intake manifold.

**NOTE:** Supplying increased air flow to the engine provides:

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

**INTERCOOLER—CHARGE AIR COOLER**

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 (intercooler) located in front of the radiator. From the charge air cooler (Intercooler) the air flows back into the intake manifold.

The charge air cooler (Intercooler) is a heat exchanger that uses air flow 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.

**INTAKE MANIFOLD—V-6 and V-8 ENGINES**

The aluminum intake manifold is a single plane design with equal length runners. The manifold is sealed by flange side gaskets with front and rear cross-over gaskets.

**INTAKE MANIFOLD—V-10 ENGINE**

The aluminum intake manifold has two plenum chambers an upper and lower which supply air to five runners each. Passages across the longitudinal center of the manifold feed air from the throttle body to the plenum chambers.

**ENGINE EXHAUST MANIFOLD—V-6 and V-8 ENGINES**

Engine exhaust manifolds are LOG type with porting for air injection into the LOG.

**EXHAUST MANIFOLD—V-10 ENGINE**

Engine exhaust manifolds are made of high molybdenum ductile cast iron. A special ribbed design helps control permanent dimensional changes during heat cycles.

**DIAGNOSIS AND TESTING****INTAKE MANIFOLD DIAGNOSIS**

An intake manifold leak is characterized by lower than normal manifold vacuum. Also, one or more cylinder may not be functioning.

## DIAGNOSIS AND TESTING (Continued)

## 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>

**CAUTION:** 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.

**WARNING:** USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR THE FAN. DO NOT WEAR LOOSE CLOTHING.

- (1) Start the engine allowing it to warm up.
- (2) Inspect for disconnected vacuum hoses or hardened or cracked vacuum lines.
- (3) With a spray bottle, spray a small stream of water on the suspect area.
- (4) If there is a change in RPM'S, the suspected leak has been found.
- (5) Repair as required.

## REMOVAL AND INSTALLATION

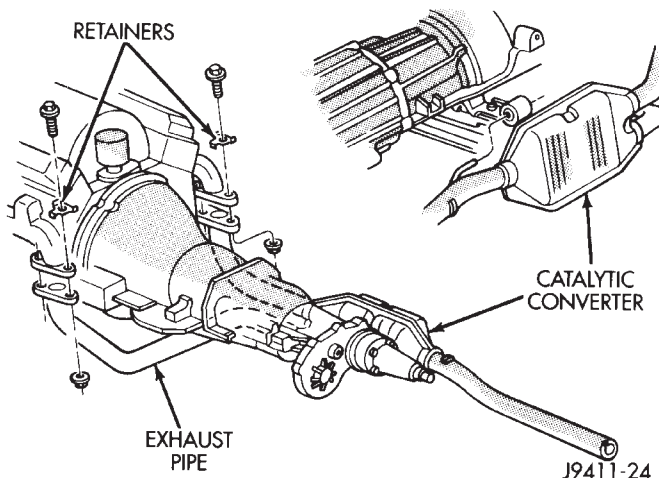
## EXHAUST PIPE

## 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. 3) (Fig. 4).
- (4) Remove the clamp nuts (Fig. 5).
- (5) Disconnect the exhaust pipe from the support hangers on the 5.9L (Heavy Duty) and the 8.0L engines (Fig. 4).
- (6) Remove the exhaust pipe.

## INSTALLATION

- (1) Connect the exhaust pipe support hangers on the 5.9L (Heavy Duty) and the 8.0L engine (Fig. 4).

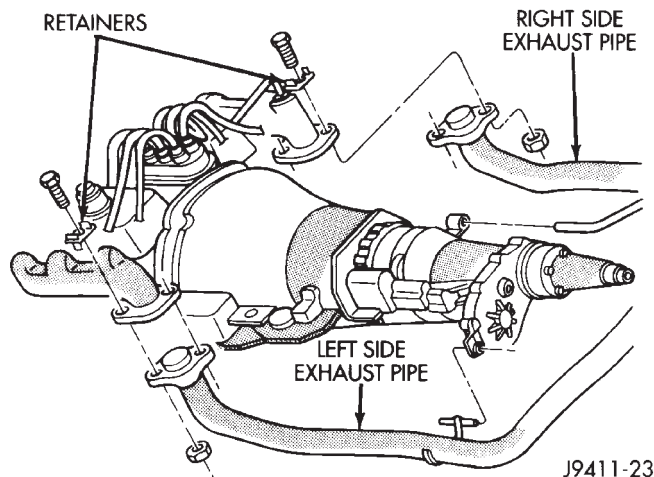


**Fig. 3 Exhaust Pipe—3.9/5.2/5.9L (Light Duty)**

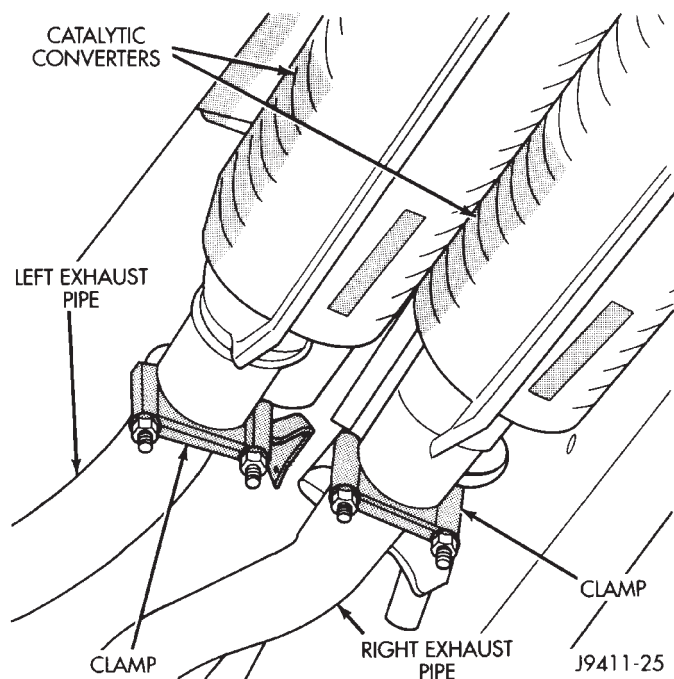
- (2) Position the exhaust pipe for proper clearance with underbody parts.
- (3) Position the exhaust pipe to manifold. Install the bolts, retainers and nuts. Tighten the nuts to 34 N·m (25 ft. lbs.) torque.
- (4) Tighten the clamp nuts to 54 N·m (40 ft. lbs.) torque.
- (5) Lower the vehicle.
- (6) Start the engine and inspect for exhaust leaks and exhaust system contact with the body panels. Adjust the alignment, if needed.



## REMOVAL AND INSTALLATION (Continued)



**Fig. 4 Exhaust Pipe—5.9L Heavy Duty and 8.0L—Typical**

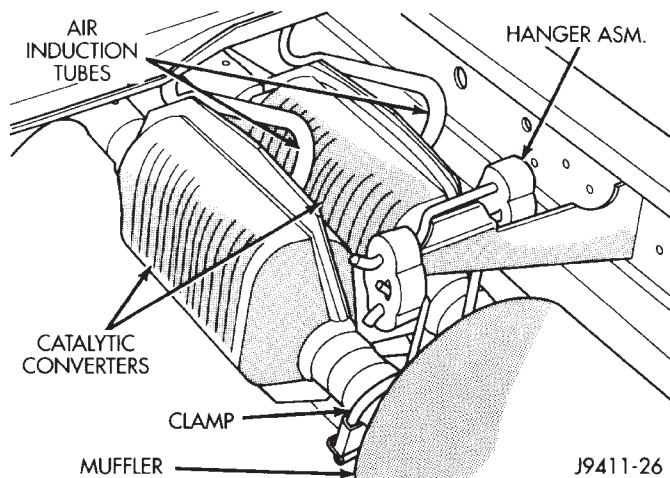


**Fig. 5 Exhaust Pipe Clamp Location for 5.9L—Heavy Duty and 8.0L**

## CATALYTIC CONVERTERS

## 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).
- (4) Disconnect the catalytic converter from the support hanger on the 3.9L, 5.2L and 5.9L—Light Duty engines (Fig. 3).
- (5) Remove the catalytic converter.



**Fig. 6 Catalytic Converter Clamp Location for 5.9L—Heavy Duty and 8.0L**

## INSTALLATION

- (1) Connect the support hanger on the 3.9L, 5.2L and 5.9L—Light Duty engines (Fig. 3).
- (2) Assemble converter and clamps loosely to permit proper clearance with exhaust heat shields and underbody parts.
- (3) Tighten all clamp nuts to 54 N·m (40 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.

## MUFFLERS

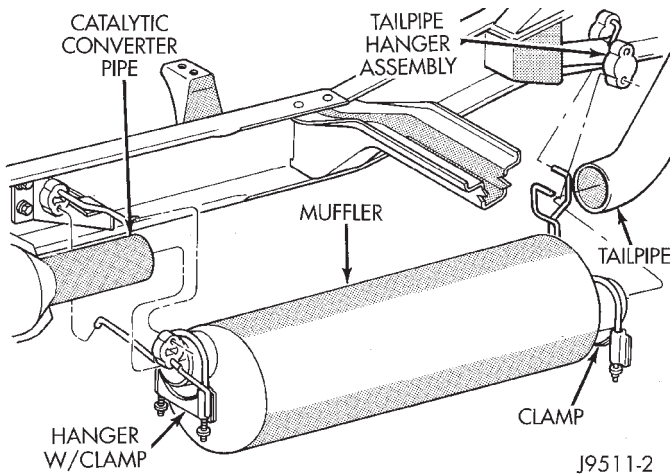
## REMOVAL

- (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. 6) (Fig. 7).
- (4) Remove clamps and nuts (Fig. 6) (Fig. 7).
- (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 54 N·m (40 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.

## REMOVAL AND INSTALLATION (Continued)



**Fig. 7 Muffler for 3.9L, 5.2L and 5.9L-Light Duty Engines**

## EXHAUST TAILPIPE

## 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.

## 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 54 N·m (40 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 HEAT SHIELDS

## 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.

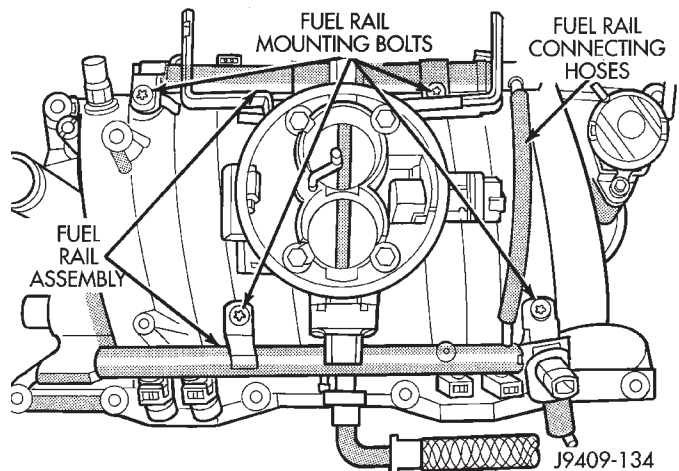
## INSTALLATION

- (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.
- (3) Lower the vehicle.

## INTAKE MANIFOLD—V-6 and V-8 ENGINES

## REMOVAL

- (1) Disconnect the negative cable from the battery.
- (2) Drain the cooling system (refer to Group 7, Cooling System for the proper procedures).
- (3) Remove the generator.
- (4) Remove the air cleaner.
- (5) Perform the Fuel System Pressure release procedure (refer to Group 14, Fuel System). Disconnect the fuel lines.
- (6) Disconnect the accelerator linkage and if so equipped, the speed control and transmission kick-down cables.
- (7) Remove the return spring.
- (8) Remove the distributor cap and wires.
- (9) Disconnect the coil wires.
- (10) Disconnect the heat indicator sending unit wire.
- (11) Disconnect the heater hoses and bypass hose.
- (12) Remove the closed crankcase ventilation and evaporation control systems.
- (13) Remove intake manifold bolts.
- (14) Lift the intake manifold and throttle body out of the engine compartment as an assembly.
- (15) Remove and discard the flange side gaskets and the front and rear cross-over gaskets.
- (16) Remove the throttle body bolts and lift the throttle body off the intake manifold (Fig. 8). Discard the gasket.



**Fig. 8 Throttle Body Assembly**

- (17) Remove the plenum pan as follows:
  - (a) Turn the intake manifold upside down. Support the manifold.
  - (b) Remove the bolts and lift the pan off the manifold. Discard the gasket.

## INSTALLATION

- (1) Install the plenum pan, if removed, as follows:

## REMOVAL AND INSTALLATION (Continued)

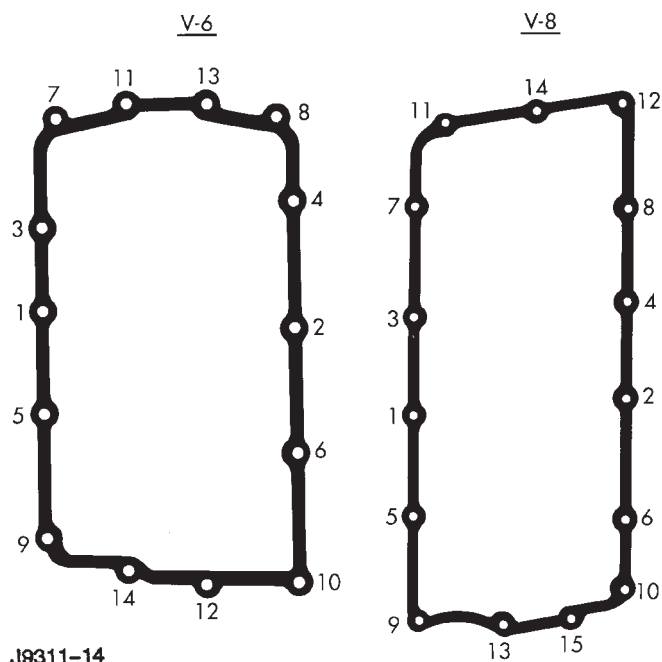
(a) Turn the intake manifold upside down. Support the manifold.

(b) Place a new plenum pan gasket onto the seal rail of the intake manifold. Position the pan over the gasket. Align all the gasket and pan holes with the intake manifold.

(c) Hand start all bolts.

(d) Tighten the bolts, in sequence (Fig. 9), as follows:

- Step 1—Tighten bolts to 2.7 N·m (24 in. lbs.) torque.
- Step 2—Tighten bolts to 5.4 N·m (48 in. lbs.) torque.
- Step 3—Tighten bolts to 9.5 N·m (84 in. lbs.) torque.
- Step 4—Check that all bolts are tighten to 9.5 N·m (84 in. lbs.) torque.



**Fig. 9 Plenum Pan Bolt Tightening Sequence**

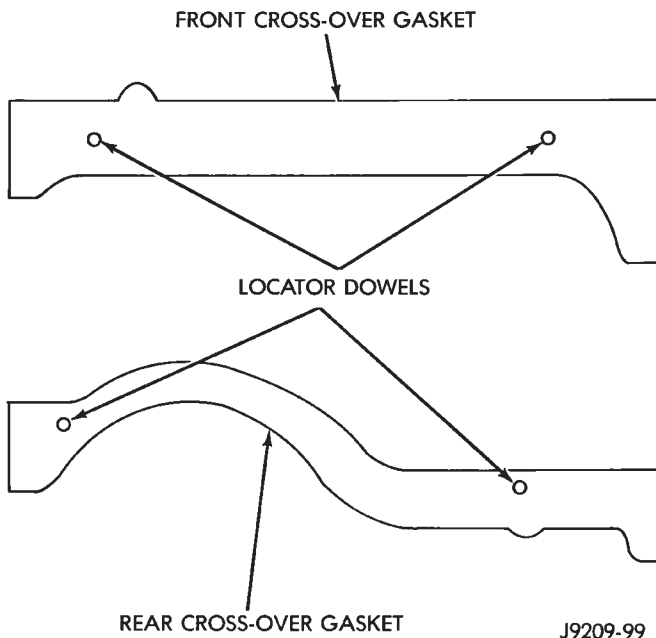
(2) Using a new gasket, install the throttle body onto the intake manifold. Tighten the bolts to 23 N·m (200 in. lbs.) torque.

(3) Place the 4 plastic locator dowels into the holes in the block (Fig. 10).

(4) Apply Mopar® Silicone Rubber Adhesive Sealant, or equivalent, to the four corner joints. An excessive amount of sealant is not required to ensure a leak proof seal. However, an excessive amount of sealant may reduce the effectiveness of the flange gasket. The sealant should be slightly higher than the cross-over gaskets, approximately 5 mm (0.2 in.).

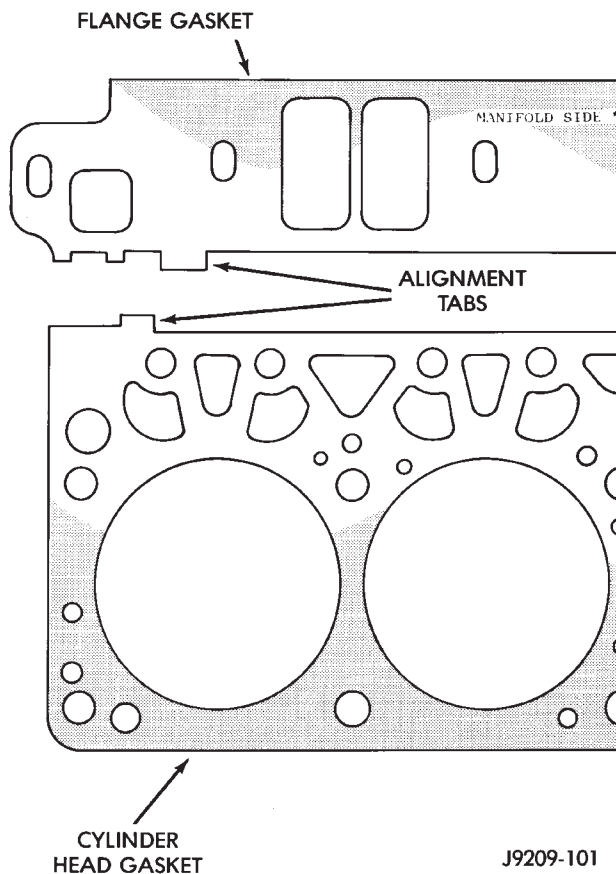
(5) Install the front and rear cross-over gaskets onto the dowels (Fig. 10).

(6) Install the flange gaskets. Ensure that the vertical port alignment tab is resting on the deck face of



**Fig. 10 Cross-Over Gaskets and Locator Dowels**

the block. Also the horizontal alignment tabs must be in position with the mating cylinder head gasket tabs (Fig. 11). The words MANIFOLD SIDE should be visible on the center of each flange gasket.



**Fig. 11 Intake Manifold Flange Gasket Alignment**

## REMOVAL AND INSTALLATION (Continued)

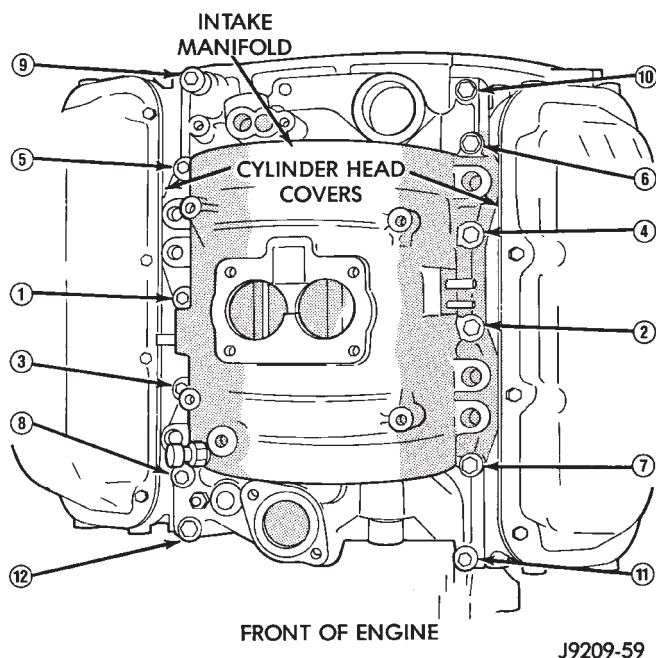
(7) Carefully lower intake manifold into position on the cylinder block and cylinder heads. Use the alignment dowels in the cross-over gaskets to position the intake manifold. After intake manifold is in place, inspect to make sure seals are in place.

(8) Install the intake manifold bolts and tighten as follows:

(a) V-6 ENGINE— (Fig. 12)

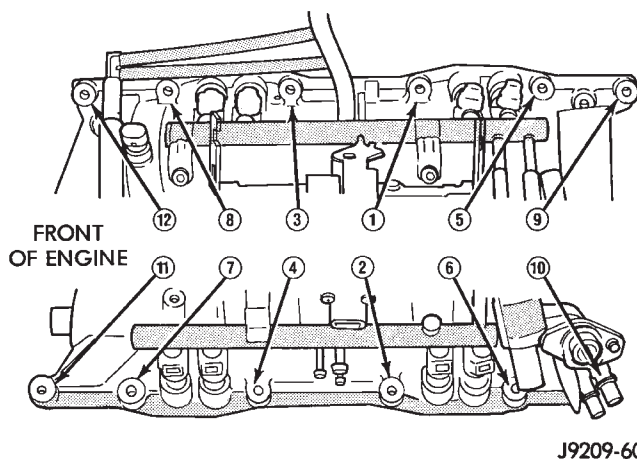
- Step 1—Tighten bolts 1 and 2 to 8 N·m (72 in. lbs.) torque. Tighten in alternating steps 1.4 N·m (12 in. lbs.) torque at a time.
- Step 2—Tighten bolts 3 through 12, in sequence, to 8 N·m (72 in. lbs.) torque.
- Step 3—Check that all bolts are tighten to 8 N·m (72 in. lbs.) torque.
- Step 4—Tighten all bolts, in sequence, to 16 N·m (12 ft. lbs.) torque.
- Step 5—Check that all bolts are tighten to 16 N·m (12 ft. lbs.) torque.

(b) V-8 ENGINE— (Fig. 13)



**Fig. 12 Intake Manifold Bolt Tightening Sequence—V-6**

- Step 1—Tighten bolts 1 through 4, in sequence, to 8 N·m (72 in. lbs.) torque. Tighten in alternating steps 1.4 N·m (12 in. lbs.) torque at a time.
- Step 2—Tighten bolts 5 through 12, in sequence, to 8 N·m (72 in. lbs.) torque.
- Step 3—Check that all bolts are tighten to 8 N·m (72 in. lbs.) torque.
- Step 4—Tighten all bolts, in sequence, to 16 N·m (12 ft. lbs.) torque.
- Step 5—Check that all bolts are tighten to 16 N·m (12 ft. lbs.) torque.



**Fig. 13 Intake Manifold Bolt Tightening Sequence—V-8**

- (9) Install closed crankcase ventilation and evaporation control systems.
- (10) Connect the coil wires.
- (11) Connect the heat indicator sending unit wire.
- (12) Connect the heater hoses and bypass hose.
- (13) Install distributor cap and wires.
- (14) Hook up the return spring.
- (15) Connect the accelerator linkage and if so equipped, the speed control and transmission kick-down cables.
- (16) Install the fuel lines.
- (17) Install the generator and drive belt. Tighten generator mounting bolt to 41 N·m (30 ft. lbs.) torque.
- (18) Install the air cleaner.
- (19) Fill cooling system (refer to Group 7, Cooling System for the proper procedure).
- (20) Connect the negative cable to the battery.

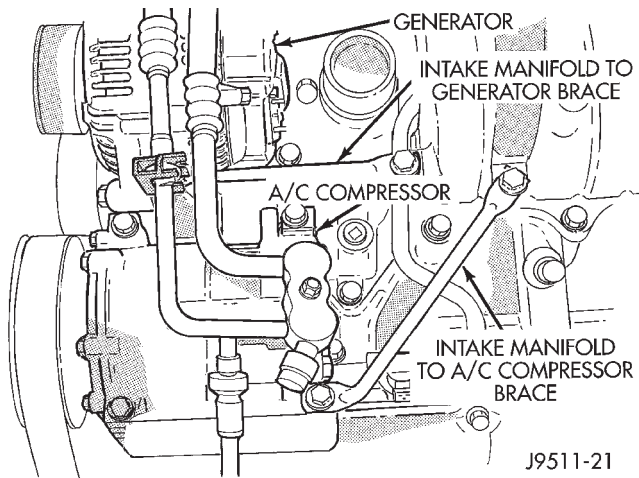
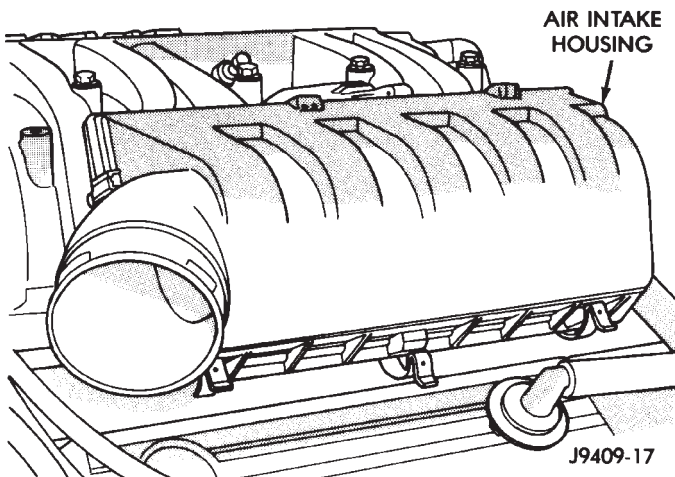
## INTAKE MANIFOLD V-10

### REMOVAL

- (1) Disconnect the negative cable from the battery.
- (2) Drain the cooling system (refer to Group 7, Cooling System for the proper procedures).
- (3) Remove the accessory drive belt (refer to Group 7, Cooling System for the proper procedures).
- (4) Remove the generator brace and generator (Fig. 14).
- (5) Remove the A/C compressor brace (Fig. 14). Remove the compressor and set aside.
- (6) Remove the air cleaner cover and filter. Remove the air cleaner housing (Fig. 15). Discard the gasket.
- (7) Perform the Fuel System Pressure release procedure (refer to Group 14, Fuel System). Disconnect the fuel lines.



## REMOVAL AND INSTALLATION (Continued)

**Fig. 14 Generator and A/C Compressor Braces****Fig. 15 Air Intake Housing**

(8) Disconnect the accelerator linkage and if so equipped, the speed control and transmission kick-down cables.

(9) Remove the coil assemblies with the ignition cables.

(10) Disconnect the vacuum lines.

(11) Disconnect the heater hoses and bypass hose.

(12) Remove the closed crankcase ventilation and evaporation control systems.

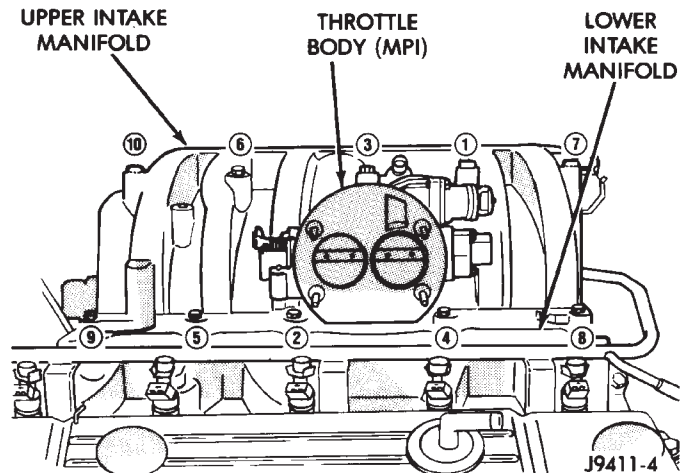
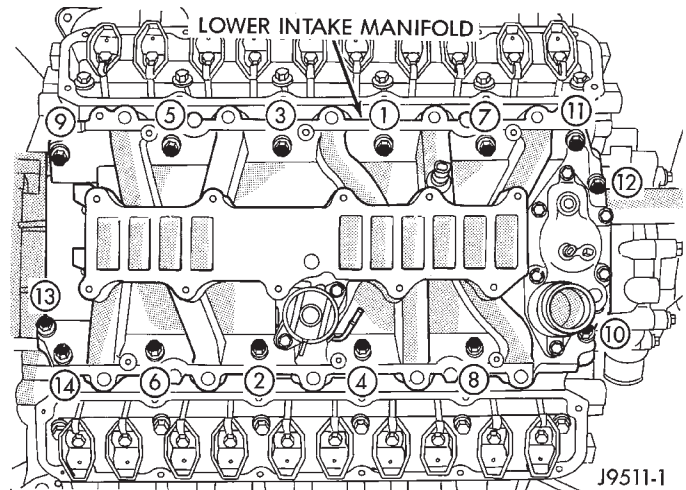
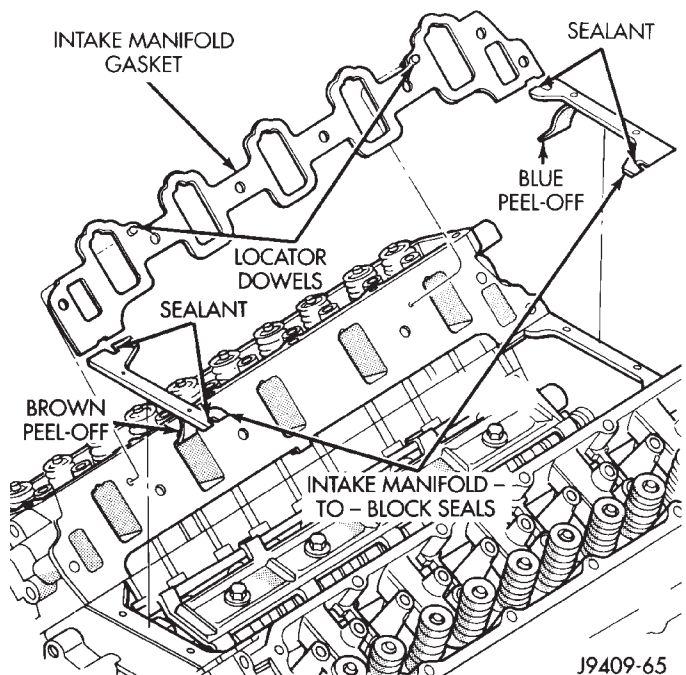
(13) Remove the throttle body bolts and lift the throttle body off the upper intake manifold (Fig. 16). Discard the gasket.

(14) Remove upper intake manifold bolts.

(15) Lift the upper intake manifold out of the engine compartment (Fig. 16). Discard the gasket.

(16) Remove the lower intake manifold bolts and remove the manifold (Fig. 17).

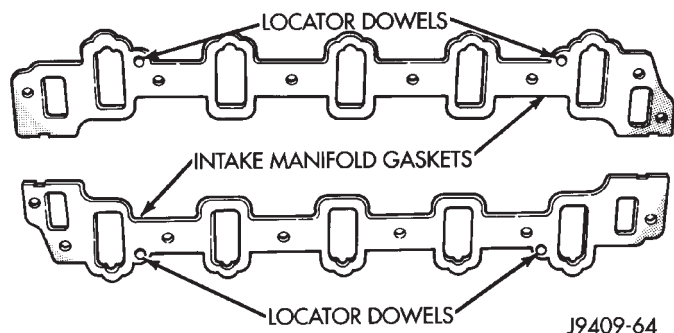
(17) Discard the lower intake manifold gaskets (Fig. 18).

**Fig. 16 Upper Intake Manifold and Throttle Body****Fig. 17 Lower Intake Manifold****Fig. 18 Lower Intake Manifold Gaskets**

## REMOVAL AND INSTALLATION (Continued)

## INSTALLATION

(1) Install the intake manifold side gaskets. Be sure that the locator dowels are positioned in the head (Fig. 19).



**Fig. 19 Intake Manifold Flange Gasket Alignment**

(2) Peel off the protective paper (blue - rear and brown - front) and press firmly onto the block (Fig. 18). **BE SURE THE BLOCK IS OIL FREE.** Aligning slots in end seals with notches in intake manifold gaskets.

(3) Insert Mopar® Silicone Rubber Adhesive Sealant, or equivalent, into the four corner pockets (Fig. 18). **Fill the pocket, but DO NOT overfill.**

(4) The lower intake manifold **MUST** be installed within 3 minutes of sealant application. Carefully lower intake manifold into position on the cylinder block and heads. After intake manifold is in place, inspect to make sure seals and gaskets are in place. Finger start all the lower intake bolts.

(5) Tighten the lower intake manifold bolts in sequence to 54 N·m (40 ft. lbs.) torque (Fig. 17).

(6) Using a new gasket, position the upper intake manifold onto the lower intake manifold.

(7) Finger start all bolts, alternate one side to the other.

(8) Tighten upper intake manifold bolts in sequence to 22 N·m (16 ft. lbs.) torque (Fig. 16).

(9) Using a new gasket, install the throttle body onto the upper intake manifold. Tighten the bolts to 23 N·m (200 in. lbs.) torque.

(10) Install closed crankcase ventilation and evaporation control systems.

(11) Connect the heater hoses and bypass hose.

(12) Connect the vacuum lines.

(13) Install the coil assemblies and the ignition cables.

(14) Connect the accelerator linkage and if so equipped, the speed control and transmission kick-down cables.

(15) Install the fuel lines.

(16) Using a new gasket, install the air cleaner housing. Tighten the nuts to 11 N·m (96 in. lbs.) torque. Install the air cleaner filter and cover.

(17) Install the A/C compressor. Position the compressor brace and install the bolts. Tighten the brace bolts to 41 N·m (30 ft. lbs.) torque.

(18) Install the generator. Position the generator brace and install the bolts. Tighten the brace bolts to 41 N·m (30 ft. lbs.) torque.

(19) Install the accessory drive belt (refer to Group 7, Cooling System).

(20) Fill cooling system (refer to Group 7, Cooling System for the proper procedure).

(21) Connect the negative cable to the battery.

## ENGINE EXHAUST MANIFOLD—V-6 and V-8 ENGINES

## REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Raise and support the vehicle.

(3) Remove the bolts and nuts attaching the exhaust pipe to the engine exhaust manifold.

(4) Lower the vehicle.

(5) Remove the exhaust heat shields.

(6) Remove bolts, nuts and washers attaching manifold to cylinder head.

(7) Remove manifold from the cylinder head.

## INSTALLATION

**CAUTION:** If the studs came out with the nuts when removing the engine exhaust manifold, install new studs. Apply sealer on the coarse thread ends. Water leaks may develop at the studs if this precaution is not taken.

(1) Position the engine exhaust manifolds on the two studs located on the cylinder head. Install conical washers and nuts on these studs (Fig. 20) (Fig. 21).

(2) Install two bolts and conical washers at the inner ends of the engine exhaust manifold outboard arms. Install two bolts **WITHOUT** washers on the center arm of engine exhaust manifold (Fig. 20) (Fig. 21). Starting at the center arm and working outward, tighten the bolts and nuts to 34 N·m (25 ft. lbs.) torque.

(3) Install the exhaust heat shields.

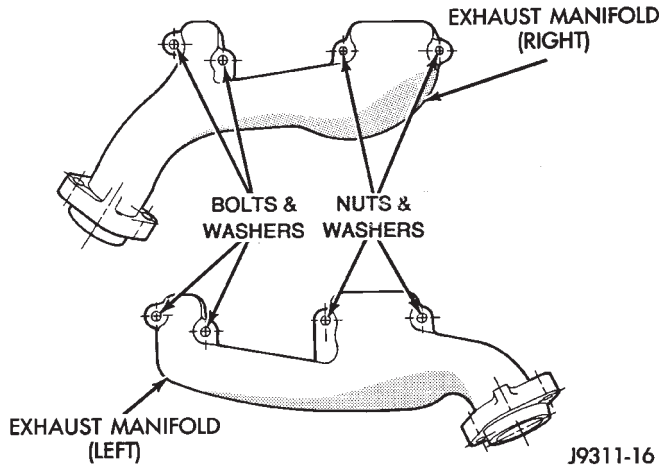
(4) Raise and support the vehicle.

(5) Assemble exhaust pipe to manifold and secure with bolts, nuts and retainers. Tighten the bolts and nuts to 34 N·m (25 ft. lbs.) torque.

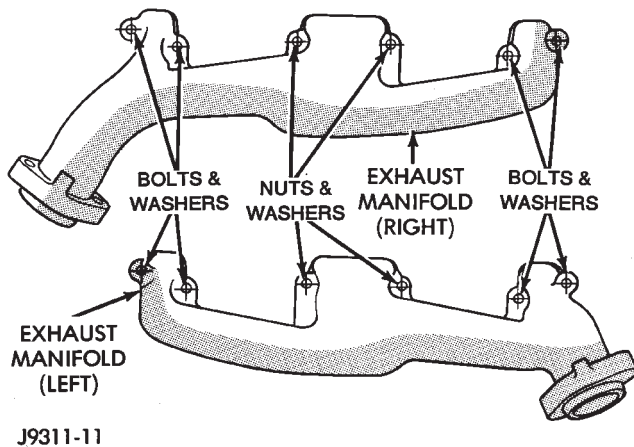
(6) Lower the vehicle.

(7) Connect the negative cable to the battery.

## REMOVAL AND INSTALLATION (Continued)



**Fig. 20 Engine Exhaust Manifold Installation—3.9L Engine**



**Fig. 21 Engine Exhaust Manifold Installation—5.2L/5.9L Engines**

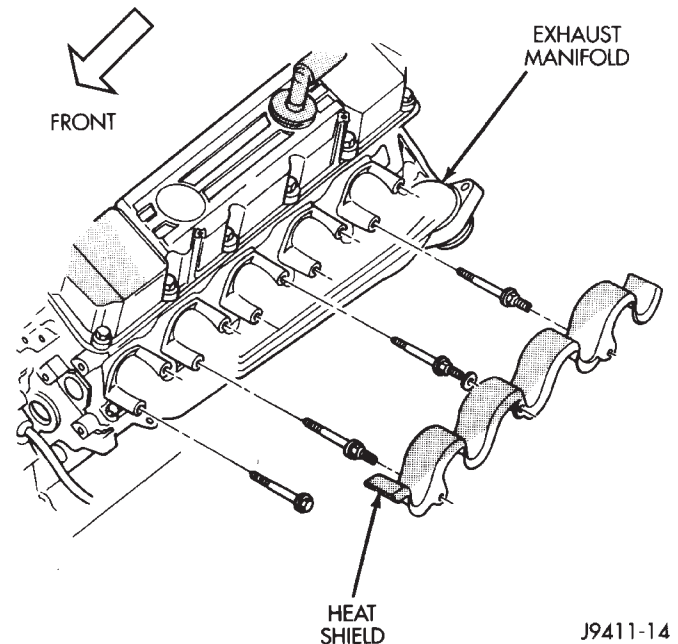
## EXHAUST MANIFOLD V-10

## REMOVAL

- (1) Disconnect the negative cable from the battery.
- (2) Raise and support the vehicle.
- (3) Remove the bolts and nuts attaching the exhaust pipe to the engine exhaust manifold.
- (4) Lower the vehicle.
- (5) Remove the exhaust heat shields (Fig. 22).
- (6) Right exhaust manifold and discard the gasket.
- (7) Right exhaust manifold—Remove the dipstick bracket from the manifold.
- (8) Remove bolts attaching manifold to cylinder head.
- (9) Remove manifold from the cylinder head. Discard the gasket.

## INSTALLATION

- (1) Using a new gasket position the engine exhaust manifold onto the cylinder head. Install bolts



**Fig. 22 8.0L Engine Exhaust Manifold—Typical**

and stud bolts in the proper position. (Fig. 22) Tighten the bolts to 22 N·m (16 ft. lbs.) torque.

- (2) Right exhaust manifold—Install the dipstick bracket to the manifold.

(3) Position washers and exhaust heat shields onto the manifold stud bolts (Fig. 22). Be sure the tabs on the heat shields are hooked over the top of the exhaust gasket. Install the nuts and tighten to 20 N·m (175 in. lbs.) torque.

- (4) Raise and support the vehicle.

(5) Assemble exhaust pipe to manifold and secure with bolts. Tighten the bolts to 34 N·m (25 ft. lbs.) torque.

- (6) Lower the vehicle.

- (7) Connect the negative cable to the battery.

## EXHAUST PIPE—DIESEL

## REMOVAL

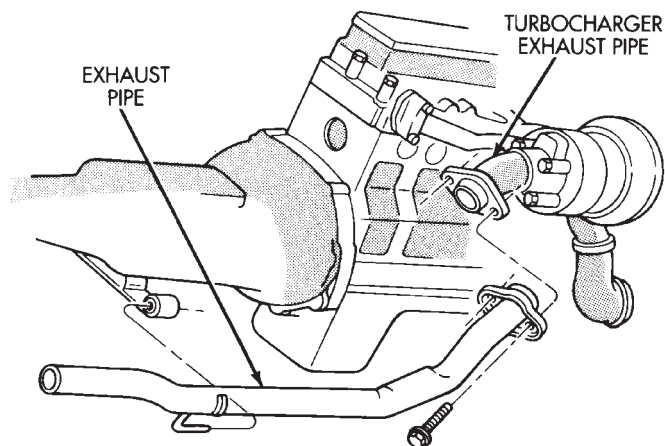
- (1) Raise and support the vehicle on a hoist.
- (2) Saturate the bolts and nuts with heat valve lubricant. Allow 5 minutes for penetration.
- (3) Remove the bolts and nuts from the exhaust pipe to turbocharger exhaust pipe (Fig. 23).
- (4) Remove the clamp nuts.
- (5) Disconnect the exhaust pipe support hanger.

## INSTALLATION

- (1) Connect the exhaust pipe support hangers.
- (2) Align the exhaust pipe with the turbocharger exhaust pipe and the catalytic converter. Install the bolts and nuts. Tighten the nuts to 34 N·m (25 ft. lbs.) torque.



## REMOVAL AND INSTALLATION (Continued)



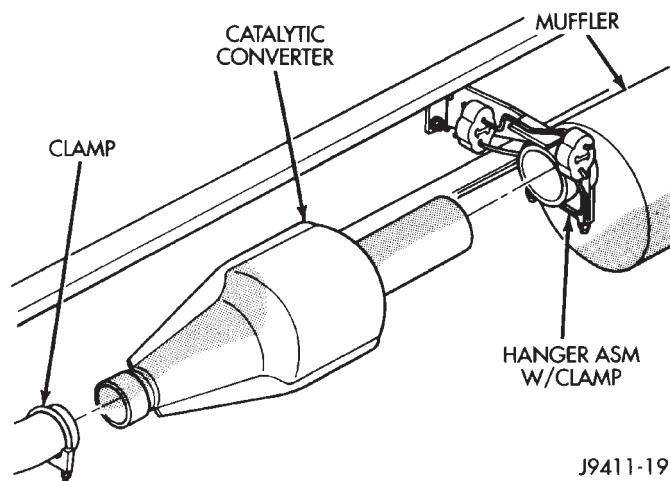
J9411-18

**Fig. 23 Exhaust Pipe Mounting**

- (3) Tighten the clamp nuts to 54 N·m (40 ft. lbs.) torque.
- (4) Install the exhaust pipe support clamps and nuts. Tighten the nuts to 54 N·m (40 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.

**CATALYTIC CONVERTER—DIESEL****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. 24).
- (4) Remove the catalytic converter.



J9411-19

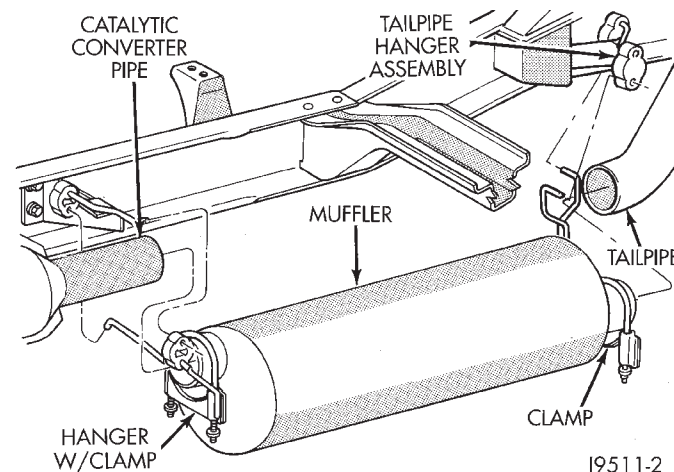
**Fig. 24 Catalytic Converter****INSTALLATION**

- (1) Assemble converter and clamps loosely to permit proper clearance with exhaust heat shields and underbody parts.

- (2) Tighten all clamp nuts to 43 N·m (32 ft. lbs.) torque.
- (3) Lower the vehicle.
- (4) Start the engine and inspect for exhaust leaks and exhaust system contact with the body panels. Adjust the alignment, if needed.

**MUFFLER—DIESEL****REMOVAL**

- (1) Raise and support the vehicle.
- (2) Remove the clamps and nuts.
- (3) Disconnect the support hanger (Fig. 25).
- (4) Remove the muffler.



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**Fig. 25 Muffler****INSTALLATION**

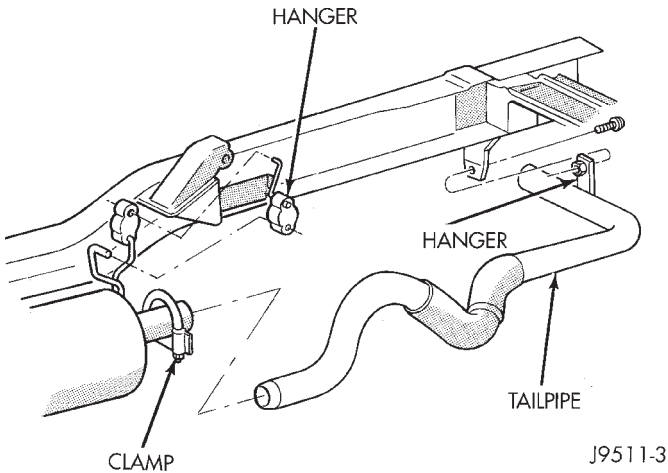
- (1) Connect the support hanger.
- (2) Install the clamps and nuts. Tighten the nuts to 43 N·m (32 ft. lbs.) torque.
- (3) Lower the vehicle.
- (4) Start the engine and inspect for exhaust leaks and exhaust system contact with the body panels. Adjust the alignment, if needed.

**EXHAUST TAILPIPE—DIESEL****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 (Fig. 26). If used, disconnect the extension pipe support hanger (Fig. 25).
- (4) Remove clamps and nuts (Fig. 26).
- (5) Remove the exhaust tailpipe and extension pipe, if used.



## REMOVAL AND INSTALLATION (Continued)

**Fig. 26 Exhaust Tailpipe HD****INSTALLATION**

(1) Loosely assemble exhaust tailpipe and extension pipe, if used, to permit proper alignment of all parts.

(2) Connect the support hangers.

(3) Position the exhaust tailpipe and extension pipe, if used, for proper clearance with the underbody parts.

(4) Tighten all clamp nuts to 43 N·m (32 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.

**HEAT SHIELDS—DIESEL****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.

(3) Lower the vehicle.

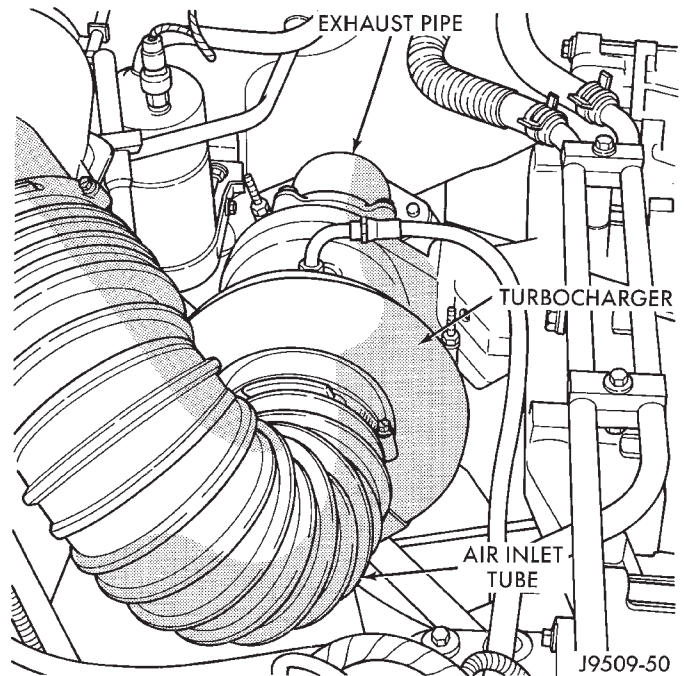
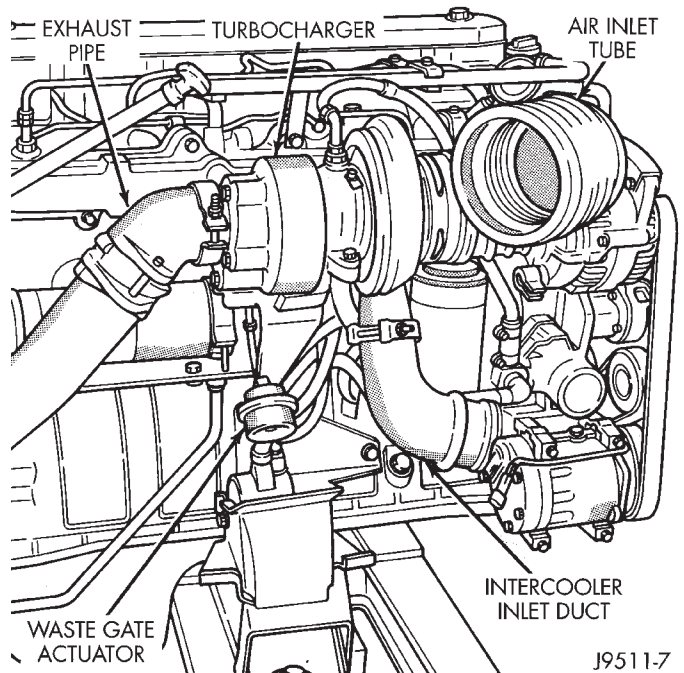
**EXHAUST MANIFOLD—DIESEL****REMOVAL**

(1) Disconnect the air intake and exhaust pipes (Fig. 27).

(2) Disconnect the turbocharger oil supply line and the oil drain tube from the turbocharger (Fig. 28).

(3) Disconnect the charge air cooler (Intercooler) inlet duct from the turbocharger (Fig. 28).

(4) Remove the turbocharger and gasket.

**Fig. 27 Air Intake Pipe, Exhaust Pipe and Turbocharger****Fig. 28 Oil Supply Line and Charge Air Cooler (Intercooler) Inlet Duct**

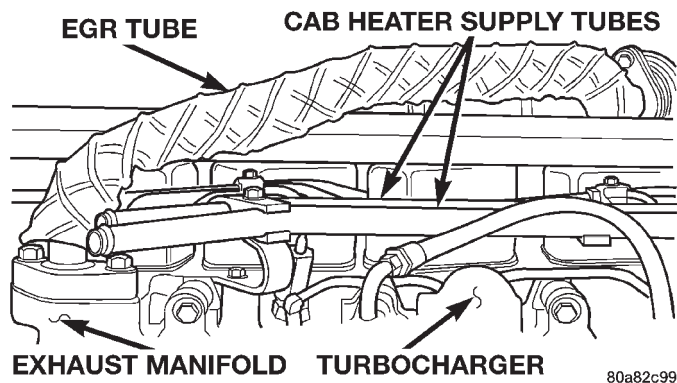
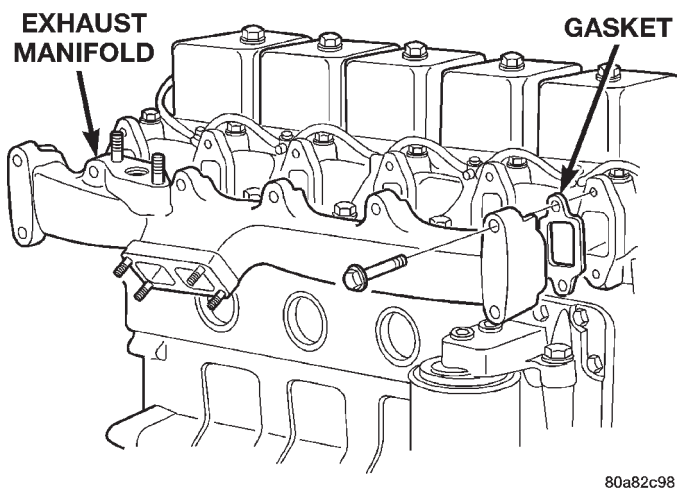
(5) Remove EGR tube (Fig. 29).

(6) Remove the cab heater supply and return lines.

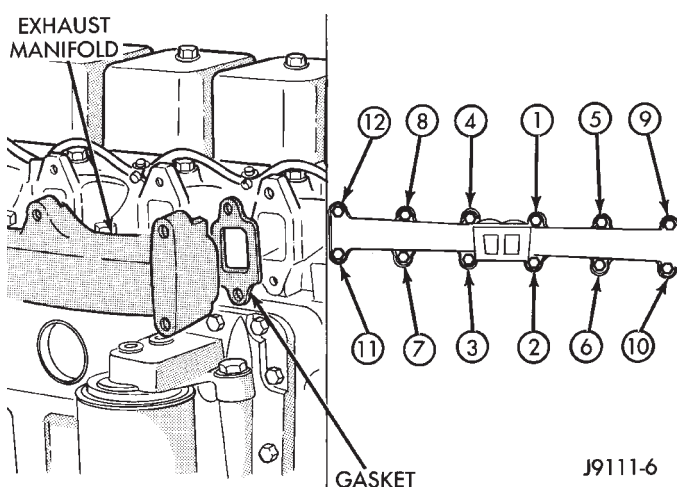
(7) Remove the engine exhaust manifold and gaskets (Fig. 30).

(8) Clean the sealing surfaces.

## REMOVAL AND INSTALLATION (Continued)

**Fig. 29 EGR TUBE****Fig. 30 Engine Exhaust Manifold and Gaskets****INSTALLATION**

(1) Install the engine exhaust manifold and gaskets use anti-seize on capscrews. Tighten the exhaust manifold bolts in sequence to 43 N·m (32 ft. lbs.) torque (Fig. 31).

**Fig. 31 Engine Exhaust Manifold Bolt Tightening Sequence**

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

(3) Position the charge air cooler (intercooler) inlet duct to the turbocharger. With the clamp in position, tighten the clamp nut to 8 N·m (72 in. lbs.) torque.

(4) Position the air intake pipe and the exhaust pipe onto the turbocharger. Tighten the clamps to 8 N·m (74 in. lbs.) torque.

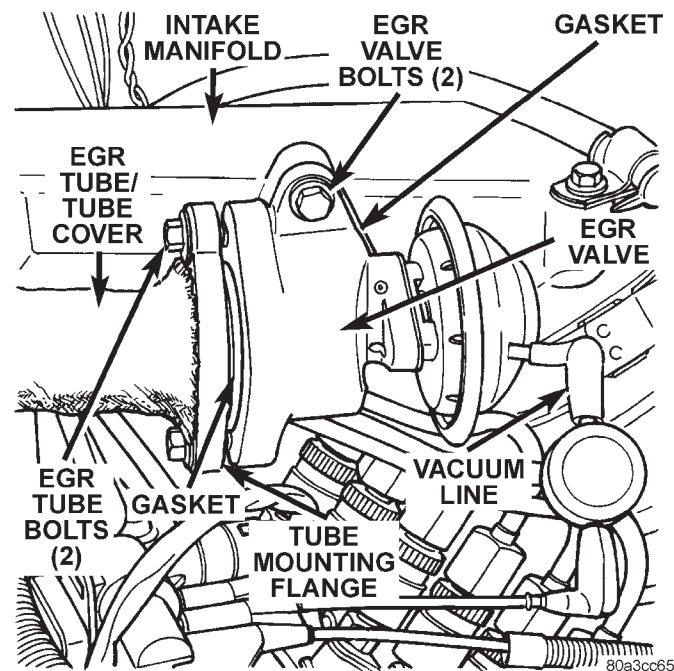
(5) Install the oil drain tube and oil supply line to the turbocharger. Tighten the drain tube bolts to 24 N·m (18 ft. lbs.) torque. Tighten the oil supply line fitting nut to 15 N·m (11 ft. lbs.) torque.

(6) Connect the cab heater supply and return lines. Tighten the line nuts to 24 N·m (18 ft. lbs.) torque.

(7) Install the EGR tube and start fasteners by hand.

(8) Tighten all bolts/nuts to 24 N·m (212 in. lbs.) torque. **When tightening bolts at EGR valve end of tube, alternate between the upper and lower bolt to allow face of EGR valve to remain square to tube mounting flange on EGR tube (Fig. 32).**

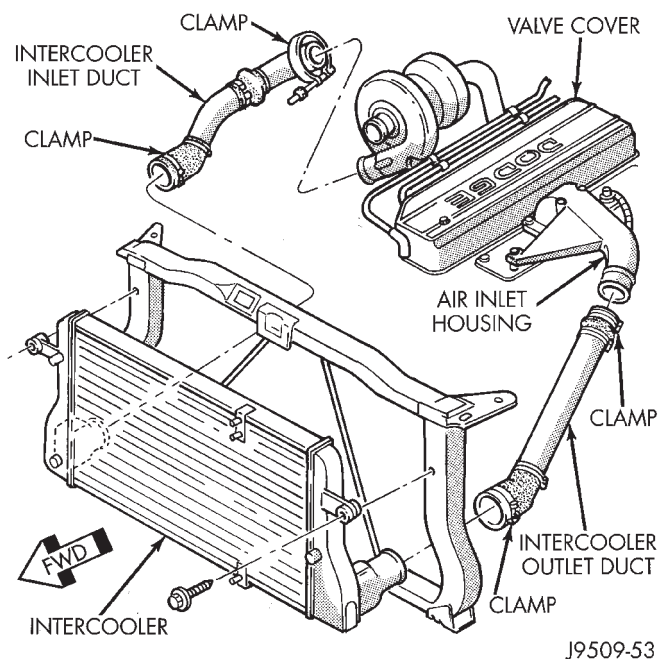
(9) Operate the engine to check for leaks.

**Fig. 32 EGR Tube Connection at Valve**  
**INTAKE MANIFOLD COVER—AIR INTAKE HEATER (DIESEL)****REMOVAL**

(1) Disconnect both negative battery cables.

(2) Remove the charge air cooler (intercooler) outlet duct from the air inlet housing (Fig. 33).

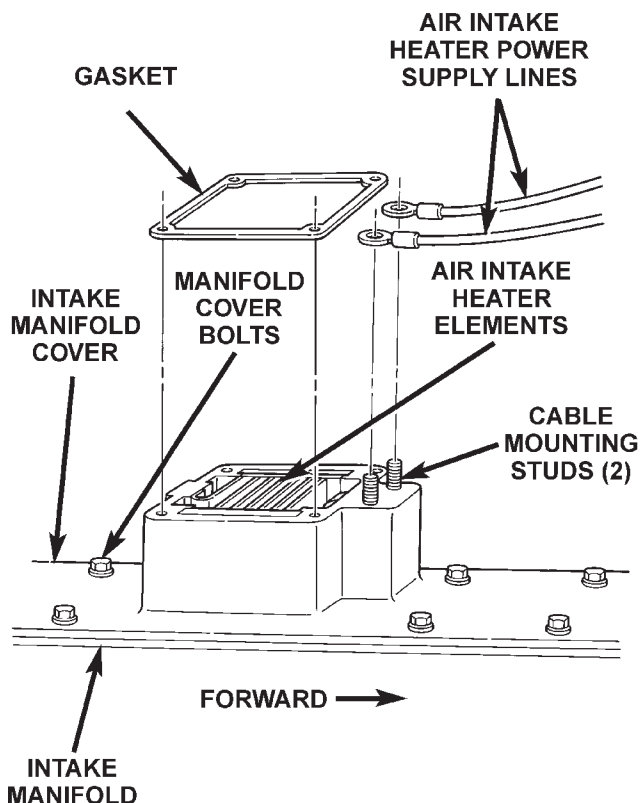
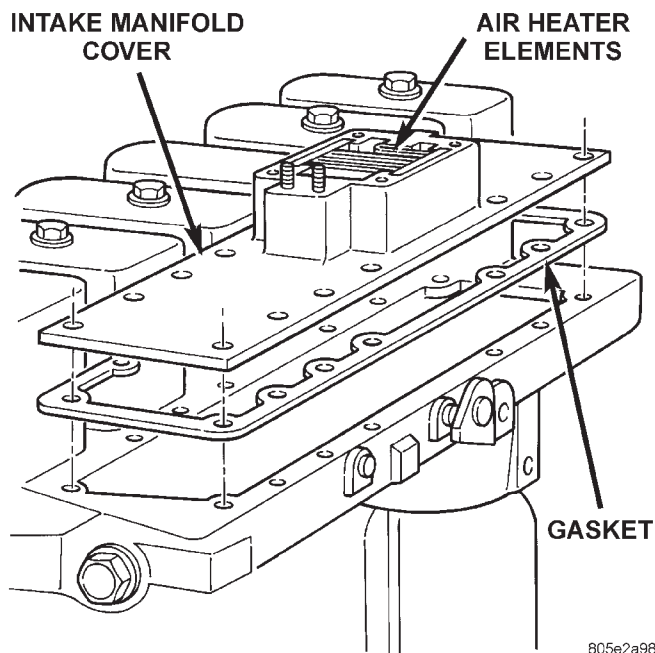
## REMOVAL AND INSTALLATION (Continued)

**Fig. 33 Intercooler Outlet Duct**

- (3) Remove the valve cover name plate.
- (4) Remove air inlet housing.
- (5) Remove the EGR tube (Refer to Group 25, Emission Control Systems for proper procedures).
- (6) Remove the high pressure fuel lines as an assembly (refer to Group 14, Fuel System for proper procedures).
- (7) Disconnect the air intake heater power supply lines (Fig. 34).
- (8) Disconnect the charge air temperature sensor connector.
- (9) Remove the manifold intake cover and gasket (Fig. 35). Keep the gasket material and any other material out of the air intake.
- (10) Clean the sealing surface.

**INSTALLATION**

- (1) Using a new gasket, install the intake manifold cover.
- (2) Some of the intake manifold bolt holes are drilled through and must be sealed. Apply liquid teflon sealant to the bolts. Install the intake manifold cover bolts. Tighten the bolts to 24 N·m (18 ft. lbs.) torque.
- (3) Connect the charge air temperature connector to the sensor.
- (4) Install a new gasket on top of the air intake heater.
- (5) Install the air inlet housing. Tighten the air inlet housing bolts to 24 N·m (18 ft. lbs.) torque.
- (6) Install and tighten the air intake heater power supply nuts to 14 N·m (10 ft. lbs.) torque.

**Fig. 34 Air Intake Heater****Fig. 35 Manifold Intake Cover**

- (7) Position the charge air cooler (intercooler) outlet duct onto the air inlet housing. Tighten the charge air cooler (intercooler) outlet duct clamps to 8 N·m (74 in. lbs.) torque.
- (8) Install and bleed the high pressure fuel lines (Refer to Group 14, Fuel System for proper procedure).



## REMOVAL AND INSTALLATION (Continued)

dures). Tighten the high pressure fuel line nuts to 24 N·m (18 ft. lbs.) torque.

(9) Install the valve cover name plate.

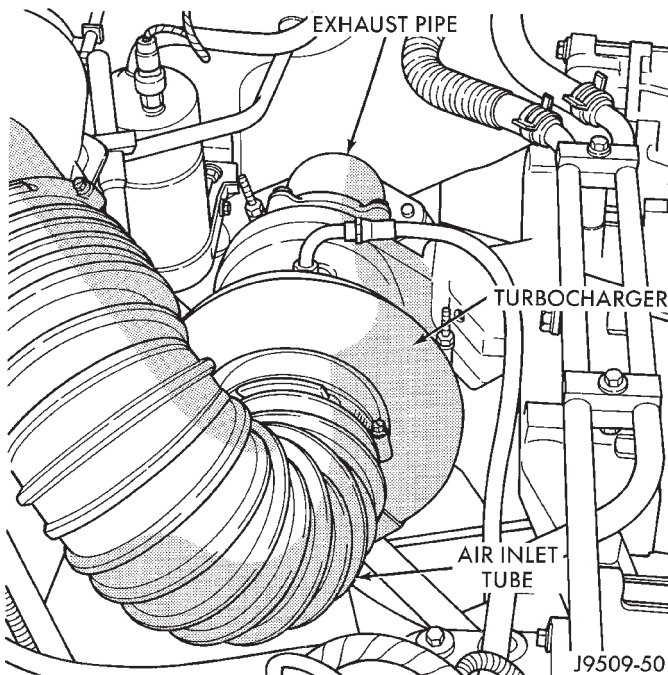
(10) Install the EGR tube. Tighten all bolts/nuts to 24 N·m (212 in. lbs.) torque. **When tightening bolts at EGR valve end of tube, alternate between the upper and lower bolt to allow face of EGR valve to remain square to the mounting flange on the EGR tube.**

(11) Connect both negative battery cables.

## TURBOCHARGER

## REMOVAL

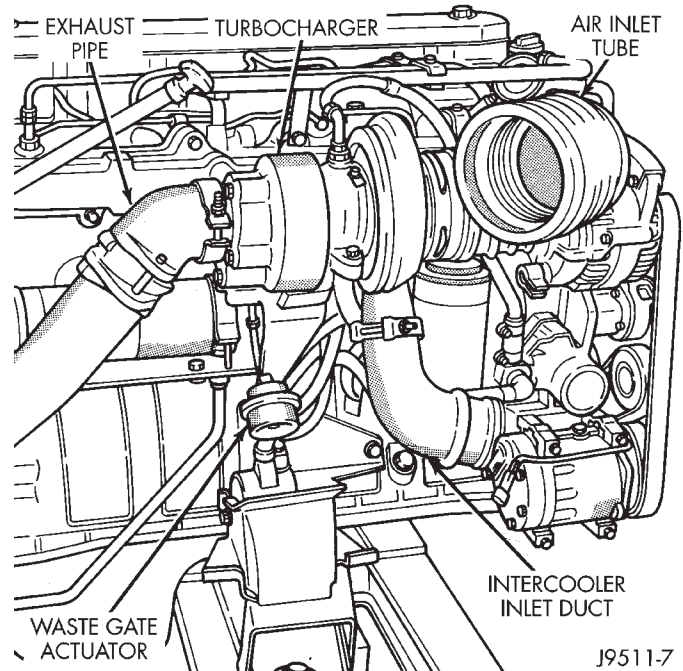
- (1) Disconnect the negative cable from the battery.
- (2) Disconnect the air intake pipe and exhaust pipe (Fig. 36).



**Fig. 36 Air Intake Pipe, Exhaust Pipe and Turbocharger**

- (3) Remove the oil drain tube bolts.
- (4) Remove the oil supply line.
- (5) Disconnect the charge air cooler (intercooler) inlet duct from the turbocharger (Fig. 37).
- (6) Remove the turbocharger mounting nuts and the turbocharger.
- (7) If the turbocharger is not to be installed immediately, cover the opening to prevent material from entering into the manifold.
- (8) Clean and inspect the sealing surface.

**CAUTION:** The turbocharger is a precision piece of equipment and should only be repaired by an authorized facility. Disassembly is not recommended, as engine/turbo failure could result.



**Fig. 37 Air Cooler (Intercooler) Inlet Duct**

## INSTALLATION

- (1) Install a new gasket and apply anti-seize compound to the mounting studs.
- (2) Install the turbocharger. Tighten the turbocharger mounting nuts to 32 N·m (24 ft. lbs.) torque.
- (3) Use a new gasket and connect the drain line. Tighten the drain line connection bolts to 24 N·m (18 ft. lbs.) torque.
- (4) New turbocharger must be pre-lubricated with clean engine lubricating oil before start up. Pour 50-60 cc (2-3 ounces) of oil into supply fitting.

**WARNING: DO NOT USE YOUR FINGER TO TURN THE TURBINE WHEEL.**

- (5) Rotate the turbine wheel to allow oil to enter the turbocharger.
- (6) Install the oil supply line. Tighten the oil supply line fitting nut to 15 N·m (11 ft. lbs.) torque.
- (7) Position the Charge air cooler (intercooler) inlet duct to the turbocharger. With the clamp in position, tighten the clamp nut to 8 N·m (72 in. lbs.) torque.
- (8) Position the air intake pipe and the exhaust pipe onto the turbocharger. Tighten the clamps to 8 N·m (72 in. lbs.) torque.
- (9) Connect the negative cable to the battery.
- (10) Operate the engine and check for leaks.

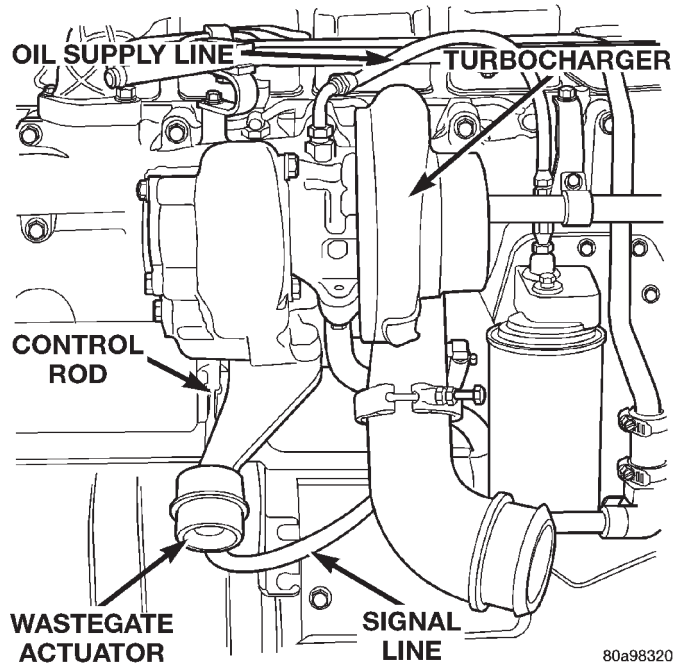
## WASTEGATE ADJUSTMENT

The wastegate turbocharger provides additional low speed boost without over-boost at high speeds. This increases low speed torque and better driveability.



## REMOVAL AND INSTALLATION (Continued)

Proper adjustment of the wastegate assembly is critical to the operation of the wastegate turbocharger (Fig. 38). The control rod is set at the factory and no adjustment should be necessary, unless wastegate assembly is damaged.



**Fig. 38 Wastegate Turbocharger**

**CAUTION:** DO NOT adjust the wastegate so that higher pressures are required to open the wastegate valve. The turbocharger speed will be increased and can cause damage to the turbocharger and cause a loss of engine performance.

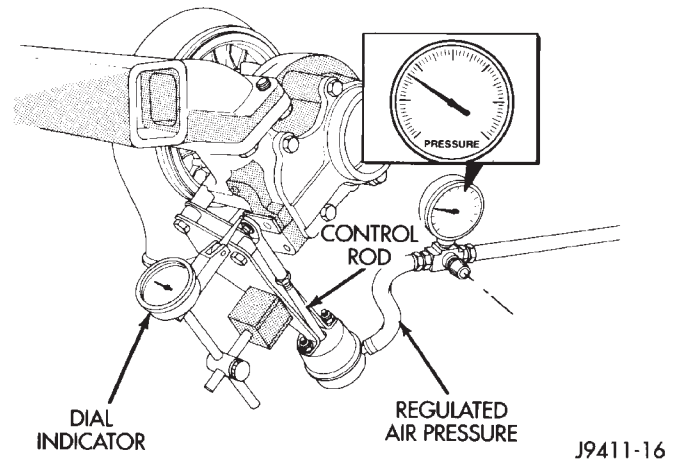
(1) Disconnect signal line from wastegate actuator. **The signal line may be installed with tamper-proof clamps. These can be discarded and replaced with standard worm-gear clamps.**

(2) Connect regulated air pressure to the wastegate actuator (Fig. 39). Install a dial indicator to measure the control rod movement. Apply 103 - 138 kPa (15 - 20 psi) to seat the components and take any slack out of the control rod. Release the air pressure and zero the dial indicator gauge.

(3) Apply 193 kPa (28 psi) air pressure to the actuator. The control rod should move 0.33 - 1.33 mm (0.013 - 0.052 in) total travel. If the rod travel is out of limits, the wastegate linkage must be adjusted.

(4) To adjust the wastegate linkage, apply air pressure to the actuator to release the spring tension on the lever. Remove the control rod from the wastegate lever (Fig. 40). Pull the wastegate lever toward the actuator (closed position).

(5) Adjust the length of the clevis end of the control rod to align the clevis pin hole to the wastegate



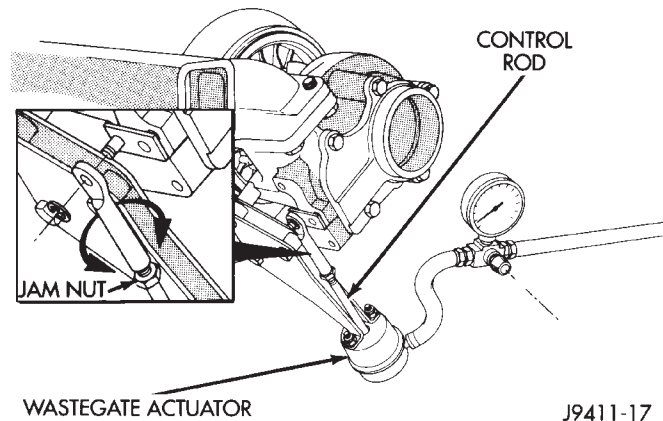
**Fig. 39 Wastegate and Dial Indicator**

lever. Install the adjusting link and retaining clip (Fig. 40).

**CAUTION:** DO NOT pull, push or force the alignment of the clevis pin.

(6) After the adjustment is complete, tighten the actuator rod jam nut.

(7) Recheck the travel on the wastegate control rod. Adjust, if necessary.



**Fig. 40 Adjustment of Wastegate Actuator**

## CHARGE AIR COOLER—DIESEL

### REMOVAL

**WARNING:** IF THE ENGINE WAS JUST TURNED OFF, THE INTAKE AND OUTLET DUCTS MAY BE HOT.

(1) Remove the front bumper (refer to Group 23, Body for the proper procedure).

(2) Remove the front support bracket (Fig. 41).

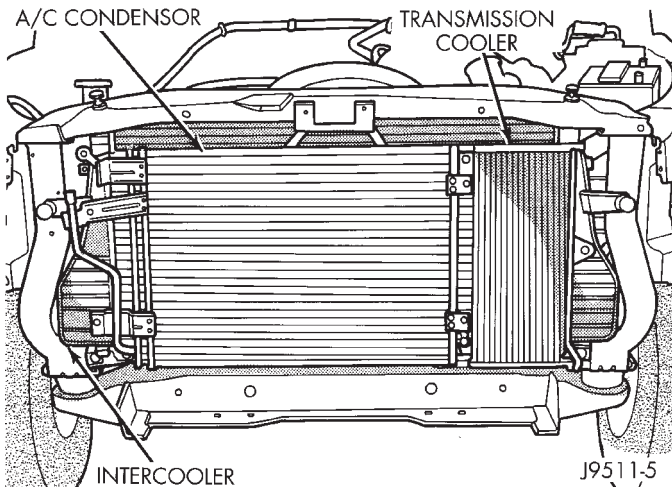
(3) If the vehicle is equipped with air conditioning, remove the condenser as follows:

## REMOVAL AND INSTALLATION (Continued)

(a) Discharge the air conditioning system (refer to Group 24, Heating and Air Conditioning for the proper procedures).

(b) Remove the bolt from the sealing plate.

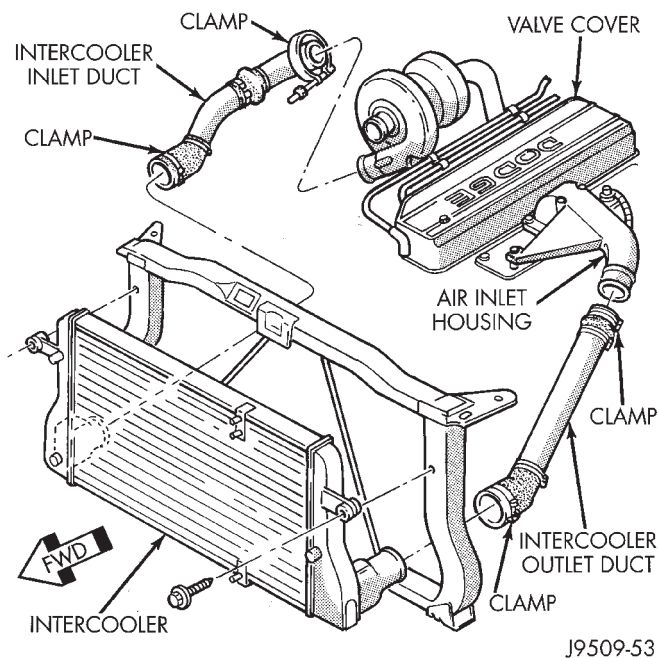
(c) Remove the nuts holding the condenser to the charge air cooler. Lift the condenser and sealing plate assembly away from the charge air cooler.



**Fig. 41 Condenser and Charge Air Cooler—Intercooler**

(4) Remove the inlet and outlet ducts from the charge air cooler (Fig. 42).

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



**Fig. 42 Charge Air Cooler Intercooler Ducts**

## INSTALLATION

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

(2) Install the inlet and outlet ducts to the charge air cooler. With the clamps in position, tighten the clamp nut to 8 N·m (72 in. lbs.) torque.

(3) If the vehicle is equipped with air conditioning, install the condenser as follows:

(a) Position the condenser and sealing plate assembly onto the charge air cooler studs. Install the nuts and tighten.

(b) Connect the halves of the sealing plate. Install the bolt and tighten.

(c) Charge the air conditioning system (refer to Group 24, Heating and Air Conditioning for the proper procedures).

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

(5) Install the front bumper (refer to Group 23, Body for the proper procedure).

## CLEANING AND INSPECTION

## 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.

## CLEANING

Clean ends of pipes to assure mating of all parts.

## INTAKE MANIFOLD

## CLEANING INTAKE

Clean manifold in solvent and blow dry with compressed air.

Clean cylinder block front and rear gasket surfaces using a suitable solvent.

The plenum pan rail must be clean and dry (free of all foreign material).

## INSPECTION

Inspect manifold for cracks.

Inspect mating surfaces of manifold for flatness with a straightedge.

## EXHAUST MANIFOLD

## CLEANING

Clean mating surfaces on cylinder head and manifold. Wash with solvent and blow dry with compressed air.

## CLEANING AND INSPECTION (Continued)

## INSPECTION

Inspect manifold for cracks.

Inspect mating surfaces of manifold for flatness with a straight edge. Gasket surfaces must be flat within 0.2 mm per 300 mm (0.008 inch per foot).

## CHARGE AIR COOLER

## CLEANING

If the engine experiences a turbocharger failure or any other occasion where oil or debris is put into the charge air cooler, the charge air cooler must be cleaned.

(1) Remove the charge air cooler from the vehicle, refer Charge Air Cooler in this section.

(2) Flush the charge air cooler internally with a non caustic solvent in the opposite direction of normal air flow. Shake the charge air cooler and **LIGHTLY** tap on the end tanks with a rubber mallet to dislodge trapped debris. Continue flushing until all debris or oil is removed.

(3) Use a flashlight and mirror to visually inspect the charge air cooler for internal debris.

**CAUTION:** If internal debris cannot be removed, scrap the charge air cooler. **DO NOT USE CAUSTIC CLEANERS TO CLEAN THE CHARGE AIR COOLER. DAMAGE TO THE CHARGE AIR COOLER WILL RESULT.**

(4) After the charge air cooler has been thoroughly cleaned of all oil and debris with the non caustic solvent, wash the charge air cooler internally with hot soapy water to remove the remaining solvent.

(5) Rinse thoroughly with clean water.

(6) Blow compressed air into the charge air cooler in the opposite direction of normal air flow until the charge air cooler is dry internally.

## INSPECTION

(1) Visually inspect the charge air cooler

(2) Inspect the tubes, fins and welds for tears, breaks or other damage. If any damage causes the charge air cooler to fail, the charge air cooler must be replaced.

## 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.

**WARNING: UNLEADED FUEL MUST BE USED TO PREVENT BLOCKAGE OR CONTAMINATION TO THE CATALYST CORE.**

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

## CLEANING

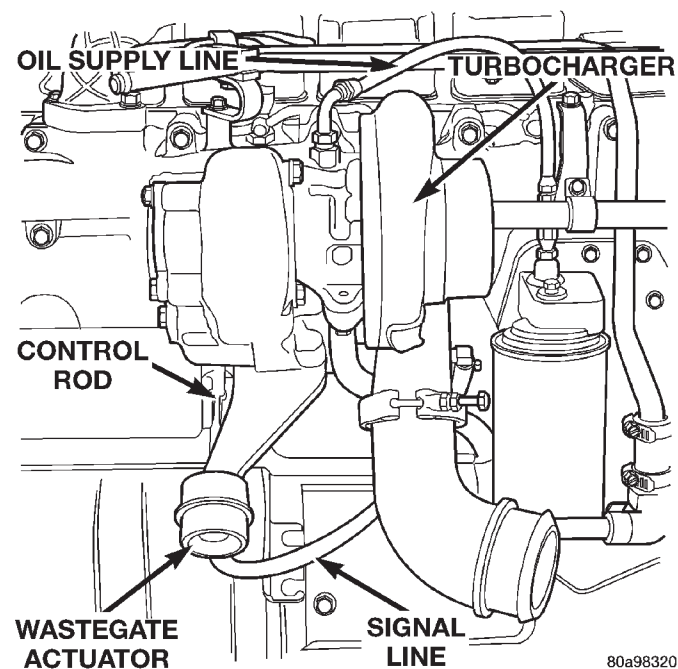
Clean ends of pipes and muffler to assure a good seal at mating surfaces.

## ADJUSTMENTS

## WASTEGATE ADJUSTMENT

The wastegate turbocharger provides additional low speed boost without over-boost at high speeds. This increases low speed torque and better driveability.

Proper adjustment of the wastegate assembly is critical to the operation of the wastegate turbocharger (Fig. 43). The control rod is set at the factory and no adjustment should be necessary, unless wastegate assembly is damaged.



**Fig. 43 Wastegate Turbocharger**

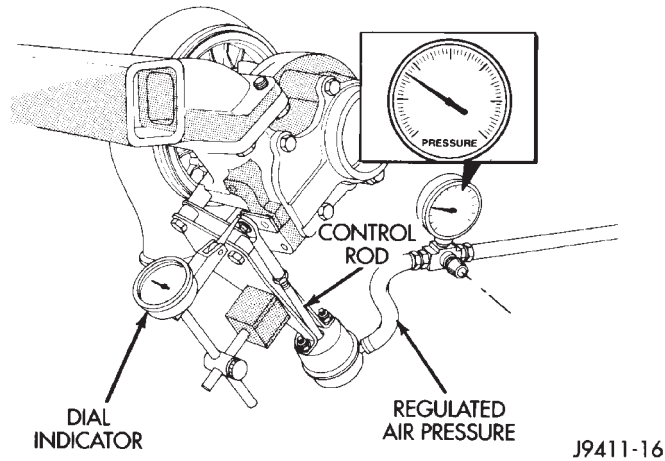
**CAUTION:** **DO NOT** adjust the wastegate so that higher pressures are required to open the wastegate valve. The turbocharger speed will be increased and can cause damage to the turbocharger and cause a loss of engine performance.

(1) Remove signal line from wastegate actuator. **The signal line may be installed with tamper-proof clamps. These can be discarded and replaced with standard worm-gear clamps.**

(2) Connect regulated air pressure to the wastegate actuator (Fig. 44). Install a dial indicator to

## ADJUSTMENTS (Continued)

measure the control rod movement. Apply 103 - 138 kPa (15 - 20 psi) to seat the components and take any slack out of the control rod. Release the air pressure and zero the dial indicator gauge.



**Fig. 44 Wastegate and Dial Indicator**

(3) Apply air pressure to the actuator:

- Manual Trans 193 kPa (28 psi)
- Auto Trans 144.7 kPa (21 psi)
- CARB 158.5 kPa (23 psi)

The control rod should move 0.33 - 1.33 mm (0.013 - 0.052 in) total travel. If the rod travel is out of limits, the wastegate linkage must be adjusted.

(4) To adjust the wastegate linkage, apply air pressure to the actuator to release the spring tension on the lever. Remove the control rod from the wastegate lever (Fig. 45). Pull the wastegate lever toward the actuator (closed position).

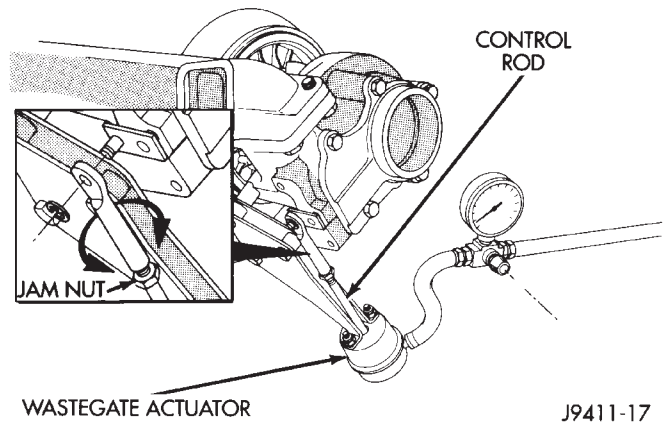
1998 BR/BR Ram Truck  
Publication No. 81-370-8108  
TSB 26-06-98 June, 1998

(5) Adjust the length of the clevis end of the control rod to align the clevis pin hole to the wastegate lever. Install the adjusting link and retaining clip (Fig. 45).

**CAUTION: DO NOT pull, push or force the alignment of the clevis pin.**

(6) After the adjustment is complete, tighten the actuator rod jam nut.

(7) Recheck the travel on the wastegate control rod. Adjust, if necessary.



**Fig. 45 Adjustment of Wastegate Actuator**



## SPECIFICATIONS

## TURBOCHARGER SPECIFICATIONS

COMPONENT	DIMENSIONS
Air Intake Restrictions . . . . .	635 mm Water (25 in. Water) Max.
Turbo Radial Clearance . . . . .	0.300–0.460 mm (0.012–0.018 inch)
Turbo Rotor Assembly End Play	
Before S/N 840638 . . . . .	0.102–0.152 mm (0.004–0.006 inch)
S/N 840638 AND AFTER . . . . .	0.026–0.076 mm (0.001–0.003 inch)

J9511-23

## TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
<b>Adjusting Strap</b>	
Bolt . . . . .	.23 N·m (200 in. lbs.)
<b>Air Heater Power Supply</b>	
Nuts . . . . .	.14 N·m (124 in. lbs.)
<b>Air Inlet Housing</b>	
Bolts . . . . .	.24 N·m (18 ft. lbs.)
<b>Cab Heater Supply/Return Line</b>	
Nuts . . . . .	.24 N·m (18 ft. lbs.)
<b>EGR Tube (Diesel)</b>	
Bolts/Nuts . . . . .	.24 N·m (212 in. lbs.)
<b>Exhaust Clamps (All)</b>	
Nuts . . . . .	.43 N·m (32 ft. lbs.)
<b>Exhaust Manifold to Cylinder Head (Diesel)</b>	
Bolts . . . . .	.43 N·m (32 ft. lbs.)
<b>Exhaust Manifold to Cylinder Head (3.9/5.2/5.9L)</b>	
Bolts . . . . .	.34 N·m (25 ft. lbs.)
<b>Exhaust Manifold to Cylinder Head (8.0L)</b>	
Bolts . . . . .	.22 N·m (195 in. lbs.)
<b>Exhaust Pipe to Manifold (All)</b>	
Bolts . . . . .	.34 N·m (25 ft. lbs.)

DESCRIPTION	TORQUE
<b>Fuel Line</b>	
Nuts . . . . .	.24 N·m (18 ft. lbs.)
<b>Generator Mounting</b>	
Bolts . . . . .	.41 N·m (30 ft. lbs.)
<b>Intake Manifold (3.9/5.2/5.9L)</b>	
Bolts . . . . .	Refer to procedure in this section.
<b>Intake Manifold (8.0L)</b>	
Bolts . . . . .	.54 N·m (40 ft. lbs.)
<b>Intake Manifold Cover (Diesel)</b>	
Bolts . . . . .	.24 N·m (18 ft. lbs.)
<b>Intercooler Attaching</b>	
Bolts . . . . .	.2 N·m (17 in. lbs.)
<b>Intercooler Duct Clamp</b>	
Nuts . . . . .	.8 N·m (72 in. lbs.)
<b>Throttle Body (All)</b>	
Bolts . . . . .	.23 N·m (200 in. lbs.)
<b>Turbocharger Mounting</b>	
Nuts . . . . .	.32 N·m (24 ft. lbs.)
<b>Turbocharger Oil Drain Tube</b>	
Bolts . . . . .	.24 N·m (18 ft. lbs.)
<b>Turbocharger Oil Supply Line</b>	
Fitting . . . . .	.15 N·m (133 in. lbs.)
<b>Turbocharger V-Band Clamp</b>	
Nut . . . . .	.9 N·m (75 in. lbs.)

