

# EXHAUST SYSTEM AND TURBOCHARGER

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### DESCRIPTION AND OPERATION

#### EXHAUST SYSTEM

##### DESCRIPTION

The basic exhaust system consists of an engine exhaust manifold, turbocharger, exhaust down pipe, exhaust pipe, exhaust heat shield(s), muffler and exhaust tailpipe

The exhaust system uses a single muffler.

The exhaust system must be properly aligned to prevent stress, leakage and body contact. If the system contacts any body panel, it will transfer objectionable noises originating from the engine to the 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 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.**

### REMOVAL AND INSTALLATION

#### EXHAUST AND INTAKE MANIFOLD

##### REMOVAL

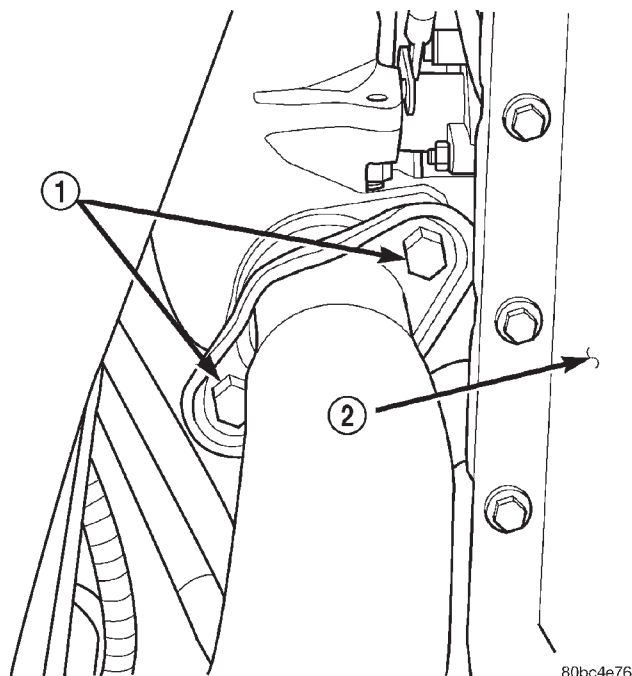
**NOTE: Both the intake and exhaust manifolds must be removed due to a single sealing gasket for both manifolds.**

- (1) Disconnect the negative battery cable.
- (2) Raise the vehicle on a hoist.

**WARNING: DO NOT LOOSEN THE RADIATOR VENT OR DRAINCOCK WITH THE SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM COOLANT CAN OCCUR.**

- (3) Drain the cooling system. Refer to Group 7, Cooling System for procedure.
- (4) Remove the exhaust system inlet pipe retaining bolts (Fig. 1).
- (5) Disconnect the turbocharger oil return hose from the turbocharger.
- (6) Lower the vehicle on the hoist.
- (7) Remove the intercooler inlet hose from the vehicle (Fig. 2).
- (8) Disconnect the breather hose from the fresh air inlet tube (Fig. 2).
- (9) Unclip the air filter cover and remove the fresh air inlet tube from the turbocharger (Fig. 2). Remove the assembly from the vehicle.

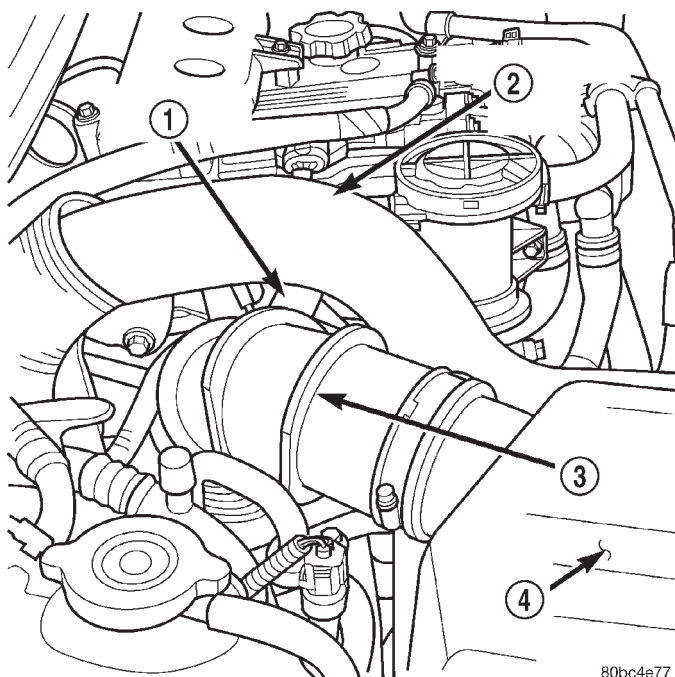
## REMOVAL AND INSTALLATION (Continued)



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**Fig. 1 Exhaust System Inlet Pipe Retaining Bolts**

- 1 - EXHAUST SYSTEM INLET PIPE RETAINING BOLTS
- 2 - ENGINE OIL PAN

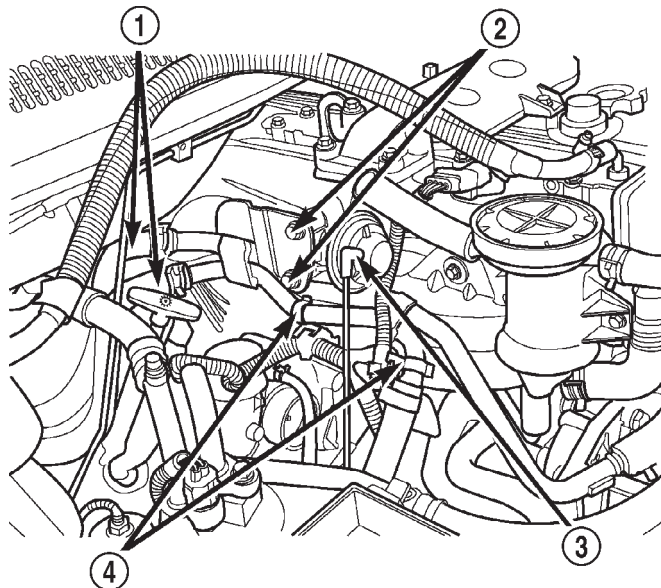


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**Fig. 2 Air Intake Hoses**

- 1 - BREATHER HOSE
- 2 - INTERCOOLER INLET HOSE
- 3 - FRESH AIR INLET TUBE
- 4 - AIR FILTER COVER

(10) Remove the EGR vacuum supply hose from the EGR valve (Fig. 3).



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**Fig. 3 Engine Compartment**

- 1 - HEATER CORE COOLANT SUPPLY HOSES
- 2 - EGR VALVE/COOLANT SUPPLY LINE BRACKET RETAINING BOLTS
- 3 - EGR VALVE VACUUM SUPPLY LINE
- 4 - WIRE HARNESS RETAINING CLIPS

(11) Disconnect the heater core coolant supply lines from the engine assembly (Fig. 3).

(12) Unclip the wire harness from the coolant supply lines (Fig. 3).

(13) Remove the (2) EGR valve / coolant supply line retaining bolts (Fig. 3).

(14) Remove the coolant supply line support bracket bolt from the water pump housing.

(15) Disconnect the two remaining hoses and remove the coolant lines from the vehicle.

(16) Remove the oil separator retaining bolts.

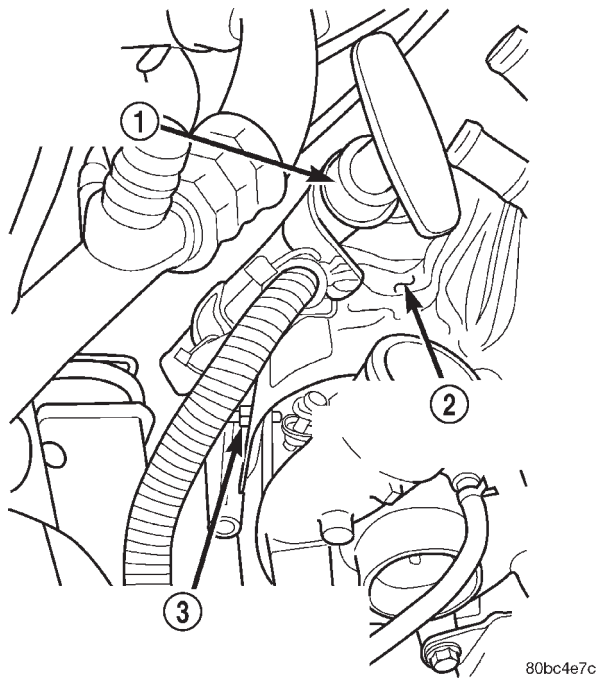
(17) Disconnect the crankcase vapor supply and return hoses and remove the oil separator from the vehicle.

(18) Remove the transmission dipstick tube support bracket nut from the turbocharger heatshield (Fig. 4).

(19) Remove the exhaust manifold / turbocharger heatshield retaining bolts and remove the heatshield from the vehicle.

(20) Pull back the EGR tube heatshield to access and remove the EGR tube nut from the exhaust manifold. Remove the EGR valve and tube assembly from the vehicle.

REMOVAL AND INSTALLATION (Continued)



**Fig. 4 Transmission Dipstick Tube Support Bracket**

- 1 - TRANSMISSION DIPSTICK TUBE
- 2 - TURBOCHARGER EXHAUST MANIFOLD HEATSHIELD
- 3 - TRANSMISSION DIPSTICK TUBE SUPPORT BRACKET RETAINING NUT

(21) Remove the oil pressure supply line banjo bolt from the turbocharger.

(22) Position a drain pan under the transmission.

(23) Remove the transmission dipstick tube from the transmission oil pan by pulling straight up. Position the tube assembly out of the way to allow for manifold / turbocharger removal.

(24) Remove the exhaust manifold retaining nuts and remove the manifold and turbocharger assembly from the vehicle (Fig. 6).

**NOTE:** If only servicing the intake manifold the following two steps are not required.

(25) Place the assembly in a vice.

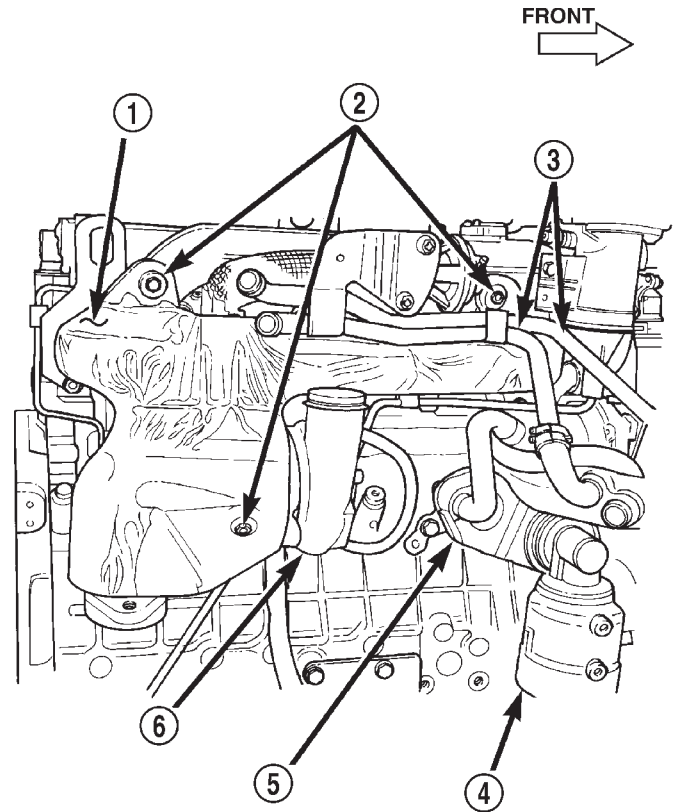
(26) Remove the (4) turbocharger to exhaust manifold retaining nuts and separate.

(27) Remove the (4) intake air duct retaining bolts from the intake manifold.

(28) Remove the remaining bolts from the intake air duct and position the duct and hose assembly out of the way.

(29) Remove the intake manifold retaining bolts and remove the intake manifold from the vehicle (Fig. 6).

(30) Remove the intake/exhaust manifold gasket from the manifolds mounting studs.



**Fig. 5 Exhaust Manifold/Turbocharger Heatshield**

- 1 - EXHAUST MANIFOLD/TURBOCHARGER HEATSHIELD
- 2 - HEATSHIELD RETAINING BOLTS
- 3 - HEATER CORE SUPPLY/RETURN LINES
- 4 - OIL FILTER HOUSING
- 5 - ENGINE OIL COOLER
- 6 - TURBOCHARGER

**CLEANING**

All old gaskets should be inspected for any tears or signs of prior leakage. If any gaskets show such indications, they should be replaced with new gaskets. All gasket mating surfaces must be cleaned of old gasket material to produce a smooth and dirt/oil free sealing surface for the new gasket.

**INSTALLATION**

(1) Position the new intake/exhaust manifold gasket on the manifolds mounting studs.

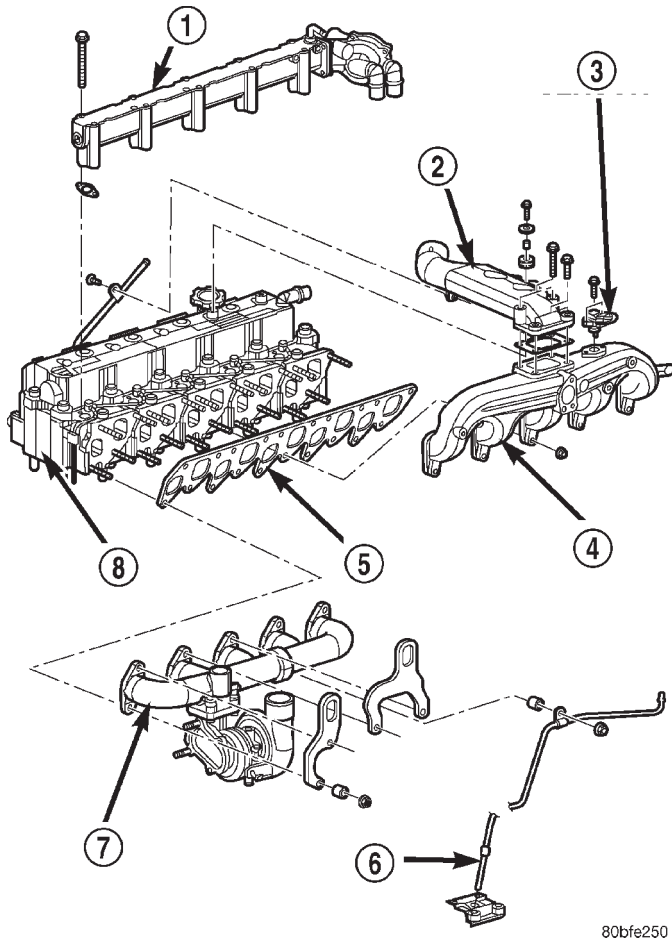
(2) Install the intake manifold and install the retaining nuts (Fig. 6). Torque the nuts to 32 N·m (23 ft. lbs.).

(3) Position the new intake air duct gasket.

(4) Install the intake air duct on the engine. Torque the bolts to 32 N·m (23 ft. lbs.).

**NOTE:** If only servicing the intake manifold the following two steps are not required.

## REMOVAL AND INSTALLATION (Continued)



**Fig. 6 Intake and Exhaust Manifold**

- 1 - WATER MANIFOLD
- 2 - INTAKE MANIFOLD ELBOW
- 3 - BOOST PRESSURE SENSOR
- 4 - INTAKE MANIFOLD
- 5 - INTAKE/EXHAUST MANIFOLD GASKET
- 6 - TURBOCHARGER OIL RETURN LINE
- 7 - EXHAUST MANIFOLD
- 8 - CYLINDER HEAD

(5) Position the gasket and install the turbo on the exhaust manifold. Torque the nuts to 32 N·m (23 ft. lbs.).

(6) Remove the assembly from the vice and position on the exhaust manifold mounting studs.

(7) Install the exhaust manifold retaining nuts and torque to 32 N·m (23 ft. lbs.) (Fig. 6).

(8) Install the transmission dipstick tube in the transmission case.

(9) Remove the drain pan.

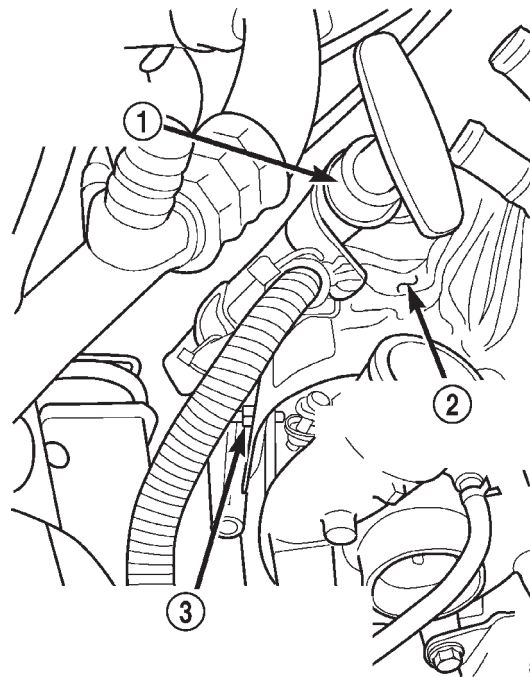
(10) Install the oil pressure supply line on turbocharger. Torque the banjo bolt fitting to 27 N·m (20 ft. lbs.). Be certain the copper sealing washers are installed. One on the top and bottom of the supply line.

(11) Install the EGR tube nut on the exhaust manifold and temporarily install one of the EGR valve retaining bolts. Be certain the EGR valve gasket is in place.

(12) Torque the EGR tube retaining nut to 34 N·m (25 ft.lbs.). Remove the temporarily installed EGR valve bolt

(13) Install the exhaust manifold heatshield (Fig. 5). Torque bolts to 11 N·m (97 in. lbs.).

(14) Install the transmission dipstick tube support bracket retaining nut on the turbocharger heatshield (Fig. 7). Torque the nut to 20 N·m (177 in. lbs.).



**Fig. 7 Transmission Dipstick Tube Support Bracket**

- 1 - TRANSMISSION DIPSTICK TUBE
- 2 - TURBOCHARGER EXHAUST MANIFOLD HEATSHIELD
- 3 - TRANSMISSION DIPSTICK TUBE SUPPORT BRACKET RETAINING NUT

(15) Install the front (front of engine) heater core coolant supply hoses on the coolant line assembly and install the line assembly on the engine. Torque the (3) retaining bolts to 27 N·m (20 ft. lbs.) (Fig. 8).

(16) Connect the crankcase vapor supply and return hoses on the oil separator.

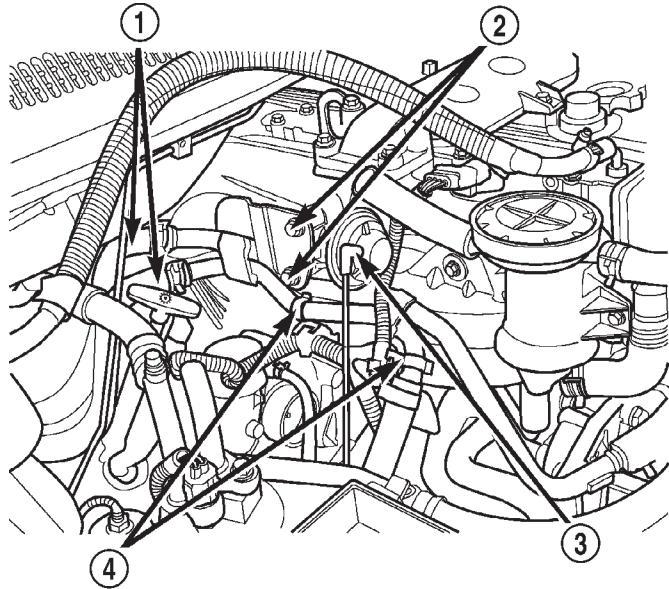
(17) Install the oil separator retaining bolts.

(18) Install the heater core coolant supply hoses on the coolant line assembly (Fig. 8).

(19) Clip the wire harness on the coolant supply lines (Fig. 8).

(20) Install the EGR vacuum supply hose on the EGR valve.

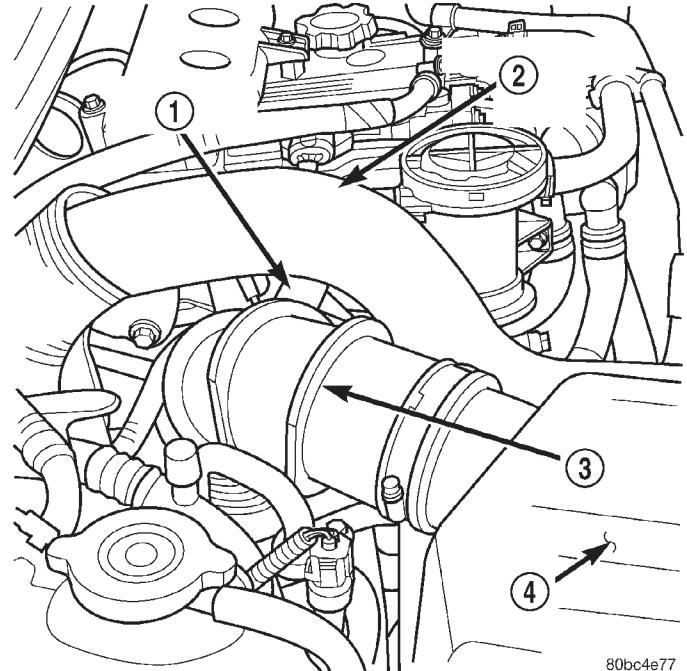
REMOVAL AND INSTALLATION (Continued)



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**Fig. 8 Diesel Engine Compartment**

- 1 - HEATER CORE COOLANT SUPPLY HOSES
- 2 - EGR VALVE/COOLANT SUPPLY LINE BRACKET RETAINING BOLTS
- 3 - EGR VALVE VACUUM SUPPLY LINE
- 4 - WIRE HARNESS RETAINING CLIPS



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**Fig. 9 Air Intake Hoses**

- 1 - BREATHER HOSE
- 2 - INTERCOOLER INLET HOSE
- 3 - FRESH AIR INLET TUBE
- 4 - AIR FILTER COVER

(21) Install the fresh air inlet tube assembly on the turbocharger. Clip the air filter cover in position and connect the breather hose (Fig. 9).

(22) Install the intercooler inlet hose on the vehicle (Fig. 9).

(23) Raise the vehicle on the hoist.

(24) Install the turbocharger oil return hose on the turbocharger.

(25) Install the exhaust system inlet pipe on the turbocharger (Fig. 10). Torque the bolts to 22 N·m (194 in. lbs.).

(26) Lower the vehicle on the hoist.

(27) Fill the cooling system. Refer to Group 7, Cooling System for procedure.

(28) Check the transmission fluid level and top off if necessary.

(29) Connect the negative battery cable.

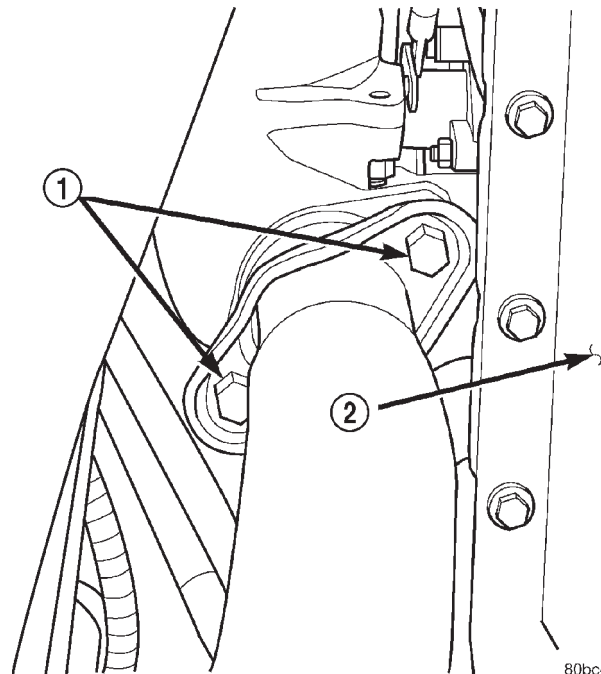
(30) Start the engine and check for leaks.

**TURBOCHARGER**

**REMOVAL**

- (1) Disconnect the negative battery cable
- (2) Raise the vehicle on a hoist.

**WARNING: DO NOT LOOSEN THE RADIATOR VENT OR DRAINCOCK WITH THE SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM COOLANT CAN OCCUR**



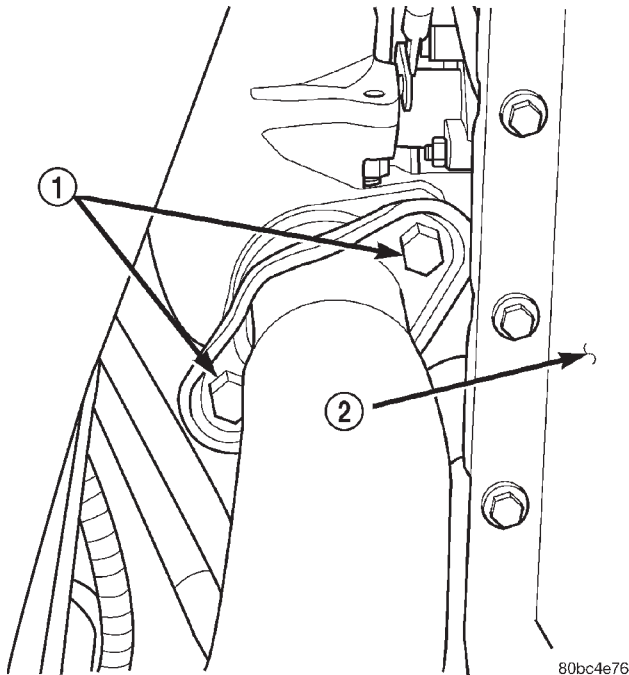
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**Fig. 10 Exhaust System Inlet Pipe Retaining Bolts**

- 1 - EXHAUST SYSTEM INLET PIPE RETAINING BOLTS
- 2 - ENGINE OIL PAN

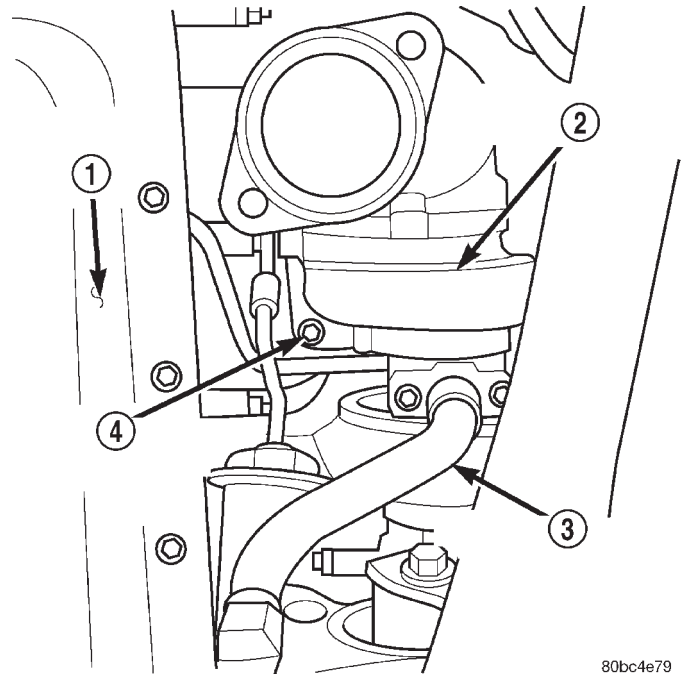
REMOVAL AND INSTALLATION (Continued)

(3) Drain the cooling system. Refer to Group 7, Cooling System for procedure.



**Fig. 11 Exhaust System Inlet Pipe Retaining Bolts**

- 1 - EXHAUST SYSTEM INLET PIPE RETAINING BOLTS
- 2 - ENGINE OIL PAN



**Fig. 12 Turbocharger Oil Return Line & Retaining Nut**

- 1 - ENGINE OIL PAN
- 2 - TURBOCHARGER ASSEMBLY
- 3 - TURBOCHARGER OIL RETURN LINE
- 4 - TURBOCHARGER RETAINING NUT

(4) Remove the exhaust system inlet pipe retaining bolts (Fig. 11).

(5) Disconnect the turbocharger oil return hose from the turbocharger (Fig. 12).

(6) Remove the turbocharger retaining nut (Fig. 12).

(7) Lower the vehicle on the hoist.

(8) Remove the intercooler inlet hose from the vehicle (Fig. 13).

(9) Disconnect the breather hose from the fresh air inlet tube (Fig. 13).

(10) Unclip the air filter cover and remove the fresh air inlet tube from the turbocharger (Fig. 13). Remove the assembly from the vehicle.

(11) Remove the EGR vacuum supply hose from the EGR valve (Fig. 14).

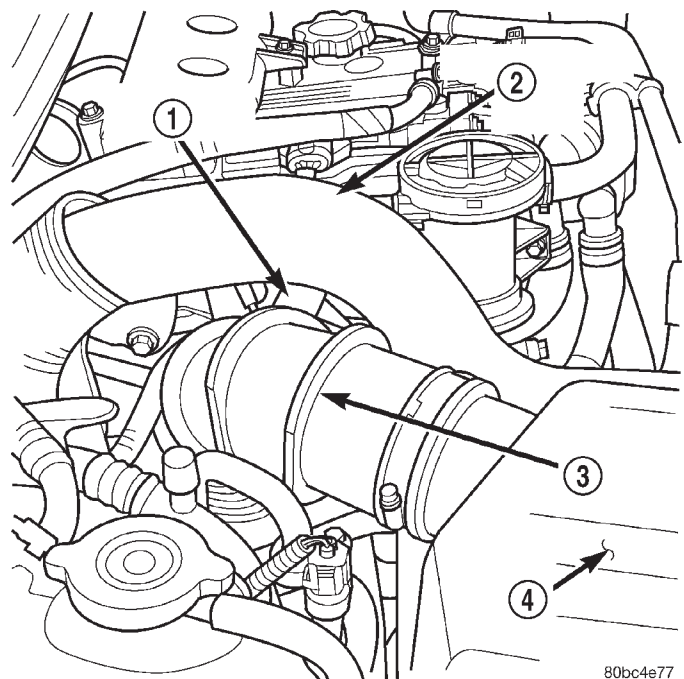
(12) Disconnect the heater core coolant supply lines from the engine assembly (Fig. 14).

(13) Unclip the wire harness from the coolant supply lines (Fig. 14).

(14) Remove the (2) EGR valve / coolant supply line retaining bolts (Fig. 14).

(15) Remove the coolant supply line support bracket bolt from the water pump housing.

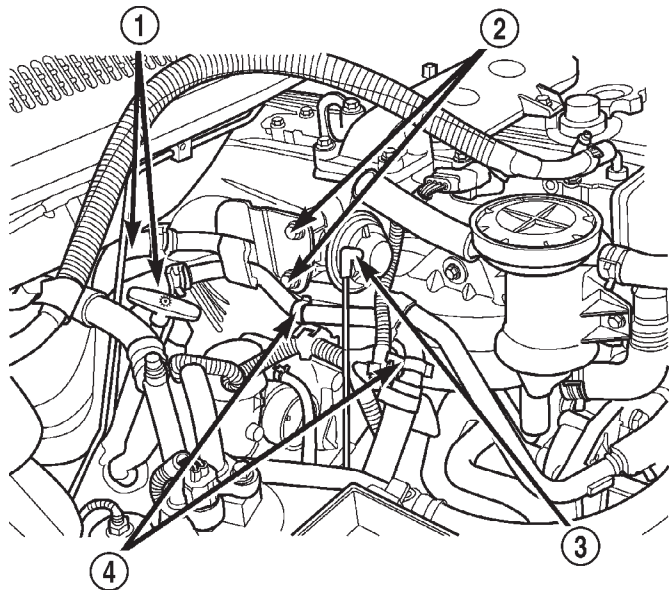
(16) Disconnect the two remaining hoses and remove the coolant lines from the vehicle.



**Fig. 13 Air Intake Hoses**

- 1 - BREATHER HOSE
- 2 - INTERCOOLER INLET HOSE
- 3 - FRESH AIR INLET TUBE
- 4 - AIR FILTER COVER

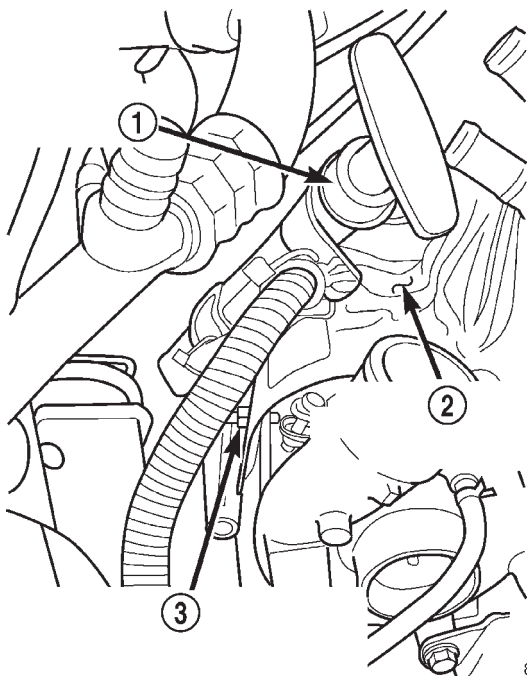
REMOVAL AND INSTALLATION (Continued)



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**Fig. 14 3.1 L Diesel Engine**

- 1 - HEATER CORE COOLANT SUPPLY HOSES
- 2 - EGR VALVE/COOLANT SUPPLY LINE BRACKET RETAINING BOLTS
- 3 - EGR VALVE VACUUM SUPPLY LINE
- 4 - WIRE HARNESS RETAINING CLIPS



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**Fig. 15 Transmission Dipstick Tube Support Bracket**

- 1 - TRANSMISSION DIPSTICK TUBE
- 2 - TURBOCHARGER EXHAUST MANIFOLD HEATSHIELD
- 3 - TRANSMISSION DIPSTICK TUBE SUPPORT BRACKET RETAINING NUT

(17) Remove the transmission dipstick tube support bracket nut from the turbocharger heatshield (Fig. 15).

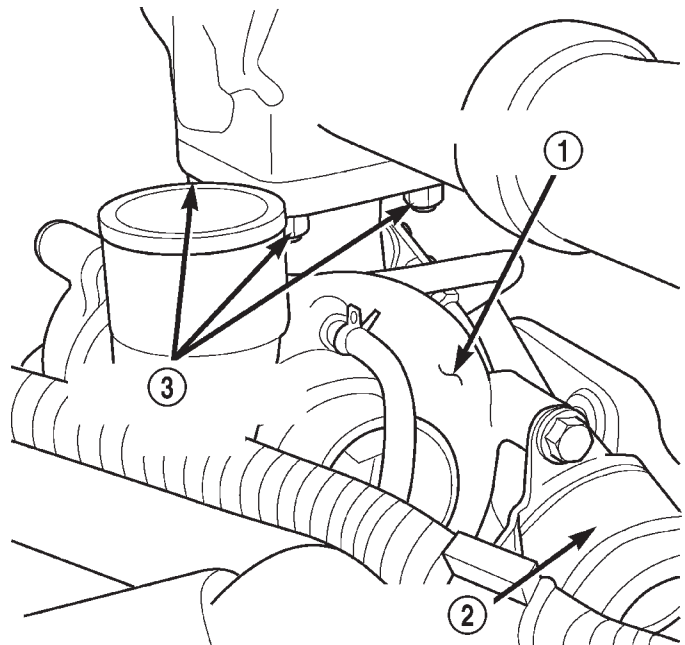
**WARNING:** Heatshield is very sharp. Wear gloves to prevent injury.

(18) Remove the exhaust manifold / turbocharger heatshield retaining bolts and remove the heatshield from the vehicle.

(19) Remove the oil pressure supply line banjo bolt from the turbocharger.

(20) Position a drainpan under the transmission.

(21) Remove the transmission dipstick tube from the transmission oil pan by pulling straight up. Position the tube assembly out of the way to allow for turbocharger removal.



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**Fig. 16 Turbocharger Retaining Nuts**

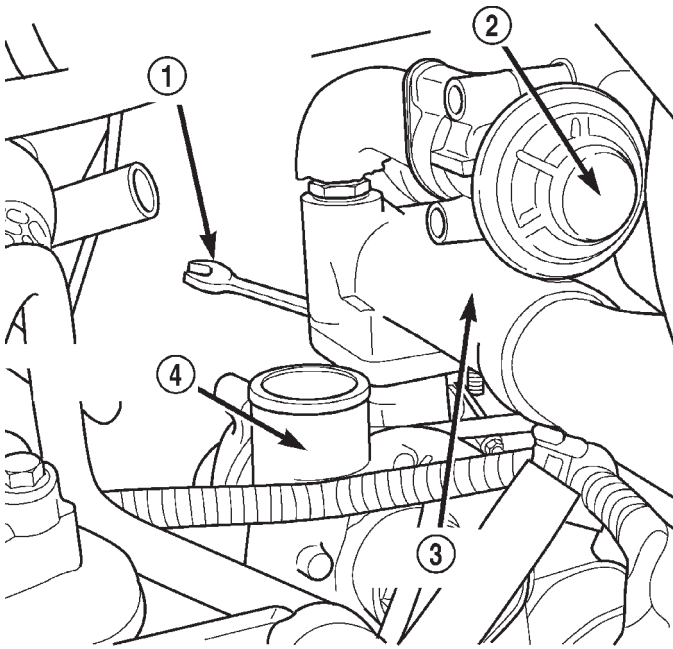
- 1 - TURBOCHARGER ASSEMBLY
- 2 - TURBOCHARGER WASTEGATE ACUATOR
- 3 - TURBOCHARGER RETAINING NUTS (3 OF 4)

(22) Remove the remaining turbocharger retaining nuts (Fig. 17) (Fig. 16) and remove the turbocharger from the vehicle.

**CLEANING**

All old gaskets should be inspected for any tears or signs of prior leakage. If any gaskets show such indications, they should be replaced with new gaskets. All gasket mating surfaces must be cleaned of old gasket material to produce a smooth and dirt free sealing surface for the new gasket.

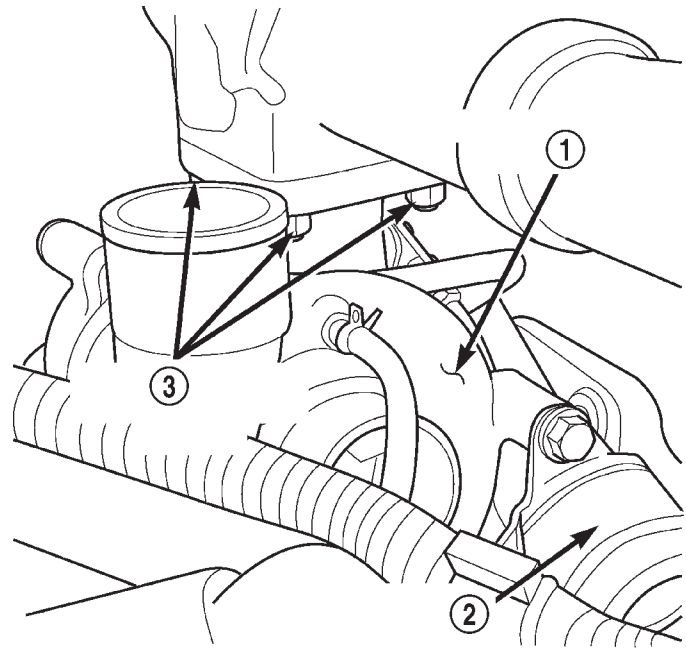
## REMOVAL AND INSTALLATION (Continued)



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**Fig. 17 Rear Turbocharger Retaining Nut**

- 1 - WRENCH ON TURBOCHARGER RETAINING NUT
- 2 - EGR VALVE
- 3 - EXHAUST MANIFOLD
- 4 - TURBOCHARGER ASSEMBLY



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**Fig. 18 Turbocharger Retaining Nuts**

- 1 - TURBOCHARGER ASSEMBLY
- 2 - TURBOCHARGER WASTEGATE ACUATOR
- 3 - TURBOCHARGER RETAINING NUTS (3 OF 4)

**INSTALLATION**

(1) Position the gasket and install the turbo on the exhaust manifold. Torque the nuts to 32 N·m (23 ft. lbs.) (Fig. 18).

(2) Install the oil pressure supply line on turbocharger. Torque the banjo bolt fitting to 27 N·m (20 ft. lbs.). Be certain the copper sealing washers are installed. One on the top and bottom of the supply line.

(3) Install the transmission dipstick tube in the transmission oil pan.

(4) Remove the drain pan.

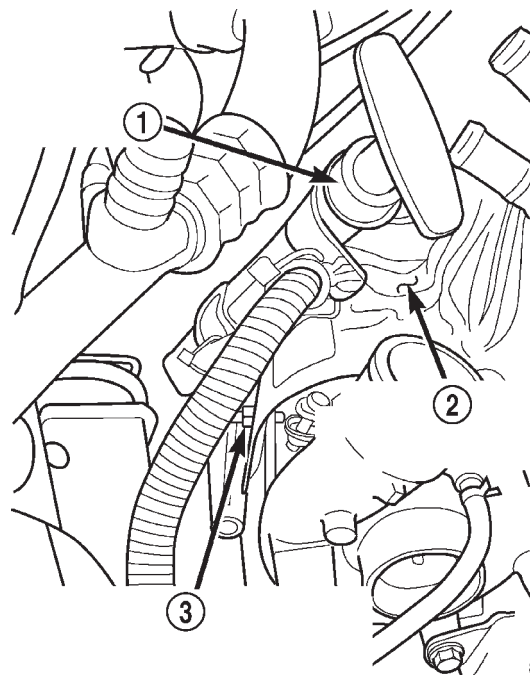
**WARNING: Heatshield is very sharp. Wear gloves to prevent injury.**

(5) Install the exhaust manifold heatshield. Torque bolts to 11 N·m (97 in. lbs.).

(6) Install the transmission dipstick tube support bracket retaining nut on the turbocharger heatshield (Fig. 19). Torque the nut to 20 N·m (177 in. lbs.).

(7) Install the front (front of engine) heater core coolant supply hoses on the coolant line assembly and install the line assembly on the engine. Torque the (3) retaining bolts to 27 N·m (20 ft. lbs.) (Fig. 20).

(8) Install the heater core coolant supply hoses on the coolant line assembly (Fig. 20).



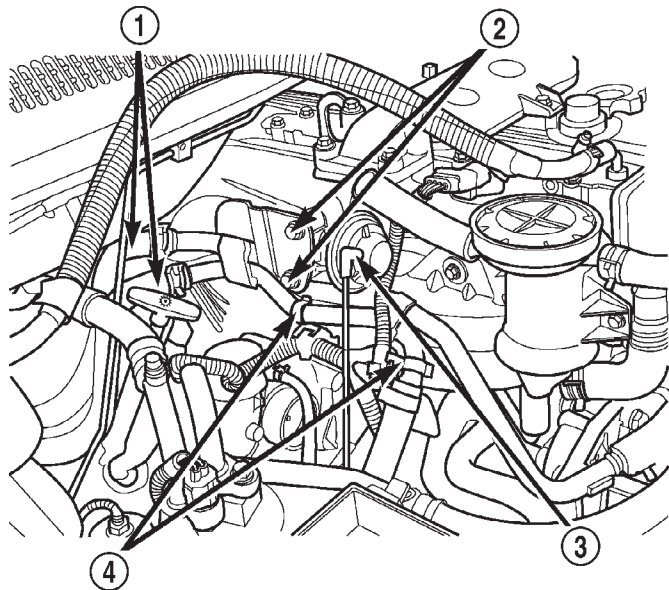
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**Fig. 19 Transmission Dipstick Tube Support Bracket**

- 1 - TRANSMISSION DIPSTICK TUBE
- 2 - TURBOCHARGER EXHAUST MANIFOLD HEATSHIELD
- 3 - TRANSMISSION DIPSTICK TUBE SUPPORT BRACKET RETAINING NUT



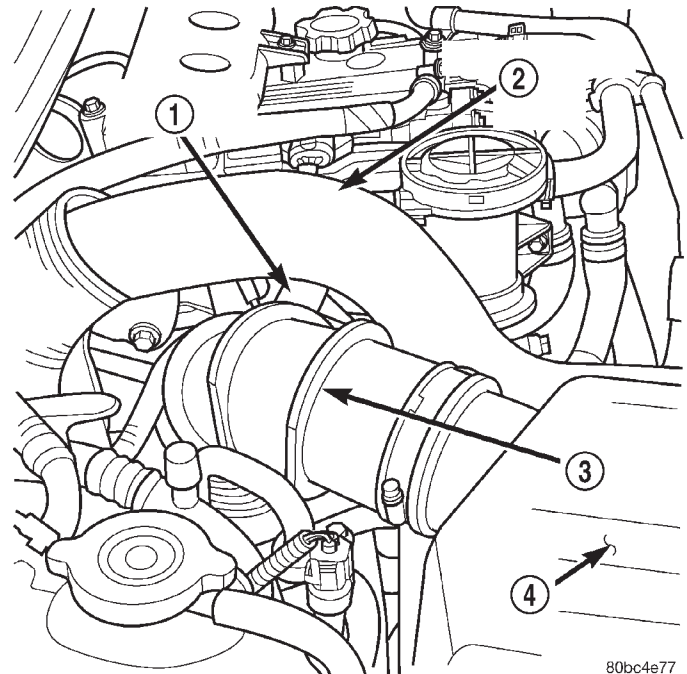
REMOVAL AND INSTALLATION (Continued)



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**Fig. 20 3.1L Diesel Engine**

- 1 - HEATER CORE COOLANT SUPPLY HOSES
- 2 - EGR VALVE/COOLANT SUPPLY LINE BRACKET RETAINING BOLTS
- 3 - EGR VALVE VACUUM SUPPLY LINE
- 4 - WIRE HARNESS RETAINING CLIPS



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**Fig. 21 Air Intake Hoses**

- 1 - BREATHER HOSE
- 2 - INTERCOOLER INLET HOSE
- 3 - FRESH AIR INLET TUBE
- 4 - AIR FILTER COVER

(9) Clip the wire harness on the coolant supply lines (Fig. 20).

(10) Install the EGR vacuum supply hose on the EGR valve.

(11) Install the fresh air inlet tube assembly on the turbocharger. Clip the air filter cover in position and connect the breather hose (Fig. 21).

(12) Install the intercooler inlet hose on the vehicle (Fig. 21).

(13) Raise the vehicle on the hoist.

(14) Install the remaining turbocharger retaining nut (Fig. 22). Torque the nut to 32 N·m (23 ft. lbs.).

(15) Install the turbocharger oil return hose on the turbocharger (Fig. 22).

(16) Install the exhaust system inlet pipe on the turbocharger (Fig. 23). Torque the bolts to 22 N·m (194 in. lbs.).

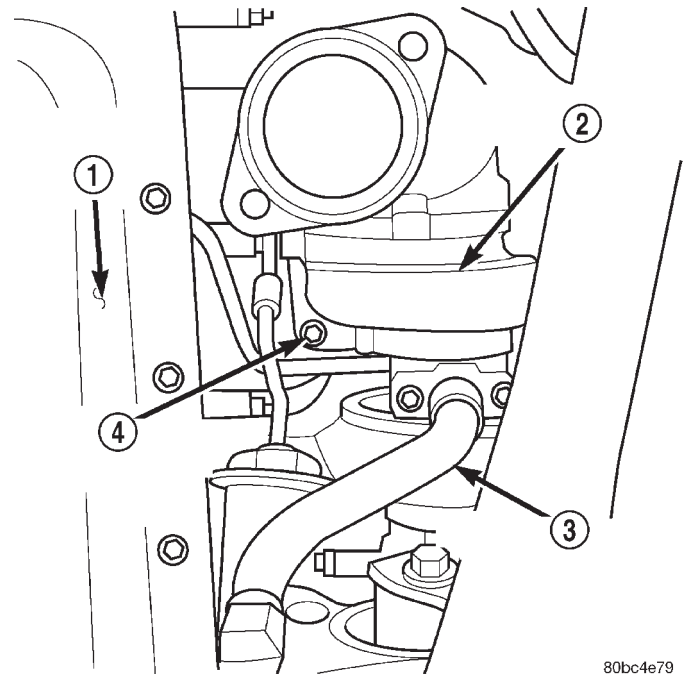
(17) Lower the vehicle on the hoist.

(18) Fill the cooling system. Refer to Group 7, Cooling System for procedure.

(19) Check the transmission fluid level and top off if necessary.

(20) Connect the negative battery cable.

(21) Start the engine and check for leaks.

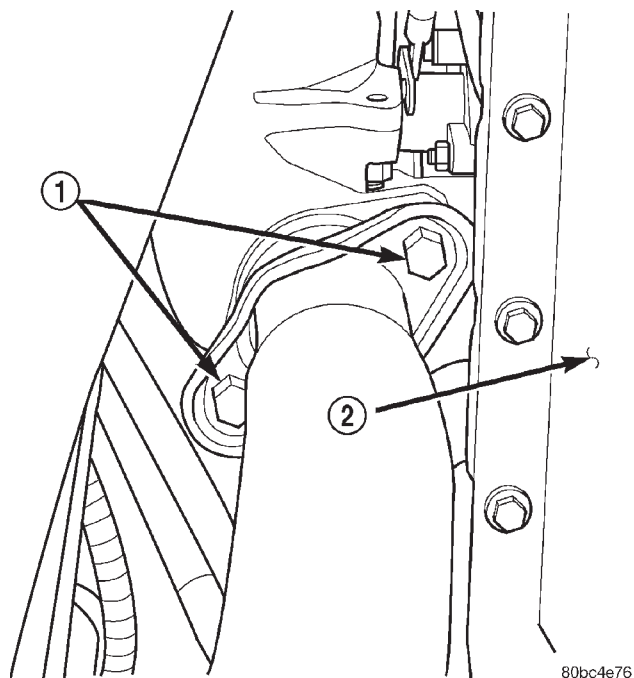


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**Fig. 22 Turbocharger Oil Return Line & Retaining Nut**

- 1 - ENGINE OIL PAN
- 2 - TURBOCHARGER ASSEMBLY
- 3 - TURBOCHARGER OIL RETURN LINE
- 4 - TURBOCHARGER RETAINING NUT

REMOVAL AND INSTALLATION (Continued)



**Fig. 23 Exhaust System Inlet Pipe Retaining Bolts**

- 1 - EXHAUST SYSTEM INLET PIPE RETAINING BOLTS
- 2 - ENGINE OIL PAN

**CHARGE AIR COOLER (INTERCOOLER)**

The cooling module assembly includes the radiator, charge air cooler (intercooler) and the A/C condenser. To replace any one of these components, the entire assembly must be removed from the vehicle and then disassembled. Refer to Group 7, Cooling System - Cooling Module removal and installation procedure for replacement of the intercooler.

SPECIFICATIONS

TORQUE SPECIFICATIONS

| <b>Description</b>                            | <b>Torque</b> |
|---|---------------|
| <b>EGR</b>                                    |               |
| Attaching Bolts .....                         | 27N·m         |
| <b>EGR</b>                                    |               |
| Tube Nut .....                                | 34 N·m        |
| <b>EGR</b>                                    |               |
| Tube Flange Bolts .....                       | 27 N·m        |
| <b>Exhaust Manifold</b>                       |               |
| Nuts .....                                    | 32 N·m        |
| <b>Exhaust Manifold</b>                       |               |
| Heat Shield Bolts .....                       | 11 N·m        |
| <b>Exhaust Pipe</b>                           |               |
| Support Clamp Bolts .....                     | 22.5 N·m      |
| <b>Exhaust Pipe</b>                           |               |
| Support Clamp Screw .....                     | 22.5 N·m      |
| <b>Intake Elbow to Intake Manifold</b>        |               |
| Bolts .....                                   | 11 N·m        |
| <b>Intake Manifold</b>                        |               |
| Nuts .....                                    | 32 N·m        |
| <b>Muffler-to-Exhaust Pipe</b>                |               |
| Clamp Nuts .....                              | 43 N·m        |
| <b>Tail Pipe Clamp</b>                        |               |
| Hanger bolt .....                             | 22.5 N·m      |
| <b>Turbocharger-to-Exhaust manifold</b>       |               |
| Nuts .....                                    | 32 N·m        |
| <b>Turbocharger</b>                           |               |
| Oil Feed Line .....                           | 27.4 N·m      |
| <b>Turbocharger Down Pipe-to-Exhaust Pipe</b> |               |
| Bolts/Nuts .....                              | 22.5 N·m      |
| <b>Turbocharger Down Pipe-to-Turbocharger</b> |               |
| Bolts .....                                   | 27 N·m        |