Jeep Wagoneer/Commando/Cherokee 1984-1998

Emission Controls

Crankcase Ventilation System (PCV/CCV)

OPERATION

Crankcase emission control equipment is separated into two different systems: Positive Crankcase Ventilation (PVC) and Crankcase Ventilation System (CCV). The systems perform the same function, differing only in the way the exhaust gases are metered. The PVC system uses a valve, containing spring loaded plunger, which meters the amount of crankcase vapors routed to the combustion chamber based on manifold vacuum. The CCV system contains a metered orifice of a calibrated size which meters the amount of crankcase vapors drawn from the engine based on manifold vacuum.

When the engine is running, a small portion of the gases which are formed in the combustion chamber during combustion leak by the piston rings and enter the crankcase. Since these gases are under pressure, they tend to escape from the crankcase and enter into the atmosphere. If these gases were allowed to remain the the crankcase for any length of time, they would contaminate the engine oil and cause sludge to build up. If the gases are allowed to escape into the atmosphere, they would pollute the air, as they contain unburned hydrocarbons. The crankcase emission control equipment recycles these gases back into the engine combustion chamber where they are burned.

While the engine is running, clean filtered air is drawn into the crankcase either directly through the oil filler cap, or through a filter mounted in the air cleaner assembly and connected to the oil filler cap. As the air passes through the crankcase it picks up combustion gases, carries them out of the crankcase, through the PCV valve, and into the intake manifold. After entering the intake manifold gases are drawn into the combustion chamber and burned.

The most critical component in the system is the metering device-the PCV valve in the PVC system, or the metered orifice in the CCV system-which controls the amount of gases recycled into the combustion chamber. If the metering device should become clogged, gases will be prevented from escaping the crankcase by the normal route. Since the gases are under pressure, they will find a point of least resistance, usually a weak oil seal or gasket, and create an oil leak. In addition to creating oil leaks, clogged ventilation systems also allow gases to remain in the crankcase for an extended period of time. This promotes the formation of sludge in the engine and ultimately leads to decreased engine life.

COMPONENT TESTING

PCV Valve

See Figure 1

To inspect the PCV valve, remove the valve from the rocker arm cover hose, then shake it. If the valve rattles, it is probably fine; if there is no sound, it must be replaced and the PCV hose cleaned by spraying solvent (such as a carburetor cleaner type of solvent) through it.

If the valve rattles, you should still check the PCV valve with the engine idling. Pull it out of the vent module and place your finger or thumb over the end to stop air flow. You should feel some suction, and the engine speed should drop slightly. If there is no suction, or if the engine idle speeds up and smooths out considerably, replace the valve. Remove the PCV hose from the engine, then inspect it and, if the inside is coated with gum and varnish, clean it by spraying solvent through it.

Check the vacuum at the PCV inlet (from the rocker arm cover to the air cleaner) tube, as well. Disconnect this tube from the air cleaner and loosely hold a piece of paper over the tube. After a few seconds (10-15 seconds), enough vacuum should build up to cause the paper to be sucked against the opening with a noticeable amount of force. This test proves whether or not the suction side of the system is clear.

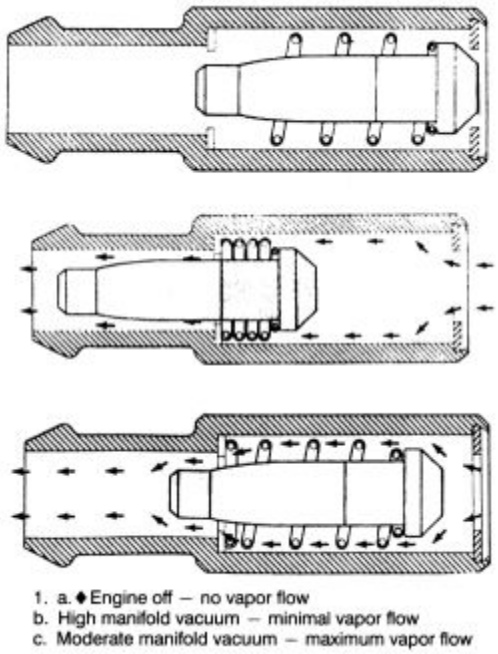

Fig. 1: View of common PCV valve operation

CCV Fitting

See Figures 2 and 3

1. With the engine running, remove the CCV fitting.

a. If the fitting is not plugged, a hissing noise will be heard as air passes through the valve. A strong vacuum should also be felt when a finger is placed over the fitting.
b. Install the CCV fitting.
c. Remove the fresh air hose from the air cleaner assembly and loosely hold a piece of paper over the open end of the hose. After allowing about one minute for the crankcase pressure to reduce, the paper should be sucked against the opening with a noticeable amount of force.

2. Turn the engine *OFF*. Remove the metered orifice fitting, and check for a plugged condition. A clicking noise should be heard to indicate that the valve mechanism is free.
3. If the crankcase ventilation system meets the tests in Steps 1 and 2 above, no further service is required. If not, the CCV fitting must be cleaned and the system checked again.
4. If Step 1c fails when the CCV fitting is cleaned, it will be necessary to replace the molded vacuum hose with a new one, and to clean the metered orifice port.
5. Clean or replace the engine air cleaner filter element with a new one-for more details, refer to the air cleaner procedure located in General Information & Maintenance.

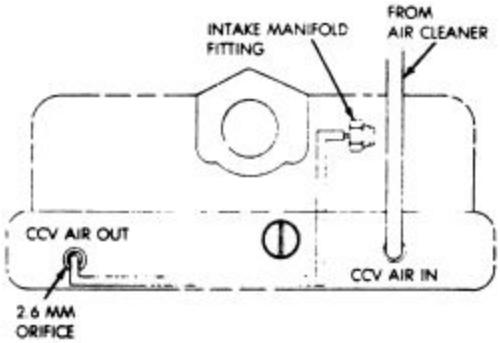

Fig. 2: CCV system diagram for 4.0L engine

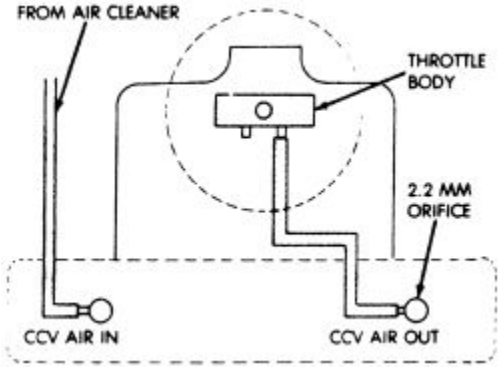

Fig. 3: CCV system diagram for the 2.5L engine

Evaporative Emission Control System

OPERATION

The evaporative emission control system prevents the release of unburned hydrocarbons, from gasoline or gasoline vapor, into the atmosphere. When pressure in the fuel tank is below 3 psi (20 kPa), the pressure relief/rollover valves open allowing fuel vapors to flow to the evaporative canister where they are absorbed by a charcoal mixture. This prevents excessive pressure build-up in the fuel system. Most canisters are equipped with a calibrated orifice at the inlet to the canister.

The evaporative canister is mounted to the passenger side frame rail. Inlet ports on the canister are connected to the rollover/pressure relief valves, the air cleaner, and the fuel tank vent through hoses and tubes.

Canister purge operation is activated by the purge shutoff switch. An air cleaner venturi provides the vacuum to open the switch which allows vapors collected in the canister to be drawn into the airstream. The vapors then pass through the intake manifold and are burned in the combustion process.

The fuel tanks of all vehicles are equipped with two pressure relief/rollover valves. The valves relieve fuel tank pressure and prevent fuel flow through the fuel tank vent hoses in the event of vehicle rollover.

The valves consist of a plunger, spring, orifice and guide plate. The valve is normally open allowing fuel vapor to vent to the canister. If the bottom of the plunger is contacted by sloshing fuel, the plunger seats in the guide plate preventing fuel from reaching the canister.

If the vehicle should roll over, the valve is inverted and the plunger is forced against the guideplate, preventing fuel from flowing through the vent tube.

Removal & Installation

Evaporative Canister

EXCEPT 1996-98 GRAND CHEROKEE and 1998 CHEROKEE

See Figure 1

1. Tag and disconnect the vacuum lines from the canister.
2. Remove the canister strap bolt and remove the canister from the vehicle.
3. Installation is the reverse of removal. Tighten the bolt to 45 inch. lbs. (5 Nm).

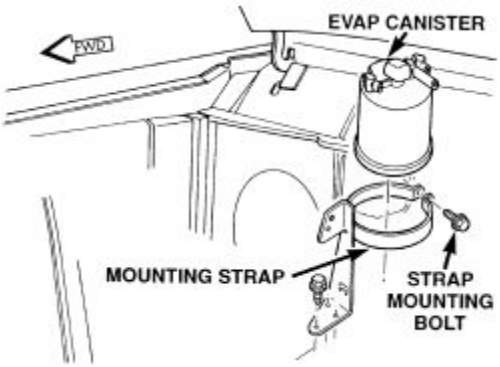

Fig. 1: Exploded view of the EVAP cannister and related components-1996 Cherokee model shown

1996-98 GRAND CHEROKEE

See Figures 2 and 3

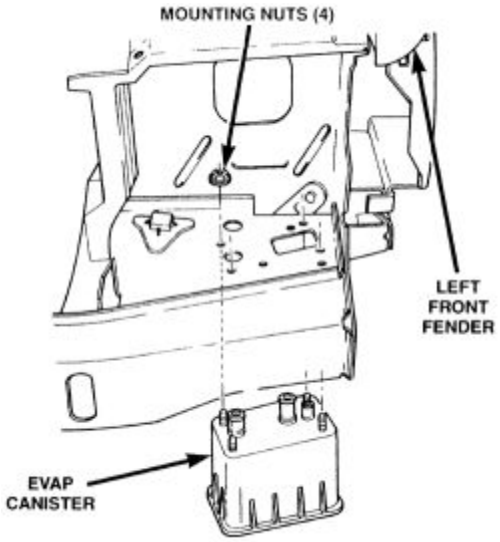

Fig. 2: Exploded view of the cannister location for the 4.0L California emission package-1996 Grand Cherokee model

1. Remove the grille and the front bumper/fascia assembly as outlined in General Information & Maintenance.
2. Tag and disconnect the vacuum lines from the canister.
3. Unfasten the canister retaining nuts and remove the canister through the bottom of the vehicle.

To install:

4. Install the canister and tighten the retaining nuts to 80 inch. lbs. (9 Nm).
5. Connect the vacuum lines.
6. Install the front bumper/fascia assembly and the grille as outlined in General Information & Maintenance.

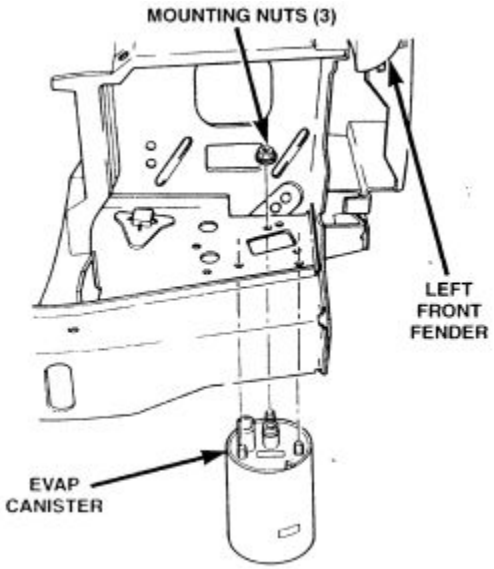

Fig. 3: Exploded view of the cannister location except the California emission package-1996 Grand Cherokee model

1998 CHEROKEE

The EVAP canister is located below the left side of the vehicle near the front of the rear axle.

1. Tag and disconnect the vacuum lines from the canister.
2. Unfasten the canister mounting bracket retaining nuts and remove the canister/bracket assembly from the vehicle.
3. Installation is the reverse of the removal procedures.

Purge Solenoid

See Figure 4

1. Disengage the solenoid electrical connection.
2. Tag and disconnect the solenoid vacuum lines.
3. Unfasten the solenoid retaining nuts and remove the solenoid.
4. Installation is the reverse of removal. Tighten the retaining fasteners to 45 inch. lbs. (5 Nm).

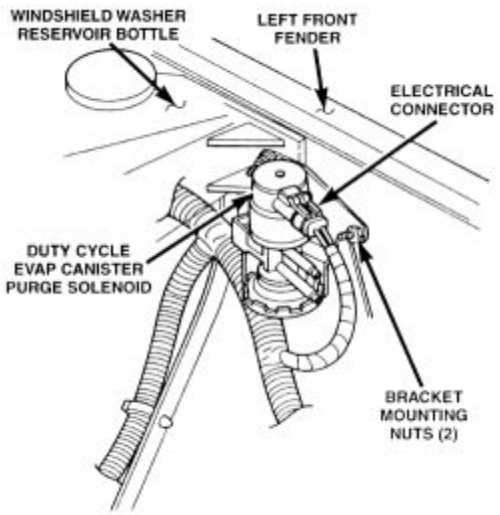

Fig. 4: Common EVAP canister purge solenoid and related components

Pressure Relief/Rollover Valve

See Figures 5 and 6

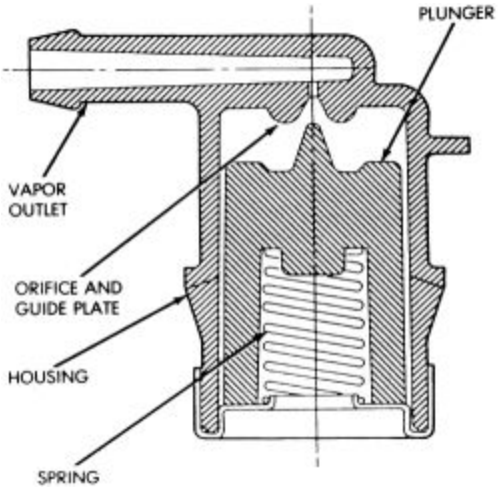

Fig. 5: Cutaway view of the pressure relief/rollover valve

1. Disconnect the battery negative cable.
2. Relieve the fuel system as outlined in Fuel System.

DO NOT allow fuel to spill on the intake or exhaust manifolds. Use shop rags to absorb any spilled fuel.

3. Drain the fuel tank dry using a siphon pump.

4. Raise and support the vehicle with jackstands.
5. Remove the fuel tank. See appropriate procedure in Fuel System.
6. If equipped, remove the vapor hose at the valve.
7. The rollover valve is seated in a grommet. Pry one side of the valve up and twist to remove the grommet from the tank.

To install:

8. Start one side of the grommet into the fuel tank opening and using finger pressure only, press the valve grommet into position.
9. Engage the vapor hose, if equipped.
10. Install the tank as outlined in Fuel System.
11. Fill the tank and connect the negative battery cable.
12. Start the vehicle and check for leaks.

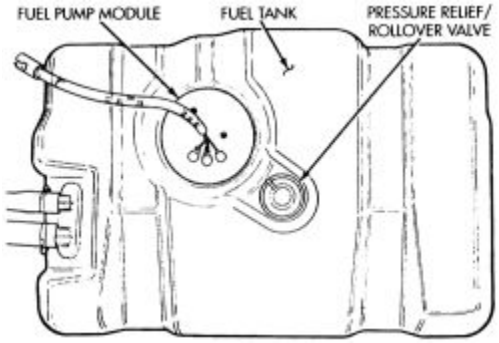

Fig. 6: View of the pressure relief/rollover valve location

Pressure-Vacuum Fuel Tank Filler Cap

The fuel filler cap is equipped with a two-way relief valve that is closed during normal operation of the vehicle. The relief valve is calibrated to open only when conditions equal or exceed 1.5 psi of pressure or 1.8 in.Hg of vacuum. When the vacuum or pressure is relieved, the valve returns to the closed position.

Exhaust Gas Recirculation (EGR) System

OPERATION

See Figure 1

NOx (oxides of nitrogen) is a tailpipe emission caused by the oxidation of nitrogen in the combustion chamber. When the peak combustion temperatures go over 2500°F (1371°C) NOx is formed in excessive amounts. To keep the combustion temperatures down, exhaust gas is recirculated.

Recirculation of the exhaust gases is accomplished by having a movable valve between the exhaust and intake manifolds. Upon a predetermined demand, engine vacuum is routed to the valve, opening the connecting port and allowing exhaust gases to enter the intake tract.

The EGR valves used on Jeep vehicles fall into three categories:

- An EGR valve with no backpressure sensor which is controlled by ported vacuum only. 2.5L and 2.8L engines are equipped with this type of EGR valve.
- An EGR valve with an external backpressure sensor which is controlled by ported vacuum and backpressure. 4.0L engines are equipped with this type of EGR valve.
- An EGR valve with an electric EGR transducer is found on 5.2L engines.

Thermal vacuum switches, which control the amount of vacuum available to the EGR valve based on air or water temperature, are used to disable the EGR system before the vehicle reaches operating temperature.

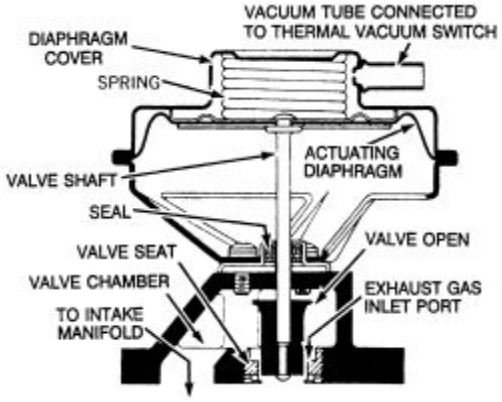

Fig. 1: Cutaway view of a common EGR valve

COMPONENT TESTING

EGR Solenoid

1. Start engine and bring to normal operating temperature. Allow engine to idle while performing tests.
2. Check vacuum at solenoid vacuum source hose. Disconnect the hose and attach a vacuum gauge.
3. Vacuum should be 15 in. Hg. (103 kPa), If low, check for leaks, loose fittings or kinks in the line.
4. Check vacuum at solenoid port. Disconnect the line and attach a vacuum gauge.
5. If vacuum reading is zero, go to Step 6. If vacuum is present, check solenoid operation with the Diagnostic Readout Box (DRB II) service tester and repair as necessary.

6. Disengage electrical connector at solenoid. If vacuum is present, proceed to EGR valve test. If not, replace the solenoid.

EGR Valve

1. Leave solenoid electrical connector disengaged. Bypass the vacuum transducer, if equipped, and connect EGR valve solenoid output hose directly to the nipple on the EGR valve.
2. The engine should run roughly or stall. If this occurs, the valve is good. Proceed to the transducer test, for 4.0L engines. If engine rpm does not change, disconnect hose from EGR and connect a hand vacuum pump.
3. Apply 12 in. Hg (82 kPa) of vacuum. If engine runs rough or stalls, inspect vacuum lines in EGR system for leaks and repair as necessary. If no leaks are found, go to transducer test for the 4.0L engine; Step 4 for the other engines.
4. If engine idle still does not change, remove the EGR valve and inspect for a blockage in the intake manifold passage. Repair as necessary. If no blockage is found, replace the EGR valve.

Vacuum Transducer

See Figures 2, 3 and 4

This is used on 4.0L engines only.

1. Disconnect all transducer lines and remove transducer.
2. Plug transducer output port. Apply 1-2 pounds air pressure to transducer backpressure port (used compressed air adjusted to correct pressure). Apply a minimum of 12 in. Hg (kPa) of vacuum to transducer input port.
3. Replace transducer if it will not hold vacuum.

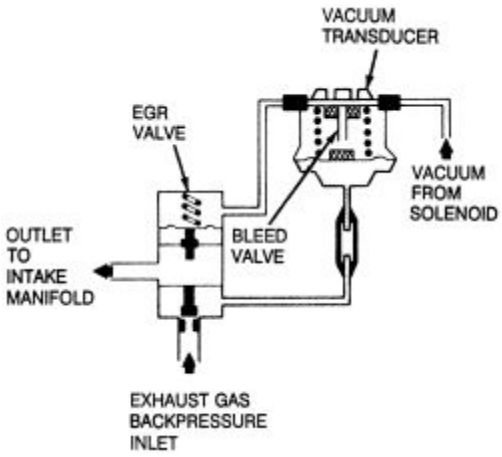

Fig. 2: EGR system with a vacuum transducer

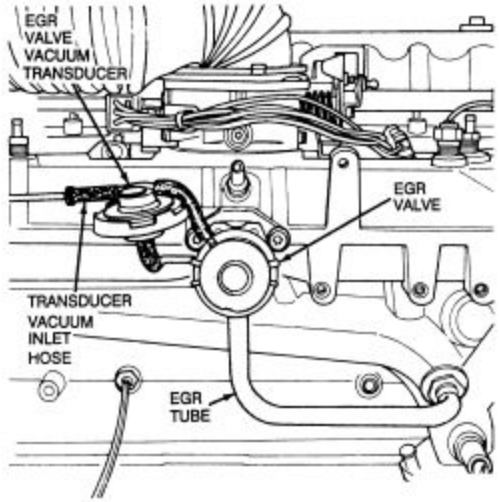

Fig. 3: View of a 4.0L engine with an EGR valve and a vacuum transducer

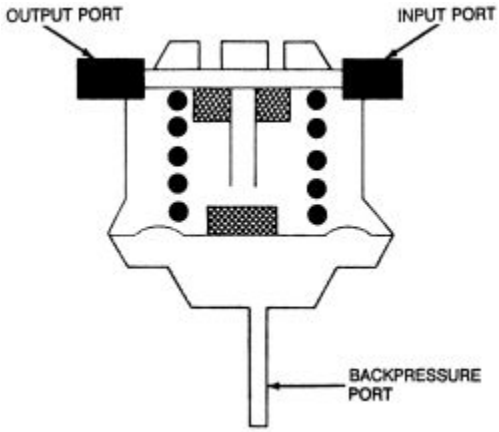

Fig. 4: Vacuum transducer port identification

Coolant Temperature Override (CTO) Switch

See Figure 5

1. Check vacuum lines for leaks and proper routing.
2. Disconnect vacuum line from EGR valve and connect a vacuum gauge.
3. Start engine and ensure that coolant is below 100°F (38°C).
4. Operate engine a 1,500 rpm. There should be no vacuum. If vacuum is present, replace the CTO switch.
5. Allow engine to idle until coolant temperature exceeds 115°F (46°C).
6. Operate the engine at 1,500 rpm. Vacuum should be present. If not, replace the CTO switch.

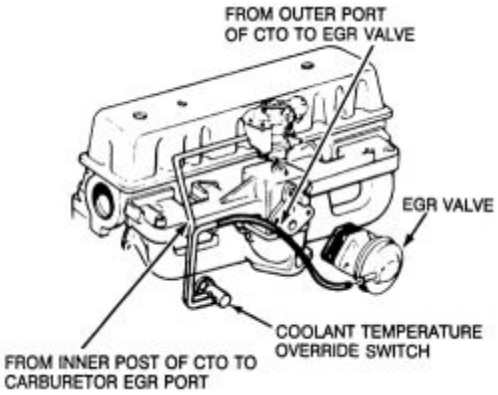

Fig. 5: EGR system using a coolant temperature override switch

Thermal Vacuum Switch (TVS)

1. With the engine cold and ambient air temperature in the air cleaner below 40°F (4°C), disconnect the vacuum hoses from the TVS (located on the air cleaner).
2. Connect a hand vacuum pump to the inner port and apply vacuum.
3. Vacuum should be maintained at air cleaner intake temperatures below 40°F (4°C). If vacuum is not held, check to see that temperature is below 40°F (4°C). If so, replace the TVS.
4. Start the engine and warm to normal operating temperature. With an air cleaner intake temperature above 55°F (13°C), the switch should not hold vacuum. If vacuum is held, check to see that temperatures are above 55°F (13°C). If so, replace the TVS.

Temperatures are nominal values and the actual switching temperature may vary.

Removal & Installation

EGR Valve

See Figures 6, 7 and 8

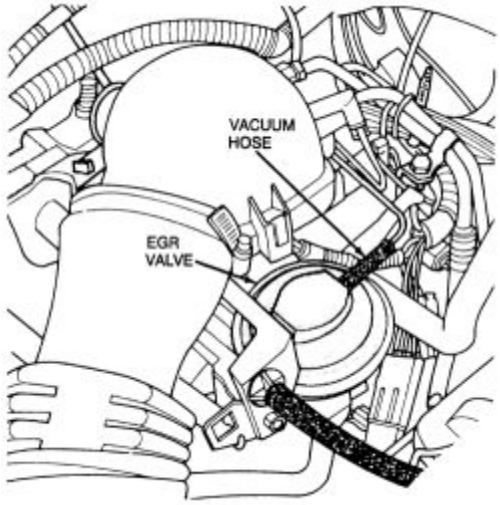

Fig. 6: View of the 2.5L engine EGR valve location

1. Tag and disengage the vacuum hoses to the EGR valve and the valve control.
2. Remove the EGR retaining bolts, then the valve and gasket.

To install:

3. Clean both mating surfaces and install a new gasket.
4. Install the EGR valve and tighten the retaining bolts to 200 inch. lbs. (23 Nm).
5. Engage the vacuum hoses.

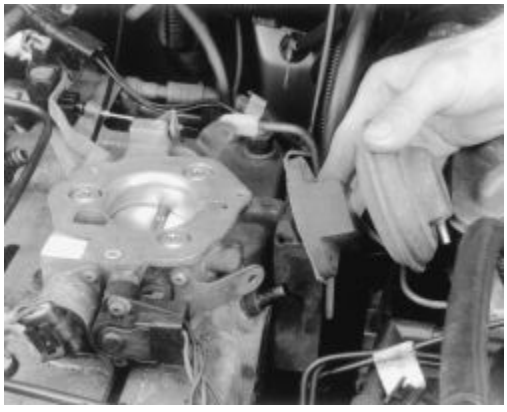
Fig. 7: Removing the EGR valve

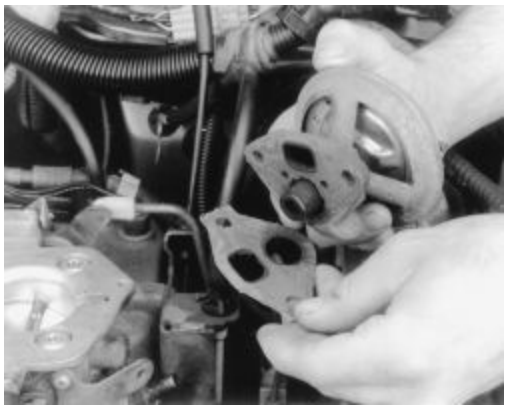

Fig. 8: Remove and discard the old EGR valve gasket

EGR Tube

See Figures 9 and 10

EXCEPT 5.2L and 5.9L ENGINES

1. Remove EGR tube-to-exhaust manifold bolts.
2. Unscrew EGR tube line nut at intake manifold. Remove EGR tube.
3. Install EGR tube with a new gasket. Tighten line nut to 30 ft. lbs. (40 Nm) and exhaust manifold bolts to 14 ft. lbs. (18 Nm).

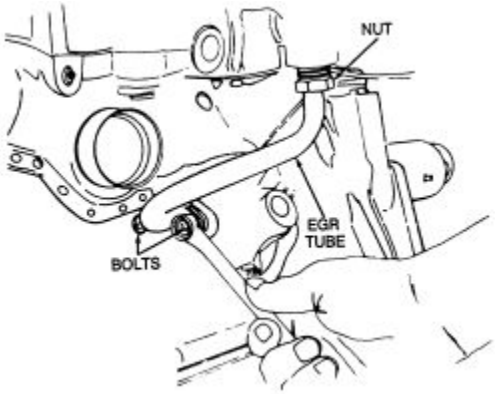

Fig. 9: View of the 2.5L engine EGR tube

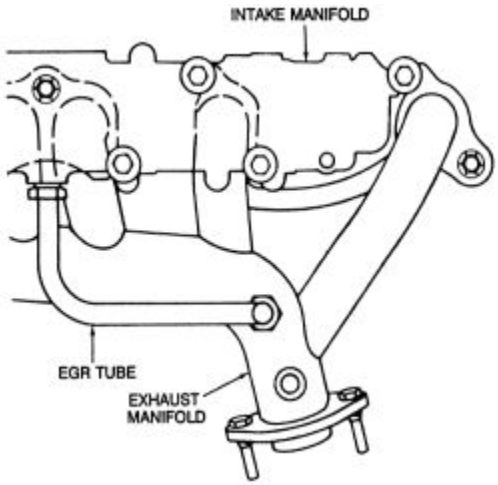

Fig. 10: View of the 4.0L engine EGR tube

5.2L and 5.9L ENGINES

See Figure 11

1. Remove the spark plug wire loom and wires from the valve cover. Position the wires to one side.
2. Remove the right exhaust manifold heat shield retainers and the shield.
3. Remove the EGR valve. Refer to the proper procedure in this section.
4. Disengage the oil pressure sending unit electrical connection and remove the sending unit using tool C-4597 or its equivalent.
5. Unfasten the EGR tube nut at the intake manifold and the tube mounting bolts at the exhaust manifold.
6. Remove the EGR tube and gasket. Discard the old gasket.

To install:

7. Clean the EGR tube and exhaust manifold mating surfaces and install a new gasket.
8. Install the EGR tube and engage it to both manifolds. Fasten the nut at the intake manifold and tighten the bolts at the exhaust manifold to 204 inch. lbs. (23 Nm).
9. Coat the threads of the oil pressure sender with a thread sealant and install the sender. Tighten the sender to 130 inch. lbs. (14 Nm).
10. Engage the sender electrical connection.
11. Install the EGR valve. Refer to the proper procedure in this section.
12. Install the right exhaust shield and tighten the retainers.
13. Install the spark plug loom and wires.

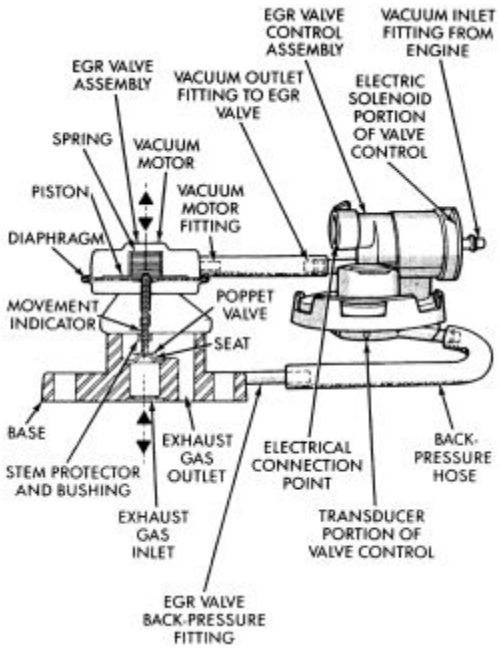

Fig. 11: View of the EGR system and related components-1995 5.2L Grand Cherokee model shown

Electric EGR Transducer (EET)

1. Disengage the EET electrical connector.
2. Tag and disengage the hoses to the EET.
3. Remove the EET from the engine.

To install:

4. Install the EET and engage the hoses.
5. Engage the EET electrical connections.