MERCEDES-BENZ DIESEL EXHAUST GAS RECIRCULATION

240D, 300 Series

DESCRIPTION

All diesel models are equipped with exhaust gas recirculation (EGR). The sysytem reduces oxides of nitrogen (NOx) by allowing a small quantity of exhaust gas to enter the intake manifold. This lowers combustion chamber temperatures and reduces NOx formation.

The 5-cylinder system consists of an EGR valve, thermal vacuum valve, switch-over valves, vacuum control valve, several orifices and connecting hoses.

The 4-cylinder system consists of a control unit, electric switch-over valve, throttle valve housing, corrugated tube to return gases, several orifices and a TDC transmitter.

OPERATION

5-CYLINDER ENGINES

When engine coolant is below 63°F (17°C), no EGR takes place. When engine coolant is above this temperature, EGR is permitted except when the engine is at idle or full throttle. The vacuum control valve and an orifice regulate vacuum flow to EGR valve at different engine speeds, ensuring that EGR flow is correct. Individual system components function as described in the paragraphs that follow.

4-CYLINDER ENGINES

With coolant temperature below 63°F (17°C), no EGR takes place. The thermo-vacuum valve opens at temperatures above this level. Vacuum is now available for the electric switch-over valve. At idle speeds there is no EGR and switch-over valve is not energized. EGR valve is vented externally.

Starting at speeds of 1300 RPM, the impulses from the TDC transmitter are converted into electrical signals. The switch-over valve is energized and opens. Vacuum arrives at the EGR valve and opens valve. EGR opening is dependent upon engine load. As RPM increases, throttle valve will open and pressure between intake and exhaust manifolds is reduced. As a result, less exhaust gas is drawn into intake manifold.

The vacuum control valve determines amount of vacuum at EGR valve depending on engine load. This amount of vacuum serves as controlling factor for EGR position and shifting of the automatic transmission.

Shortly before full throttle, a lever with a cam switches mechanical switch-over valve to external venting, venting EGR vacuum and eliminating EGR operation.

At speeds above 45 MPH, the impulses transmitted from speedometer impulse transmitter are converted to a control signal. Current to electric switch-over valve is interrupted, EGR is vented, and no further EGR takes place. Individual component operation is described in the following paragraphs

EGR VALVE

All Models

The EGR valve is operated by vacuum signals. The valve controls the amount of EGR depending upon strength of vacuum signal. A corrugated tube from exhaust manifold provides exhaust gases to EGR valve located on intake manifold.

THERMAL VACUUM VALVE

All Models

The thermal vacuum valve is Blue and is installed in the thermostat housing. The valve is closed below 63°F (17°C) and open above this temperature. When the valve is open, EGR can take place.

SWITCH-OVER VALVE

All Models

The switch-over valves control vacuum flow to EGR valve. Two valves are used in EGR system (a third valve controls full-throttle downshifts on Non-Turbo models). One valve vents vacuum when engine is at idle, while other vents vacuum when engine is at full-throttle operation. Valves are located under a plastic cover on cylinder head cover and are actuated by a throttle linkage cam.

VACUUM CONTROL VALVE

All Models

The vacuum control valve is located on the fuel injection pump. It vents vacuum to atmosphere as throttle opens. With increasing engine load, vent size increases, decreasing vacuum signal to EGR valve. This reduces EGR as engine load increases. The Black plastic line leads to passenger compartment where vacuum is vented.

ORIFICE

All Models

Several vacuum restrictors are used to control system vacuum levels. These restrictors should not be changed unless system testing indicates adjustment is needed.

THROTTLE VALVE HOUSING

4-Cylinder Engines

The throttle valve housing is required to increase the amount of EGR in partial load range. Outside diameter of throttle valve housing is designed so that in its closed position an annular cross-section remains open. This allows the engine to idle smoothly at high altitudes with air conditioning on and power steering activated.

The lower half of housing is provided with guide vanes. These vanes ensure complete mixing of intake air and recirculated exhaust gas, so that each cylinder is provided with same quantity of exhaust gas.

ELECTRIC SWITCH-OVER VALVE

4-Cylinder Engines

The switch-over valve controls vacuum to EGR valve. It opens or closes by way of an electronic control unit depending on engine RPM and speed.

ELECTRIC CONTROL UNIT

4-Cylinder Engines

The electronic control unit processes input data such as engine RPM from the TDC transmitter and driving speed from the impulse transmitter of the speedometer.

TDC TRANSMITTER

4-Cylinder Engines

A TDC transmitter is attached to the front of the cylinder block and transmits engine RPM information to the control unit for EGR operation.

MERCEDES-BENZ DIESEL EXHAUST GAS RECIRCULATION (Cont.)

TESTING

NOTE: For location of components described in Testing procedures, see Mercedes-Benz Vacuum Diagrams in this section. Testing procedures should be used if customer complaints describe poor performance, excessive smoke, knocking at full throttle or rough idle.

4-CYLINDER ENGINES

EGR Valve

1) With Yellow orifice installed, connect vacuum gauge between EGR valve and electric switch-over valve. Run engine at idle and note vacuum. If vacuum is present, check all vacuum lines for blockage and proper connection. Connect volt/ohmmeter to plug of switch-over valve and measure voltage. If no voltage, replace valve. If voltage is present, check electrical wiring and components.

2) If no vacuum in step **1)**, increase engine speed to 1300 RPM and note vacuum. If vacuum reads 9.4-10.7 in. Hg, stop engine and connect hand vacuum pump to EGR valve and apply 10.7 in. Hg. Pull off vacuum line and EGR valve should be heard to close. If not, replace valve. If it does, proceed to Vacuum Control Check.

3) If in step **2)**, no vacuum or low vacuum was noted, check vacuum lines for proper connections and leaks. Disconnect White/Brown line from angled connection of thermo-vacuum valve. Pull White/Purple/Brown line from EGR valve and blow through it. If no air escapes, replace thermo-vacuum valve.

4) Place hand on switch-over valve and run engine to about 1300 RPM. Valve should noticeably switch. If not, check electrical wiring and components. If it does switch, pull off vacuum line and check for vacuum. If no vacuum, replace switch-over valve.

Vacuum Control

1) Connect vacuum tester between EGR valve and switch-over valve. Disconnect connecting rod on ball head. Start engine and run at about 1300 RPM. Place adjusting roller (916 589 00 21 00) on vacuum control valve and move lever against stop. Check vacuum reading.

2) If vacuum reads 5.3-6.4 in. Hg, proceed to step **3)**. If reading is above or below this value, check orifice for obstruction. If vacuum reading was too low, install a smaller orifice. If this does not increase vacuum, or if reading was too high and Yellow orifice is installed, replace vacuum control valve.

3) Pull off central plug. Connect test line between tapping point on Black orifice and valve plate connection. Connect vacuum tester to port 3 on central plug. Start engine and read vacuum. If vacuum does not drop, replace switch-over valve. If vacuum is 18.8-21.5 in. Hg at idle, and zero when regulating linkage is moved to full throttle stop, stop engine.

4) Vacuum should remain constant for about 2 minutes. If not, replace switch-over valve. If vacuum holds, remove connections and proceed to step **5)**.

5) Connect vacuum tester between EGR valve and switch-over valve. Operate vehicle on a dynamometer or road, but not at full throttle. Read vacuum. If there is no vacuum above 40 MPH, and vacuum is present below 40 MPH, system is okay and test is finished. If vacuum does not drop at speeds above 40 MPH, proceed to step **6)**.

6) Connect voltmeter to plug of switch-over valve and drive vehicle. If about 12 volts are present at speeds above 40 MPH, check electrical wiring and components and replace any defective parts. If there is no voltage, replace switch-over valve.

5-CYLINDER ENGINES

System Check

1) Connect vacuum gauge between thermal vacuum valve and EGR valve using "T". With engine idling and throttle against stop, no vacuum should be present. Open throttle until all slack in free travel rod is taken up. Vacuum level should be 5-7 in. Hg. If system operates correctly, test EGR valve. If not, proceed with system check, with engine at normal operating temperature.

2) Check all vacuum lines for tight connections. Blow through lines to be sure none are plugged. Clean vacuum source fitting on pump.

3) Disconnect vacuum line at EGR valve, then pull off White/Purple/Brown hose at thermal vacuum valve. Blow through hoses. If no air passes, replace thermal vacuum valve.

4) Disconnect vacuum hose plug at switch-over valve plate. Connect a jumper hose from vacuum source point to point 1 at switch-over valve plug. Plug point 2 and connect a vacuum gauge to point 3.

5) With engine idling, no vacuum should be present. Open throttle until slack is taken up in free travel rod. About 10-12 in. Hg should be present. Return engine to idle speed, then watch vacuum gauge. Vacuum should remain constant for at least 2 minutes.

6) Pull plug from point 2. Vacuum should drop to zero. If valve does not operate properly, replace it. Connect vacuum source jumper hose to point 2 and plug point 1. Leave vacuum gauge connected to point 3.

7) With engine idling, about 10-12 in. Hg vacuum should be present. Clamp vacuum source jumper hose tightly and stop engine. Vacuum should remain constant for at least 2 minutes. Move throttle to full throttle stop, pull off hose at point 1, and observe vacuum gauge.

8) Vacuum should remain constant. Return throttle to idle and pull off jumper hose. Vacuum should drop to zero. If switch does not operate properly, replace it. If switch is okay, check EGR valve.

EGR Valve

Start engine. With engine at idle, eliminate slack in free travel rod by pulling with hand. Disconnect and connect vacuum line at EGR valve and listen for valve operation. If valve does not operate, replace it.

Vacuum Control Valve

1) Connect vacuum gauge between thermal vacuum valve and EGR valve. Increase engine speed to 1000 RPM (do not pull on STOP lever).

2) Vacuum should measure 5.7-6.7 in. Hg on non-Turbo models, and 4.9-5.7 in. Hg on Turbo models. If not, check orifice to ensure it is clean. If level is too high, install a larger orifice. If level is too low, install a smaller orifice. If vacuum level cannot be correctly adjusted, replace vacuum control valve.