1982 Exhaust Emission Systems

GENERAL MOTORS EXHAUST GAS RECIRCULATION

DESCRIPTION

Exhaust Gas Recirculation (EGR) is used on all Light Duty Emission models to reduce oxides of nitrogen (NOx) emissions. This process is accomplished by lowering combustion temperatures of burning gases. Recirculated and metered amounts of exhaust gases are reintroduced into engine through the intake manifold, where they are mixed with air/fuel mixture.

The back pressure modulated system regulates timed vacuum according to exhaust back pressure level. A special control valve within the EGR valve housing responds as a pressure regulator.

OPERATION

BACK PRESSURE EGR SYSTEM

Two types of back pressure type EGR valves are used by General Motors: a Positive Back Pressure EGR valve (used on Federal V8 models) and a Negative Back Pressure EGR valve (used on some 6-cylinder and most California V8 models).

Operation of the positive and negative back pressure systems is explained as follows:

Positive Back Pressure EGR Valve

A small diaphragm control valve inside EGR valve assembly acts as a pressure regulator. Control valve receives an exhaust back pressure signal through a hollow shaft, which exerts a force on bottom of control valve diaphragm, opposed by a light spring. A metal deflector plate prevents hot exhaust gases from flowing directly onto diaphragm. *See Fig. 1.*

Vacuum is applied to EGR valve assembly from carburetor spark port, to assure no exhaust gas recirculation at idle. During off-idle operation, manifold vacuum is applied to vacuum chamber through a restriction in signal tube.

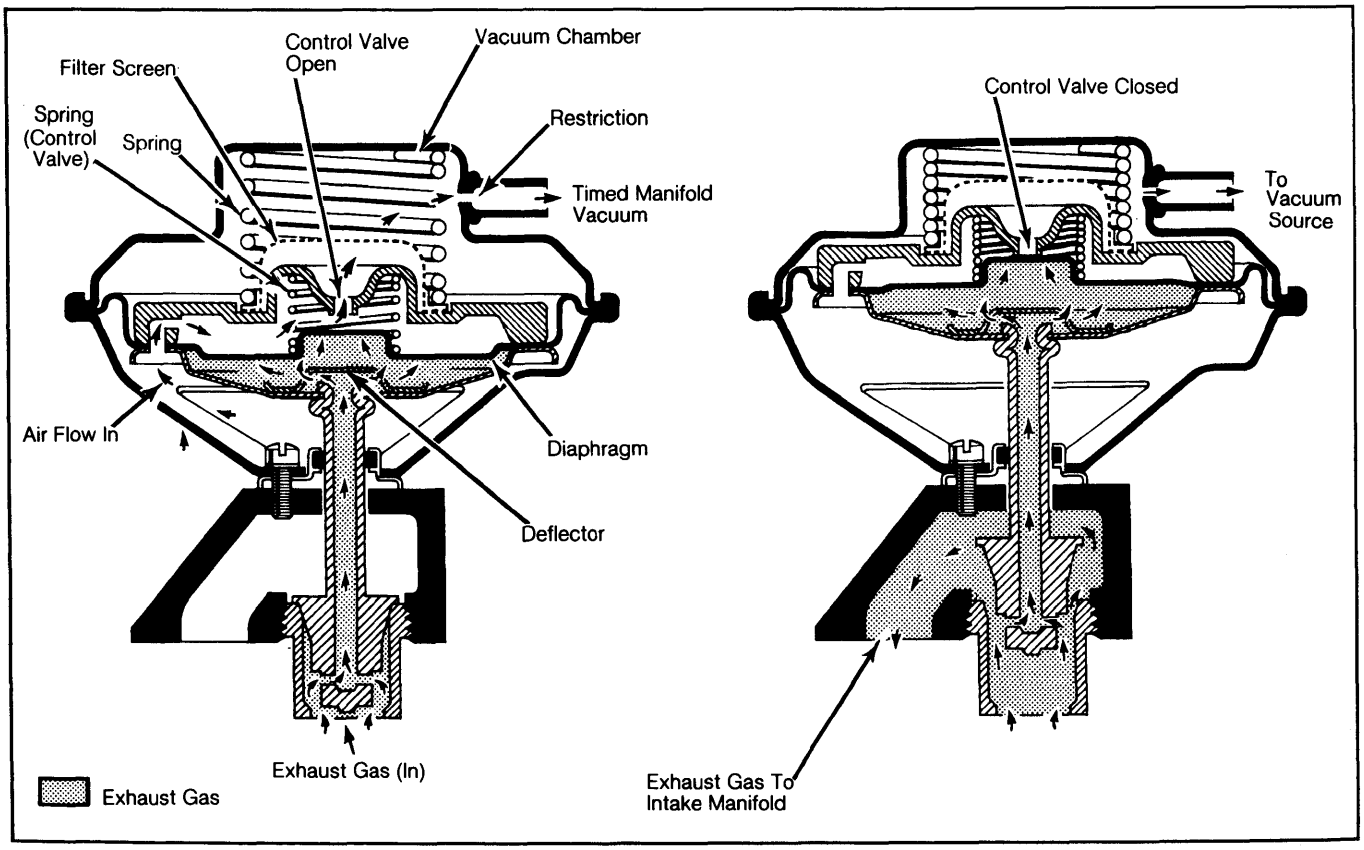
When engine load is light, and back pressure is low, control valve is open. This allows air to flow from 6 bleeds in diaphragm plate, through control valve orifice, into vacuum chamber. Air bleeds off vacuum, decreasing signal trying to open EGR valve. Therefore, if back pressure does not close control valve, sealing off air flow, there will be no vacuum built up to open EGR valve for exhaust gas recirculation.

When power demands are made on engine, and exhaust gas recirculation is needed, exhaust gas back pressure increases, closing control valve. This shuts off air flow through valve. Vacuum builds up in vacuum chamber, until spring force holding EGR valve closed is overcome.

Once EGR valve opens, exhaust pressure decreases, because some of the exhaust gas is flowing into intake manifold through EGR passage. In actual operation, system will reach a balanced condition, providing optimum EGR operation.

Any increase in engine load will momentarily increase exhaust signal, causing control valve to close. This allows a stronger vacuum signal. The system will then stabilize at a greater EGR flow.

Fig. 1: Sectional View of Positive Back Pressure EGR Valve



EGR valve sends metered amounts of exhaust gases back through intake manifold.

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At maximum engine load, when manifold vacuum is nearly zero, momentarily, there will be no EGR operation. This is because of insufficient vacuum to pull valve open, even though high exhaust back pressure has closed control valve.

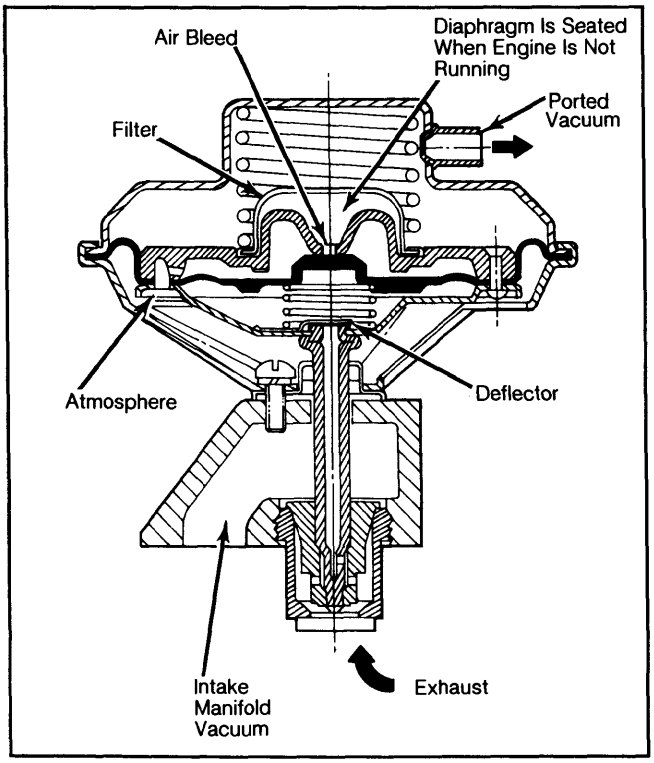
Negative Transducer Back Pressure EGR Valve

The negative transducer back pressure EGR valve assembly has the same function as positive back pressure EGR valve except transducer is designed to allow valve to open with negative exhaust back pressure.

Flow of valve is controlled by manifold vacuum, negative exhaust back pressure and carburetor ported vacuum signal. Control valve spring in transducer is placed on bottom side of diaphragm.

When carburetor ported vacuum signal is applied to main vacuum chamber partially opening valve, vacuum signal from manifold side (reduced by exhaust back pressure) is transmitted up the hollow stem of valve. This enables signal to act on diaphragm, opening bleed and causing transducer to modulate providing a specific valve flow. Thus flow of valve is a constant percentage of engine air flow.

Fig. 2: Sectional View of Negative Back Pressure EGR Valve



Transducer allows valve to open with negative exhaust back pressure.

EGR THERMAL VACUUM SWITCH

EGR TVS, used on all models, closes to prevent EGR operations when engine coolant temperature is below 85°F (29°C). This improves cold engine driveability. When coolant temperature rises above 85°F (29°C), TVS opens to allow vacuum to be directed to EGR valve.

TESTING

SYSTEM OPERATION

1) With engine at normal operating temperature, set engine speed to fast idle (or high enough to obtain at least 5 in. Hg at EGR valve). Place gloved finger beneath EGR valve so diaphragm movement can be felt.

2) Disconnect vacuum hose from EGR valve and watch for diaphragm movement. Diaphragm should move downward (valve closed) and an increase in engine RPM should be noticed.

3) Reconnect vacuum hose. Diaphragm should move upward (valve open) and engine RPM should decrease.

4) If no diaphragm movement is noticed during test, check for vacuum at hose. If vacuum is present, replace EGR valve. If no vacuum is present, check for plugged or leaking hose or carburetor port.

5) If diaphragm moves with no change in engine RPM, check manifold EGR passages for blockage.

FUNCTIONAL TESTS

EGR Valve Installed
Negative Back Pressure Types

1) Check for proper hose routing, according to appropriate diagrams. *See "General Motors Vacuum Diagrams" in this Section.* Check EGR signal tube orifice for obstructions.

2) Hook vacuum gauge between EGR valve and carburetor and check vacuum with engine running at normal operating temperature. With engine at 3,000 RPM, there should be at least 5 in. Hg.

3) Check operation of Thermal Vacuum Switch by installing a vacuum gauge in line between TVS and its sources and noting presence of vacuum with engine operating warm. Valve can also be removed and checked by placing in pails of warm and cold water (with vacuum source and gauge attached on either side) to check for valve open while warm and closed while cold.

4) With engine off and valve on or off the vehicle, manually depress valve diaphragm. While depressed, hold finger over source tube and release diaphragm.

5) Check for diaphragm and seat movement. Valve is okay if it takes over 20 seconds for diaphragm to move to seated position. If less, replace EGR valve.

EGR Valve Removed
Positive Back Pressure Type

1) Apply external vacuum of 10 in. Hg or more to EGR valve signal tube.

NOTE: A constant vacuum supply must be used.

2) Valve should not open. If it does, transducer control valve is stuck closed and EGR valve must be replaced.

3) With vacuum still applied, apply a stream of air from a low pressure source 15 psi (1.05 kg/cm²) into EGR valve exhaust gas intake passage. Valve should open completely. If it does not open at all, transducer control valve is stuck open or exhaust passages are plugged. Replace EGR valve.

4) If EGR valve and control valve are both functioning properly, clean mounting surfaces. Using a

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new gasket, install valve on engine. Reconnect vacuum hose.

EGR-TVS Test (Hot)

1) Remove EGR valve vacuum hose at EGR valve and connect hose to a vacuum gauge. Start engine. With transmission in Park or Neutral, open throttle partially. As throttle is opened, vacuum gauge should respond with an increase in vacuum reading. If operation is satisfactory, remove gauge and reconnect hose to EGR valve. If gauge does not respond to throttle opening, proceed to step **2)**.

2) Remove carburetor-to-TVS hose from switch and connect hose to vacuum gauge. Start engine. With transmission in Park or Neutral open throttle partially. If vacuum gauge responds to throttle opening, switch is defective. Remove switch and replace with new part. If gauge does not respond to throttle opening, check for plugged hose or defective carburetor.

EGR-TVS Test (Cold)

1) Engine coolant must be below 85°F (29°C). Drain coolant to below level of switch. Disconnect vacuum lines and remove switch. Inspect switch to make sure it is in good condition.

2) Connect a vacuum hose to lower nipple of switch, marked "C" or "CARB". Connect a vacuum gauge to upper nipple, marked "E" or "EGR". Place switch in water at 75°F (24°C) and submerge completely for 2 minutes while agitating water thoroughly. Apply 12 in. Hg to hose on lower nipple of switch. Under this condition, switch should be closed.

NOTE: Leakage of up to 2 in. Hg in 2 minutes is allowable and does not mean a defective switch.

3) If operation is satisfactory, reinstall switch. If switch is defective, replace with a new part. Replace coolant and check level.

MAINTENANCE

EGR PASSAGE CLEANING

If inspection of EGR passages in intake manifold indicates excessive build up of exhaust deposits, passages should be cleaned. Care should be taken to ensure that all loose particles are completely removed to prevent them from clogging EGR valve or from being ingested into engine.

GENERAL MOTORS VACUUM ADVANCE SPARK CONTROL

DESCRIPTION

TRAPPED VACUUM SPARK

Trapped vacuum spark is used on all models. A thermal vacuum switch (TVS) is mounted in cylinder head and used to sense engine coolant temperature. A vacuum check valve is mounted between manifold vacuum, distributor and thermal vacuum switch. The system maintains high vacuum levels to distributor during cold engine operation and cold engine acceleration.

SPARK VACUUM DELAY

The spark vacuum delay is used on 5.7L V8 engines with Heavy Duty Emissions. It is installed between TVS check valve and distributor.

OPERATION

TRAPPED VACUUM SPARK

When engine temperature is below a pre-set specified value, manifold vacuum signal is routed through check valve to distributor. Ports on TVS are blocked. The check valve will keep distributor vacuum at levels higher than manifold depression during vehicle acceleration.

A small sintered iron bleed orifice is provided in check valve to allow for a leak-down to enable engine to be restarted if it stalls. (This applies to all models except: Light Duty California and High Altitude Emissions; 5.7L V8 with Heavy Duty Emissions; all 7.4L V8 engines.)

When engine temperature is above pre-set value, TVS ports will be open to allow manifold vacuum to distributor. During this mode of operation, check valve will act as a connector.

SPARK VACUUM DELAY

As manifold vacuum increases, check valve opens and allows distributor vacuum to increase to same level. When vacuum decreases during vehicle acceleration, check valve closes and distributor vacuum will decrease at a rate controlled by internal bleed.