

1975-79 EXHAUST EMISSION SYSTEMS

Air Injection Systems

All Manufacturers

DESCRIPTION

The air injection systems, used on many applications, are designed to reduce carbon monoxide and hydrocarbon emissions. This is done by injecting fresh air into the exhaust manifold to continue the burning process of gases which pass through the combustion cycle. The air injection system consists of an air pump with integral filter, diverter/by-pass valve, check valve(s), external or internal injection tubing and connecting hoses.

Some late 1977 Ford models use a pulse air type system. This system does not use a belt driven pump. General Motors models with 250" 6-cylinder engines use a Pulse Air Injection Reactor (PAIR) type air injection system (no air pump). This system uses check valves and connecting pipes to inject air.

OPERATION

AIR PUMP TYPE

The air pump uses an eccentric (off-center) vane to draw in fresh air, compress it and pass it on through the system. The pump is belt driven. See Fig. 1.

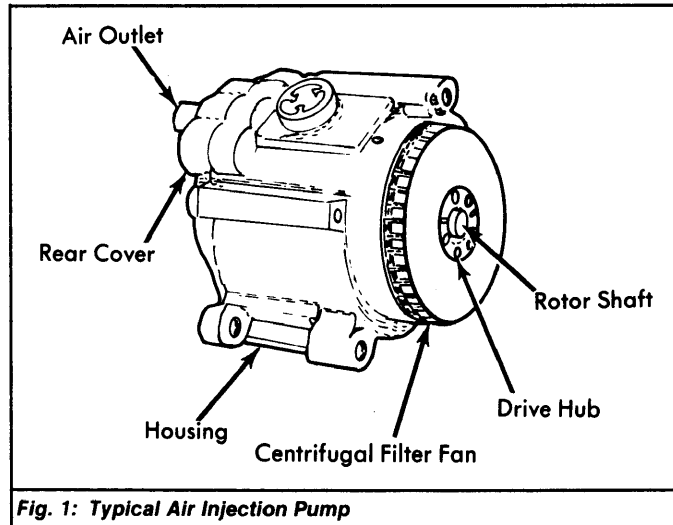


Fig. 1: Typical Air Injection Pump

PULSE AIR INJECTION TYPE

General Motors models with 250" 6-cylinder engines and late 1977 Ford 300" 6-cylinder models use a Pulse Air Injection type air injection system (no air pump). This system uses the negative and positive pulses of the exhaust manifold to inject air. When a negative pulse is present, fresh air is drawn into the exhaust manifold through a check valve. A positive pulse closes the check valve, preventing hot exhaust gases from flowing backwards in the system. See Figs. 7 and 8.

DIVERTER VALVE

After the air leaves the air pump, it goes immediately into the diverter valve. This valve serves to prevent backfire by stopping air injection flow during deceleration. The diverter valve will dump the air supply to the atmosphere for the first few seconds of deceleration. Most diverter valves also have a pressure relief valve which bleeds off excessive air pump pressure to prevent damage to the system. Diverter valves used on many applications are similar to the one shown. See Fig. 2.

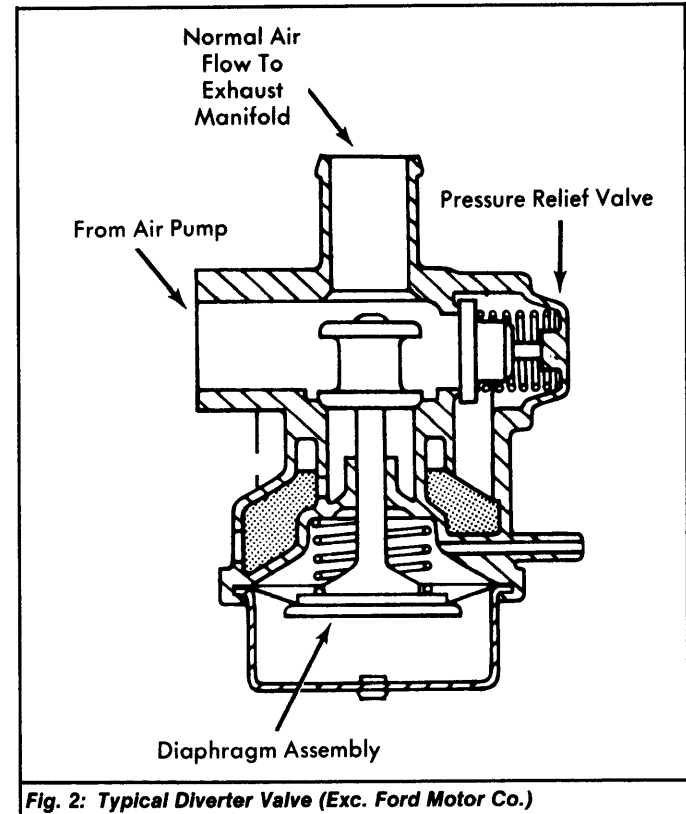
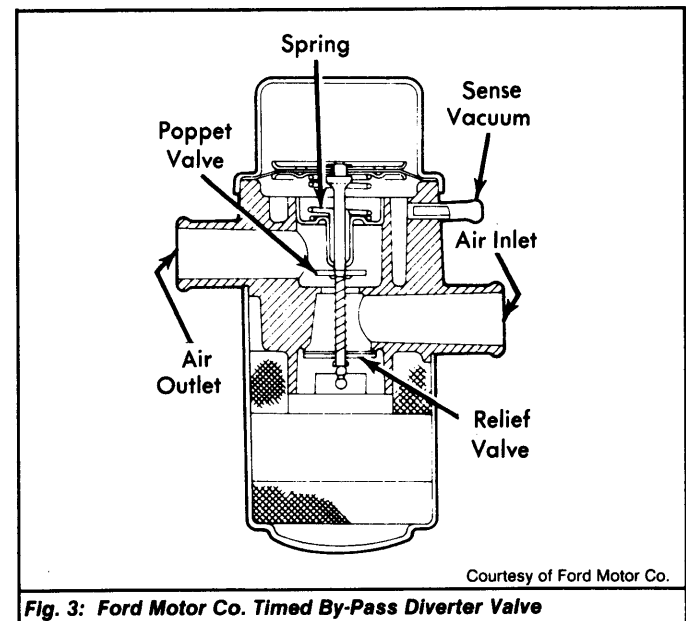


Fig. 2: Typical Diverter Valve (Exc. Ford Motor Co.)

Ford Motor Co. Timed By-Pass Diverter Valve - This is a normally-open valve. During normal operation, vacuum is equalized on both sides of the diaphragm. Spring pressure holds the valve open, allowing fresh air to the exhaust system. On deceleration, manifold vacuum pulls the diaphragm so that air is directed to the atmosphere. A small orifice in the diaphragm will allow the pressure to quickly equalize again. See Fig. 3.

Ford Motor Co. Normally-Closed By-Pass Diverter Valve - When no vacuum is applied, all air pump air is diverted to the atmosphere to protect the converter. When vacuum is received, air then passes to the exhaust ports. See Fig. 4.



Courtesy of Ford Motor Co.

Fig. 3: Ford Motor Co. Timed By-Pass Diverter Valve

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Air Injection Systems (Cont.)

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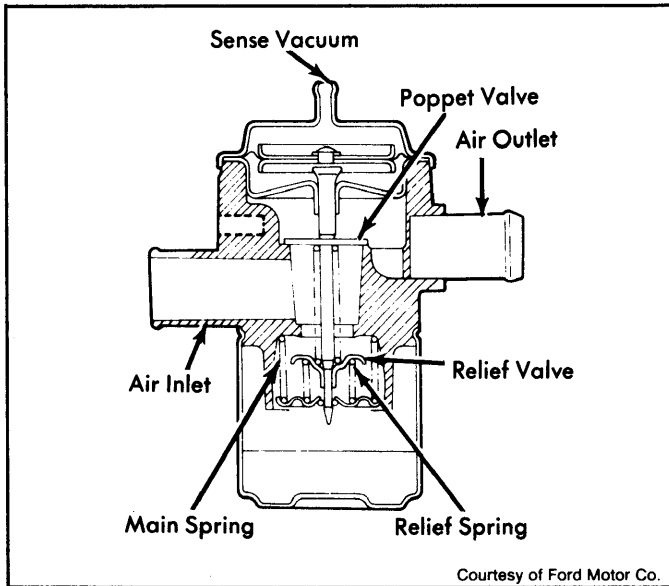


Fig. 4: Ford Motor Co. Normally-Closed By-Pass Diverter Valve

Ford Motor Co. Timed & Vented By-Pass Diverter Valve – This valve operates similar to the timed valve described earlier. When vacuum signal is 4 in. Hg or more, the valve will continuously vent air pump air to the atmosphere. See Fig. 5.

CHECK VALVE

The check valve is a one-way flow valve. It prevents air from the exhaust manifold from backing up through the system and reaching the air pump. The check valve is located either in the tubing leading to the injection manifold or as an integral part of the manifold.

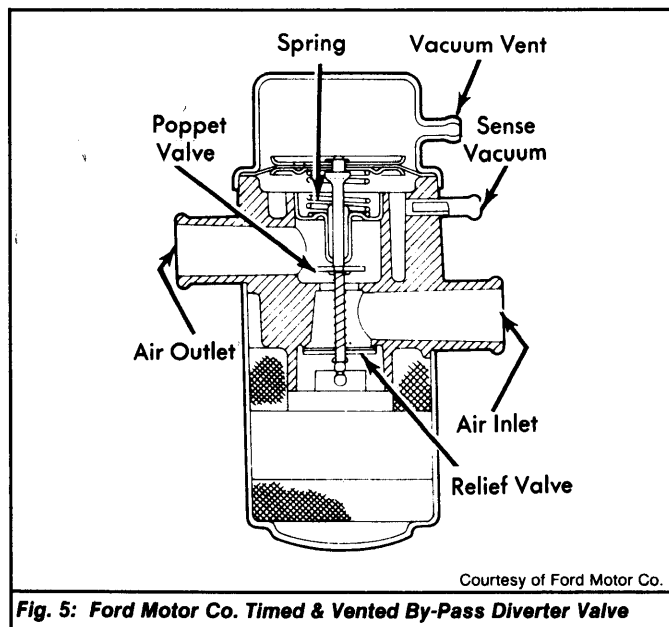


Fig. 5: Ford Motor Co. Timed & Vented By-Pass Diverter Valve

INJECTION MANIFOLD

The injection manifold on many applications is an external tubing system, mounted to the exhaust manifold with air delivery ports for each exhaust port. Some applications have an internal air injection system which is specially drilled passages which carry the air pump air to the exhaust ports. This eliminates the need for external tubing.

IDLE VACUUM VALVE

Ford Motor Co. – This valve is used on Ford Motor Co. models which have a catalytic converter. The air injection system on these models is also tied into the EGR system. See Fig. 6.

Operating in conjunction with a vacuum delay valve, the idle vacuum valve provides backfire control, full-time idle air dump, cold temperature catalyst protection and cold EGR lock-out. On long idle, the air dump prevents high underbody temperatures in the exhaust system. During cold engine operation, the valve prevents air injection and EGR operation until the catalyst and engine are warm.

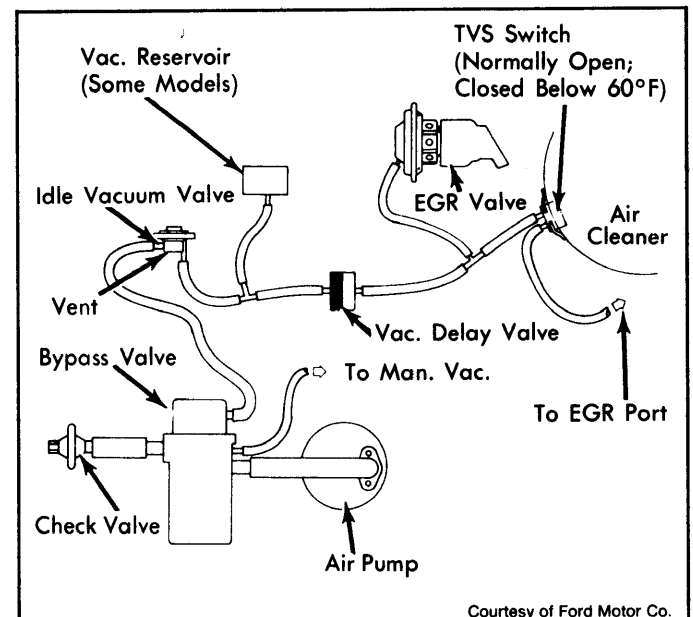


Fig. 6: Schematic of Ford Motor Co. Air Injection System with Idle Vacuum Valve

TROUBLE SHOOTING

AIR PUMP TYPE

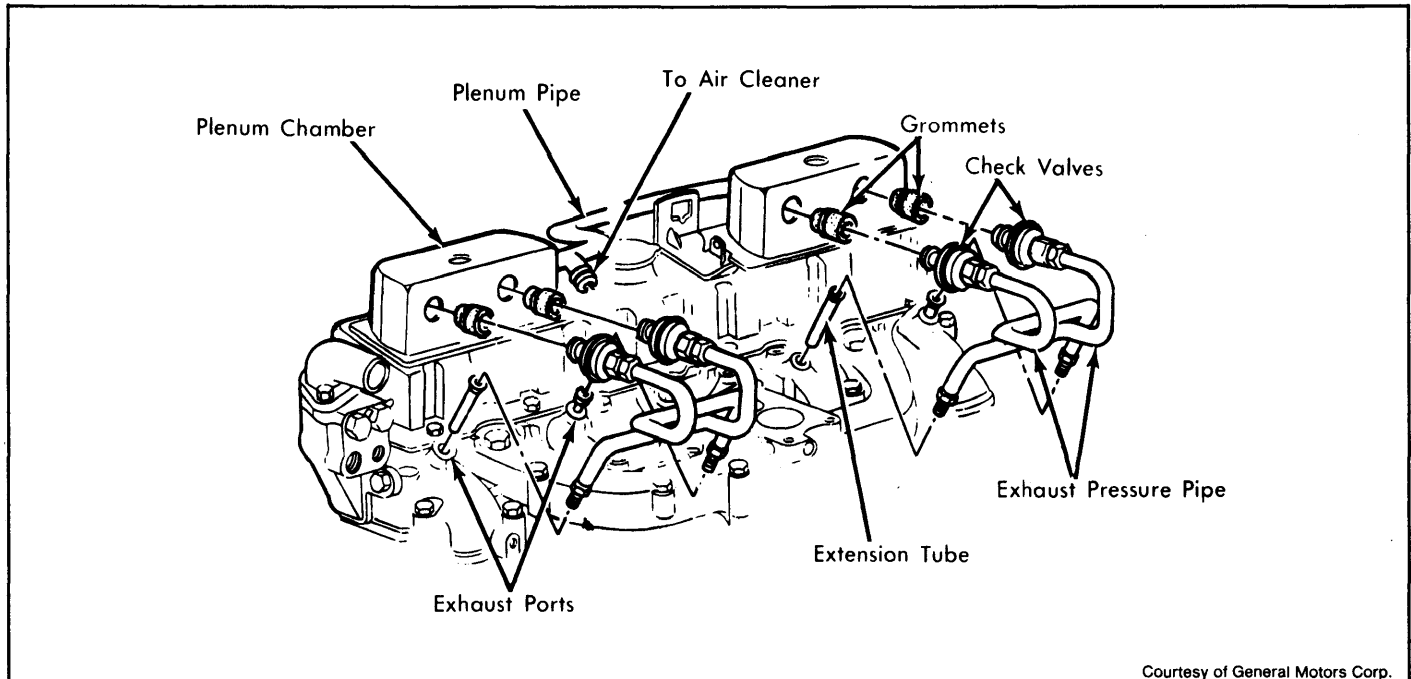
- Excessive Belt Noise** – Loose pump drive belt or seized pump.
- Excessive Pump Noise** – Leak in hose, loose hose, hose touching other engine parts, diverter valve or by-pass valve failure, check valve failure, pump mounting loose, pump or impeller damaged.
- No Air Supply** – Loose drive belt, leak in hose or hose fitting, diverter valve or by-pass valve failure, check valve failure, pump failure.
- Exhaust Backfire** – Incorrect engine tune-up, engine vacuum leaks, faulty diverter valve or check valve.

PULSE AIR INJECTION TYPE

- Short Hissing Noise** – May indicate a defective check valve or improper torque at manifold. Inspect check valves.
- Surge Or Poor Performance** – May be caused by failure of one or more check valves. Exhaust gas will enter carburetor through air cleaner and cause poor driveability.
- Excessive Heat; Paint Burned Off Of Valve** – Exhaust gas passing through pulse air valve, sending heat to valve body. Rubber hose will also be damaged. A short hissing noise may also be noticed. Repair plenum chamber-to-valve cover seals, and replace grommets and hose as required.
- Poor Driveability** – Rubber hose deteriorated. Hose particles entering carburetor causing poor driveability. Clean carburetor, and remove particles from plenum chambers and connecting pipe.

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Courtesy of General Motors Corp.

Fig. 7: General Motors Pulse Air Injection Reactor (PAIR) System Components

TESTING

AIR PUMP TYPE

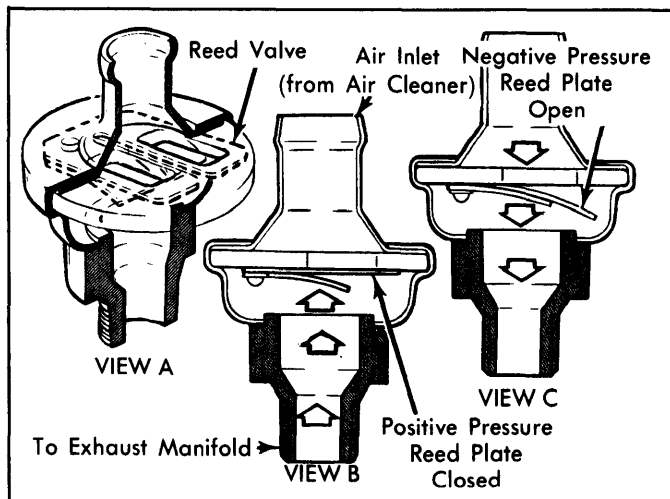
Diverter Valve Test - Test valve by accelerating engine and allowing throttle to close rapidly. A momentary rush of air should be noted at diverter air outlet.

Check Valve Test - To check operation of this valve, remove air supply hose from check valve. With engine operating, listen for exhaust leakage at check valve. At low engine speeds, a fluttering noise is common at the check valve due to exhaust pulses.

PULSE AIR INJECTION TYPE

Ford Motor Co. - 1) With engine off, check all hoses, clamps and valve for proper condition. Disconnect hose from pulse air valve. Attach Check Valve Tester (T751-9487-A) to open end of pulse air valve.

2) Squeeze test bulb on tester. Bulb should completely collapse. If bulb does not collapse, pulse air valve is defective and must be replaced.



Courtesy of Ford Motor Co.

Fig. 8: Ford Motor Co. Pulse Air Injection Valve Operation

General Motors - 1) Remove air cleaner-to-plenum pipe hose from plenum pipe. Slide a length of tight-fitting $\frac{3}{4}$ " hose onto plenum pipe. Using an adapter, connect a hand vacuum pump to hose.

2) Apply more than 15 in. Hg. Note the time required for vacuum level to drop from 15 in. Hg to 5 in. Hg. If less than 2 seconds, remove check valves and test individually. Replace check valve(s) which fails leak-down test.

NOTE: If system fails leak-down test, ensure that failure is not due to a leaking test hose or connection.

MAINTENANCE

Approximately every 15,000 miles, air injection system components should be checked for proper operation and condition. No regular parts replacement schedule is required. Service on air pump is limited to replacement of air pump filter if it becomes clogged.

Centrifugal Fan Filter - To replace, remove drive belt, pulley mounting bolts, and pulley. Break off remaining portions of centrifugal fan filter from pump hub, being careful that fragments do not enter air intake hole. Install new filter by drawing it on with the pulley and pulley bolts. Do not attempt to hammer or press filter on.

NOTE: A new filter may squeal until its outside diameter has worn in. This may require 20 to 30 miles of operation.

Exhaust Emission System Cleaning - DO NOT attempt to clean diverter valve. Do not blow compressed air through check valve.

NOTE: If engine or engine compartment is to be cleaned with steam or high pressure washer, centrifugal filter fan should be masked off to prevent liquids from entering air pump.

Air Pump Overhaul - Overhaul of air pump is not recommended since internal components of pump are not serviceable.

Pump Exhaust Tube Replacement - Remove by placing tube in a vise, or use a suitable pair of pliers to pull tube with a twisting motion. Insert new tube into hole and tap in with a block of wood to protect tube. Approximately $\frac{7}{8}$ " of tube should extend above cover.