GENERAL MOTORS AIR INJECTION REACTOR SYSTEM

NOTE — *A Pulse Air (PAIR) Injection system is also used on some General Motors models. See "General Motors Pulse Air Injection System" article in this section.*

DESCRIPTION

The Air Injection Reactor (A.I.R.) system is used to reduce HC and CO by injecting air into the exhaust ports, which induces further burning of exhaust gases. Two new valves were introduced in 1980 to provide additional functions along with standard divert air functions. Single valve systems will direct air from the air pump to either the exhaust ports or divert it to the air cleaner or intake manifold. Two valve and integral valve systems add air switching functions to those of the single systems. This system is used with the dual bed converter emission control system. The air switching function will divert air flow either to the exhaust ports or between the catalytic converter beds when the catalytic converter is up to operating temperature and the emission system switches to "closed loop".

V6 ENGINES (231" VIN A)

This system consists of a belt driven air pump, differential vacuum delay and separator valve, check valves, air control valve, and special cylinder head assemblies. The air system reduces the hydrocarbon and carbon monoxide content of the exhaust gases by injecting air into the exhaust ports of 4 cylinders.

NOTE — *The carburetor and distributor used with this system are specially designed for the special A.I.R. system on these engines. Components are not interchangeable with other engines.*

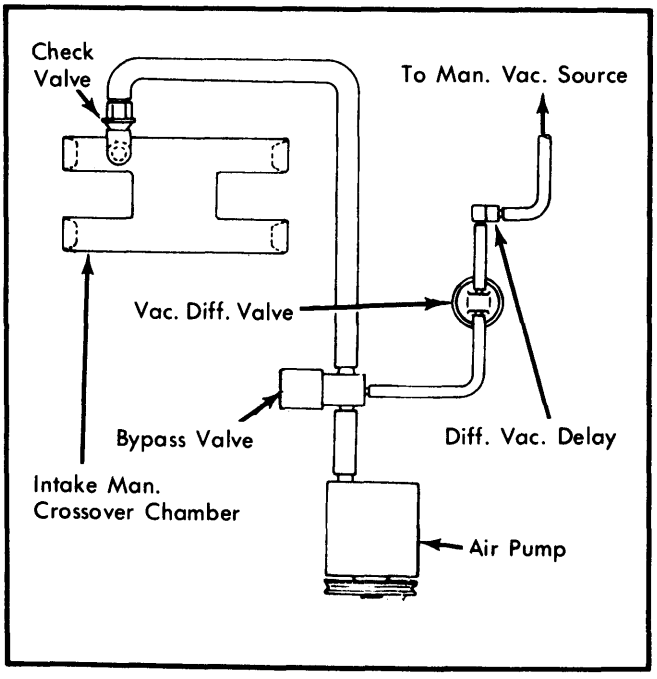

Fig. 1 231" V6 (VIN A) A.I.R. System Schematic

OPERATION

AIR PUMP

Intake air passes through the centrifugal filter at front of pump. Air is delivered to injection manifold by hoses and tubing.

AIR CONTROL VALVE

The air control valve is located in the air supply line between the pump and check valve, The control valve is vacuum controlled. During normal operation, a vacuum signal is applied to the control valve and all the air supply is directed to the check valve and air delivery system. When the vacuum signal to the port is less than 2 in Hg, the air supply from the air pump is diverted to the engine air cleaner. When there is excess back pressure in the system, there is a spring loaded relief valve which comes unseated.

AIR BYPASS VALVE & DIFFERENTIAL VACUUM VALVE

These two types of valves are used for the same purpose — to prevent backfiring in the exhaust system during sudden deceleration. When the valve senses a sharp rise in intake manifold vacuum, it opens to allow air from air pump to vent to atmosphere. In addition, some bypass valves also act to prevent high exhaust temperatures under certain engine load conditions. This type of valve will vent injection air to the atmosphere.

DIFFERENTIAL VACUUM DELAY & SEPARATOR VALVE

This valve delays the air bypass function during heavy acceleration. It allows immediate air injection during sudden acceleration, but will bypass air injection under sustained high load operation where high exhaust temperatures can occur. This valve also has a fuel separator. It is designed to prevent liquid fuel from reaching the vacuum-operated components of the A.I.R. system.

CHECK VALVE

The check valve prevents backflow of exhaust gas into the air distribution system. The valve prevents backflow when air pump bypasses at high speed and loads, or in case the air pump malfunctions.

ELECTRIC AIR CONTROL VALVE (3.8L WITH C-4 SYSTEM)

This valve combines 3 separate functions into a single valve. It provides normal diverter valve function, pressure relief by diverting air to the engine air cleaner when system pressure exceeds a predetermined value, and by utilizing a solenoid the valve can be electronically controlled to divert air under any desired operating mode. When the solenoid is energized, the valve will perform like a standard diverter valve; and de-energized the solenoid causes air to divert during all operating modes.

GENERAL MOTORS AIR INJECTION REACTOR SYSTEM (Cont.)

ELECTRIC AIR SWITCHING VALVE (3.8L TURBO WITH C-4 SYSTEM)

The air switching valve is a spring biased 2-way valve that is located in series between the air control valve and the exhaust system. When the solenoid is de-energized, a vacuum is applied to the diaphragm chamber to provide air flow to the exhaust ports. When the solenoid is energized, vacuum to the diaphragm chamber is blocked and the chamber is vented to the atmosphere. This allows the spring to open the port to the catalytic converter and close the port to the engine.

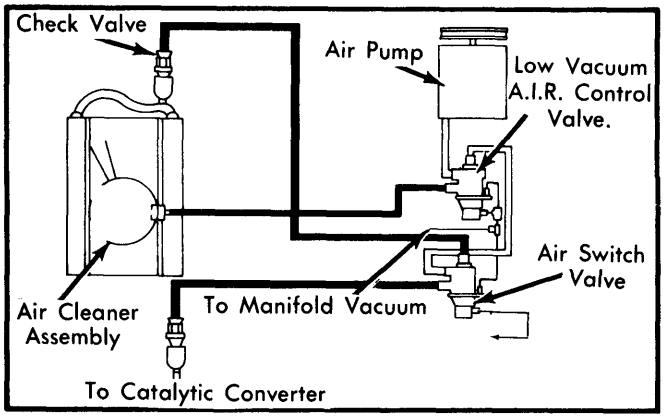

Fig. 2 Typical Air Management System Schematic

TESTING

AIR MANAGEMENT SYSTEM FUNCTIONAL TEST

1) Check diverter valve operation; valve should not pump air to air cleaner hose at part throttle, but should on quick deceleration or any time vacuum signal drops below 3 in. Hg.

2) To check select valve operation, start engine and run at fast idle. Pulsation should be felt in hose to exhaust ports until system goes to closed loop, then it should switch to catalytic converter hose.

ALL OTHERS – FUNCTIONAL TEST

1) Inspect check valve whenever working on system. If pump was inoperative and had signs of exhaust gases reaching pump, a failed check valve would be indicated.

2) Seal off vacuum supply to diverter valve by pinching hose. Hold for at least one second, then release hose. Air should now be exhausting from bottom of diverter valve. It should do so for about four seconds. Replace diverter valve if air does not exhaust.

CHECK VALVE

1) Inspect check valve whenever working on A.I.R. system. If pump was inoperative and had signs of exhaust gases reaching pump, a failed check valve would be indicated.

2) After detaching valve, blow through it in direction of flow to cylinder head, then attempt to suck back against direction of flow. Replace valve if it allows airflow against direction of flow.

AIR PUMP

1) Accelerate engine to approximately 1500 RPM and observe airflow from hoses. If airflow increases as engine is accelerated, pump is operating satisfactorily. If it does not increase, or is not present, proceed to next step.

2) Check for proper pump belt tension, leaky valves, seized pump, or improperly routed or disconnected hoses.

NOTE – *Do not oil air pump. Also note that air pump system is not completely noiseless.*

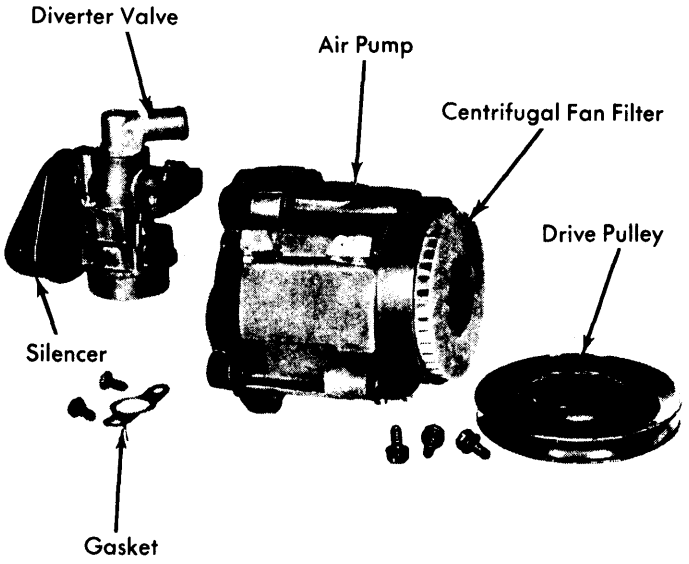

Fig. 3 Typical Air Pump Showing Components

TROUBLE SHOOTING

EXCESSIVE NOISE

Loose drive belt or seized pump. Leaking hose. Improperly positioned hose. Diverter and/or bypass valve failure. Loose pump mounting. Pump damaged.

NO AIR SUPPLY

Loose drive belt. Leak in hoses or tubing. Diverter or bypass valve failure. Check valve failure. Pump malfunction.

EXHAUST BACKFIRE

Engine not tuned to specifications. Engine vacuum leaks. Faulty diverter valve or check valve. On C-4 systems, make sure that diverter valve shifts air pump discharge to air cleaner for up to 5 seconds after starting engine and on quick deceleration.

POOR GAS MILEAGE

On C-4 system, make sure that diverter valve shifts air pump output to dual bed catalytic converter upon TVS signal after warmup.