85

POSITIVE CRANKCASE VENTILATION AND SECONDARY AIR-INJECTION SYSTEMS

Figure 85-1 A PCV valve in a cutaway valve cover, showing the baffles that prevent liquid oil from being drawn into the intake manifold.

Figure 85-2 Spring force, crankcase pressure, and intake manifold vacuum work together to regulate the flow rate through the PCV valve.

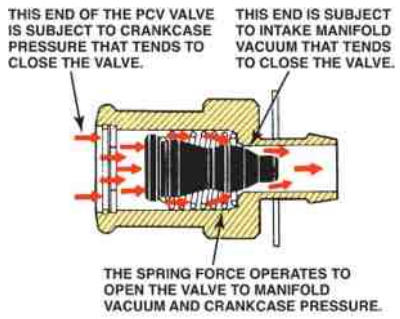


Figure 85-3 Air flows through the PCV valve during idle, cruising, and light-load conditions.

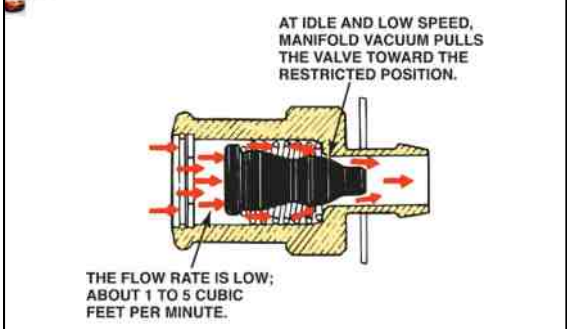


Figure 85-4 Air flows through the PCV valve during acceleration and when the engine is under a heavy load.

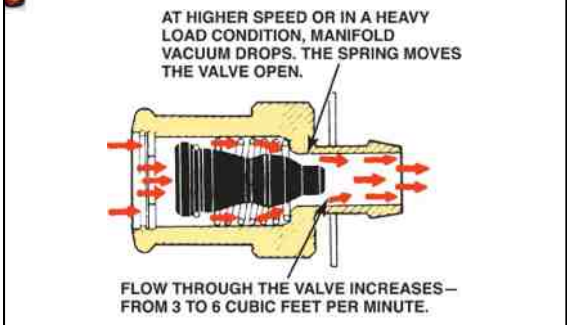
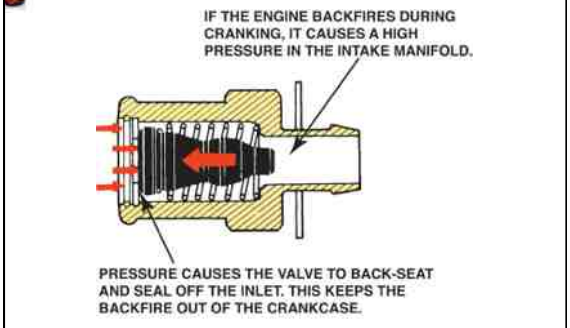


Figure 85-5 PCV valve operation in the event of a backfire.



REAL WORLD FIX

The Whistling Engine

An older vehicle was being diagnosed for a whistling sound whenever the engine was running, especially at idle. It was finally discovered that the breather in the valve cover was plugged and caused high vacuum in the crankcase. The engine was sucking air from what was likely the rear main seal lip, making the "whistle" noise. After replacing the breather and PCV, the noise stopped.

TECH TIP

Check for Oil Leaks with the Engine Off

The owner of an older vehicle equipped with a V-6 engine complained to his technician that he smelled burning oil, but only *after* shutting off the engine. The technician found that the rocker cover gaskets were leaking. But why did the owner only notice the smell of hot oil when the engine was shut off? Because of the positive crankcase ventilation (PCV) system, engine vacuum tends to draw oil away from gasket surfaces. When the engine stops, however, engine vacuum disappears, and the oil remaining in the upper regions of the engine will tend to flow down and out through any opening. Therefore, a good technician should check an engine for oil leaks not only with the engine running but also shortly after shutdown.

REAL WORLD FIX

The Oil-Burning Chevrolet Astro Van

An automotive instructor was driving a Chevrolet Astro van to Fairbanks, Alaska, in January. It was cold, around −32°F (−36°C). As he pulled into Fairbanks and stopped at a traffic light, he smelled burning oil. He thought it was the vehicle ahead of him because it was an older model and in poor condition. However, when he stopped at the next light he still smelled burning oil. He looked under the van and discovered a large pool of oil. After checking the oil and finding very little left, he called a local shop and was told to bring it in. The technician looked over the situation and said, "You need to put some cardboard across the grill to stop the PCV valve from freezing up." Apparently the PCV valve froze, which then caused the normal blowby gases to force several quarts out the dipstick tube. After installing the cardboard, the instructor had no further problems.

CAUTION: Do not cover the radiator when driving unless under severe cold conditions and carefully watch the coolant temperature to avoid overheating the engine.

Figure 85-6 Using a gauge that measures vacuum in units of inches of water to test the vacuum at the dipstick tube, being sure that the PCV system is capable of drawing a vacuum on the crankcase (28 in. H_2O = 1 PSI, or about 2 in. Hg of vacuum).

Figure 85-7 Most PCV valves used on newer vehicles are secured with fasteners, making it more difficult to disconnect and thereby less likely to increase emissions.

FREQUENTLY ASKED QUESTION

What Are the Wires for at the PCV Valve?

Ford uses an electric heater to prevent ice from forming inside the PCV valve and causing blockage.

Water is a by-product of combustion, and resulting moisture can freeze when the outside air temperature is low. General Motors and others clip a heater hose to the PCV hose to provide the heat needed to prevent an ice blockage.

Figure 85-8 A typical belt-driven AIR pump. Air enters through the revolving fins behind the drive pulley. The fins act as an air filter because dirt is heavier than air, and therefore the dirt is deflected off of the fins at the same time air is being drawn into the pump.

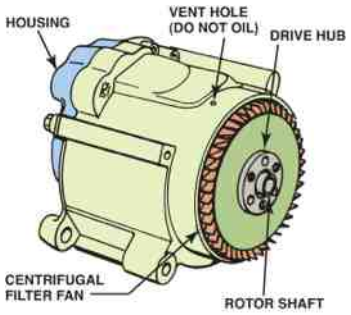


Figure 85-9 The external air manifold and exhaust check valve on a restored muscle car engine.

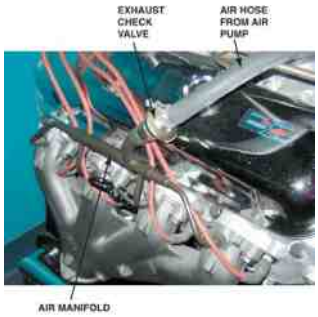


Figure 85-10 (a) When the engine is cold and before the oxygen sensor is hot enough to achieve closed loop, the airflow from the air pump is directed to the exhaust manifold(s) through the one-way check valves, which keep the exhaust gases from entering the switching solenoids and the pump itself.

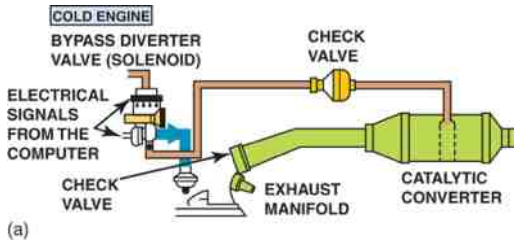


Figure 85-10 (b) When the engine achieves closed loop, the air is directed to the catalytic converter.

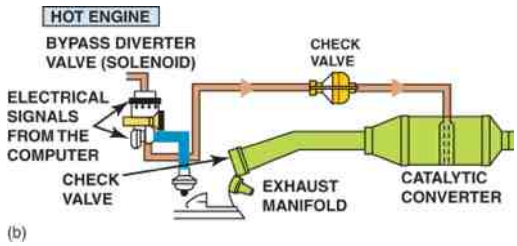


Figure 85-11 A typical electric motor–driven SAI pump. This unit is on a Chevrolet Corvette and only works when the engine is cold.

CHART 85–1 Typical SAI system operation showing location of airflow from the pump.

Engine Operation	Normal Operation of a Typical SAI System
Cold engine (open-loop operation)	Air is diverted to the exhaust manifold(s) or cylinder head
Warm engine (closed-loop operation)	Air is diverted to the catalytic converter
Deceleration	Air is diverted to the air cleaner assembly
Wide-open throttle	Air is diverted to the air cleaner assembly

CHART 85–1