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.

**AT IDLE AND LOW SPEED, MANIFOLD VACUUM Pulls THE VALVE TOWARD THE RESTRICTED POSITION.**

THE FLOW RATE IS LOW; ABOUT 1 TO 5 CUBIC FEET PER MINUTE.

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

**AT HIGHER SPEED OR IN A HEAVY LOAD CONDITION, MANIFOLD VACUUM DROPS, THE SPRING MOVES THE VALVE OPEN.**

FLOW THROUGH THE VALVE INCREASES—FROM 3 TO 6 CUBIC FEET PER MINUTE.

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

**IF THE ENGINE BACKFIRES DURING CRANKING, IT CAUSES A HIGH PRESSURE IN THE INTAKE MANIFOLD.**

PRESSURE CAUSES THE VALVE TO BACK-SEAT AND SEAL OFF THE INLET. THIS KEEPS THE BACKFIRE OUT OF THE CRANKCASE.
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 dissipates, 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 or another vehicle waiting at the signal, but when he pulled into the hotel he still noticed the smell. He decided to check the engine and found that the PCV system was freezing up. He covered the grill with cardboard and the vehicle did not burn oil anymore. 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.
Using a gauge that measures vacuum in units of inches of water to test the vacuum in the charging line, check that the PCV system is capable of drawing a vacuum on the crankcase (28 in. H\(\text{H}_2\text{O} = 1\) PSI, or about 2 in. Hg of vacuum).

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 air filters, and therefore the dirt is deflected away from the fins during vehicle deceleration.

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.
When the engine achieves closed loop, the air is directed to the catalytic converter.

Figure 85-10 (b)

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

Figure 85-12

Typical SAI system operation showing location of airflow from the pump.

Chart 85-1