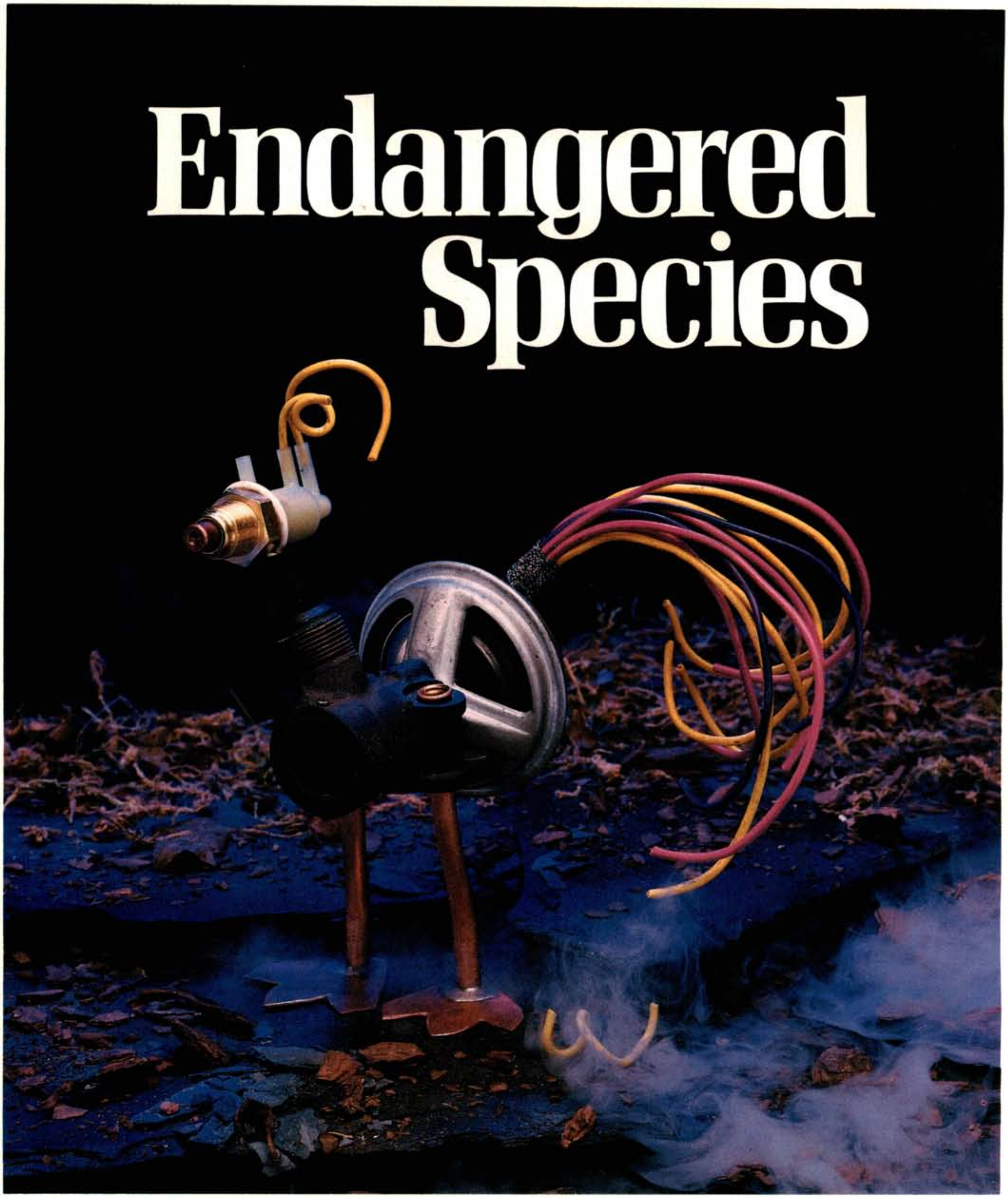
Endangered Species



Ever heard of the whooping crane? How about the California condor? Survival of the fittest has sent many a wayward bird from a precarious perch on the endangered species list to the brink of extinction. They just couldn't cope with some nasty changes in their environment.

It's survival of the fittest in the auto world too. Changes in the automotive environment have made a whole list of hang on emission components into future dodo birds. The underhood environment is getting less friendly for them every day. Many still struggle to survive, but their days are numbered.

If an emission component isn't getting the job done today, it will probably be replaced tomorrow (or at least next year). But even after the "new and improved" component makes its debut, thousands of cars are left to wander the countryside with the old emission component.

This presentation of the Autobon Society will look at these endangered components. Few of us will shed a tear when they're gone.

What Do You Call It?

Different manufacturers often use similar emission control systems and components. There's never been much agreement on what to call all these parts. The coolant temperature-controlled vacuum switch is a good example. Every import car manufacturer seems to have a different name for it.

To clear up the confusion, we've included a sample photo of each part. Use the photos like a bird watcher uses his spotter's guide. That way you'll know what we're talking about if we call an emission component by one name and you've always known it as something else.

Our automotive endangered species were often used in combination with carburetors, another rapidly disappearing breed. We'll identify each component, describe what it does, and detail the problems it can cause if it's broken.

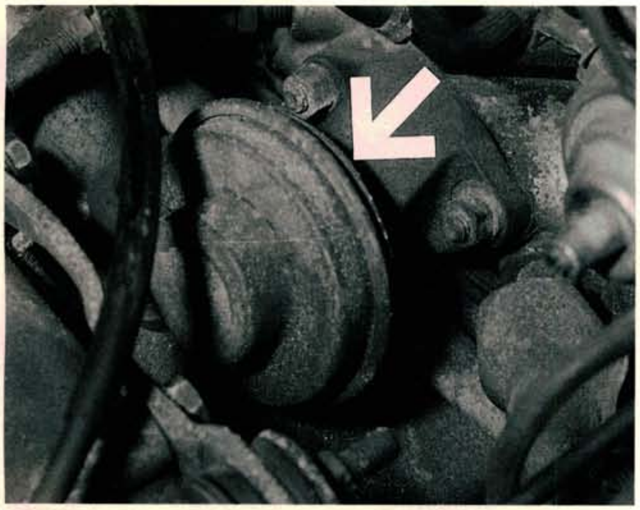
The End Of The Line

Fuel injection systems allow today's engines to run much cleaner than was possible with carburetors. An injected engine usually needs fewer emission control components than a carbureted engine. Emission control is an integral part of the engine management system, rather than being "hung on" to an existing fuel system as an afterthought.

So the next time you get ready to complain about how complicated today's cars are, stop to consider that they're really getting simpler. Computer controlled outputs are taking over where mechanical, temperature, and vacuum operated emission control parts once did the job.

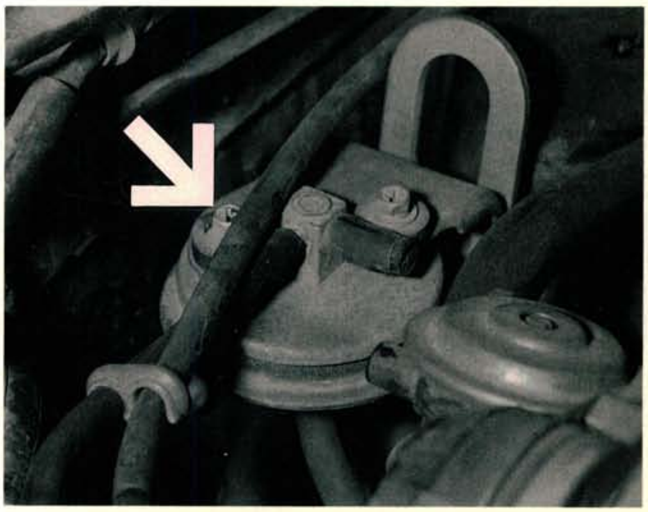
With any luck, we won't be worrying about BCDDs, TVSs, BPTs, TVVs, and all the other emission control parts with their hard-to-remember names and initials for too much longer. They're already on the endangered list, and soon to be extinct.

—By Karl Seyfert



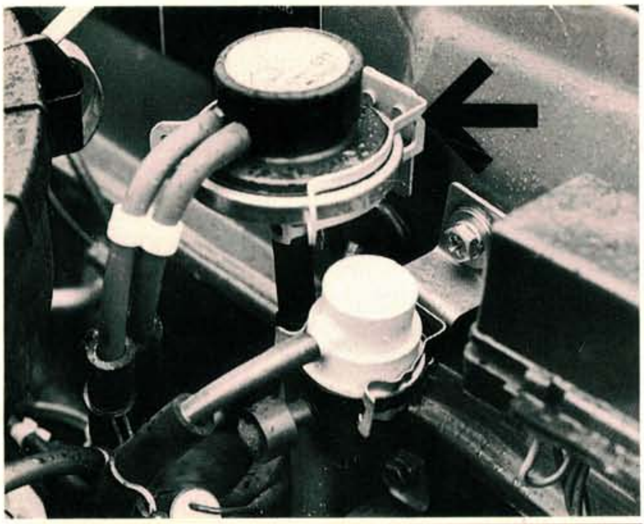
The Exhaust Gas Recirculation (EGR) Valve can be identified by sooty deposits which form around its pointy snout.

The valve reduces NOx emissions by directing exhaust gases into the intake manifold. Rev the engine to 3000 RPM and check for EGR diaphragm movement. Opening the valve at idle should cause engine idle speed to drop. Check EGR controls and vacuum circuits before condemning the EGR. Also check for internal carbon deposits if the valve sticks open, causing a rough idle or stalling.



A timid creature, the Back Pressure Transducer (BPT) stays close to the EGR valve.

The BPT tailors the EGR supply to the engine's needs. As engine RPM increases, exhaust backpressure increases. The increasing backpressure causes a valve in the BPT to seat, allowing a ported vacuum signal to reach the EGR valve. To test the BPT, apply pressure to its backpressure port to seat the valve. Now apply vacuum to the EGR supply port and check for leakage. Replace the BPT if it leaks vacuum.



Higher up the evolutionary tree, the Venturi Vacuum Transducer (VVT) uses exhaust back pressure and a venturi vacuum signal to regulate EGR delivery.

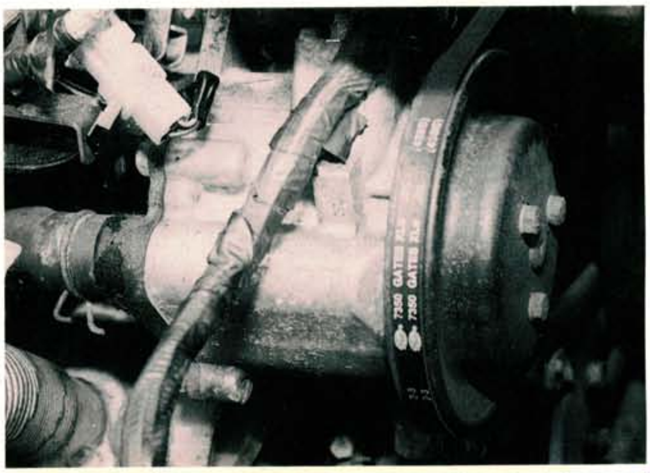
At low speed, the ported EGR supply signal is too weak to make it past the VVT. The VVT's internal valve moves in response to the increase in exhaust back pressure and venturi vacuum as the engine accelerates. Ported vacuum reaches the EGR valve and opens it. Some engine management systems now control EGR operation through vacuum solenoids.

Known to nest near wetlands, Thermal Vacuum Valves spend their lives half submerged in coolant.

These valves can fail in a closed, open, or partially open position. This can cause interesting driveability problems when vacuum is delivered to emission devices at the wrong time. Non-aquatic vacuum delay valves prevent sudden changes in vacuum supply to EGR valves and distributor advance units. Check the operation of all vacuum control valves before you condemn other (more expensive) emission components.

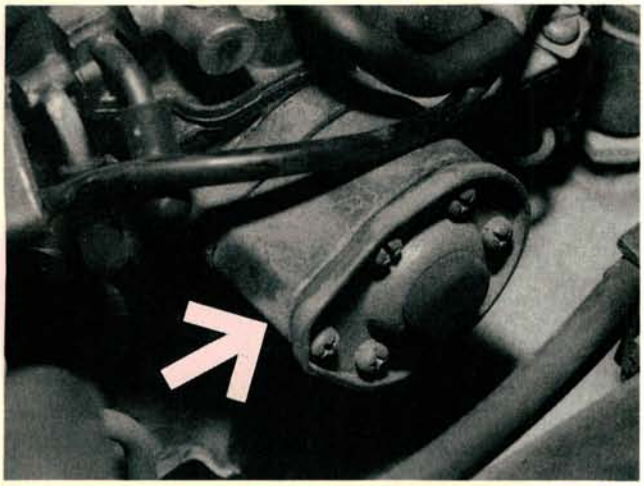
The Toyota EGR modulator valve's plumage is similar to the VVT's.

The modulator uses back pressure and venturi vacuum signals to match the EGR supply to the engine's load requirements, preventing surges and hesitation. Place a vacuum tee in the EGR's vacuum supply line to test the modulator valve's operation. Run vacuum hose to a vacuum gauge inside the car, then road test the car. Replace an EGR modulator that supplies vacuum to the EGR right off idle or during light throttle cruising.



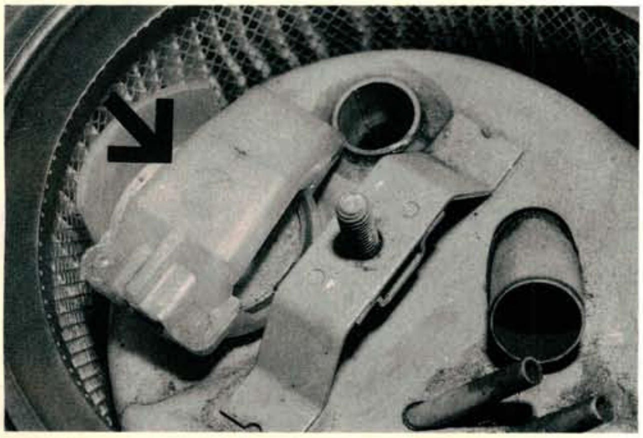
Known for its large lung capacity, the horsepower hungry belt-driven Air Injection Pump blows extra air into the exhaust system.

Vacuum switching valves are used to interrupt the flow of air to the exhaust system. A one-way valve prevents exhaust from backing up into the air pump. Faulty vacuum switching valves, clogged air inlet passages, a loose drive belt, or leaking delivery hoses can affect air delivery and make the air injection pump sound like a trumpeter swan.



The Boost Controlled Deceleration Device (BCDD) is often sighted clinging to the shady side of carburetors and intake manifolds.

The BCDD lowers manifold vacuum during closed throttle deceleration to reduce HC emissions and oil consumption. Connect a vacuum gauge to a manifold vacuum source, then raise the idle speed above 2000 RPM (3500 on fuel injected models). Release the throttle while watching the vacuum gauge. The needle should peak, then drop to the BCDD operating pressure before returning to the idle reading. A leaking BCDD seat causes rough running or stalling at idle.

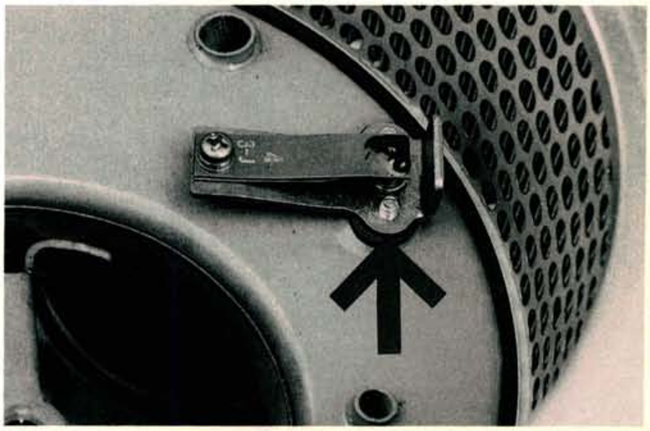


Well-suited to life in all climates, the Automatic Temperature Controlled (ATC) air cleaner improves fuel vaporization during cold engine operation, for better driveability and reduced HC and CO emissions.

The spring loaded air-mix door opens to outside air when the engine is off. A temperature control (arrow) routes vacuum to a vacuum motor, which diverts heated air to the carburetor during cold engine operation. As the engine warms, the temperature control diverts the vacuum and the door reopens. Use a heat gun to test ATC operation.

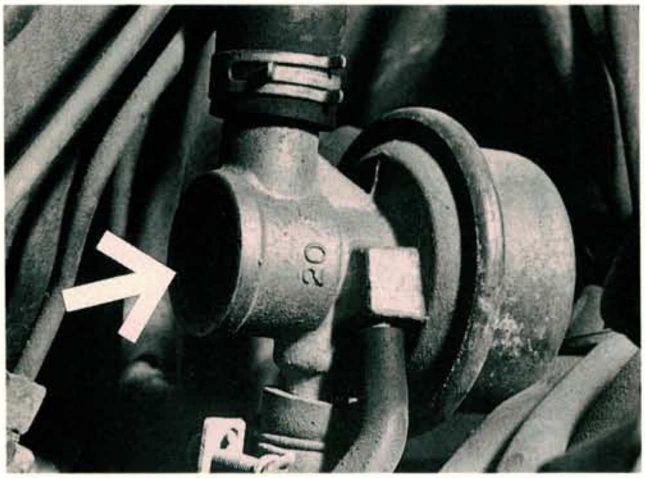
Well adapted to life above the tree line, the High Altitude Compensator (HAC) feeds extra air to the carburetor's primary and secondary air bleeds above a preset altitude.

An HAC that sticks open or opens below the correct altitude will lean out the fuel mixture and cause stalling at idle, and rough engine operation the rest of the time. To test the HAC, remove its vacuum hoses. No air should pass through the inlet or outlet hoses below the HAC's preset opening altitude. Consult a service manual for opening altitudes on specific models.



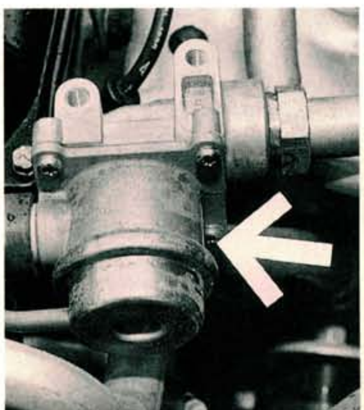
Often scrawny from lack of exercise in cooler climates, the Hot Idle Compensator (HIC) prevents rich idle mixtures during hot engine operation.

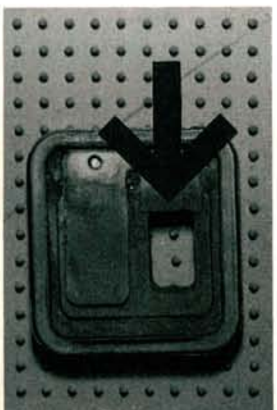
The HIC's bi-metal valve opens a vacuum port to the intake manifold when engine temperatures are high. The small vacuum leak raises the idle speed. The HIC should hold vacuum when the engine is cold, and vent vacuum at a set temperature. Some models use two HICs which open at different temperatures. Test the HIC opening temperature with a heat gun and an air conditioning thermometer.



Normally quiet and well-mannered, the large-throated Anti-backfire (AB) Valve (arrow) reduces HC emissions and prevents backfires by adding air to the intake manifold during closed throttle deceleration.

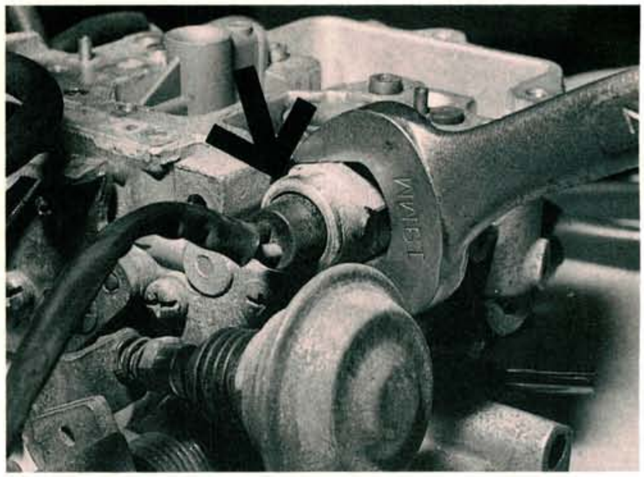
To test the AB valve, place a finger over its inlet pipe in the air cleaner assembly. Replace the valve if there's any suction at idle. Rev the engine to 3000 RPM, then release the throttle quickly. You should feel a strong suction at the AB valve inlet as the engine returns to idle. Check the AB valve's vacuum source if it doesn't open during this test.





Easily identified by its flapping flat beaks, the Air Induction Valve (AIV) (left photo) routes air to the exhaust system, using the exhaust system's negative pressure pulses.

The extra air helps unburned fuel continue burning in the exhaust system, reducing HC and CO levels. This damaged Subaru AIV (right photo) allowed exhaust and moisture to leak back into the air filter. The AIV is usually vacuum controlled because the extra air isn't always needed.



Like a hummingbird, the Anti-diesel or Fuel Shut Off Solenoid (arrow) dips its beak into the carburetor's idle circuit, controlling the fuel supply when the ignition is turned off.

The solenoid can also be used to cut the fuel supply during closed throttle deceleration. For a quick check of the solenoid, disconnect its lead wire with the engine running. The engine should stall. If the engine won't idle, check for battery voltage at the solenoid's lead wire before condemning the solenoid. A dirty seat or bent plunger needle can also cause the solenoid to stick open or closed.

The oldest emission bird still in existence, the Positive Crankcase Ventilation (PCV) Valve reduces HC Emissions and motor oil contamination.

Hidden PCV valves (left photo) may be ignored until they cause problems. Oil soaked, kinked, or obstructed ventilation hoses will prevent proper PCV system operation. Most manufacturers still recommend periodic PCV valve replacement. The crankcase control valve (right photo) used on VW's Digifant II system replaces the PCV valve.