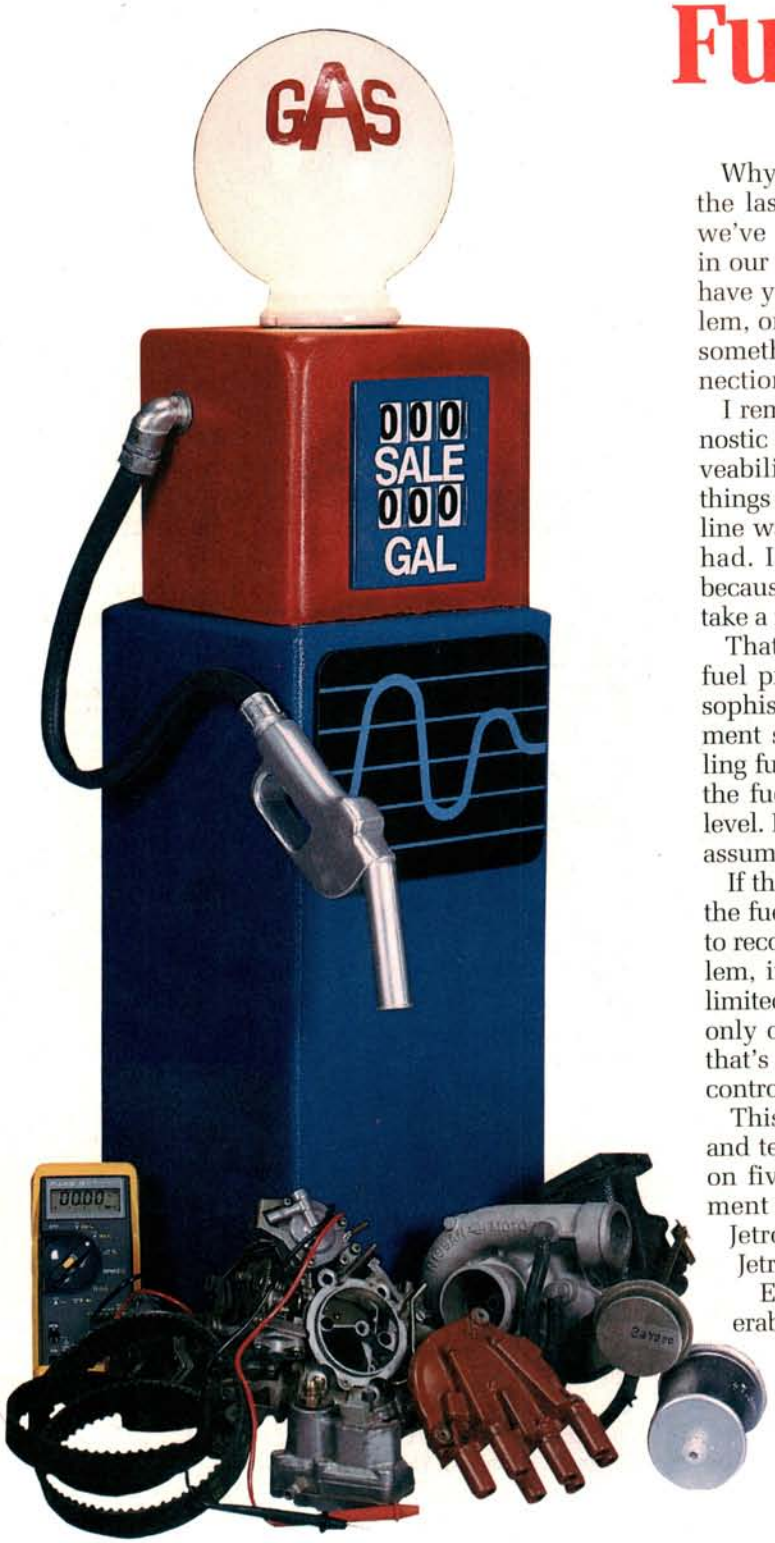
IMPORT SERVICE

Driveability Clinic

Fuel Pressure



Why is it that the simplest diagnostic tests are often the last things to be checked? It's probably because we've developed a tendency to overlook the obvious in our search for the "high tech fix." How many times have you spent an entire afternoon looking for a problem, only to find that the whole thing was caused by something simple like a loose battery terminal connection?

I remember a phone call I made to the Nissan diagnostic hotline when I was trying to solve a difficult driveability problem at the dealership. One of the first things the helpful voice on the other end of the phone line wanted to know was what kind of fuel pressure I had. I had to admit that I didn't have the answer because I hadn't bothered to check. He insisted that I take a fuel pressure reading, then call him back.

That's when I realized just how important proper fuel pressure can be. Think about it. Even the most sophisticated electronically controlled engine management systems have no way of monitoring or controlling fuel pressure. The control unit has to assume that the fuel pressure is being maintained at its intended level. It bases all of its decisions on that very important assumption.

If the fuel pressure regulator has stuck wide open or the fuel pump is weak, the control unit isn't equipped to recognize it. And even if it could recognize the problem, its powers to change the situation are also very limited. The control unit can't alter fuel pressure, so the only option is to change the injector duty cycle. And that's only an option on systems with electronically controlled injectors.

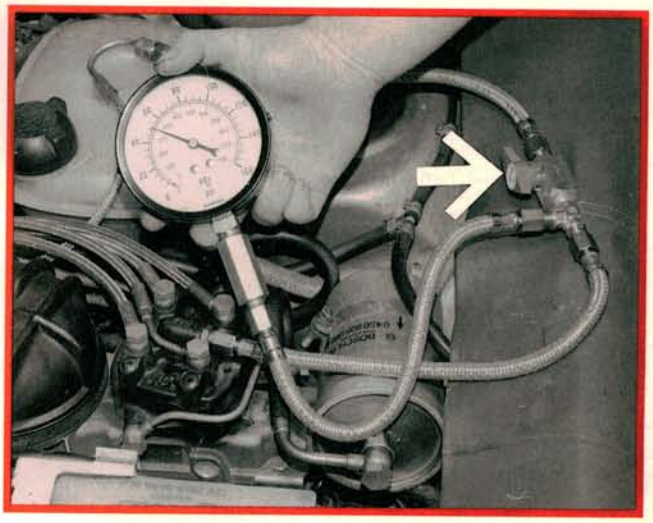
This Driveability Clinic will concentrate on the tools and techniques that are used to measure fuel pressure on five different European fuel and engine management systems. The five systems in question are K-Jetronic, KE-Jetronic, Digifant, Motronic, and LH-Jetronic.

Each of these systems has been covered in considerable detail in previous issues of *Import Service*. This time we'll look at the effects that incorrect fuel pressure can have on each system, as well as where to look for possible causes.

— By Karl Seyfert

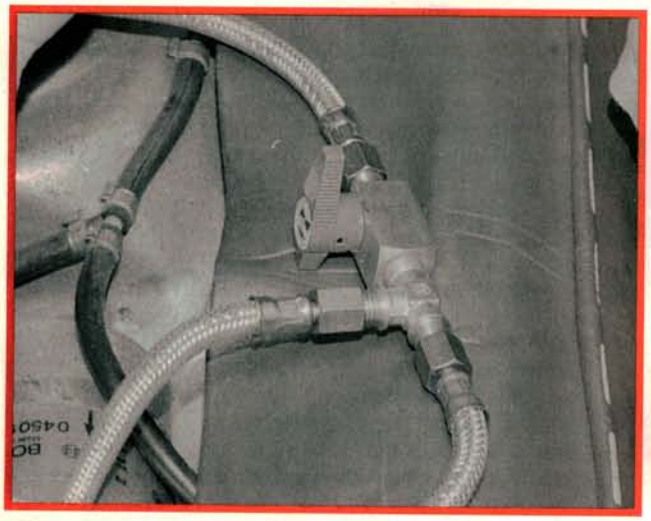
1 K-Jetronic Control Pressure

K-Jetronic system pressures can exceed 5 bar (72.5 PSI), so use care when working around fuel system components or opening fuel lines. To begin our fuel pressure tests, we'll need a gauge and hoses equipped with a shutoff valve. Connect the gauge in-line, between the control circuit output port on the fuel distributor and the control pressure regulator inlet port. Fuel must be able to pass between these two components, without interruption from the gauge.



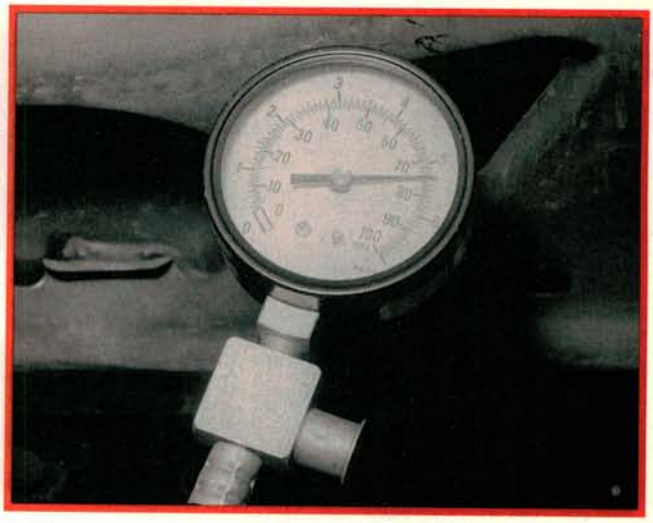
2 Measuring Cold Control Pressure

Make sure all of the air is bled out of the gauge lines. The control pressure regulator lowers control pressure by as much as 2.5 bar when the engine is cold to richen the fuel mixture. Disconnect the harness connector at the control pressure regulator, then start the engine. If the reading is high with a cold engine, either the regulator is bad or something is clogging the control circuit. Reconnect the harness connector. Control pressure should increase to 3.4-3.8 bar at operating temperature.



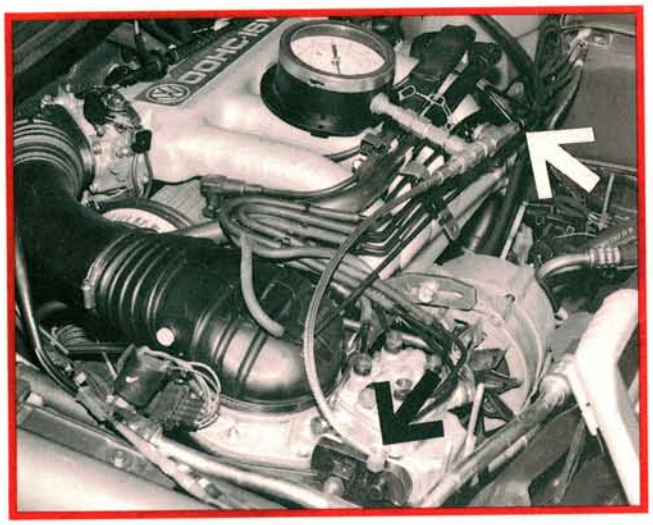
3 K-Jetronic System Pressure

Leave the gauge connected, but close the control valve. This cuts the control pressure regulator out of the circuit, causing available "system" fuel pressure to dead end at the gauge. System pressure should be 4.5-5.2 bar (65-75 PSI) when the engine is warm. Possible causes of low system pressure include a partially clogged fuel pump inlet, a weak pump, damaged high pressure fuel lines, a damaged or stuck fuel pressure regulating valve in the fuel distributor, or a clogged fuel filter.

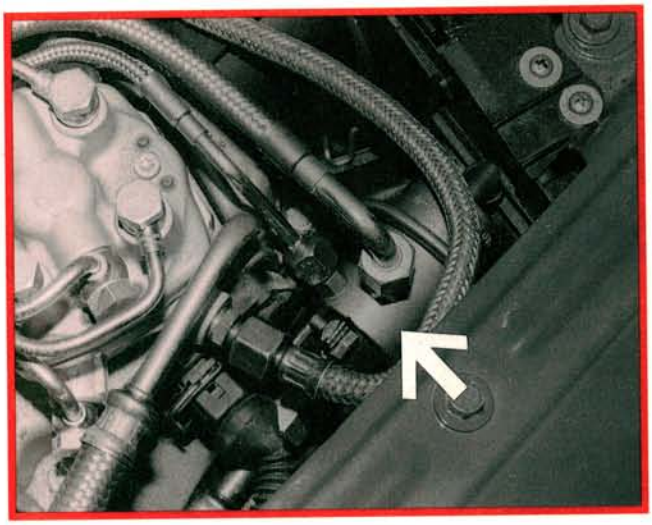


4 K-Jetronic Residual Pressure

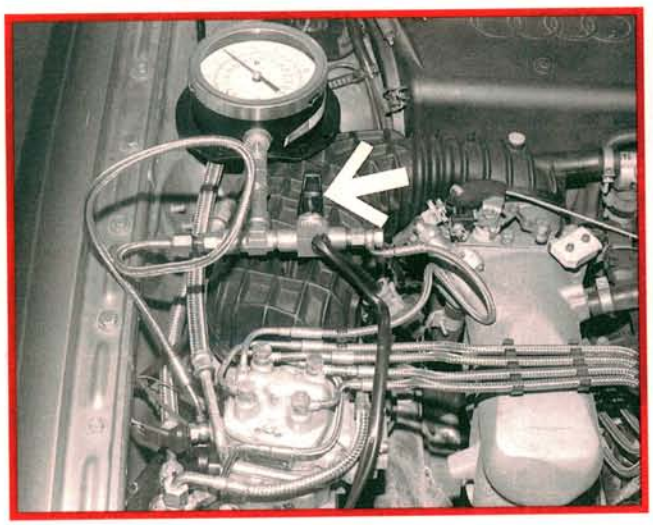
Open the gauge, then run the engine to build pressure. Shut the engine off, then check the gauge to see if the system holds residual pressure. All K-Jetronic systems must hold residual pressure for a set period to assure good hot and cold restarts. Check the vehicle specs for actual time limits. Possible causes of rapid residual pressure loss include a leaking fuel pump check valve, a leaking pressure regulator valve in the fuel distributor, a leaking accumulator, or a leaking cold start injector.



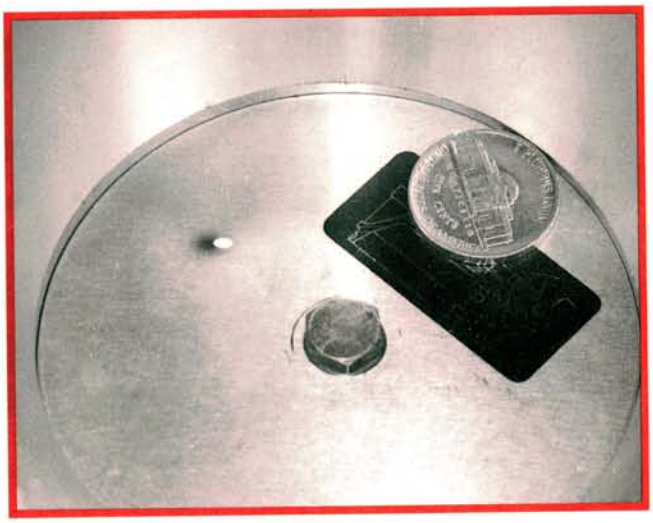
5 KE-Jetronic Pressure Testing
To measure system pressure on a KE-Jetronic system, you'll need a fuel pressure gauge equipped with a shutoff valve. The gauge must be hooked up inline, like we did on the K-Jetronic system. Connect the end of the gauge hose equipped with the shutoff valve to the cold start injector line. Connect the other end of the gauge hose to the test port at the lower chamber of the fuel distributor. Jumper the fuel pump relay terminals (30 and 87), and measure the system pressure with the shutoff valve open.



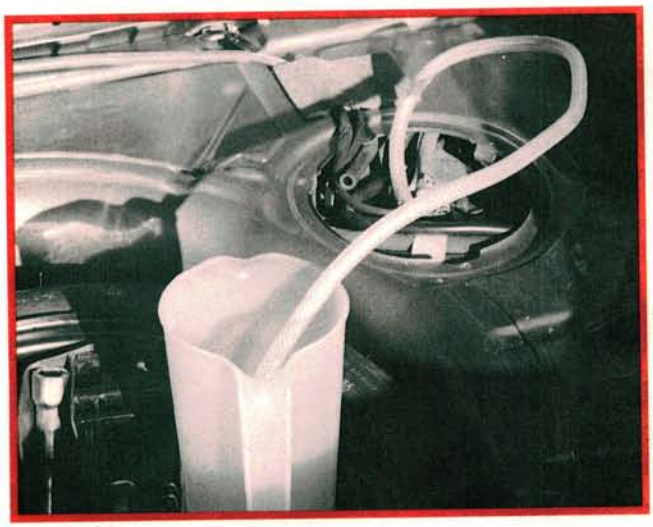
6 Measuring KE-Jetronic System Pressure
We can't give the system pressure specs on all KE systems, but we can give you possible causes if system pressure is too high or too low. Low system pressure may be caused by a clogged fuel filter, a leaking pressure regulator (arrow), a weak fuel pump, or low voltage to the pump. High system pressure may be caused by a stuck pressure regulator or a clogged regulator return line to the tank. If system pressure drops when fuel is vented from the regulator into a container, the return line is clogged.



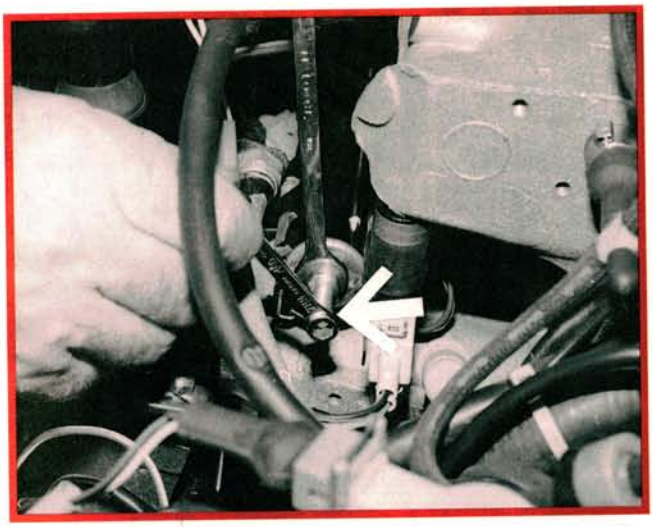
7 Measuring KE-Jetronic Differential Pressure
Disconnect the Differential Pressure Regulator (DPR) harness connector, then close the shutoff valve on the pressure gauge hose. This keeps system pressure from reaching the gauge, allowing us to measure the lower chamber pressure. Jumper the fuel pump relay contacts, then measure the differential pressure. It should be 0.2 to 0.5 bar lower than the system pressure reading in the previous test. An obstruction between the upper and lower chambers will cause a high reading. Suspect the DPR.



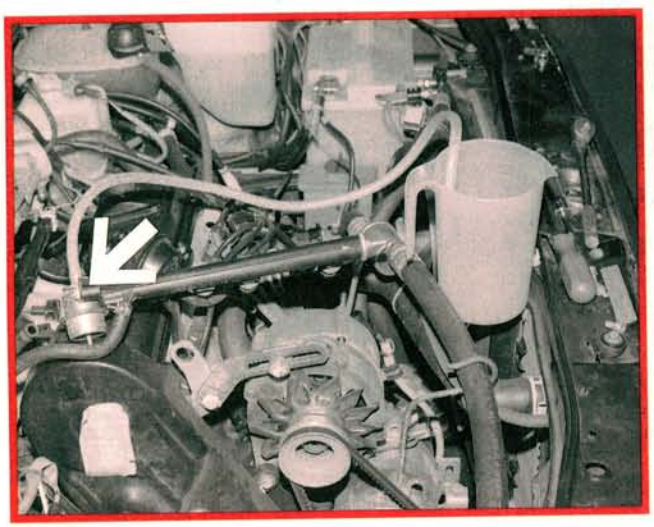
8 Measuring KE-Jetronic Residual Pressure
We test for residual pressure on a KE system the same way we did with K-Jetronic. Open the gauge valve, run the engine to stabilize pressure, then shut the engine off. If the system can't hold the specified rest pressure for at least 10 minutes, check the fuel pressure regulator for leakage at the return line. Other possible causes of lost residual pressure include leaking lines or connections, a leaking fuel pump check valve, a leaking cold start injector, or an incorrect fuel distributor sensor plate adjustment.



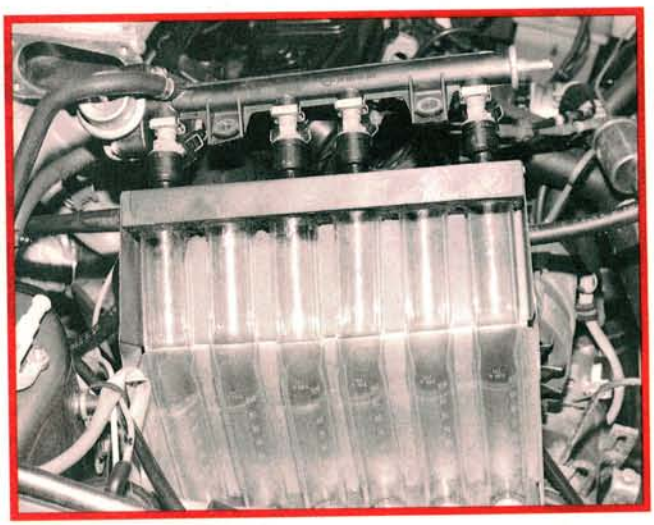
9 Digifant Transfer Pump Delivery
A main and an in-tank transfer pump are used on Volkswagen's Digifant engine management system. We'll begin by testing the transfer pump's delivery rate. Remove the fuel filler cap, then remove the sending unit trunk cover. Remove the black fuel pump feed hose and plug its end. Attach a hose to the sending unit and route the other end to a measuring beaker. Remove the fuel pump relay, then jumper terminals 30 and 87. The transfer pump should deliver at least 300 cc of fuel in 10 seconds.



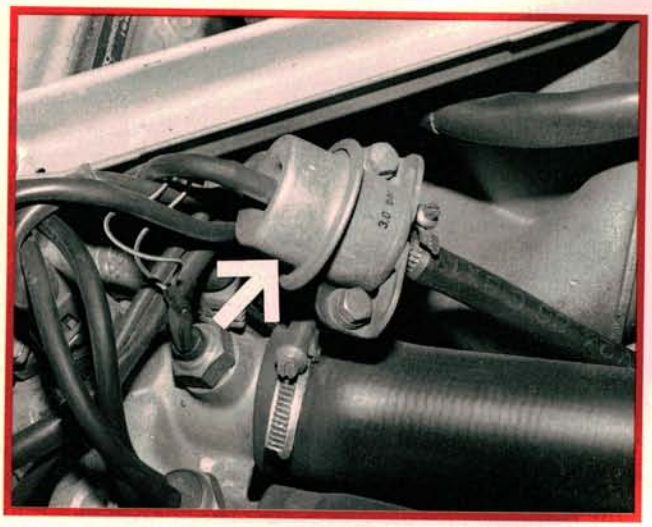
10 Digifant Fuel Pressure
Remove the threaded plug at the end of the fuel rail to test Digifant fuel pressure. Fuel pressure at idle should be 2.5 bar, and rise to 3.0 bar when the fuel pressure regulator hose is removed. If the pressure is higher than normal, check for a restricted fuel return line, leaking or plugged pressure regulator vacuum signal line, or a damaged pressure regulator diaphragm. Residual system pressure must hold at 2 bar for at least 10 minutes. Use a new sealing washer when reinstalling the fuel rail pressure tap.



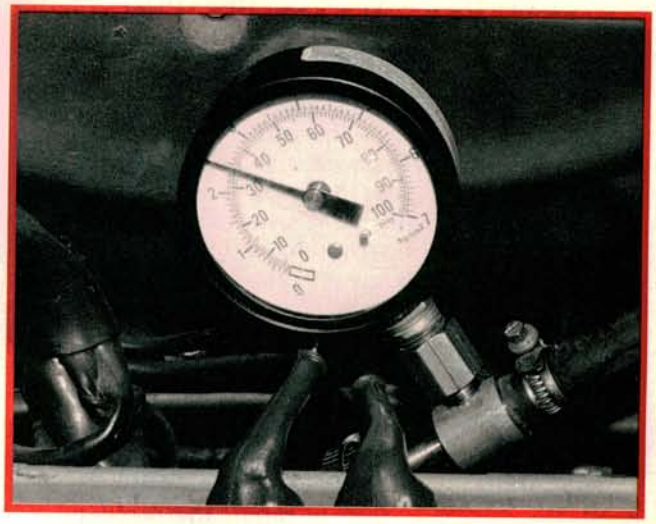
11 Digifant Main Fuel Pump Delivery
Fuel pump volume delivery can be just as important as fuel pressure, especially on dual fuel pump systems. To test the Digifant main fuel pump volume delivery rate, disconnect the fuel return hose near the right strut tower. We had already removed the fuel rail, so we attached a hose to the pressure regulator and placed the other end in a measuring beaker. Power the main pump by bridging pump relay terminals 30 and 87. The high pressure, low volume main pump must deliver 500 cc of fuel in 30 seconds.



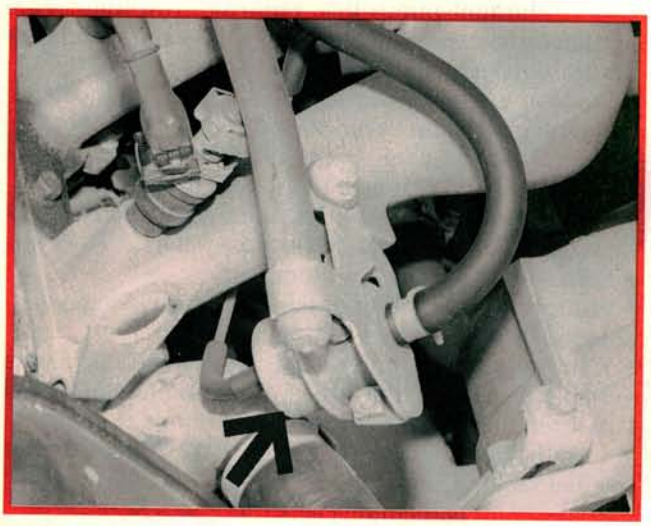
12 Digifant Injector Testing
Volume testing can also be used to accurately measure fuel delivery from individual injectors. Volkswagen/Audi technicians use a matched set of graduated cylinders to compare injector delivery. Place all four injectors in the cylinders, then use a jumper harness at the pump relay contacts to again run the pump for 30 seconds. Watch the injectors for uniform spray pattern and even fuel delivery. Total fuel delivery after 30 seconds should nearly equal the volume collected in the previous test.



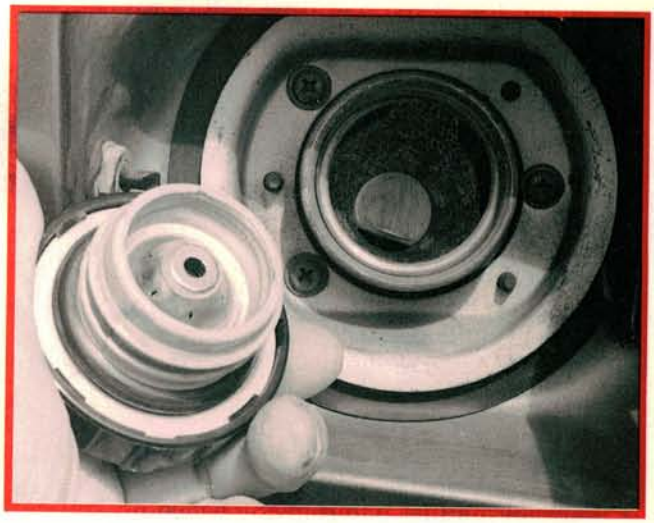
13 **Motronic Fuel Pressure Regulator**
The Motronic engine management system found on many BMWs also uses a fuel pressure regulator to adjust fuel pressure to the injectors. The regulator uses a manifold vacuum signal to determine the correct amount of fuel pressure to match engine load. The greater the engine load, the higher the fuel pressure. When fuel pressure is increased, more fuel passes through the injectors during the same period of injector open time. The Motronic ECU can't control or monitor fuel pressure.



14 **Measuring Motronic Fuel Pressure**
Since they're both air flow controlled fuel systems with electronic injectors, it shouldn't come as a surprise that Motronic and Digifant systems call for the same fuel pressure of 2.5 bar (36 PSI) at idle. Disconnect the fuel pressure regulator vacuum hose while watching for a corresponding increase in fuel pressure. Then shut off the engine. The system should hold 2.0 bar (29 PSI) for at least 15 minutes after shutdown. Rapid residual pressure loss may cause hard hot restarts or long cranking times when cold.



15 **LH-Jetronic Fuel Pressure Regulator**
The LH-Jetronic fuel system found on many Saabs and Volvos also uses an independent vacuum controlled fuel pressure regulator to adjust fuel pressure for varying engine loads. Bad fuel pressure regulators account for a high percentage of fuel pump failures on LH systems. Before you slap a brand new pump into that high mileage Volvo, hook up your fuel pressure gauge. A fuel pressure regulator that's demanding full fuel pressure at all times will cook the new pump in short order.



16 **LH-Jetronic Transfer Pump**
Most LH systems also use a low pressure, high volume in-tank transfer pump. A weak or dead transfer pump also puts a strain on the main fuel pump. The main pump's job is to push fuel forward to the injectors under pressure. The main pump may overheat and die if it has to syphon fuel out of the tank for very long. Main pump operation causes a pulsation in the fuel line that can be felt with your hand. Remove the fuel filler cap and listen for a buzzing noise that indicates the transfer pump is working.