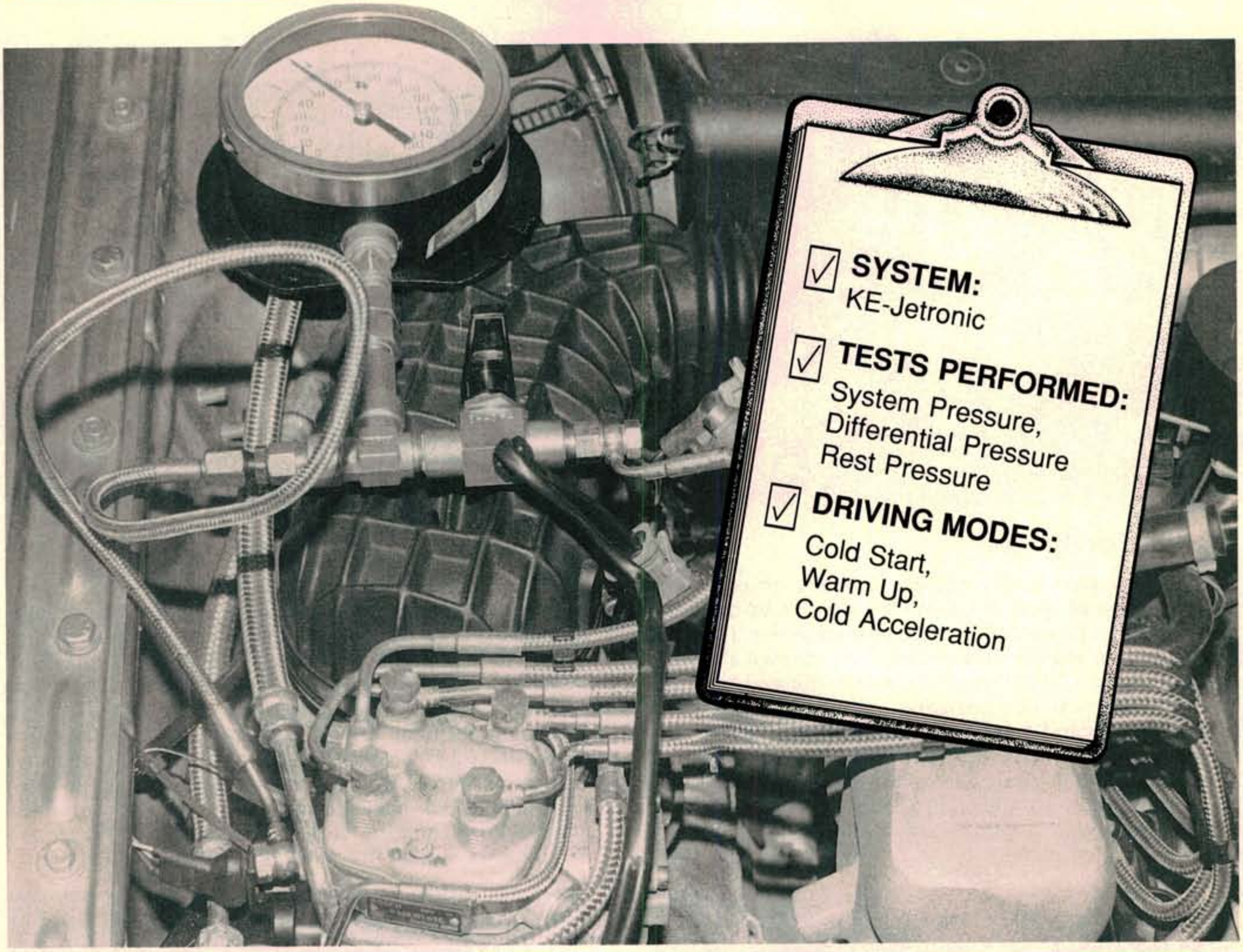


KE-Jetronic Fuel Injection

PART TWO

Last month we showed you how milliamp readings sent by the control unit to the DPR control fuel delivery to the injectors. This month, it's time to concentrate on tests and adjustments of the system.

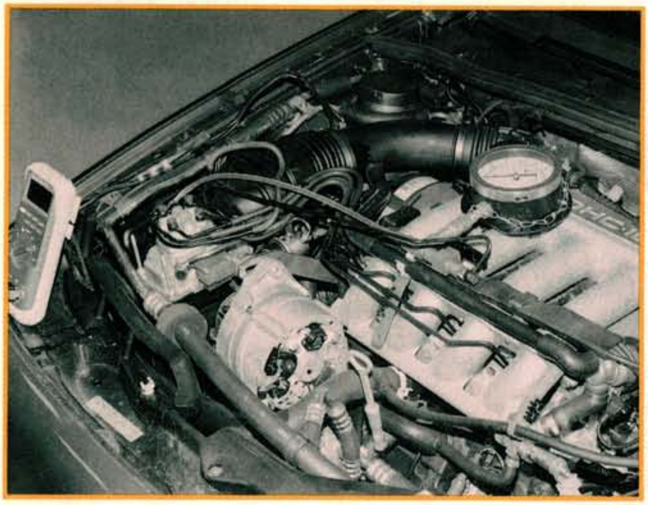
The tools you'll need are pretty basic, but any attempts to make critical adjustments to KE without them becomes a shot in the dark at best. Here's your basic issue of necessary test equipment:

- A high impedance DVOM (10 megohm)
- A test harness, either a modified Thexton 391, **Circle No. 211 on reader service card**, or VW 1315 A/1 (new number VAG 1351 A-1), from Zelenda Machine and Tools Co., **Circle No. 212 on reader service card.**
- Your old K-Jetronic fuel pressure gauges (the ones with the shut off valve in one line)
- A 3 mm hex wrench for adjusting the CO adjustment screw on the air sensor arm
- A vernier or depth gauge

There was a method to our madness when we used last month's entire article to familiarize you with the theories behind this system. There are a number of critical, mechanical adjustments in the KE system which must be done in the correct sequence. Understanding the overall operation of the system will help you understand how each adjustment affects a specific driving mode. Random adjustments done on a hit and miss basis usually do little more than make an existing problem worse. In fact, the odds are that you'll never need to make many of the adjustments shown unless you're replacing a bad part, or correcting someone else's mistakes.

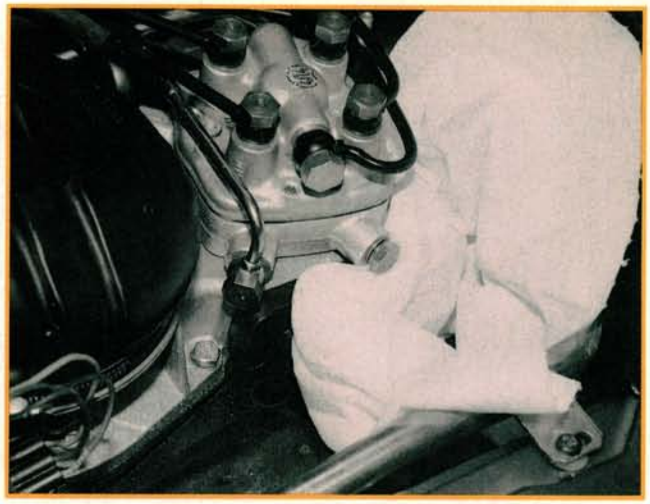
If you do find yourself making some drastic adjustments, stop and ask yourself if you're only compensating for another, more basic problem.

Photos and specifications are for a VW Passat. Specifications for other vehicle makes may differ slightly, but the principles of operation will still apply.



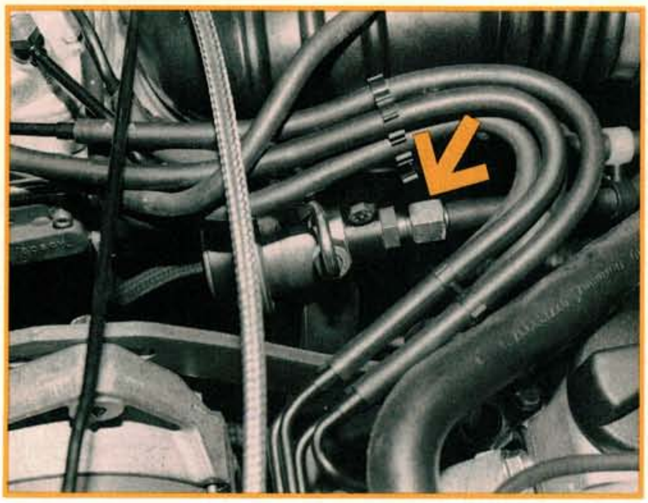
1 Basics, Basics

If you have a driveability problem or emissions which are out of spec, eliminate the obvious by checking basic ignition, power balance, compression, etc. If all the vital signs are good in these areas, the next logical step is to cross check milliamp readings at the DPR and compare them to changes in fuel pressure. These tests can be done at the same time. Remember, no matter what's going on inside the little black box, KE lives and dies on fuel pressure. If fuel pressures are out of spec, everything else you do to correct a problem is a waste of time. Let's start by finding out if we have any problems with system pressure.



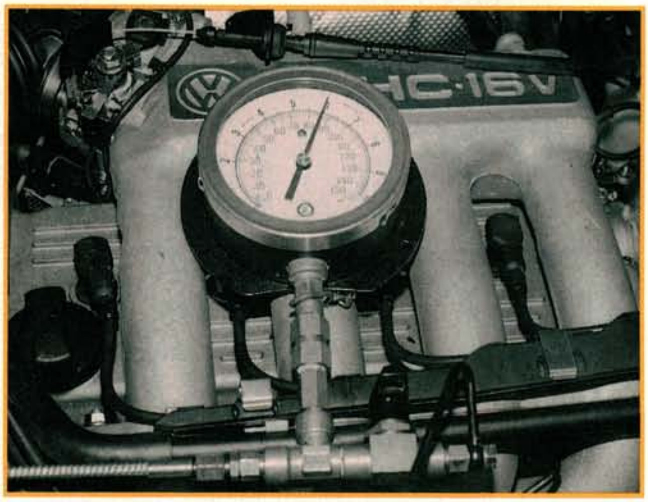
2 Setting Up to Test System Pressure

Connect your fuel gauge between the cold start injector (system pressure) and the test port on the lower chamber of the fuel distributor. We've wrapped the area around the lower fuel chamber with a large rag to catch leaking fuel as we remove the plug and connect our gauges. The other line from the fuel gauge contains a shut off valve. Connect that line to the cold start valve. Open the valve. Disconnect the DPR connector. Remove the fuel pump relay. Using a circuit protected momentary switch, jumper terminals in the socket corresponding to relay terminals 30 and 87 to energize the fuel pump. On this Passat, we should get a system pressure reading of 6.1 to 6.6 bar.



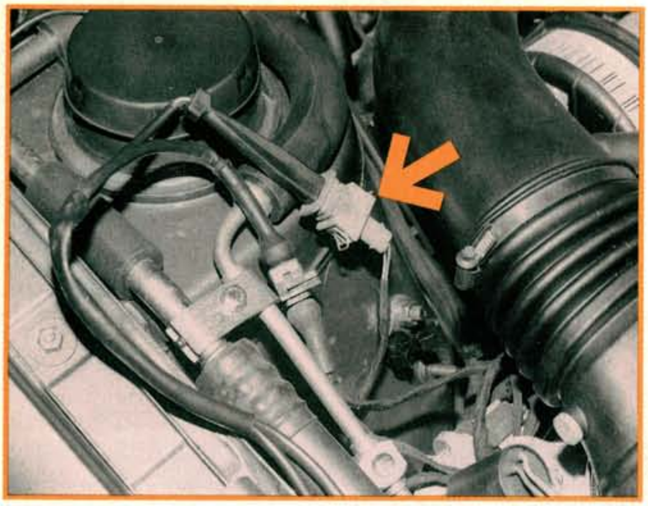
3 Too Low or Too High

If system pressure is too low, keep thinking of the basics. Things like a plugged fuel filter, a weak fuel pump (or low voltage to the pump), or a leaking pressure regulator. Pump voltage is critical to pump delivery rates. What if system pressure is too high? A pressure regulator which has stuck closed will cause high system pressure, but so will a blocked return line leading from the regulator back to the tank. If system pressure is too high, disconnect the return line at the regulator (arrow) and retest. Catch the fuel in a safe container. If system pressures come down to normal levels, an obstructed return line, not the regulator, is to blame.



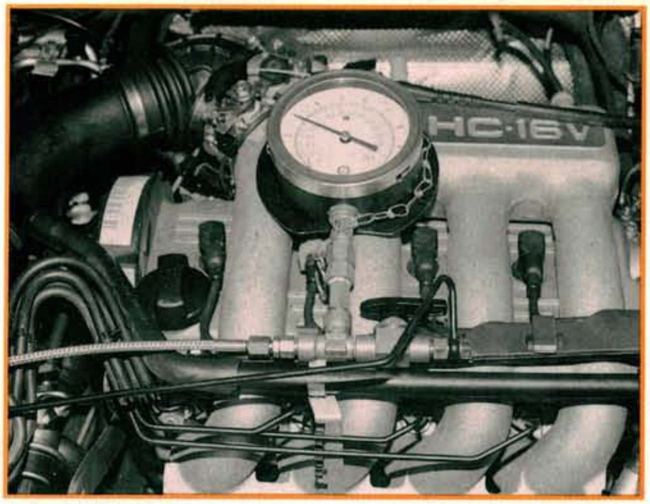
4 Testing Mechanical Components of the DPR

Leave the electrical connector at the DPR disconnected. Close the valve on the pressure gauge and run the fuel pump again. With the line from the cold start injector turned off, the gauge will read only lower chamber pressure. And since the DPR is disconnected, the reading we get this time will be the equivalent of limp home mode. The reading should be about 0.2 to 0.5 bar lower than the system pressure reading. In this case, we're showing about 6.0 bar, which is about 0.3 less than system pressure on this car. If the reading doesn't go down, there's an obstruction between the upper and lower chambers, and a bad DPR is a likely cause. Replace the DPR and retest.



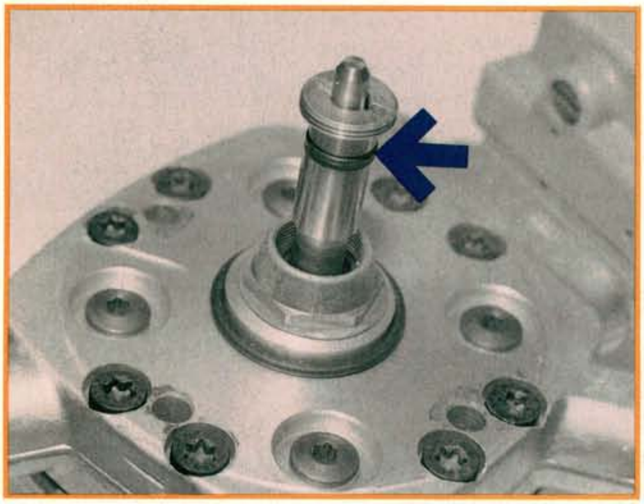
5 Testing the DPR's Electrical Circuit

Temperature sensor signals to the control unit play a big part in controlling milliamp signals to the DPR. Let's see if the control unit and DPR can respond to a cold engine. Disconnect the temp sensor, and substitute about 15K ohms across the terminals in the connector. Using the correct patch harness (arrow) connect your DVOM to monitor milliamp readings at the DPR. Turn on the ignition and jumper the fuel pump. The control unit should richen the mixture by sending more current to the DPR (in the 50 to 80 milliamp range). As we saw last month, higher current to the DPR restricts the flow of system pressure to the lower chamber. Reduced pressure in the lower chamber richens the fuel mix for smooth warm ups.



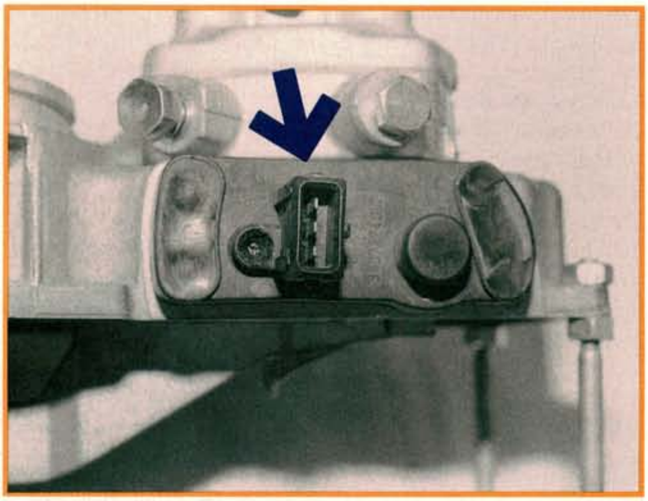
6 Hot Start Problems—Testing Rest Pressure

Rest pressure is the amount of pressure which stays in the system after the pump is shut off. This is especially important when restarting an engine which has hot soaked. Higher pressures keep the fuel from bubbling up like soda pop, which can cause hot restart problems. To test rest pressure, open the valve on the gauge again and run the pump for half a minute. Shut off the pump and go for coffee (or the beverage of your choice). Come back in 10 minutes. The gauge should be holding the rated rest pressure for the application, in this case 3.3 bar. If rest pressure drops below the system's recommended minimum, disconnect the return line at the regulator and make sure no fuel leaks out. None.



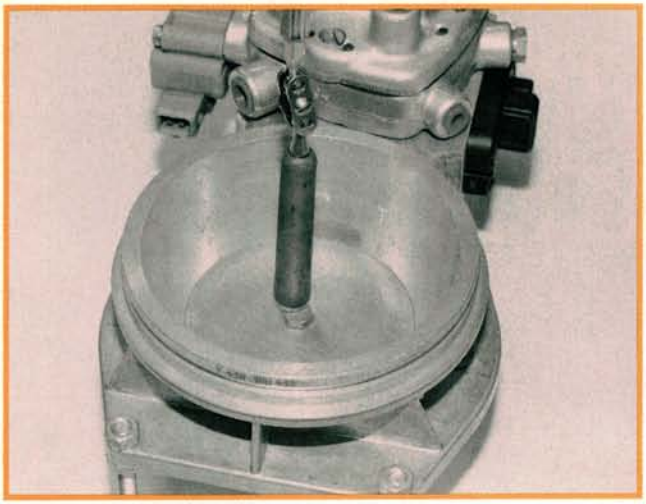
7 Other Causes of Low Rest Pressure

Aside from a bad pressure regulator shut off or external leaks at lines or connections, loss of rest pressure can result from several other causes. (1) The cold start injector can leak fuel into the intake plenum. (Remove it and check it visually with the system pressurized.) (2) The check valve in the fuel pump may be bad, allowing fuel to flow back through the pump to the fuel tank. (3) The sensor plate adjustment may be wrong. The control plunger in the KE fuel distributor has to sit all the way down on a rubber o-ring (arrow), or fuel may leak past the plunger. Insufficient clearance between the sensor arm and plunger can raise the plunger off the o-ring.



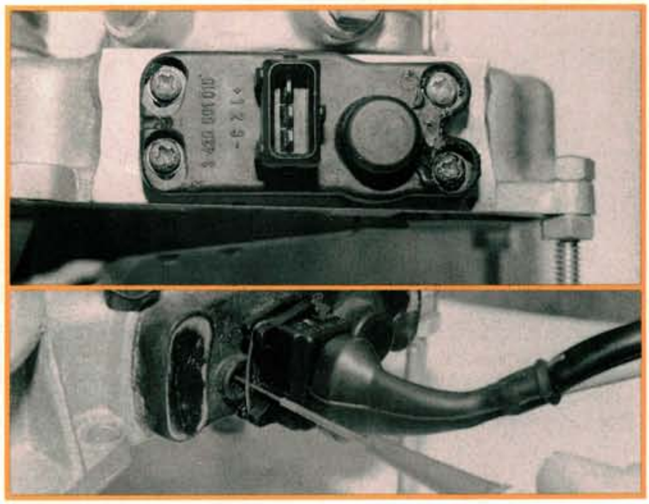
8 Diagnosing Cold Acceleration Problems

The CTS (Coolant Temperature Sensor) tells the control unit when to provide warm up enrichment. High resistance at the CTS tells the control unit that the engine is COLD. In addition to the CTS input, a potentiometer attached to the sensor arm (arrow) performs a function similar to a throttle position switch. Last month we showed you how the potentiometer calls for even more enrichment during cold acceleration. This month, we'll show you how to test and adjust it. But before we start poking around the potentiometer and its wiring, let's use our tests of milliamp readings to see if the potentiometer, control unit, and DPR are working together.



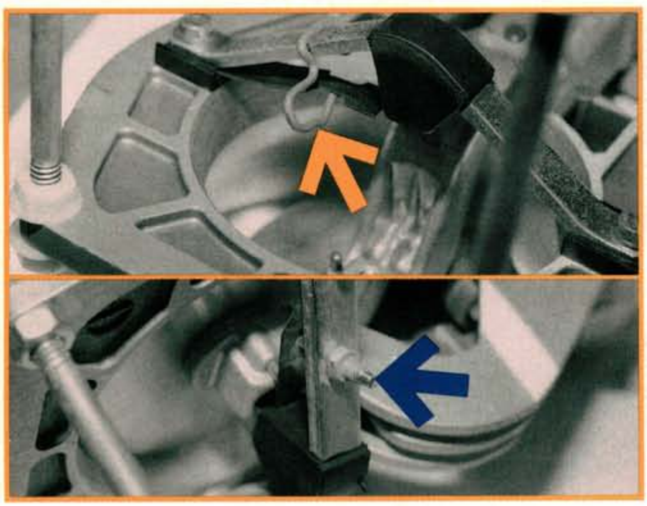
9 Testing Cold Acceleration Enrichment

Disconnect the plug at the CTS. This open circuit is the highest resistance signal you can send to the control unit. Switch on the ignition. Milliamp readings should go high, in the range of 80-110 mA. Remove the boot at the intake sensor, and crack the throttle on cars with an idle switch. Then lift up quickly on the sensor plate. Lift it all the way up. Watch the DVOM. If the potentiometer is working correctly, milliamp readings will shoot up momentarily providing the added enrichment needed to prevent a cold stumble. If the gauges are still hooked up (valve closed), lower chamber pressure should drop momentarily as mA readings rise.



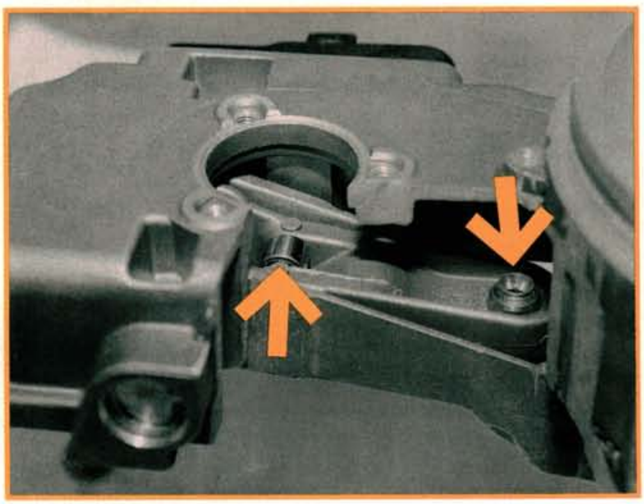
10 Adjusting the Potentiometer

Caution! Many potentiometers have been adjusted without good reason. If the system passes the test in the previous step, leave things alone. Two types are used, and unfortunately, the adjustment procedures for either are too lengthy for this article. Instead we'll offer a few general hints and cautions. The upper photo shows the earlier style which is adjusted by loosening the four mounting screws and rotating the potentiometer to achieve the proper adjustment. Later style sensors have an adjustment similar to an antenna trim screw. Finally—never adjust a potentiometer until you've checked, and if necessary, corrected the sensor plate's mechanical adjustment.



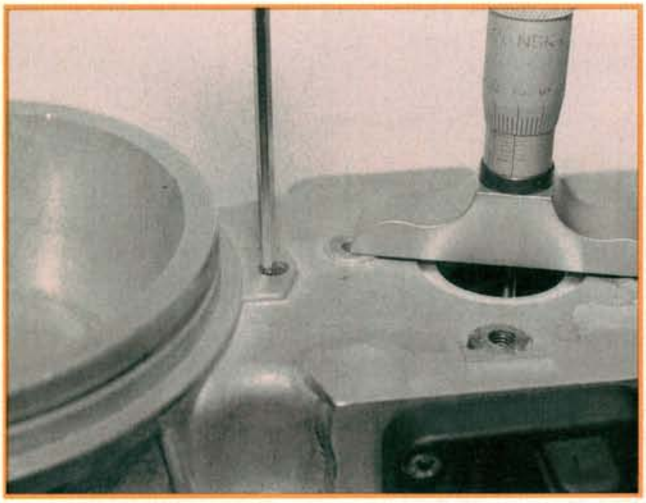
11 Adjusting the Sensor Arm Free Play

Run the pump long enough to fully pressurize the system. (This pushes the plunger down on the o-ring). Lift up on the sensor plate with a pocket magnet. There should be a nickel's worth of free travel before the sensor arm contacts the base of the control plunger. An improper base adjustment with no free play will keep the control plunger off the o-ring. On updraft models, minor adjustments in sensor plate height can be made in one of two ways. On systems using the "hooked spring" style adjuster (arrow upper photo), open or close the hook to adjust height. Other sensor arms are adjusted with a small screw/lock nut combination (arrow lower photo).



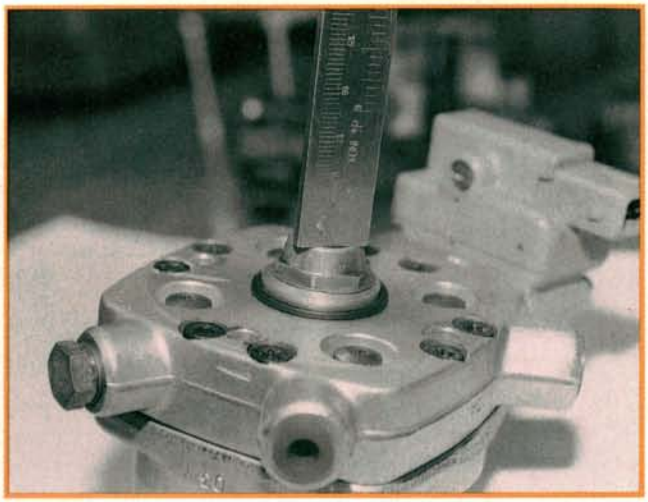
12 Basic Sensor Plate Adjustment

Unfortunately, the tiny CO adjustment screw in the fuel distributor is the object of much abuse. In an effort to compensate for vacuum leaks and other basic problems, it is often screwed in well past its normal operating range. If this is the case, or if parts are being replaced, it may be necessary for you to check and correct the basic setting of the sensor arm. This cutaway shows the relationship between the CO adjustment screw (right arrow) and the roller on the sensor arm which contacts the control plunger. Turning the adjustment screw "scissors" the roller up or down to adjust the clearance between the roller and plunger.



13 Basic Sensor Plate Adjustment

You'll need a depth gauge like the one shown in our photo to check and correct the base adjustment. (The fuel distributor has been removed.) Note that the depth gauge sits on the raised pads where the fuel distributor normally rests. We've removed the concealment plug from the CO adjustment access hole, and will use our 3 mm wrench to turn the screw until the top of the roller is at the proper height. Our updraft assembly calls for a measurement of 18.8 +/- 0.1 mm. This is not the final adjustment, just the proper starting point. Always replace the concealment plug to keep dirt out of the sensor arm housing.



14 Control Plunger Service and Adjustment

This is another case of "If it ain't broke don't fix it!" But o-rings can fail, and control plungers can varnish up and stick over time, requiring removal and chemical (never abrasive) cleaning. If you need to remove the control plunger for any reason, and it's properly adjusted to begin with, measure the depth of the slotted retaining collar as shown, and mark it for index. After you make your repairs, turn the slotted retainer back to its original depth and position. If you're starting from scratch, or someone else has already screwed things up, set the retaining collar to a depth of 0.6 mm, measuring as shown.

Basic Tests