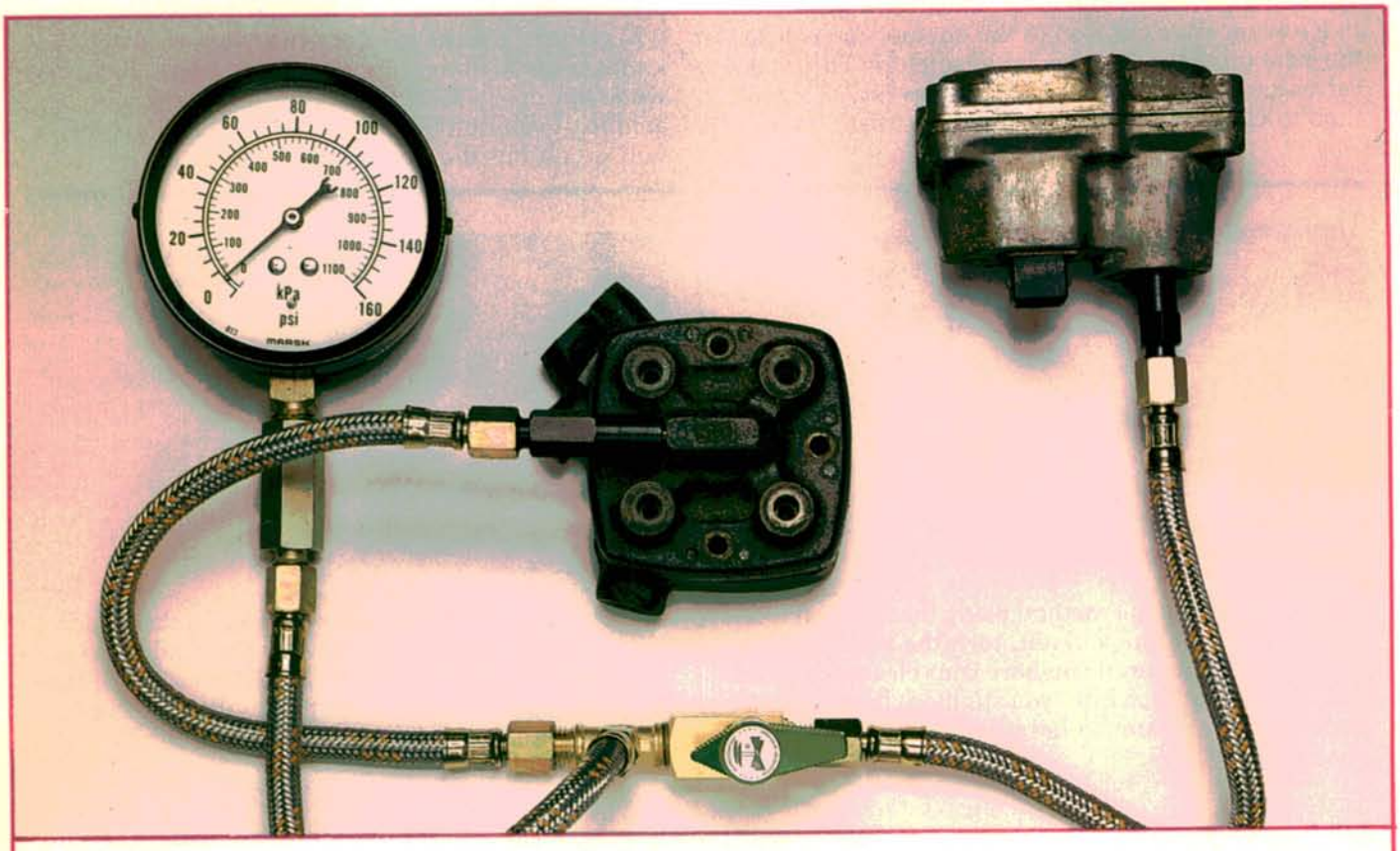
K-Jetronic

PART TWO



Last month's look at K-Jetronic showed the importance of both system and control pressures to the proper operation of the injection system. Now we'd like to expand on that base.

Checking for correct pressures is not all that difficult, and is essential when troubleshooting a problem child. We'll show you the special fuel gauge you need and the proper hook-up and test procedures.

We'll also look at those little accessory devices essential to the cold-start and warm-up needs of the engine.

In essence, we're building a fuel system, starting with basic K-Jet, and adding control devices to meet special circumstances.

It's important, as always, to remember that the fundamentals we discussed earlier are just that—fundamental and essential, regardless of how many accessories or controls we may add.

Pressure Testing

The single most important tool required for testing the K-Jet system is this three-way pressure gauge. It enables you to make four different tests.

- **Cold Control Pressure Test**—This tests whether or not the control pressure regulator properly vents control pressure during engine warmup, to lower control pressure.
- **Warm Control Pressure Test**—This tests whether or not the control pressure regulator adjusts and raises control pressure for warm operation.
- **System Pressure Test**—This tests the ability of the basic fuel supply system to maintain enough pressure for proper system operation.
- **Rest Pressure Test**—This tests the rest, or key off, (pump off) pressure.

—By Ralph Birnbaum

Caution—Contents Under Pressure

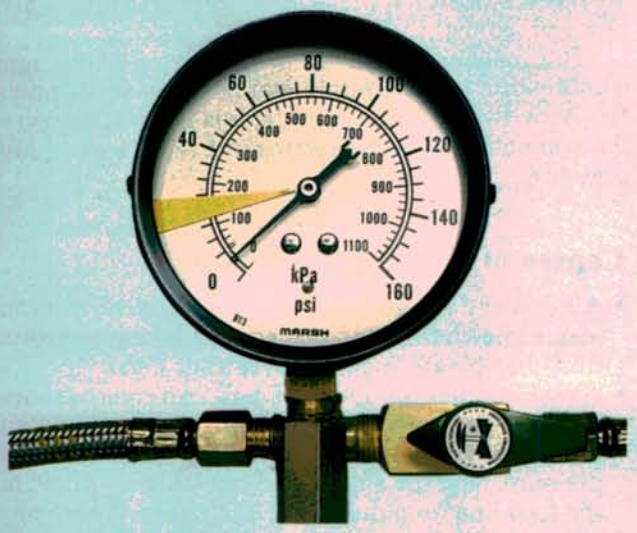
Before we get started, please remember to play it safe with this or any open fuel system. We're going to crack some fuel lines to do these tests—*high-pressure fuel lines.*

We hate to sound like somebody's nagging mother all the time, but disaster can come with the speed of lightning, and Molotov cocktails have no place in the shop. So please, be cool. No smoking. No disconnected coil wires snapping away madly in a pool of fuel. Always wear eye protection. Thank you for your kind attention.

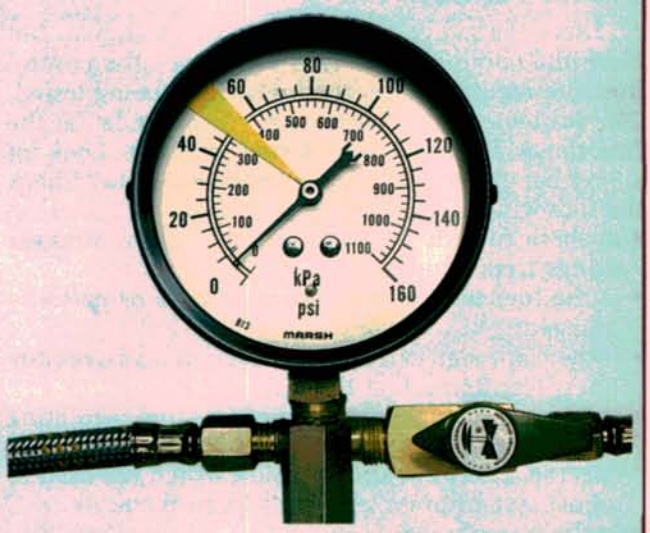
Control Pressure Checks

Take a few moments to bleed all the air from the gauge hoses to ensure accurate readings. After making your connections, let the gauge hang down at the lowest point of the loop formed when you connect the gauge. Run the fuel pump. Open and close the shut off valve on the gauge several times with the pump running. Pause between each opening and closing. This will purge any compressible air bubbles. Now hang your gauge upright so you can see it and take your readings.

Gradually, as the diaphragm in the regulator closes, the control pressure above the plunger will increase. If warm control pressure does not reach the warm pressure specs, check for current at the regulator electrical connector, an open circuit in the regulator heating coil, or insufficient system pressure. Plugged regulator drillings or lines will give you high readings all the time.



CONTROL PRESSURE COLD
AMBIENT TEMP 20°C (68°F)
1.4-1.7 bar (20-25 psi)



CONTROL PRESSURE WARM
3.4-3.8 bar (49-55 psi)

Connecting the Pressure Gauge

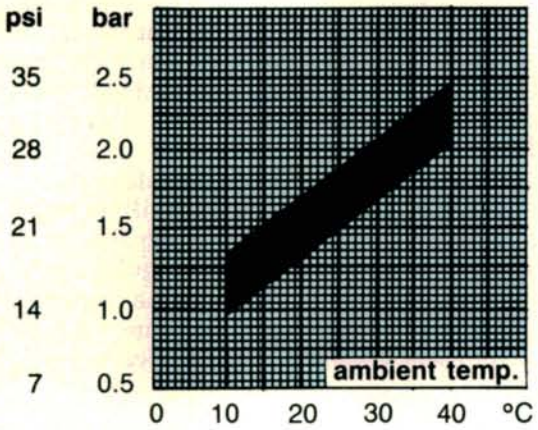
Connect the gauge in-line, between the control circuit output port on the fuel distributor and the control pressure regulator inlet port. The line in question runs between the control pressure regulator and the top of the fuel distributor. Be sure to observe the instructions for using your particular gauge. Some come with a control valve built in. Others rely on a tee with disconnect couplings.

Regardless of the style of the gauge, it helps to remember that we want to "tap into" the line between these two components without restricting fuel flow so the gauge can read the control pressure in the line joining them.

As you can see, we want reduced control pressure with the engine cold. Before testing, disconnect the electrical connector at the control pressure regulator. Start the engine. Wait about a minute for the system pressure to stabilize. Note the reading. Compare your reading to the chart. Reconnect the plug at the regulator and watch for control pressure readings to gradually increase.

If readings are too high when the engine is cold, either the regulator is bad or something is plugged in the control circuit. If you remember our photo of the inside of the regulator from last month's issue, you'll know how small the drillings are above the control diaphragm, and how little it takes to clog them.

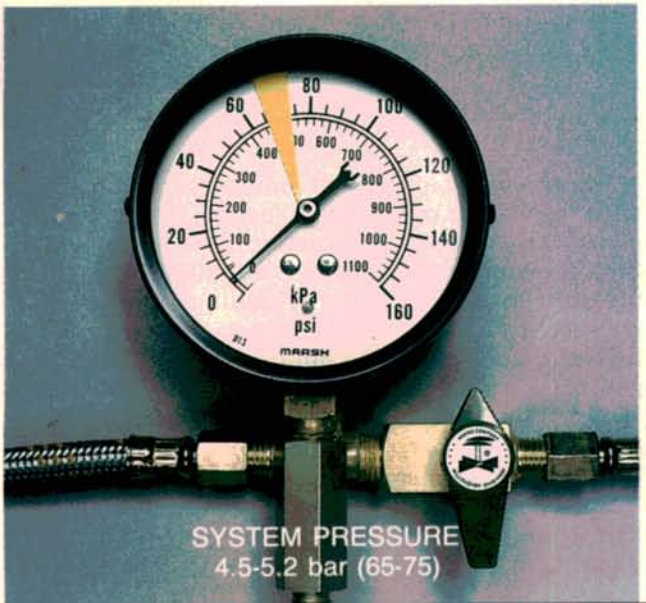
Here's a temperature/pressure chart showing how the control pressure gradually changes during warm up. Typical warm control pressure should level off at 3.4-3.8 bar (49-55 psi).



System Pressure Check

Leave the gauge connected as we've shown, but close the control valve. This eliminates the control pressure regulator from the fuel circuit being tested. Our available fuel pressure now "dead-ends" at the fuel gauge. This reading is system pressure. Look for 4.5-5.2 bar (65-75 psi). System pressure too low? Check the following:

- Is there fuel in the tank? (Don't laugh, stranger things have happened.)
- Is the fuel inlet to the pump plugged or partially plugged?
- Is there any sign of damage to the fuel high-pressure lines, restricting fuel flow?
- Is there a problem with the fuel pressure regulating valve? Be careful if you disassemble the valve to inspect it. There are shims inside which are used to adjust system pressure. Don't loose them.
- Is the pump good?



SYSTEM PRESSURE
4.5-5.2 bar (65-75)

Residual Pressure and Leak-Down Testing

Open the gauge again. Run the engine to build pressure. Stop the engine. (If you use a jumper wire to run the pump, make sure you remove your jumper before testing rest pressure.) With the pump shut off, we want to test the system's capacity to maintain pressure at a certain level for a certain period of time after shut down.

This is especially important when diagnosing hot start problems. If the system bleeds off pressure too rapidly on a sweltering July afternoon, a five minute heat-soak may cause percolation of the fuel, making the car hard to restart

There will be a normal, gradual loss of pressure over a period of time even when everything works as it should. We'll have to refer you to the specs for rest pressure for the car you're working on. Basically, these specs will tell you that you should have a certain pressure in the system after x-number of minutes.

If rest or residual pressure disappears too quickly, however, something, somewhere is leaking

The mechanical action of the spring/diaphragm combination in the accumulator becomes very important here. Even if the accumulator is perfect, however, there are other possible causes of a rapid loss in rest pressure.

Causes of Lost Rest Pressure

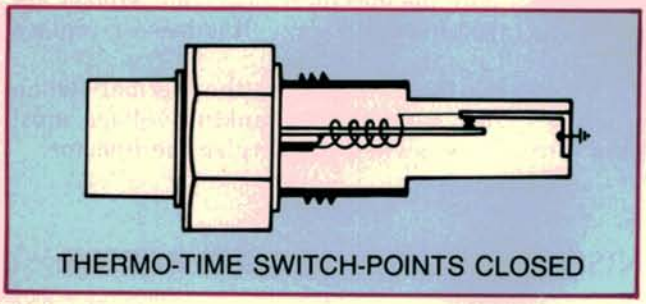
- A loose or damaged fuel line. Basically, an external leak somewhere. This one should be the easiest to find, but please look without your cigar.
- A leaking fuel pump check ball. An internal leak, this one is fairly easy to check. If rest pressures drop too quickly, restart the engine and restore system pressure. Stop the engine and immediately pinch off the feed line from the tank to the pump. If pressures stay up as they should, the outlet check ball is open and should be replaced.
- A leaking pressure regulating valve in the fuel distributor. This is another internal system leak caused when a damaged o-ring at the pressure regulating valve bleeds system pressure back to the tank through the fuel return line.

  Disassemble, clean, and check the regulating valve. Replace the o-ring if necessary. Recheck system pressure and correct it if necessary.
- A leaking accumulator. The accumulator can go bad. A leaking diaphragm or mechanical defect can keep the accumulator from doing its job.
- A leaking cold start injector. Pressurize the system and remove the cold start injector to check for leaks at the needle valve. The cold start injector gets its fuel from the lower chamber of the fuel distributor. Unlike the mechanical injectors at the cylinder ports, its fuel supply is not interrupted when the control plunger in the fuel distributor closes after the engine's shut off.

Choke? Fast Idle Cam?

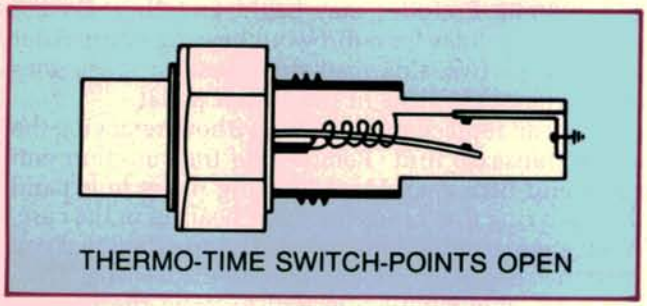
Carbureted cars have a choke and a fast idle cam to compensate for all the inefficiencies of a cold engine. Let's face it, you don't exactly run the four-minute mile at dawn's early light on a sub-zero day. Your engine isn't much different.

That engine wants extra fuel and a higher than normal idle speed to get up and at 'em. In addition to a generally richened fuel mixture, K-Jet uses an electrically activated cold start injector to get things going. The injector is opened by a solenoid, controlled by a thermo-time switch. It squirts raw fuel into the intake plenum.



THERMO-TIME SWITCH-POINTS CLOSED

The same current used to energize the starter solenoid in the crank position also feeds the time switch and cold start injector. It travels to the cold start injector to energize it. It also travels through a heating coil wrapped around another bi-metallic spring, similar to the one found in the control pressure regulator. A set of contact points on the bi-metallic arm connect it to ground. Ground is also supplied to the cold start injector as long as the points in the time switch stay closed.



THERMO-TIME SWITCH-POINTS OPEN

As a result, we have crank voltage and ground supplied to the heating coil and the cold start injector. The heating coil warms the bi-metallic spring causing it to deflect slightly. This movement opens the points, eliminating the ground circuit to both the switch heater and injector.

With no ground to the cold start injector we have an open circuit and the injector stops shooting fuel. Hopefully, the engine has started by now and the richened mixture provided by the control pressure regulator will keep the engine running.

Fast Idle

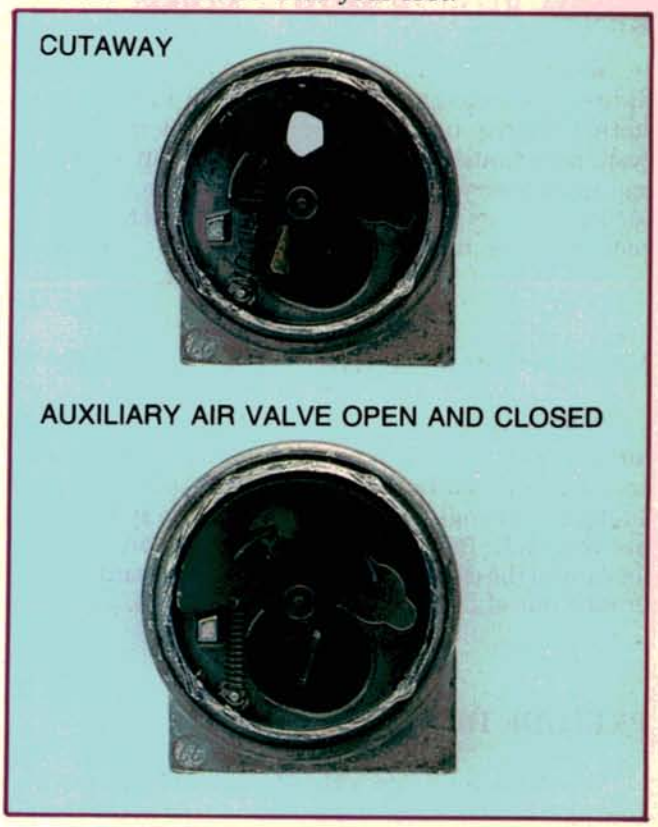
Remember here that the flow of air past the sensor plate moves it against the control plunger in the fuel distributor to increase fuel flow. (You know, the knee bone connected to the thigh bone, the thigh bone connected to the . . .)

No one wants to sit there playing with the accelerator pedal on a cold morning to keep the engine running, however. What we need is some device to increase air flow past the sensor while the engine is cold and then shut it off once the engine is warm.

Let's install a temporary by-pass around the throttle plate and call it an auxiliary air regulator (or air bypass valve). It is operated by another (you guessed it) bi-metallic spring. This gate style valve is normally open, or in this case, open cold.

Since the circuit controlled by the valve "straddles" the throttle plate this additional flow of air through the valve bypasses the throttle and increases lift at the air sensor, raising engine speed.

Once again, the movement of the bi-metallic spring closes the gate gradually, eliminating this additional flow of air. Now you won't have to sit in the car and hold the accelerator with your foot.



AUXILIARY AIR VALVE OPEN AND CLOSED

As you can see, the heart of this system is fuel pressure. There's precious little electricity involved in basic K-Jet, and the need for a good vacuum source to lift the sensor plate is not radically different from most other fuel systems.

If you can handle the pressure, you're home free.