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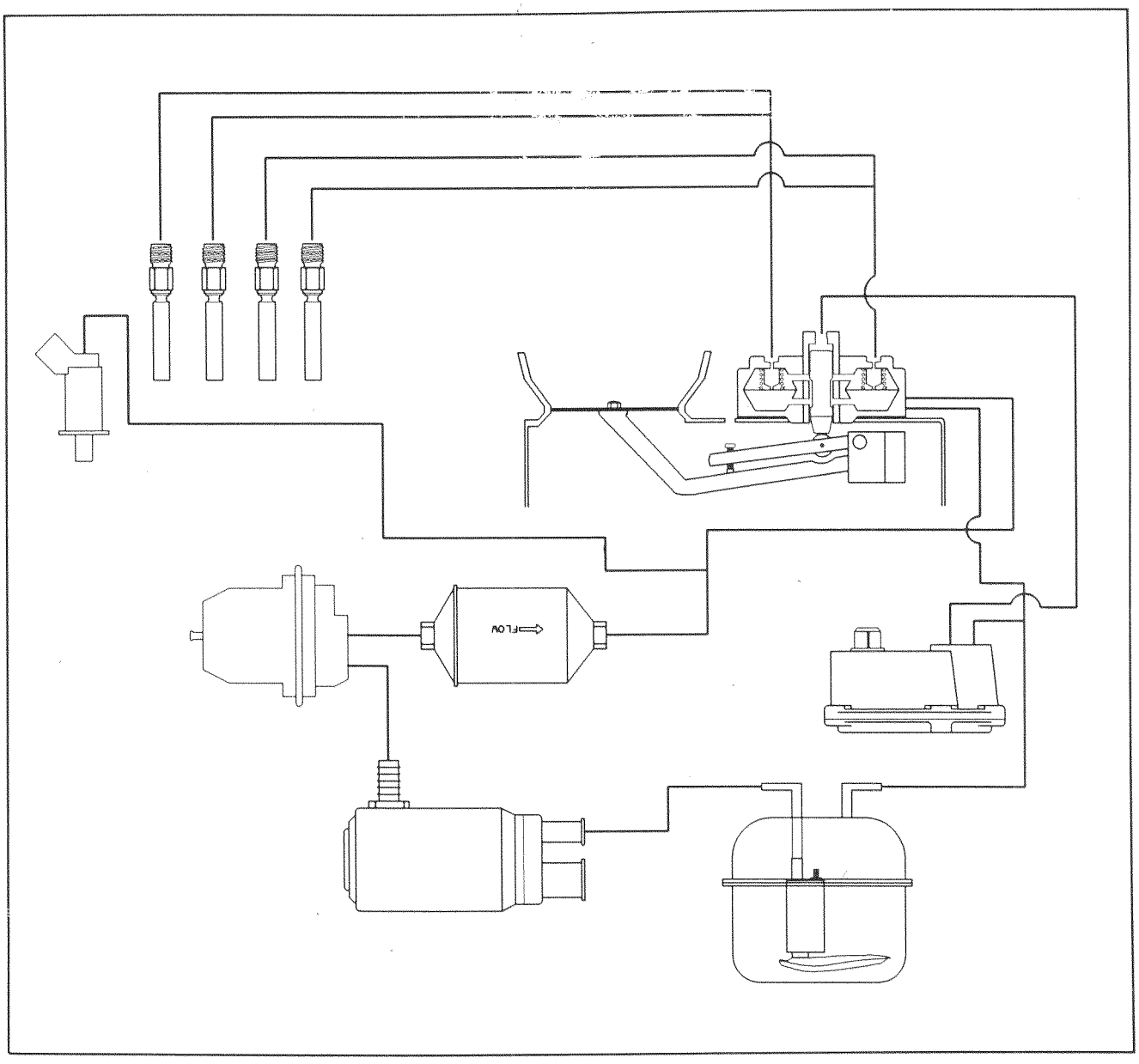
K-Jetronic Fuel Injection



The K-Jetronic system is a mechanical fuel-injection system. Introduced in 1974, the K-system is sometimes called Continuous Fuel Injection because once the engine starts, fuel is sprayed through the injectors continuously until the engine is shut off.

The K-Jetronic system owes its name to the German word *kontinuerlich* which means continuous. Thus, the K-system is often referred to as the Continuous Injection System, or CIS. The CIS is a mechanical system that sprays fuel through the injectors continuously. Although this may seem like a waste of fuel, the fuel is sprayed at a minimal rate to provide only what is needed for each cylinder to have the proper air-fuel ratio. When the intake valve closes, fuel begins to accumulate in the intake runner leading to that cylinder. Opening the intake valve results in a volume of air rushing into the intake runner and pulling the fuel along with it into the combustion chamber.

The K-Jetronic system was introduced in 1974 as a replacement for Bosch's technologically aging mechanical fuel-injection system developed in the 1930s and refined through the early 1970s. Although simple to troubleshoot, the K-system has been viewed as a nemesis by many technicians. A unique feature of this system is that rather than being controlled by electronics, the control of injection is through the hydraulic action of the fuel passing through the system.

K-Jetronic fuel-injection system applications include the following:

Audi
Fox
100
4000
5000
BMW 320i
Mercedes-Benz
6.9 liter
280
450
Porsche
Turbo Carrera
911 series
924
928
Saab
99
900
Volkswagen
Dasher
Jetta
Rabbit
Rabbit pickup
Scirocco
Volvo
140
240
260

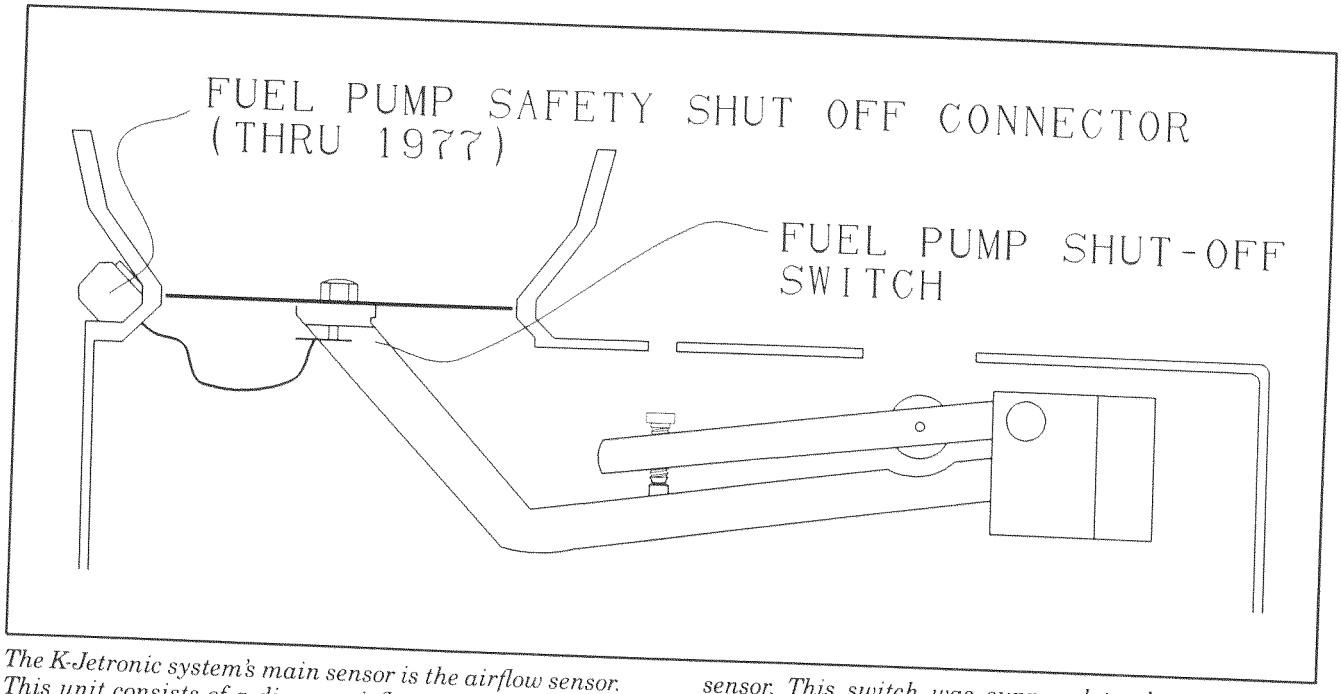
Hydraulic Theory

To easily troubleshoot the K-system one must understand two basic principles of hydraulics: (1) Pumps do not create pressure, they only supply a volume. Both wanted and unwanted restrictions in the system create the pressure. (2) Any restriction holds pressure back upstream of the restriction and causes the pressure to drop downstream.

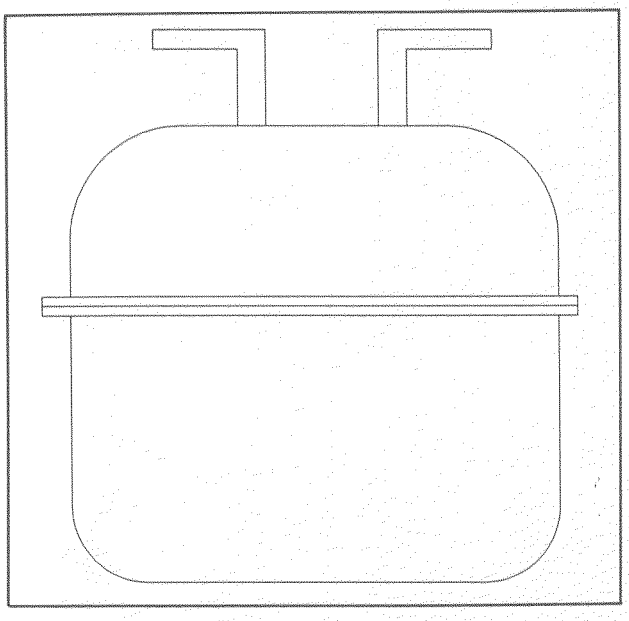
K-Jetronic Components

Fuel Tank

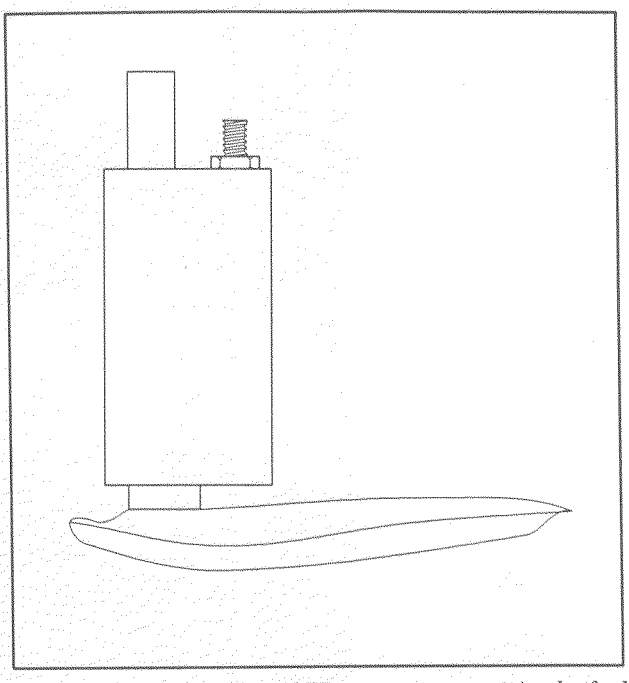
In electronic fuel-injection systems the design of the fuel tank is not critical. However, there are times when as much as 90 percent or more of the fuel pumped by the fuel pump will pass through the engine compartment, be warmed and returned to the tank unused by the engine. This warm fuel needs to combine evenly with the colder fuel sitting in the tank. For that purpose the K-Jetronic fuel tank is designed to be narrow and deep. Baffling around the fuel pickup also reduces the possibility of fuel starvation when the car is low on fuel.



The K-Jetronic system's main sensor is the airflow sensor. This unit consists of a disc, or airflow sensor plate, that lifts as air flows into the engine. Model years 1977 and earlier incorporated a fuel pump switch in the airflow sensor. This switch was supposed to shut off the fuel pump if the engine died as a result of a fuel line being ruptured in an accident.



The fuel tank in the K-system is usually narrow and deep. This design is to improve the even mixing of fuel as warm fuel from the engine compartment returns to the tank.



Most applications since 1977 use a pre-pump in the fuel tank. Its purpose is to push the fuel to the main pump. On the end of the pre-pump is the in-tank filter.

In-Tank Filter

Located on the end of the fuel pickup or in-tank fuel pump is a sock-style filter. This filter is relatively coarse and is designed specifically to prevent damage to the fuel pump from rust, metal, dirt and sand. When the filter becomes plugged it can result in a loss of volume to the extent that system pressure will drop, causing a loss of power, hesitation and stalling.

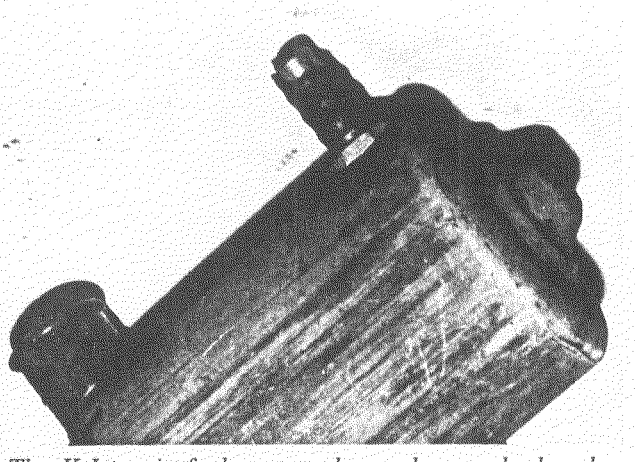
Pre-Pump

The pre-pump is used on most post 1976 applications that do not have the main pump located in the fuel tank. This pump's job is to ensure a steady volume of fuel to the chassis-mounted main pump to prevent vapor locking. The pump is fused separately from the main fuel pump and on applications such as the 1976-80, the fuse is not located in the fuse panel but rather under a plastic cover beneath the carpet in the trunk.

When the pre-pump fails, the most common symptom will be a severe stumble or hesitation off idle when the fuel level is below half a tank, especially on hot days.

Fuel Pump

The fuel pump used by the K-Jetronic system is a high-speed electrically driven roller vane pump. This type of pump delivers a high and relatively even volume to the fuel system, allowing the system to maintain an even and consistent pressure. The pump can be located in the fuel tank or on the chassis. If located in the tank, there will be no pre-pump.

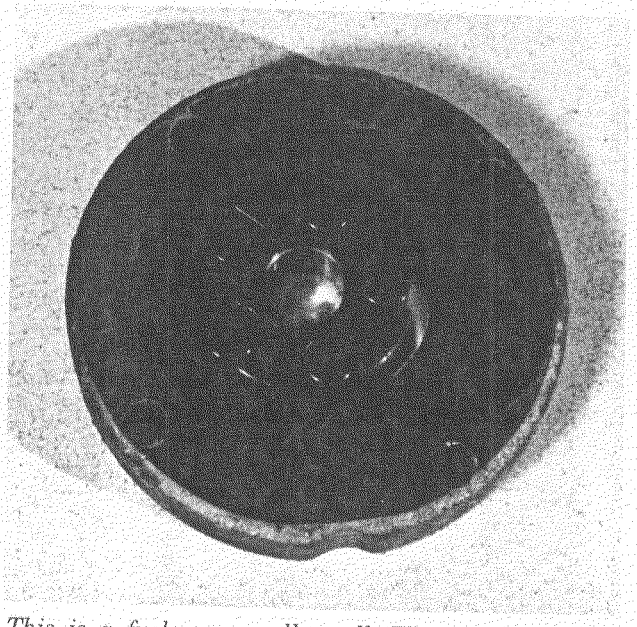


The K-Jetronic fuel pump always has a check valve. Should the check valve fail to hold pressure after the engine is shut off, the engine will be difficult to start when hot.

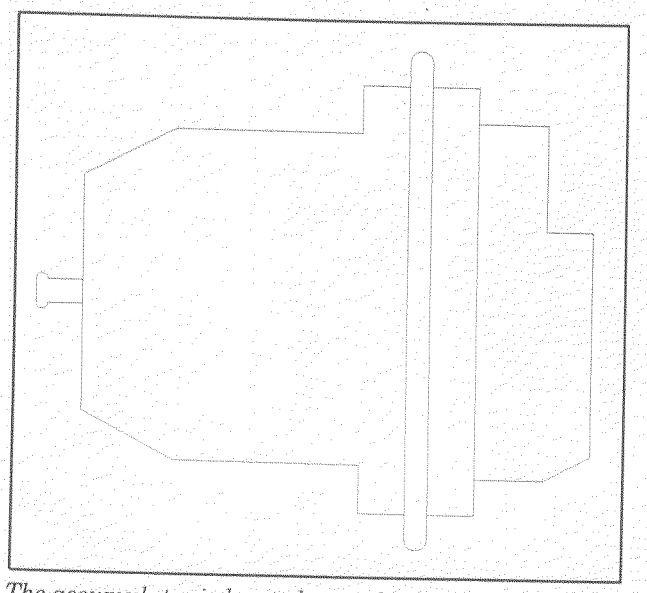
Two different safety systems are used, depending on model year, to shut down the fuel pump in the event of a ruptured fuel line. From 1974 to 1977 a safety switch is located in the airflow sensor. Should a fuel line rupture, in an accident for instance, the engine would die. When the engine dies air stops flowing into the engine and the airflow sensor plate drops, grounding a switch that turns off the fuel pump relay and shutting down the fuel pump. The problem with this method is that should the car come to rest inverted, the

airflow sensor plate will not drop to the rest position and therefore the fuel pump would continue to run even after the engine dies.

Later models utilize a relay that receives a signal from the primary ignition system. When the engine dies, the primary ignition system shuts down; the relay stops sensing the signal and shuts off the fuel pump.



This is a fuel pump roller cell. The center pumping section is about the size of a quarter. The 3500 rpm speed of the pump enables the pump to deliver 0.5 gpm at over 100 psi.



The accumulator is located near the fuel pump. It serves two functions: to reduce the noise created by pulsations of pressure from the fuel pump, and to maintain rest pressure when the pump is shut off.

Typically, a defective fuel pump or fuel pump wiring system manifests itself as a no-start problem.

Accumulator

The accumulator is located close to the fuel pump. It consists of a spring-loaded diaphragm in a can and serves two purposes in the fuel system. First, the accumulator dampens or smooths out pressure pulsations created by volume fluctuations from the fuel pump. Its second job is to help maintain pressure in the system after the engine has been shut off and the fuel pump has shut down.

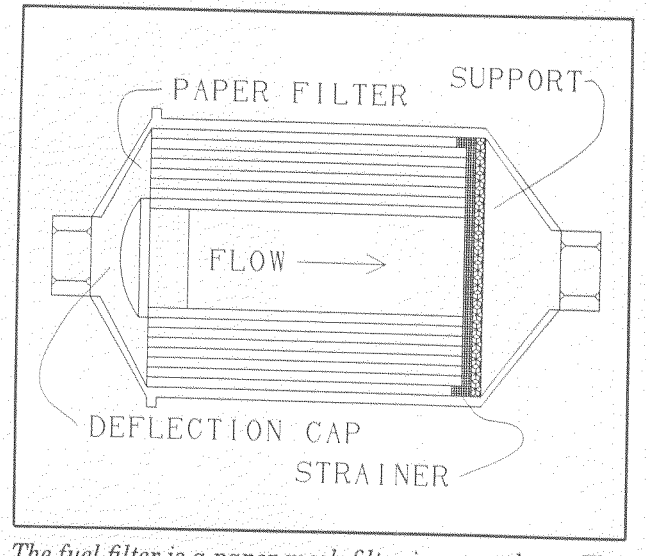
The most common failure of the accumulator is a ruptured diaphragm. On most applications, if the diaphragm ruptures fuel will leak out the back of the accumulator. Some applications have a hose connecting the back or dry side of the accumulator to the fuel tank.

If the accumulator diaphragm ruptures, system pressure will drop to the point where the engine will shut off and not restart.

Fuel Filter

The fuel filter is important to an electronic fuel-injection system, but not nearly as important as it is to the CIS system. The injectors and the fuel distributor have some tiny openings and orifices. Consequently, very small particles can collect, causing severe restrictions in the fuel system.

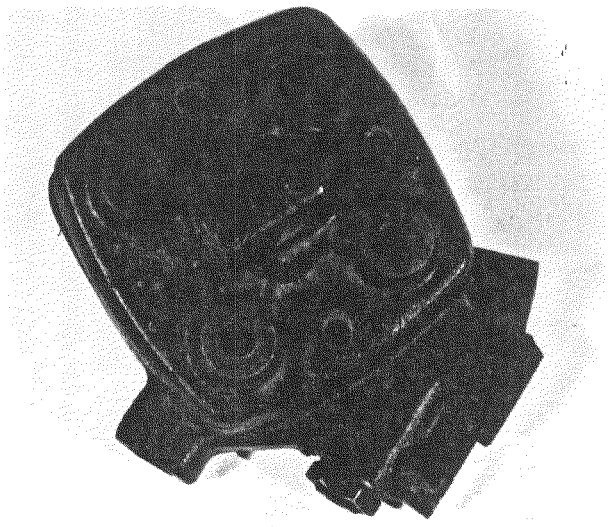
The fuel filter on the K-Jetronic is usually in plain sight in the engine compartment but probably has not been changed since the car has left the factory. The fuel filter is the only real protection that the injection system has against internal contamination from dirty fuel. The filter should be replaced every time the spark plugs are replaced.



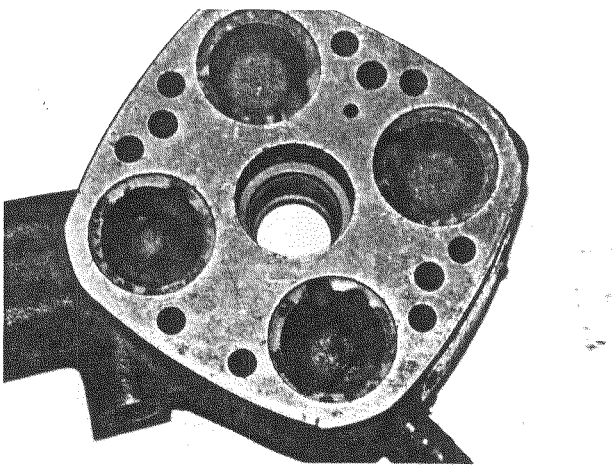
The fuel filter is a paper mesh filter in a metal can. This filter is capable of filtering to 10 microns. A restricted filter can cause poor power and dying.

Fuel Distributor

The fuel distributor is the heart of the K-Jetronic system. It is divided into two sets of chambers, the lower chambers and the upper chambers. These chambers are separated by a thin stainless-steel diaphragm which seals an orifice that protrudes down from the top of the upper chamber. A spring in the upper chamber applies pressure against the diaphragm, forcing it downward and opening the orifice when the pressures in the upper and lower chambers equalize. This pair of chambers is known as a differential pressure regulator. There is a differential pressure regulator for each engine cylinder.

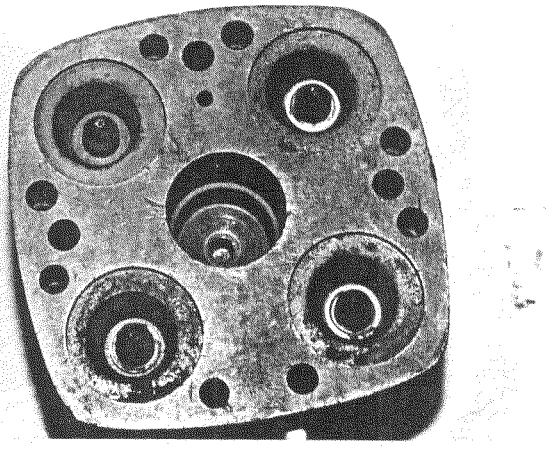


The fuel distributor routes and meters the fuel to the injectors. This high-precision device is located on the airflow sensor assembly.

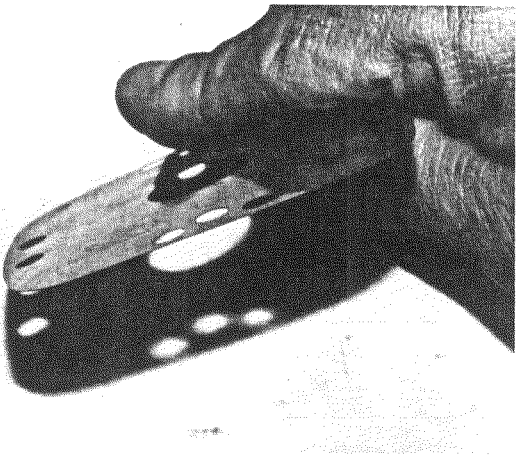


Fuel enters the fuel distributor through the lower chambers. These are the lower chambers of a four-cylinder engine. Notice that there is one lower chamber per cylinder.

With the fuel pump running but no air flowing into the engine, the pressure in the lower chambers is 1.5 psi higher than the pressure in the upper chambers. This pressure differential works against the tension of the spring in the upper chamber. In the center of the fuel distributor is the metering cylinder. In the center of the metering cylinder is the control plunger. A set of holes in the lower portion of the metering cylinder allows fuel to flow along a tapered area in the control plunger toward the upper chambers. If there is no air flowing into the engine the plunger will be in its lowest position, allowing no fuel to flow into the upper chambers. As the airflow sensor plate is lifted by air entering the engine, the control plunger is lifted as well. As the plunger is lifted, metering slots adjacent to the upper portion of the

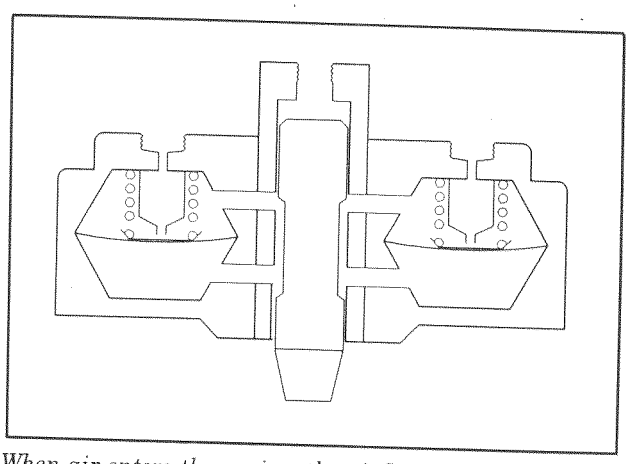


Located in the upper chambers are the injector valve orifices which control the flow of fuel to each injector.

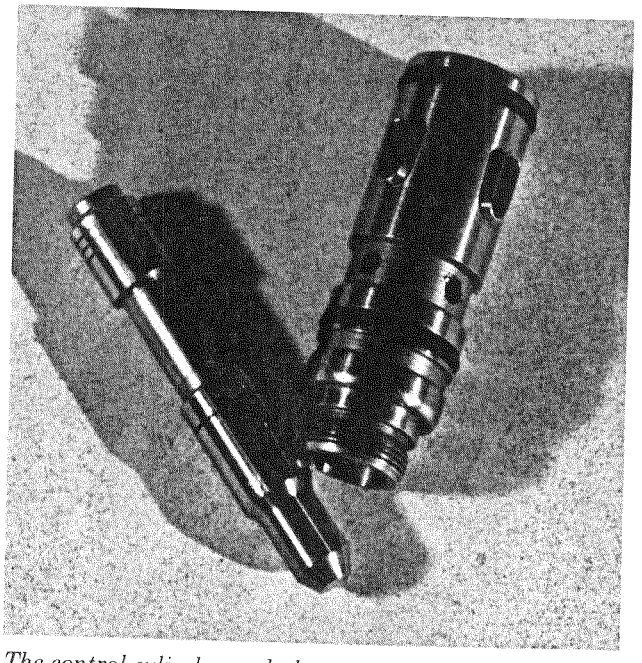


This thin stainless-steel diaphragm separates the lower chambers from the upper, and provides a seal for the injector valve orifices to shut off fuel when fuel should not be flowing to the injectors. Together with the upper and the lower chambers the diaphragm forms the differential pressure regulators.

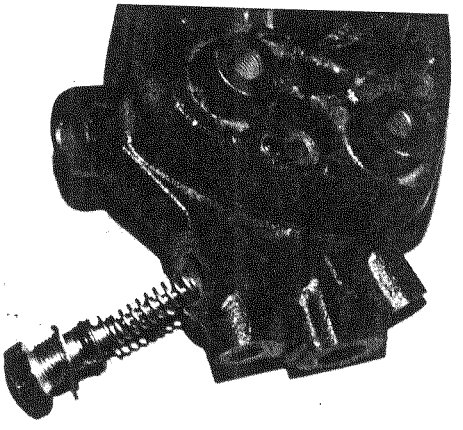
control plunger are opened, allowing fuel to flow from the lower chambers into the upper chambers. The pressures in the upper and lower chambers equalize, allowing the springs to push the diaphragm downward, in turn allowing fuel to flow to the injectors. The quantity of fuel reaching the injectors is governed by how much the control plunger has been lifted and how much the metering slots have been opened.



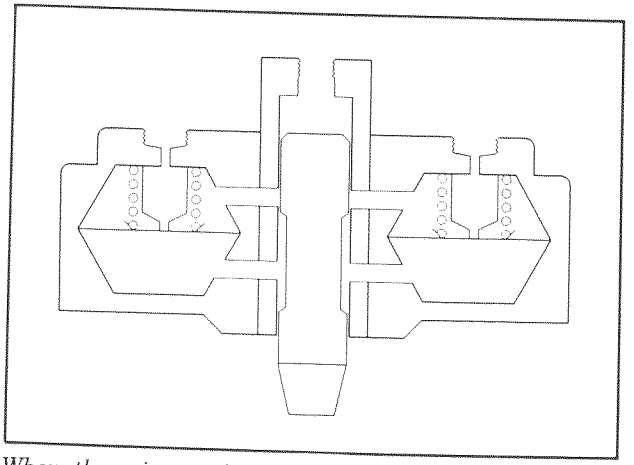
When air enters the engine, the airflow sensor plate lifts the control plunger and fuel flows from the lower chambers into the upper chambers. The pressures in the two chambers equalize and the diaphragm deflects downward, opening the injector valve orifice and allowing fuel to flow to the injectors.



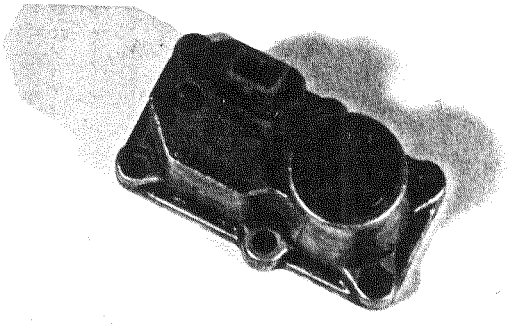
The control cylinder and plunger sit in the large hole in the center of the fuel distributor. These components are machined to a perfect match.



The system pressure regulator is located in the lower chamber section of the fuel distributor. System pressure can be adjusted by removing or adding shims.



When there is no air entering the engine, the airflow sensor plate is in its rest position. The plunger keeps the fuel in the lower chambers from flowing into the upper chambers. As a result, the pressure in the lower chambers is greater than the pressure in the upper chambers and the diaphragm is forced upward, sealing the injector valve orifices.



The control pressure regulator, or warm-up regulator, is located in a warm place on the engine. When the engine is cold the control pressure regulator lowers control pressure to around 20 psi. This lower pressure allows greater movement of the plunger which provides for a richer mixture when the engine is cold.

Rough running and poor power are symptoms associated with a defective fuel distributor.

System Pressure Regulator

The system pressure regulator is located in the side of the fuel distributor. Its primary task is to control system pressure at about 5 bar (1 bar = 15 psi), with some variation from one application to another. The secondary task of the regulator is to close off the return line to the tank when the engine is shut off in order to maintain residual or rest pressure.

The design of the system pressure regulator prior to 1978 did not seal rest pressure adequately. Later systems use a push valve with rubber O-rings to increase the valve's sealing ability.

System pressure can be adjusted to a small degree by adding or removing shims, thus altering the spring tension in the pressure regulator. These shims are not typically a stock item for most dealerships, however.

Failure of the system pressure regulator normally results in a dramatic rise or drop in system pressure. Either condition will cause the engine to run extremely lean. Typical symptoms include backfiring, stalling, rough running and poor power.

Control Pressure Regulator (or Warm-Up Regulator)

There is a tiny hole in the stainless-steel diaphragm that separates the lower from the upper chambers of the fuel distributor. This hole allows fuel to flow from the lower chambers into an area above the control plunger. The control pressure regulator controls the pressure in this area, limiting the degree to which the control plunger can be lifted for a given amount of airflow into the engine. Limiting the movement of the control plunger in turn limits the richness of the air-fuel ratio. When the engine is cold the control pressure will be relatively low (around 1.5 bar), allowing greater movement of the control plunger and therefore a richer mixture. As the engine warms up the control pressure increases (to about 3.5 bar), leaning out the air-fuel ratio.

Defects in the control pressure regulator will typically cause cold-starting problems, hot-starting problems or rough running.

Injectors

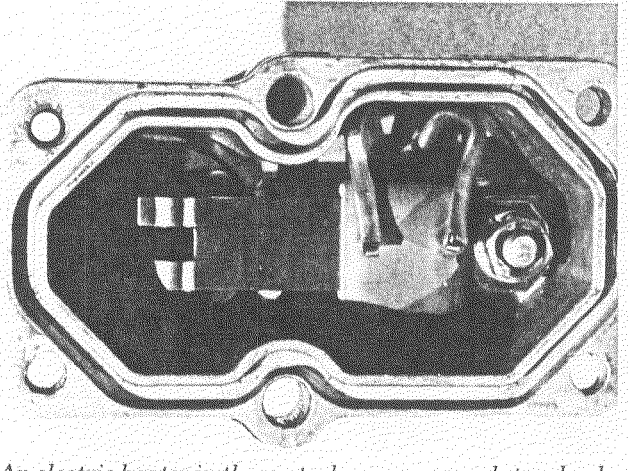
The CIS system uses pressure-opened injectors. When the pressure supplied by the upper chambers of the fuel distributor reaches approximately 3.0 bar (45 psi), the injectors open and spray fuel just above the intake valves continuously. A small disc located just above the valve in the injector vibrates as the fuel passes across it. This helps to atomize the fuel and is responsible for the characteristic hum from the injectors.

These injectors are so simple in design that nothing ever goes wrong with them, except for restrictions and leaking.

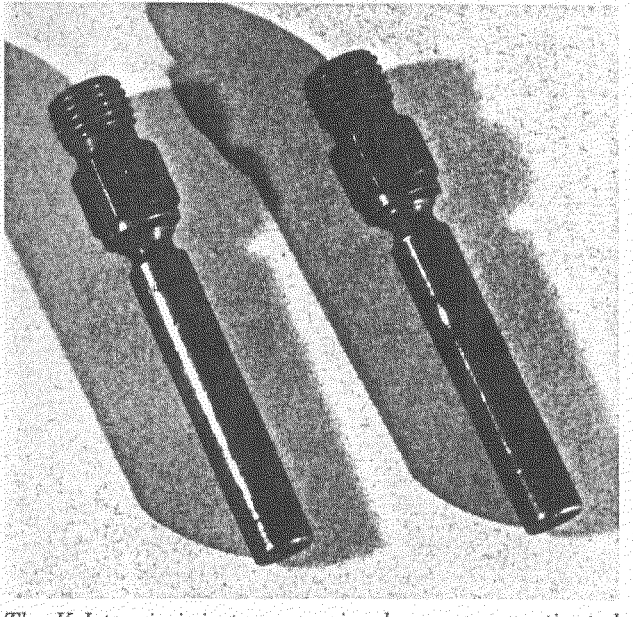
A defective injector will result in erratic engine operation, poor power and increased fuel consumption.

Cold-Start Injector

Also connected to system pressure is a solenoid-operated valve known as the cold-start injector. Since the earliest applications of the K-system were all four-cylinder, the cold-start valve picked up the moniker fifth injector. It stuck in some circles, even for six- and eight-cylinder applications.



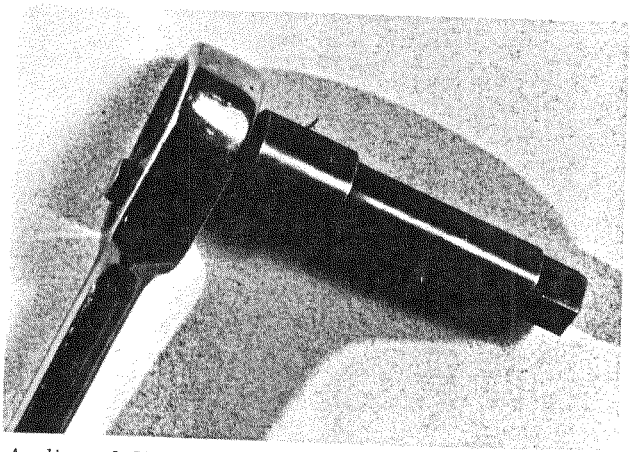
An electric heater in the control pressure regulator slowly heats a bimetal strip. This allows the control pressure to increase to about 50 psi when the engine is warmed up. The higher control pressure limits the travel of the control plunger, leaning out the mixture.



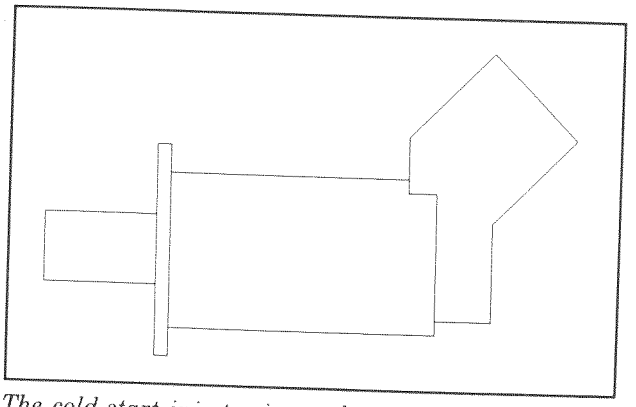
The K-Jetronic injectors are simple, pressure-activated pop-off valve injectors. When pressure behind the injectors reaches around 50 psi the injectors will open and spray continuously until the engine is shut off.

The cold-start injector receives battery voltage whenever the starter is engaged, and is grounded through a device known as a thermo-time switch. The thermo-time switch is a temperature-sensitive bimetal switch designed to provide a ground for the cold-start injector when the temperature of the engine is less than 95 deg. F. A second circuit in the switch is an electric heating element intended to heat the bimetal as the engine is being cranked. The result is that the cold-start injector should operate only when the engine is being cranked, the temperature of the engine is less than 95 deg., and for a maximum of five to twelve seconds.

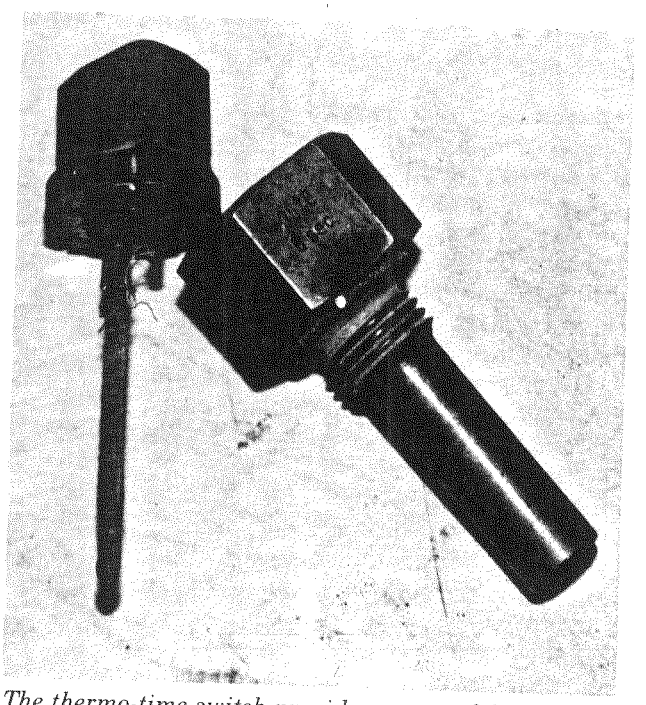
Two of the most common symptoms of a cold-start injector problem are hard starting when cold because it is not operating, and a leaking injector, which can cause an extremely rich running condition.



Audi and Volkswagen use a screw-in mount in the cylinder head for the injectors. This mount is prone to cracking with heat and time, however. The tool shown can be used to remove and replace these mounts. An alternative is a bolt with a 13 mm head.



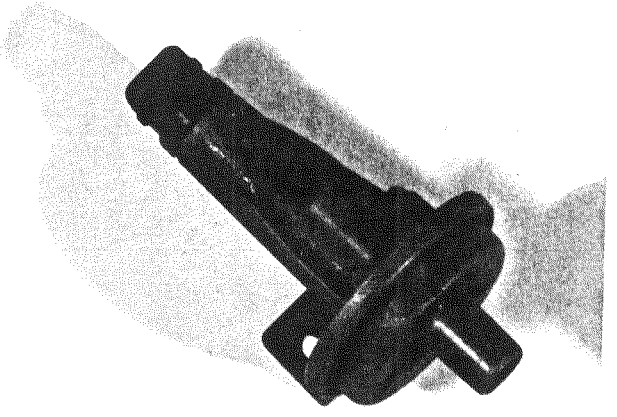
The cold-start injector is a solenoid-operated valve located in an area of the intake manifold common to all cylinders. When the key is in the crank position the cold-start injector receives 12 volts from the starter solenoid or ignition switch.



The thermo-time switch provides a ground for the cold-start injector. This switch was rated at 35 deg. Celsius (95 deg. F.) for eight seconds. You will find this marked on the switch. Therefore, it would allow the cold-start injector to spray only when the temperature of the engine was below 95 deg. and only for a maximum of eight seconds.

Auxiliary Air Valve

The auxiliary air valve is used to allow air to bypass the throttle plates while the engine is warming up to permit a higher idle speed. The valve consists of an electrically heated bimetal valve.



The fast-idle function is provided by the auxiliary air valve. This valve should be open when the engine is cold to increase the idle speed, and closed when the engine is warm.

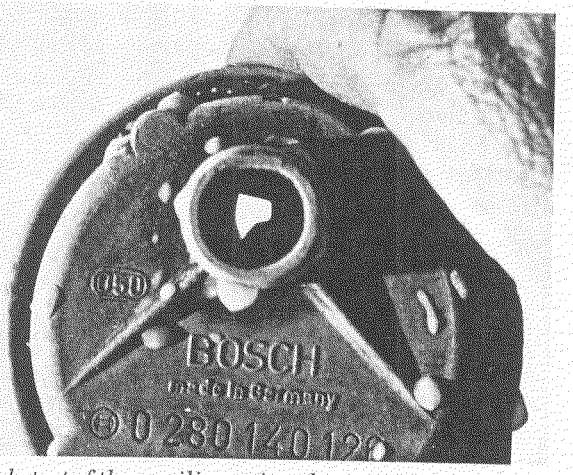
When the engine is first started the valve will be open. As the engine runs, the bimetal valve is heated by the electric element, slowly closing off the auxiliary air by-pass and reducing the volume of air to the engine. Reducing the air entering the engine reduces the idle speed.

Idle Air By-pass

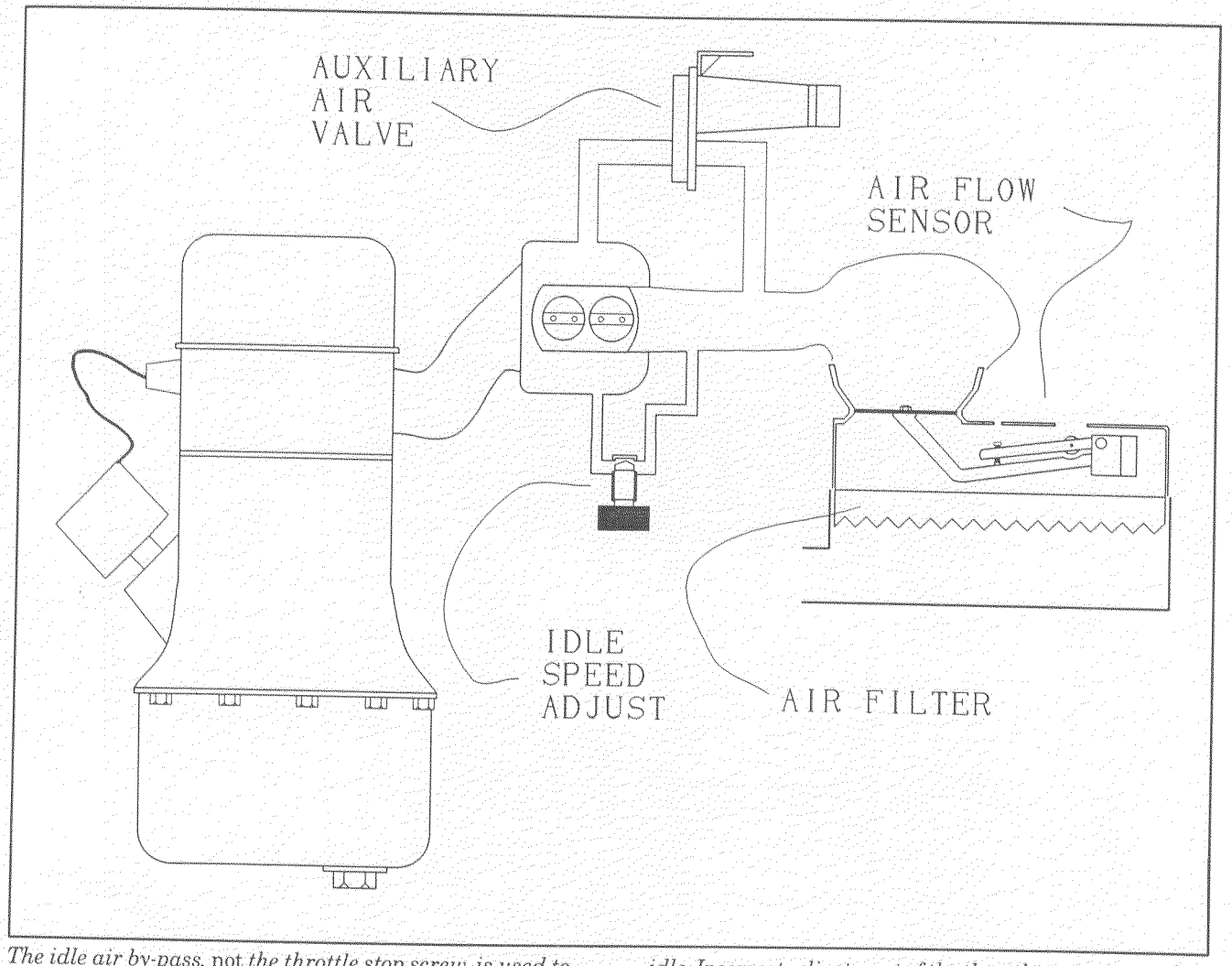
Unlike a carbureted engine, the K-Jetronic system does not use the throttle stop screw to adjust the idle speed. Instead, it uses a by-pass channel similar to the auxiliary air by-pass. Unlike the auxiliary air by-pass, however, the idle air by-pass is adjusted by the technician. Curb idle speed should be changed only by adjusting the idle air by-pass and *never* by using the throttle stop screw.

Airflow Sensor

A reference was made earlier in this chapter to the airflow sensor lifting the plunger. The airflow sensor consists of a disc called an airflow sensor



A simple test of the auxiliary air valve is to remove it from the car and place the valve in the freezer for fifteen minutes. When removed from the freezer the valve should be open like this one. If it is, install it back on the car and run it for five minutes. The valve should now be closed.



The idle air by-pass, not *the throttle stop screw, is used to adjust the curb idle speed. Be sure that the auxiliary air valve or slide has completely closed before adjusting curb idle. Incorrect adjustment of the throttle stop can result in rough idle and surging.*

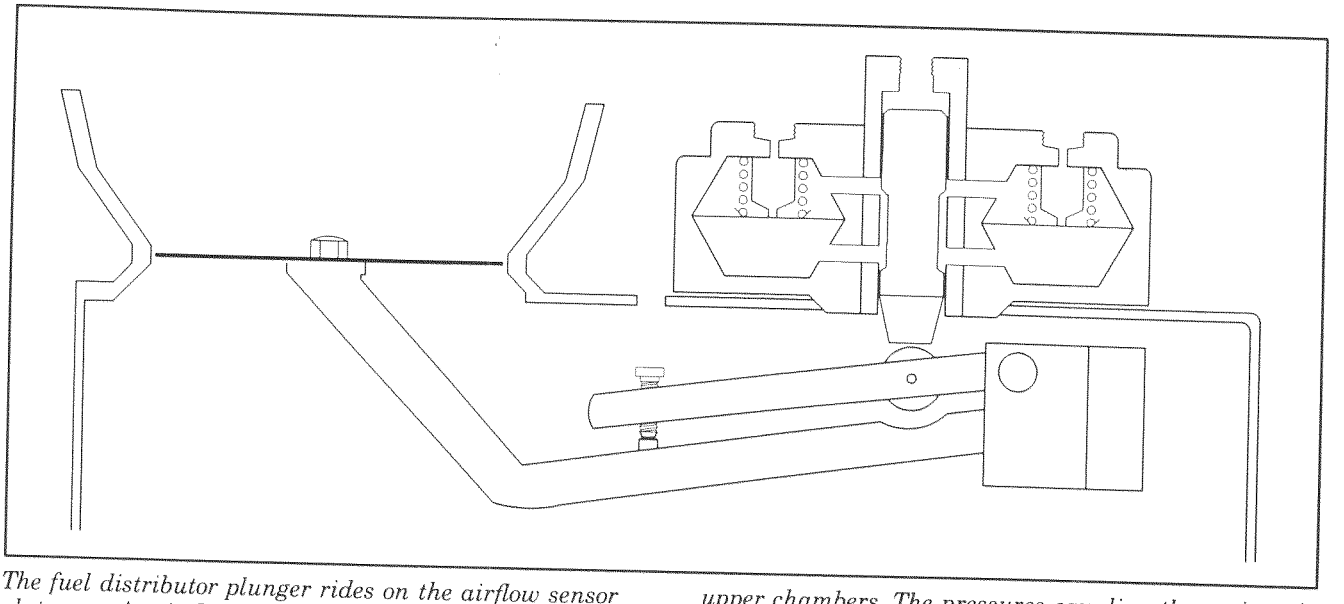
plate that is mounted on a counterweighted lever. The plate sits in a venturi. When the engine is started and air begins to flow into the engine, the airflow sensor plate is lifted. The lever rotates on the fulcrum and a roller lifts the control plunger. The lever is in two pieces, with a screw that allows for the adjustment of air-fuel ratio.

Early models incorporate a safety switch that shuts off the fuel pump when the air stops flowing into the engine and the airflow sensor plate comes to rest.

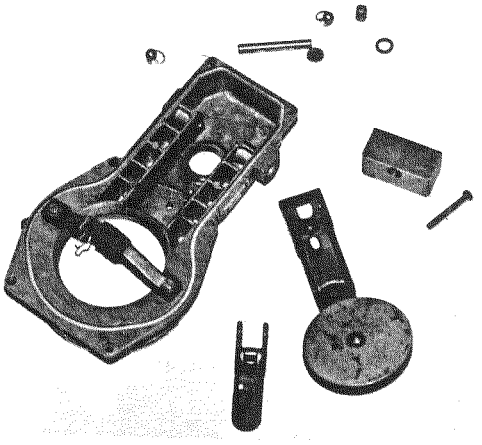
Airflow sensors on V-6s and V-8s are pulled down by air flowing into the engine. The control plunger on these applications is located on the opposite side of the fulcrum from the sensor plate so that as the air flowing into the engine presses down on the plate, the plunger is lifted.

K-Jetronic Tune-Up Adjustments

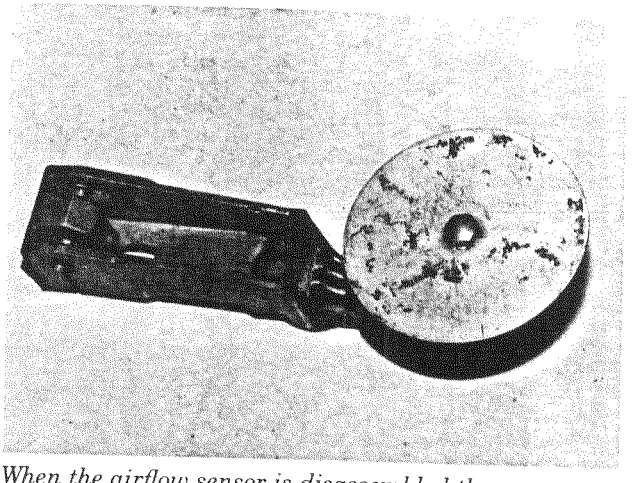
For most engines equipped with the K-Jetronic system, all of the standard ignition adjustments are made in the same way as for a carbureted engine. Spark plug gap has the same relevance, as well as ignition timing, point dwell, curb idle and so on.



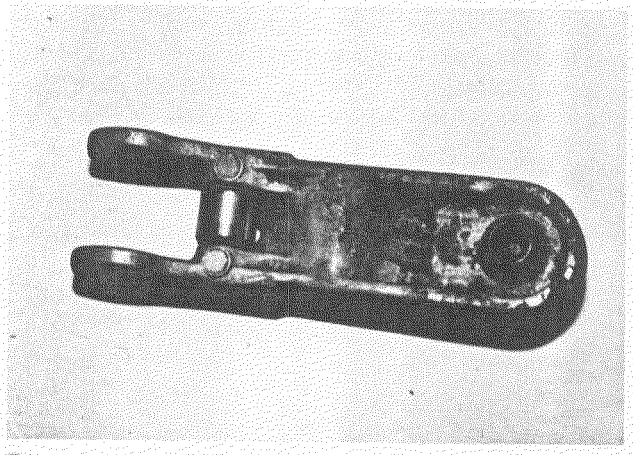
The fuel distributor plunger rides on the airflow sensor plate arm. As air flows into the engine the sensor plate is lifted. As the plate lifts the plunger moves upward, allowing pressure from the lower chambers into the upper chambers. The pressures equalize, the springs in the upper chambers push the diaphragm downward opening the orifice valves, and fuel goes off to the injectors.



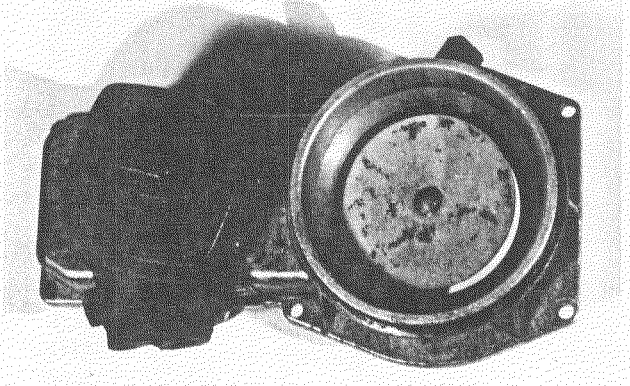
The airflow sensor assembly is the only component of the K-Jetronic system that can be overhauled. Should the plate arm begin to stick or bind, disassemble the sensor, clean and lubricate.



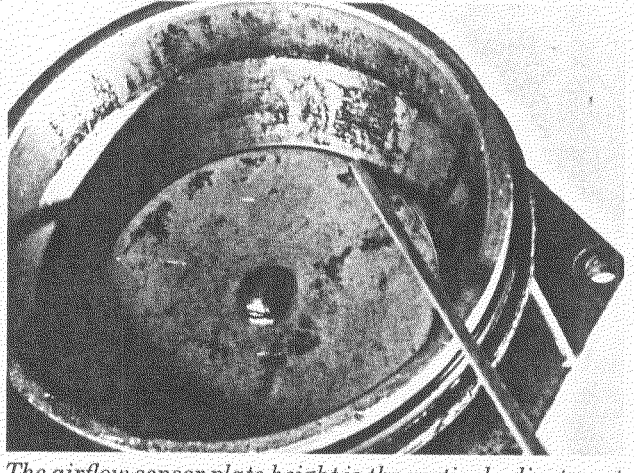
When the airflow sensor is disassembled the sensor arm can be easily cleaned and lubricated.



Dirt can get into the 3 mm CO adjustment screw and cause the screw to strip when adjustment is attempted. Thus while the airflow sensor is disassembled, be sure to clean the adjustment screw.



The bulk of the K-Jetronic tune-up adjustments are made at the airflow sensor assembly.



The airflow sensor plate height is the vertical adjustment of the sensor. Begin the adjustment by cracking loose the centerline on the top of the fuel distributor. This will relieve control pressure from the top of the plunger. The airflow sensor should rest with the top of the plate just below the top of the narrowest part of the venturi.

Airflow Sensor Plate Rest Height

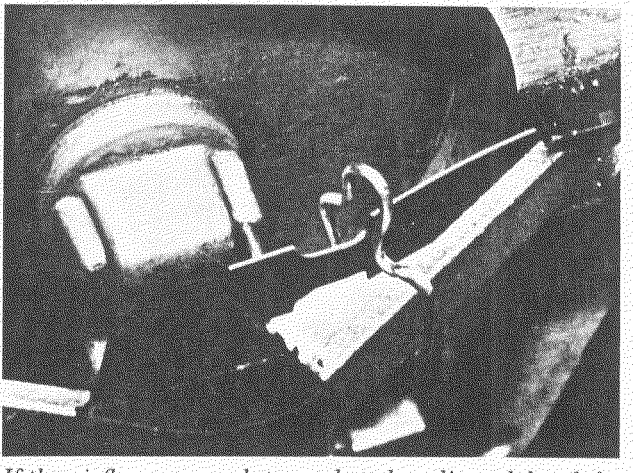
Adjust the rest height of the airflow sensor plate by adjusting the spring clip under the sensor plate. The plate should rest with the top of the plate just below the upper edge of the narrowest part of the airflow sensor venturi.

Airflow Sensor Plate Centering

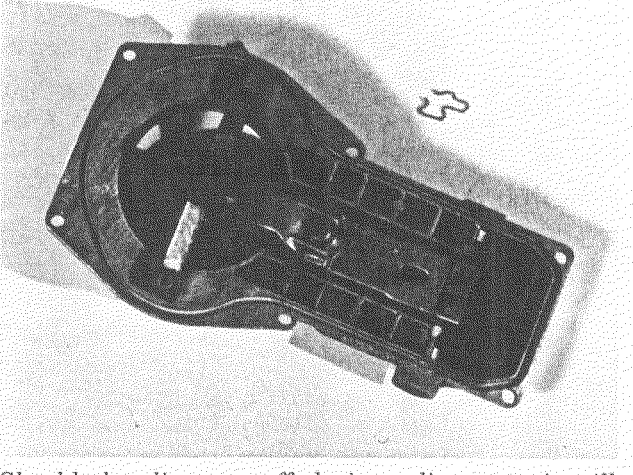
The bolt in the center of the airflow sensor plate goes through a hole that is larger than the bolt. When the bolt is loosened, the plate can be moved to center it. Center the plate visually and ensure that the plate does not stick or bend in the venturi as the plate is lifted.

Adjusting Minimum Air

After completing the standard ignition system adjustments of dwell and timing, begin work on the fuel injection by adjusting the throttle plate for

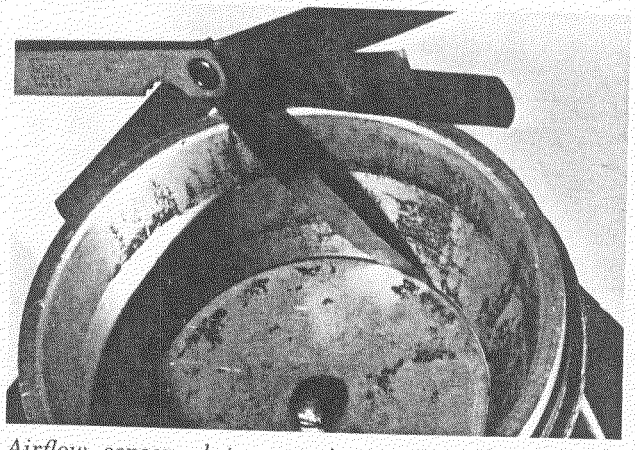


If the airflow sensor plate needs to be adjusted, bend the clip that holds the spring rest for the sensor plate.

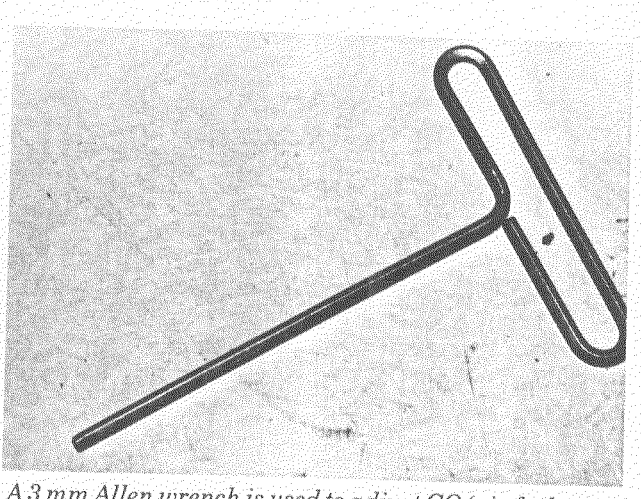


Should the clip come off during adjustment, it will usually be necessary to remove the airflow sensor assembly to reinstall it.

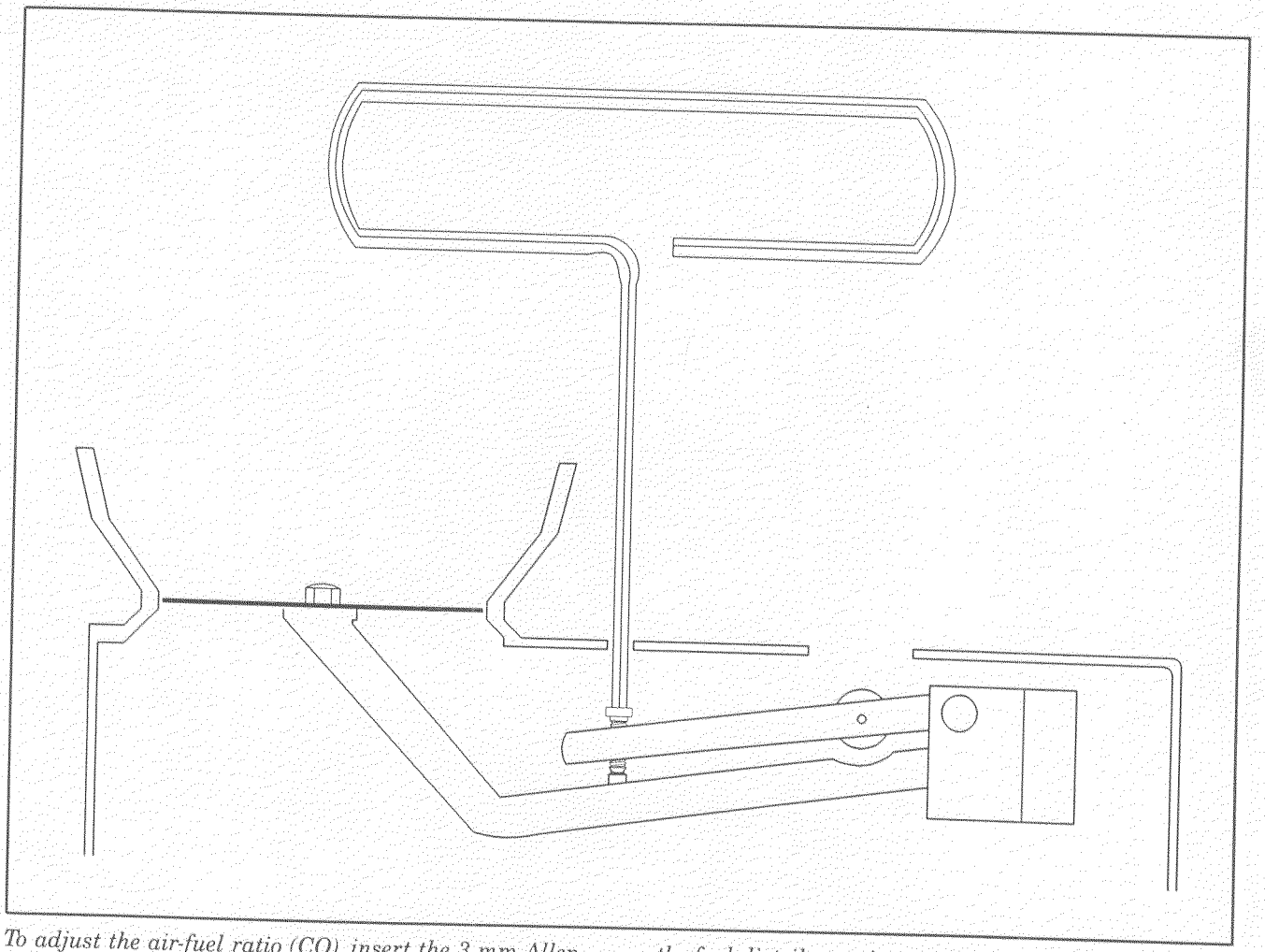
minimum airflow. Start up and warm the engine to operating temperature, then shut it off and visually inspect the auxiliary air valve to ensure that it has closed completely. Next, connect a tachometer and restart the engine. Close the manually adjusted idle air by-pass, and adjust the throttle stop screw so that the engine just barely idles—at



Airflow sensor plate centering can usually be done visually. If that does not work, a feeler gauge can be run around the plate to ensure centering.



A 3 mm Allen wrench is used to adjust CO (air-fuel ratio).



To adjust the air-fuel ratio (CO), insert the 3 mm Allen wrench in the hole between the airflow sensor venturi and the fuel distributor. A gentle hand is required since very slight turns can make drastic differences in CO.

about 450 rpm on an eight-cylinder, 550 rpm on a six-cylinder and 650 rpm on a four-cylinder.

After completing the minimum air adjustment, ensure that the throttle does not bind in the closed position.

Adjusting Curb Idle Speed

After completing the minimum air adjustment, use the manual adjustment on the idle air by-pass to set curb idle speed. Refer to the EPA chart under the hood of the car. If the EPA chart is missing, set the curb idle to 950 rpm.

Adjusting CO

The CO (carbon monoxide) adjustment on the CIS system is located in the airflow sensor near the fuel distributor. A 3 mm long Allen wrench is required for the job. After completing the minimum idle and curb idle adjustments and after ensuring again that the engine is thoroughly warmed up, insert a CO exhaust gas analyzer into either the tailpipe or the sampling port located ahead of the catalytic converter, as indicated in the EPA sticker under the hood. If the sticker is missing, set the CO to 1-1.5 percent at the tailpipe.

Very small movements of the 3 mm Allen wrench make an enormous difference in the CO reading. For this reason, the only practical and accurate way to adjust the CO is by using a gas analyzer.

After the CO is adjusted, recheck the idle speed.

Component Testing and Troubleshooting

Since the K-Jetronic system controls itself through the variation of hydraulic pressures throughout the system, the bulk of serious troubleshooting will be done by testing pressures in the system. There are six pressures that are relevant to the control of the K-Jetronic system: operating pressures, supply pressure, system pressure, cold control pressure, warm control pressure, injector opening pressure and return line pressure.

Understanding the function and purpose of each of these pressures is essential in troubleshooting system faults. However, only four pressures are actually measured directly in the troubleshooting method. These pressures include testing pressures, cold control pressure, system pressure, warm control pressure and rest pressure.

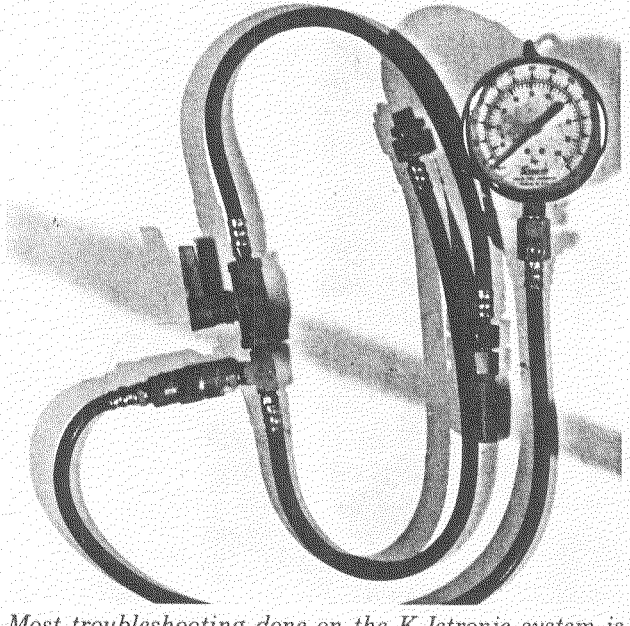
Hooking Up the Gauge

A gauge capable of reading approximately 100 psi is required to troubleshoot the K-Jetronic system. Additionally, the hoses from the gauge must form a T. One leg of the T must be equipped with a shutoff valve.

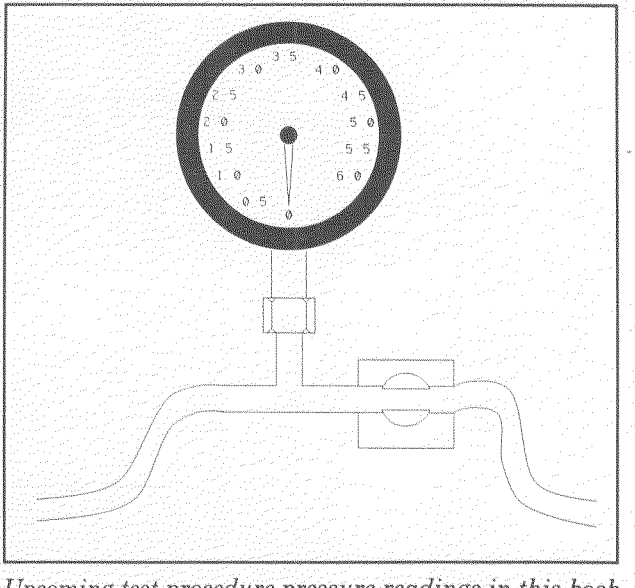
Connect the gauge in the line that runs from the center of the fuel distributor to the control pressure regulator. The hose with the valve should be installed on the control pressure regulator side of the hose going to the gauge.

For an effective and accurate diagnosis, follow the proper operational sequence from beginning to end and diagnose your results only after the entire procedure has been completed.

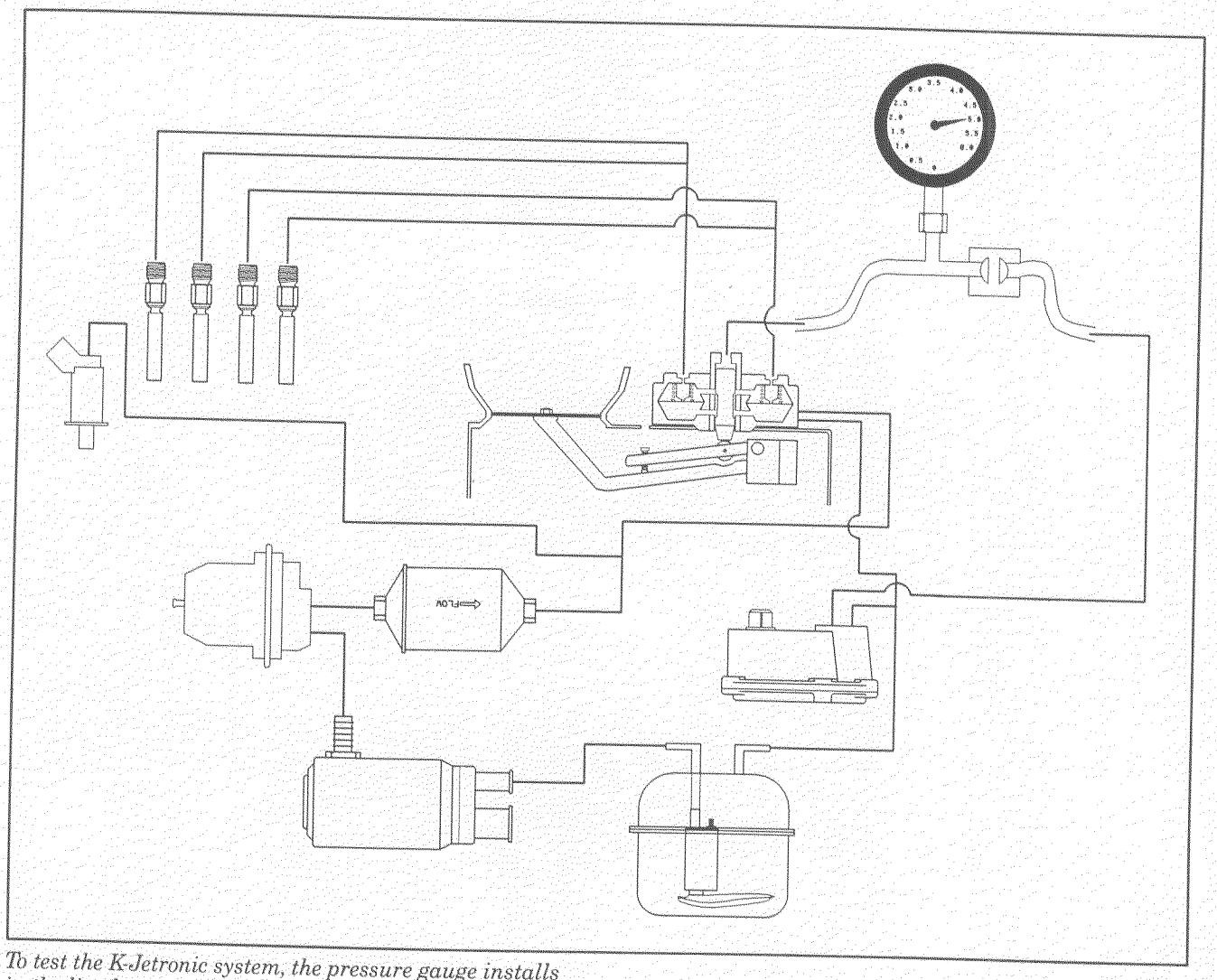
Begin with a cold engine. Disconnect the electrical connectors at the auxiliary air valve and at the control pressure regulator. Then connect the gauge. By-pass the fuel pump relay according to specifications.



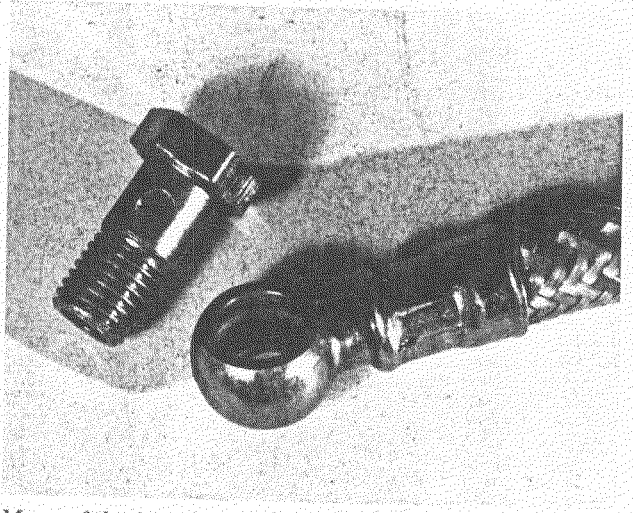
Most troubleshooting done on the K-Jetronic system is done with a pressure gauge. The gauge should be able to read over 100 psi (7 bar). Notice that there is a valve in one branch of the T on the gauge.



Upcoming test procedure pressure readings in this book will be shown with a drawing of a gauge that looks like this. Note that the valve in this drawing is in the open position.



To test the K-Jetronic system, the pressure gauge installs in the line between the center of the fuel distributor and the control pressure regulator.



Many of the fuel lines in the K-system have banjo fittings at the connections. Be careful not to lose the washers when connecting the gauges—they are very difficult to replace.

Fuel Pump Relay Specifications

Application	Procedure
Fox 1975	Disconnect the airflow meter fuel pump safety connector, disconnect the three-prong connector on the back of the alternator and turn on the ignition switch.
Fox 1976-79	Place an 8 amp fused jumper between fuel pump relay socket terminals L13 and L14.
100	Disconnect the airflow meter fuel pump safety connector, disconnect the three-prong connector on the back of the alternator and turn on the ignition switch.

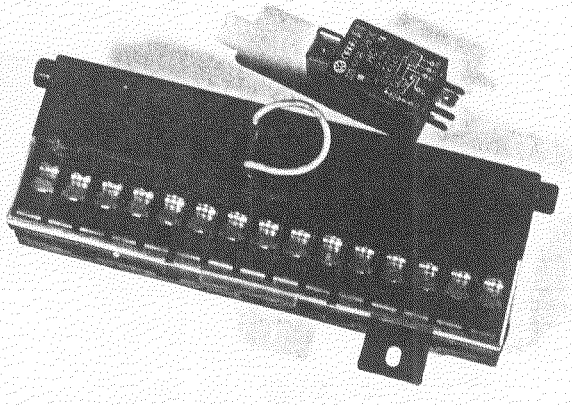
4000	Place an 8 amp fused jumper between fuel pump relay socket terminals L13 and L14.
5000	Place an 8 amp fused jumper between fuel pump relay socket terminals J39 and J40.
BMW	Place an 8 amp fused jumper between fuel pump relay socket terminals 30 and 87.
Mercedes-Benz	Place an 8 amp fused jumper between fuel pump relay socket terminals 30/51 and 87.
Porsche	
Turbo Carrera	Disconnect the airflow sensor fuel pump safety switch connector and turn on the ignition switch.
911 1973-75	Place an 8 amp fused jumper between fuel pump relay socket terminals 30/51 and 87.
911 1976-79	Place an 8 amp fused jumper between fuel pump relay socket terminals 30 and 87a.
924	Disconnect the airflow sensor fuel pump safety switch connector and turn on the ignition switch.
928	Place an 8 amp fused jumper between fuel pump relay socket terminals 30 and 87.
Saab	
To early 1977	Disconnect the airflow sensor fuel pump safety switch connector and turn on the ignition switch.
From early 1977	Place an 8 amp fused jumper between fuel pump relay socket terminals 30 and 87.
Volkswagen	
1975 Dasher only	Disconnect the airflow meter fuel pump safety connector, disconnect the three-prong connector on the back of the alternator and turn on the ignition switch.
1976-80 All models	Place an 8 amp fused jumper between fuel pump relay socket terminals L13 and L14.
Volvo	
1974-77	Disconnect the airflow sensor fuel pump safety switch connector and turn on the ignition switch.
1978-79	Obtain fuel pump test relay from the dealer and install according to manufacturer's instructions.

If all else fails in an attempt to energize the fuel pump, run a set of jumper leads from the fuel pump to the battery. Be careful about polarity between the fuel pump and battery.

With the valve on the gauge in the open position and the fuel pump running but not the engine, record the control pressure. The chart reflects what the cold control pressure should be in three typical North American climates. The temperatures listed are in degrees Fahrenheit. If the ambient temperatures listed do not reflect the temperature at which you are running the test, it will be necessary to estimate from the charts.

Cold Control Pressure Readings

Application	Pressure at 50 Deg. F. (psi)	Pressure at 75 Deg. F. (psi)	Pressure at 100 Deg. F. (psi)
Audi			
Fox 1975-77	14	24	32
Fox 1978-79	14	24	32
100	14	24	32
4000	14	24	32
5000 1978-79	14	24	32
5000 1980	14	24	32
BMW 320i	10	18	26
Mercedes-Benz			
6.9 liter	16	25	34
280 (federal)	14	21	31
280 (Calif.)	14	21	31
280 1977 (high-altitude)	17	25	33



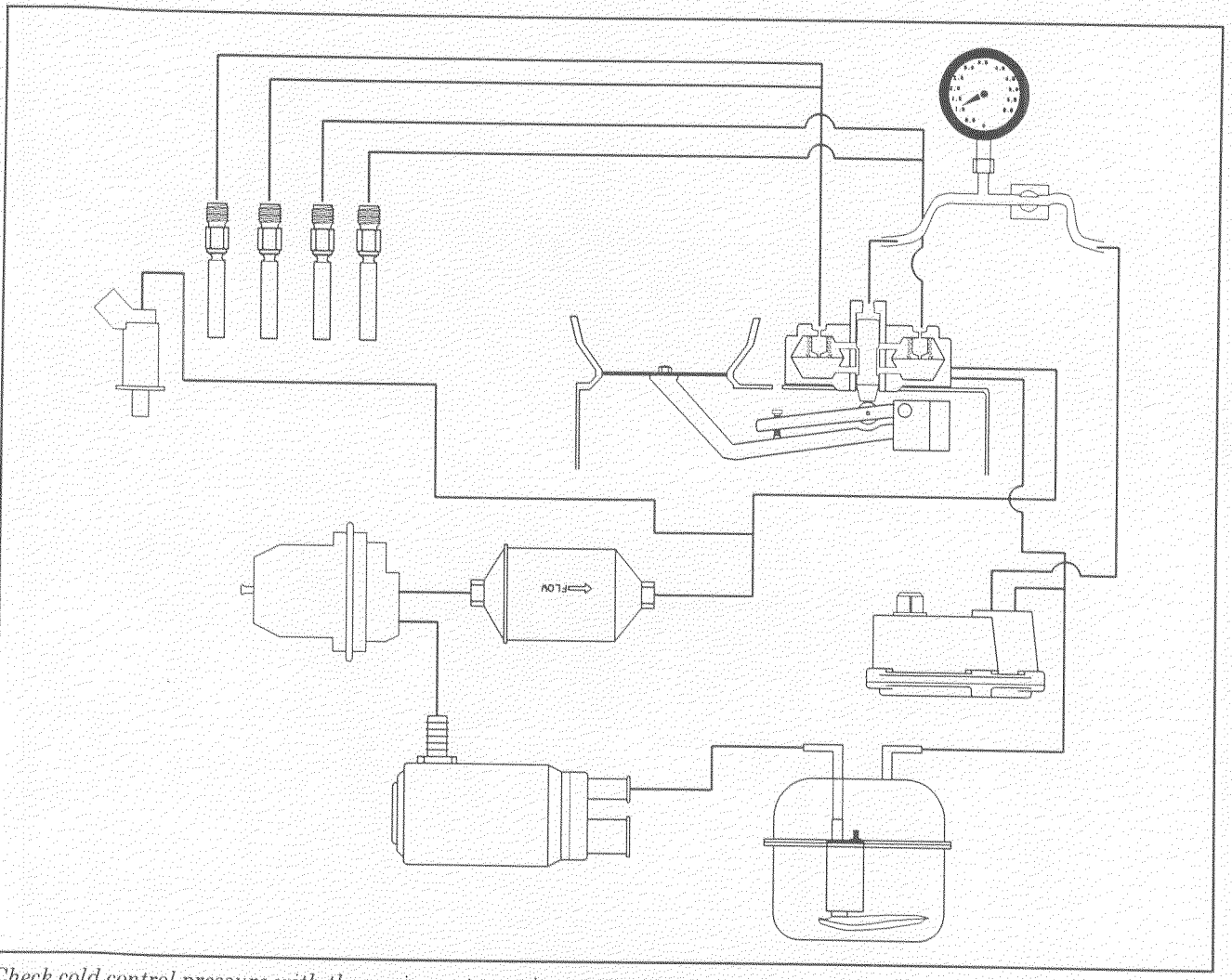
To energize the fuel pump for pressure testing on the VW and Audi products, remove the fuel pump relay. Insert a jumper across the terminals in the fuse panel that form a T. The wire shown above is a 16 amp fusible link. To avoid the possibility of damaging the car's electrical system, always use a fused wire.

Cold Control Pressure Readings

Application	Pressure at 50 Deg. F. (psi)	Pressure at 75 Deg. F. (psi)	Pressure at 100 Deg. F. (psi)
450 1976-78	19	24	34
450 1979	19	28	38
Porsche			
911 1973	15	25	35
911 1974-75	17	32	45
911 1976-77	20	32	49
911 1978-79 (Registration number 0 438 140 045)	25	32	43
911 1979 (Registration number 0 438 140 069)	21	33	47
924	16	23	32
928	17	30	44

Cold Control Pressure Readings

Application	Pressure at 50 Deg. F. (psi)	Pressure at 75 Deg. F. (psi)	Pressure at 100 Deg. F. (psi)
Turbo Carrera			
1975-77	9	22	35
1978-79	17	26	32
Saab			
99 1975-77	15	24	32
99 1978-79	15	24	32
900	15	24	32
Volkswagen			
Dasher 1976-79	16	24	32
Dasher 1980	16	24	32
Jetta, Rabbit, Scirocco to 1979	16	24	32
Jetta, Rabbit, Scirocco 1980 and later	16	24	32



Check cold control pressure with the engine not running and the valve open. The pressure for most cars is about 15-25 psi. The warmer the ambient temperature, the higher the cold control pressure will be.

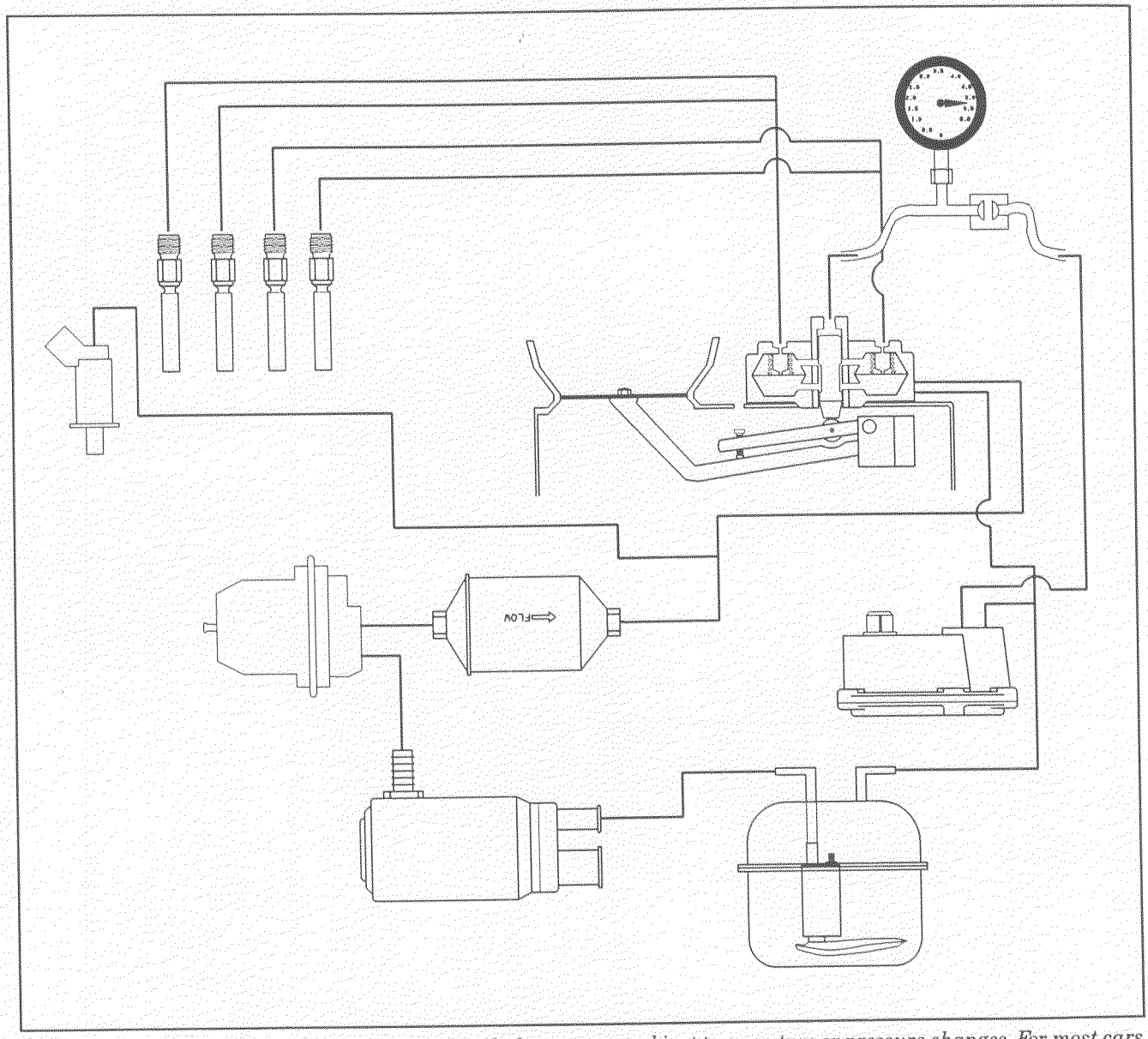
Volvo			
140	16	24	32
240 1976-77	16	24	32
240 1978-79	16	24	32
260	16	24	32

Note: All readings are plus or minus 3 psi.

Next, rotate the gauge valve to the closed position. By doing so the control pressure regulator will be isolated, thus the pressure that the gauge shows will be system pressure. Measure the system pressure and check it against the system pressure reading chart. Minor adjustments in system pressure can be made by adding or removing shims to the system pressure regulator.

System Pressure Readings

Application	Pressure (psi)
Audi	
Fox 1975-77	65-75
Fox 1978-79	65-75
100	65-75
4000	65-75
5000 1978-79	65-75
5000 1980	68-78
BMW 320i	65-75
Mercedes-Benz	
6.9 liter	75-84
280 (federal)	75-84



After checking the cold control pressure, but before starting the engine, rotate the valve to test system pressure. System pressure should not change when the ambient temperature or pressure changes. For most cars, system pressure is between 65 and 85 psi.

System Pressure Readings

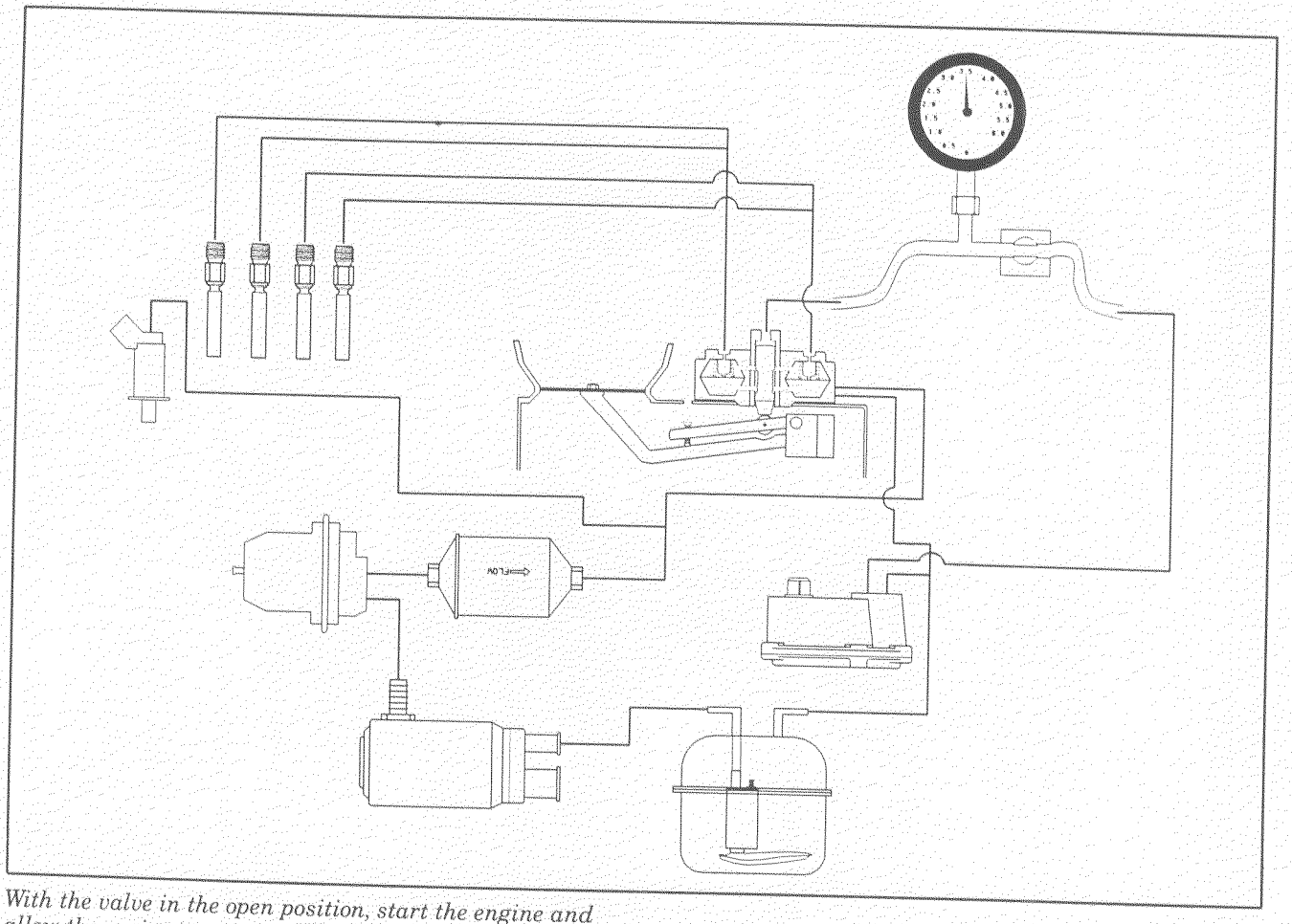
Application	Pressure (psi)
280 (Calif.)	75-84
280 1977 (high-altitude)	75-84
450 (federal and Calif.)	75-84
450 1977 (federal and high-altitude)	75-84
Porsche	
911 1973-74	65-75
911 1975	65-75
911 1976	65-75
911 1977	65-75
911 1978-79	65-75
924	65-75
928	65-75
Turbo Carrera	
1975-77	87-97
1978-79	87-97
Saab	
99 1975-77	65-74
99 1978-79	65-74
900	65-74

System Pressure Readings

Application	Pressure (psi)
Volkswagen	
Dasher 1976-79	65-75
Dasher 1980	68-78
Jetta, Rabbit, Scirocco to 1979	65-75
Jetta, Rabbit, Scirocco 1980 and later	68-78
Volvo	
140	65-75
240 1976-77	65-77
240 1978-79	65-77
260	65-77

Return the valve to the open position to measure control pressure. Reconnect the electrical connectors on the fuel pump, the control pressure regulator and the auxiliary air valve.

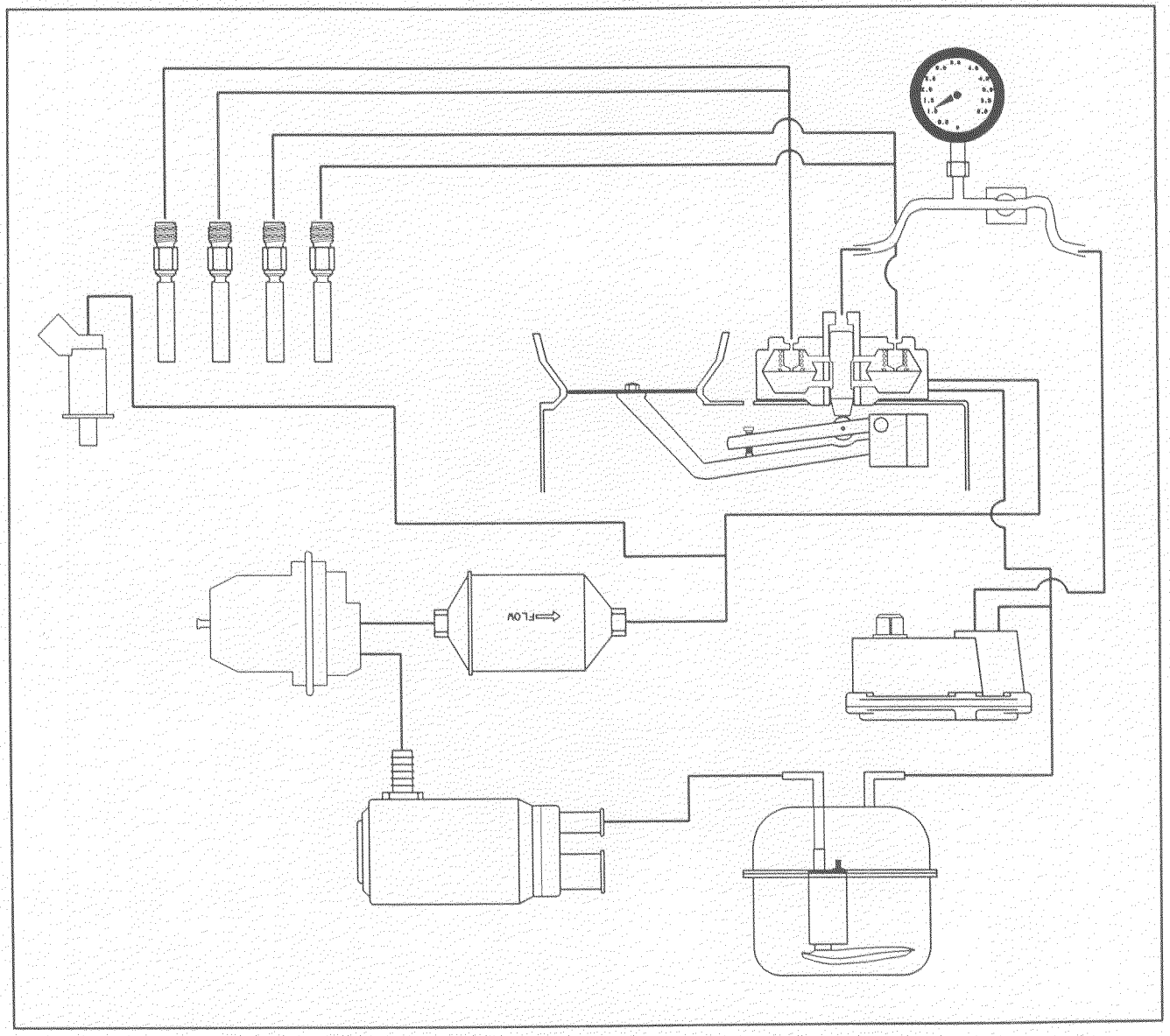
Now, start the engine and allow it to warm up. As the engine runs, the control pressure should decrease to the warm reading in about three to five minutes. After the pressure stabilizes at the warm reading, compare it to the warm control pressure chart.



With the valve in the open position, start the engine and allow the engine to warm up. When the engine is warmed up, warm control pressure should be 50-60 psi.

Warm Control Pressure Readings

Application	Pressure (psi)
Audi	49-55
Fox 1975-77	49-55
Fox 1978-79	49-55
100	49-55
4000	49-55
5000 1978-79	49-55
5000 1980	49-55
BMW 320i	39-45
Mercedes-Benz	
6.9 liter	49-55
280 (federal)	49-55
280 (Calif.)	44-49
280 1977 (high-altitude)	52-58
450 (federal and Calif.)	49-55
450 1977 (federal and high-altitude)	52-58
Porsche	
911 1973-74	Idle–41-44
	Part–49-55
	Full–38-44
911 1975	39-45
911 1976	39-45
911 1977	39-45
911 1978-79	39-45
924	49-55
928	41-46
Turbo Carrera	
1975-77	38-44
1978-79	49-55



When the engine is shut off, the fuel system should retain pressure for several minutes. Generally speaking, the pressure should not drop below 20 psi in the first ten to twenty minutes. Check the specs.

Saab	
99 1975-77	49-55
99 1978-79	49-55
900	49-55
Volkswagen	
Dasher 1976-79	49-55
Dasher 1980	49-55
Jetta, Rabbit, Scirocco to 1979	49-55
Jetta, Rabbit, Scirocco 1980 and later	49-55
Volvo	
140	51-57
240 1976-77	51-57
240 1978-79	51-57
260	54-59

Now shut off the engine and observe the residual or rest pressure over the next twenty minutes. The pressure should not drop below the readings on the rest pressure chart.

Rest Pressure Readings

Application	Pressure (psi)
Audi	
Fox 1975-77	23
Fox 1978-79	23
100	23
4000	23
5000 1978-79	23
5000 1980	35
BMW 320i	22
Mercedes-Benz	
6.9 liter	41
280 (federal)	41
280 (Calif.)	41
280 1977 (high-altitude)	41
450 (federal and Calif.)	41
450 1977 (federal and high-altitude)	41
Porsche	
911 1973-74	16
911 1975	16
911 1976	16
911 1977	16
911 1978-79	16
924	22
928	25
Turbo Carrera	
1975-77	22
1978-79	22
Saab	
99 1975-77	15
99 1978-79	22
900	22
Volkswagen	
Dasher 1976-79	23
Dasher 1980	35
Jetta, Rabbit, Scirocco to 1979	23
Jetta, Rabbit, Scirocco 1980 and later	35
Volvo	
140	25
240 1976-77	15
240 1978-79	25
260	25

Note: All readings are plus or minus 3 psi.

Pressure Test Analysis

In this section, I've listed some symptoms and possible causes that would likely occur on a K-Jetronic system.

Symptoms:
Cold control pressure low
Warm control pressure normal
System pressure normal
Rest pressure normal
Possible cause:
Defective control pressure regulator.

Symptoms:
Cold control pressure normal
Warm control pressure low
System pressure normal
Rest pressure normal
Possible cause:
Defective control pressure regulator.

Symptoms:
Cold control pressure high
Warm control pressure normal
System pressure normal
Rest pressure normal
Possible cause:
Defective control pressure regulator.

Symptoms:
Cold control pressure low
Warm control pressure low
System pressure normal
Rest pressure normal
Possible cause:
Defective control pressure regulator.

Symptoms:
Cold control pressure high
Warm control pressure high
System pressure normal
Rest pressure normal
Possible causes:
Restriction in the return line from the control pressure regulator.
Defective control pressure regulator.

To distinguish between these install a replacement return line on the control pressure regulator, allowing the fuel to flow into an approved fuel receptacle. If the control pressure drops, then repair or replace the return line. If the control pressure does not drop, replace the control pressure regulator.

Symptoms:
Cold control pressure normal
Warm control pressure normal
System pressure a little high
Rest pressure normal

Possible cause:
Leaking system pressure regulator.
Symptoms:
Cold control pressure normal
Warm control pressure normal
System pressure very high
Rest pressure normal
Possible causes:
Restricted return line.
Defective fuel distributor.

To distinguish between these remove the fuel distributor return line and connect a replacement line, allowing the fuel to flow into an approved fuel receptacle. If the pressure drops, repair or replace the return line. If the pressure does not drop, replace the fuel distributor.

Symptoms:
Cold control pressure normal
Warm control pressure normal
System pressure normal
Rest pressure drops below minimum
Possible causes:
Fuel pump check valve.
Leaking cold-start injector.
Leaking system pressure regulator.
Defective fuel distributor.
Defective control pressure regulator.

To distinguish between these, eliminate the possibilities one at a time by isolating the components.

Begin isolating the source of the loss of rest pressure by repressurizing the system, closing the valve between the control pressure regulator and the pressure gauge. If the pressure no longer drops, replace the control pressure regulator.

If the rest pressure continues to drop, pinch off the line between the fuel pump and the accumulator, then repressurize the system and watch the rest pressure. If the rest pressure no longer decreases, replace the fuel pump check valve.

If the rest pressure continues to drop, pinch off the line to the cold-start injector. If the rest pressure no longer drops, replace the cold-start injector.

If the rest pressure continues to drop, pinch off the return line from the fuel distributor. If the rest pressure no longer drops it is either the system pressure regulator or the fuel distributor. For either problem, replace the fuel distributor.

Symptoms:
Cold control pressure low
Warm control pressure low
System pressure low
Rest pressure normal
Possible causes:

Run the fuel pump volume test. Disconnect the fuel distributor return line and install a replacement line, allowing the fuel to flow into a measuring cup that reads in liters. Energize the fuel pump to run as described earlier. The volume of fuel that flows into and through the return line in thirty seconds should be according to the fuel flow chart. If the volume is less than the specification, inspect the inbound fuel lines and replace the fuel filter. If the flow is still not within spec, replace the in-tank filter. If the volume does not increase, run the test with the gas cap off to determine if the problem is plugged fuel tank vents. If none of these repairs increases fuel volume to specification, replace the fuel pump.

Return Line Fuel Flow

Application	Minimum Volume (cc per 30 sec)
Audi	
4000, 5000 1978-80	950
All other Audis	750
BMW 320i	750
Mercedes-Benz	
6.9 liter	1100
280 (federal)	930
280 (Calif.)	930
280 1977 (high-altitude)	930
450 (federal and Calif.)	1100
450 1977 (federal and high-altitude)	1100
Porsche	
911 1973-77	850
911 1978-79	1000
924	1050
928	1360
Saab	
Non-Turbo	750
Turbo	950
Volkswagen	750
Volvo	
140, 240 1976-79	750
260	850

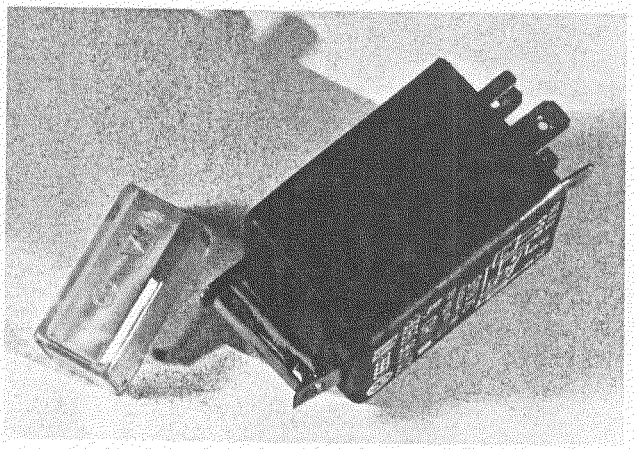
K-Jetronic Troubleshooting by Symptom

When attempting to find the cause of a driveability problem in the K-Jetronic system it is dangerous to attach symptoms to a specific component. The fuel system is a very close and symbiotic entity. The interrelationship between the various components means that a given symptom can be caused by virtually any part in the system. Therefore, in this section I will present the possible causes of a given symptom and then offer a list of components that need to be tested. Refer to earlier sections of this chapter for the test procedures related to each component.

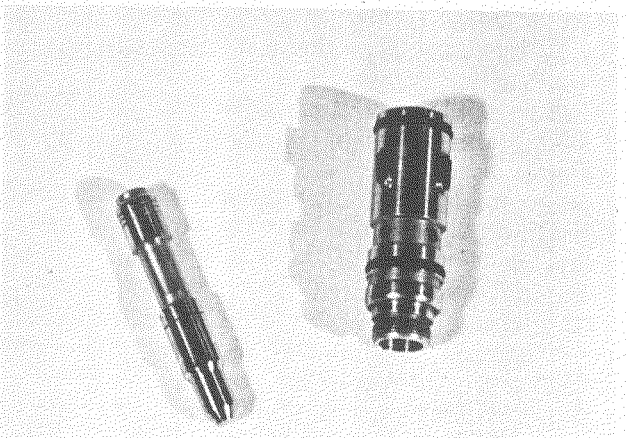
Engine Cranks but Will Not Run

Definition: Starter engages but the engine does not fire. This is a cold-starting problem.

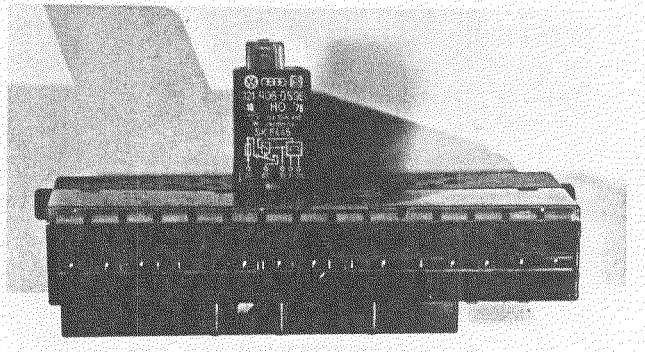
Lack of Fuel Pressure: Test the fuel pump and prepump (if applicable). Perform not only a pressure test, but also a volume test.



One of the prime causes of a no-start condition is lack of power to the fuel pump. Check the fuel pump relay and the fuel pump fuse.



Since the control cylinder and control plunger are machined to close tolerances, the plunger is prone to sticking. Although this could be a result of fuel varnishing which can be cleaned off, it will usually warrant replacement of the fuel distributor.



Volkswagen Rabbits from the late 1970s had a chronic problem with overheating and failure of the fuel pump circuit in the fuse panel. An alternative to replacing the fuse panel is a by-pass kit available from the dealer.

Jammed or Sticking Airflow Sensor: Remove the airflow sensor boot, loosen the center hose on the fuel distributor to relieve control pressure and using a pocket magnet, try to lift the airflow sensor plate by the center bolt. This procedure should also involve checking the sensor plate for the proper rest height and centering.
Auxiliary Air Valve Sticking: If the auxiliary air valve is not opening up, the cold engine will run if the driver keeps his foot on the accelerator. However, since the proper starting instructions for the K-Jetronic engine say not to depress the accelerator, the engine will not fire.
Cold-Start Injector Not Opening: If the cold-start injector fails to open, the net effect will be the same as the choke failing to close on a carbureted engine. The air-fuel ratio will be too lean to permit easy start-up.
Defective Thermo-Time Switch: One of the most common causes of the cold-start injector not working is a defective thermo-switch time.
Sticking Control Plunger: Remove the fuel distributor from the airflow sensor assembly and ensure that the plunger moves freely.
Restricted Injectors: In order for restricted injectors to cause a no-start problem these injectors would have to be severely restricted. Perform the injector equal-flow test.

Hot-Starting Problems

Definition: Engine starts only after cranking for an extended period of time (five to thirty seconds).
Loss of Rest Pressure: Run a complete K-Jetronic pressure test, paying particular attention to the rest pressure. If the rest pressure does not hold according to specification, troubleshoot the cause of pressure loss. It could be a defective fuel pump check valve, leaking cold-start injector, defective fuel distributor or faulty system pressure regulator.
Improperly Adjusted Airflow Sensor: Check airflow sensor plate for proper height, centering and binding. Remove the airflow sensor boot; loosen the center hose on the fuel distributor to relieve control pressure and using a pocket magnet, try to lift the airflow sensor plate by the center bolt. This procedure should also involve checking the sensor plate for the proper rest height and centering.
Sticking or Binding Control Plunger: Remove the fuel distributor and ensure that the control plunger is moving freely.
Leaking Injectors: Remove the injectors from the intake manifold, pressurize the system and inspect injectors for leaks.
Leaking Cold-Start Injector or Shorted Thermo-

Time Switch: Remove the cold-start injector from the intake manifold, pressurize the fuel system and inspect for leaks.
Incorrect Control Pressure: Run a complete K-Jetronic pressure test to ensure that the warm control pressure is correct.

Engine Idles Rough When Cold
Incorrect Cold Control Pressure: If the cold control pressure is too high it will limit the movement of the control plunger and therefore limit the fuel available to flow through the injectors. The engine will therefore run lean and the idle will be rough.
Auxiliary Air Valve Not Opening: If the auxiliary air valve does not open, the cold idle speed will not rise and therefore the idle will be slow and rough.
Leaking Cold-Start Valve: A leaking cold-start valve will make the engine run excessively rich, even when cold. An excessively rich running engine will tend to idle rough whether the engine is cold or warm. If the cold-start injector is leaking, the roughness will get progressively worse as the engine warms up.
Improperly Adjusted or Binding Airflow Sensor: Anytime the airflow sensor plate does not operate smoothly it can result in air-fuel ratio errors.
Unequal Injector Flow or Spray Pattern: Perform the injector flow test. Replace any injectors that are flowing an inadequate quantity or have a poor spray pattern.

Engine Idles Rough When Warm
Incorrect Warm Control Pressure: If the warm control pressure is too low or too high the air-fuel ratio will be incorrect, causing rough idle.
Leaking Cold-Start Valve: This will overfuel the engine, resulting in a rich air-fuel ratio and a rough idle.
Improperly Adjusted, Sticking or Binding Airflow Sensor: Anytime the airflow sensor plate does not operate smoothly it can result in air-fuel ratio errors.
Unequal Injector Flow or Spray Pattern: Perform the injector flow test. Replace any injectors that are flowing an inadequate quantity or have a poor spray pattern.

Engine Stalls Immediately after Starting, Warm
Warm Control Pressure: If the warm control pressure is too high the air-fuel ratio will be very lean, resulting in the engine dying.
System Pressure: If the system pressure is too high or too low, the air-fuel ratio will be incorrect. Incorrect fuel pressure can result in either a rich or lean running condition. Either condition can cause the engine to stall after start-up.

Idle Speed Too High and Cannot Be Adjusted
Check Minimum Air: If closing off the idle air bypass does not bring the idle within specs check for vacuum leaks, check the auxiliary air valve and adjust the minimum air.
Check the Auxiliary Air Valve: Remove the hoses to the auxiliary air valve and ensure that it is closing off.
Vacuum Leaks: A vacuum leak is a source of extra air entering the intake manifold after the throttle plates. As a result, a vacuum leak can cause an excessively high idle speed.

Engine Backfires in Intake
Check for Proper CO Adjustment: A lean mixture adjustment can result in a backfire under load or when starting.
Check Engine Air Tubing between Airflow Sensor and Throttle: Holes or other leaks in the tubing that runs from the airflow sensor to the throttle assembly can result in a lean air-fuel ratio. A lean ratio can result in a backfire under load or when starting.
Check for Vacuum Leaks: Vacuum leaks can result in a lean mixture, and a lean mixture can result in a backfire. One of the best techniques for locating a vacuum leak is to run a little propane around the intake system.

Engine Misfires under Load
Ignition Problems: The most likely cause of a misfire is the ignition system, regardless of the fuel system.
Inadequate Fuel Delivery (engine running lean): An insufficient supply of fuel can be the result of a binding airflow sensor or control plunger, restricted injectors, incorrect control or system pressure. Also perform an equal-flow and spray pattern test on the injectors.

Poor Power
Incorrect Tune-Up Specs or Worn Tune-Up Parts: As with a carbureted engine the most likely cause of poor power is the basic tune-up specifications of timing, dwell and air-fuel ratio. Also, worn distributor caps, spark plugs, points and plug wires can seriously impact the performance of the K-Jetronic engine.
Control Pressure Too High: High control pressure will limit the travel of the control plunger, thereby limiting the amount of fuel that can flow into the engine. When the engine begins to run lean, power can suffer.
Restricted Injectors: Restricted injectors can limit the amount of fuel that can pass through them, thereby limiting power.

Stumble or Sag on Acceleration
Sticking or Binding Airflow Sensor Plate: If the airflow sensor plate binds on the way up, fuel flow will be limited and the engine will sag or stumble.
Sticking or Binding Control Plunger: If the control plunger binds on the way up, fuel flow will be limited and the engine will stumble or sag.

Incorrect System or Warm Control Pressure: If the system pressure is too high or if the control pressure is too high (high system pressure will usually cause high control pressure) the movement of the control plunger will be limited. The engine will begin to run lean as the airflow increases. A lean running engine will sag or stumble on acceleration.
Unequal Injector Flow: Restricted injectors can limit the amount of fuel that can pass through them, thereby limiting power.

Engine Diesels
Binding or Sticking Airflow Sensor: In order for the engine to "diesel" or run-on after the engine is shut off there must be fuel entering the engine. One source of this fuel is an airflow sensor that is not dropping to the closed position as the engine is shut off.
Binding or Sticking Control Plunger: Inspect the control plunger for smooth movement without binding or sticking.
Leaking Injectors: Perform an injector flow test and inspect the injectors for proper seating when the airflow sensor drops to the rest position.
Leaking Cold-Start Injector: Remove injector, pressurize the system and inspect for leaks.

Excessive Fuel Consumption
Improperly Adjusted Air-Fuel Ratio
Leaking Injectors
Leaking Cold-Start Injector

What to Do, and When

Lack of Fuel Pressure
When there is no fuel pressure, the first thing to do is confirm that there is fuel in the tank. I have seen several methods, at various levels of sophistication, to confirm fuel quantity. Of all these methods, the best and simplest is to pour a gallon or so of fuel into the tank.

If there is an adequate amount of fuel in the tank, the next item of business is to confirm fuel pump operation. Place a mechanic's stethoscope on the fuel pump and have someone crank the engine. If the fuel pump is located inside the fuel tank, then place the stethoscope on the fuel tank. As the engine is cranked the hum of the fuel pump should be heard through the stethoscope. If no hum is heard, check electrical power to the pump.

Begin by inspecting the fuel pump fuse. If the fuel pump fuse is good, connect the alligator clip of a test light to the ground side of the fuel pump connector and probe the positive side of the fuel pump connector. If the test light goes on, then the pump is receiving power and has a good ground. If the test light fails to light up, connect the alligator clip to a good chassis ground and probe the positive terminal on the fuel pump. If the test light still fails to light up, check the fuel pump relay and inspect the fuel pump wiring harness. If the test light finally goes on, inspect the fuel pump ground.

Another reason for a lack of fuel pressure is restriction in the fuel lines or the fuel filter. Energize the fuel pump and begin loosening fittings along the fuel supply line.

USE EXTREME CAUTION THOUGH, AS THE FUEL WILL BE UNDER AS MUCH AS 100 PSI PRESSURE AND WILL TEND TO SPRAY OUT IN A FINE, HIGHLY FLAMMABLE MIST.

If there is only a small amount of pressure or volume present at a loosened fitting, inspect the components upstream of that fitting for restrictions. Restrictions are commonly found in the fuel filter and the in-tank pickup filter screen.

An obvious reason for no fuel pressure would be an external leak. Look for external leaks anywhere along the fuel lines or at the accumulator.

Jammed or Sticking Airflow Sensor
After removing the airflow sensor boot, inspect for proper adjustment of the sensor plate. Adjust as necessary. If the adjustment is OK, the binding is at the fulcrum—the only component of the K-system that can be disassembled and reassembled without damaging it.

Remove the airflow sensor assembly from the car. On each side of the sensor you will find a disc held in place by an internal snap ring. Remove the snap rings and with a small screwdriver, wobble the disc back and forth until it falls out. There is a large counterweight on the end of the airflow sensor lever; loosen the large screw that holds the counterweight in place. At the same time this will loosen the fulcrum shaft. Carefully mount the airflow sensor assembly in a vise and using a brass drift, drive the shaft out of the assembly.

Wash all the metal components in solvent, removing any varnish build-up that may have occurred over the years. Rinse the solvent off of the parts with hot water. The hot water will evaporate quickly, reducing the possibility of rusting.

Reassemble the airflow sensor using a very light film of point lube or similar lubricant. Make the sensor plate adjustments and reinstall on the car.

Auxiliary Air Valve Not Opening
There is really nothing that can be done for an auxiliary air valve that does not open, short of replacement. Be sure that the valve is not receiving power all the time and replace it.

Cold-Start Injector Not Opening
The cold-start injector is a simple, normally closed solenoid-operated valve. If the cold-start injector does not open when the engine temperature is below 95 deg. F., disconnect the cold-start injector and connect a test light across the terminals. Crank the engine. If the test light goes on, the wiring harness is good. Loosen the fuel line at the

cold-start injector and crank the engine again. If fuel leaks or sprays from the loosened line, replace the cold-start injector. If not, confirm fuel delivery to the fuel distributor and repair or replace the restricted fuel line. If the fuel line delivers fuel, then replace the cold-start injector.

If connecting the test light across the terminals and cranking the engine does not light the test light, confirm that the engine temperature is below 95 deg. F. Connect the test light alligator clip to the positive battery terminal and probe the harness connector of the cold-start injector. One of the two terminals should actuate the test light, the other should not. If neither activates the light, inspect the wire that runs from the cold-start injector to the thermo-time switch, and the one that runs from the switch to ground for an open circuit. If both wires test satisfactorily, replace the thermo-time switch.

Sticking Control Plunger

A sticking control plunger normally indicates a damaged control plunger. Simply dropping the plunger when servicing the fuel distributor might be enough to damage it. Inspect the plunger for evidence of varnishing. If the plunger continues to stick or bind, replace the fuel distributor. Care during installation will prevent damage to the new plunger.

Note: Control plungers are machined for a precise match to a given fuel distributor. Attempting to use a control plunger from another fuel distributor can result in even more severe binding or leaking.

Restricted Injectors

Restricted injectors can best be diagnosed by performing the injector flow equality test. Cleaning a restricted injector(s) can be done with an injector cleaning system. These cleaning systems range in price from about $100 to well over $1,000.

Unless you are a business specializing in fuel-injection or tune-up service, purchasing a cleaning system such as this is probably not the best use of your money. As an alternative, remove the injectors from the intake system and leave them attached to their fuel supply lines. Place them in a safe container, then activate the fuel pump as described in the section on measuring pressures. Once the fuel pump is running, lift the airflow sensor plate all the way and allow fuel to flow through the injectors at full force. Lower the sensor plate to its rest position, wait a few seconds, then slowly lift the plate between 1/8 and 1/4 in. Observe the injector spray pattern. If the pattern is good, reinstall the injectors and test drive. If the pattern is bad, replace the injectors.

Although replacing the injectors may sound drastic or expensive, for most applications a full set of injectors will probably cost less than most shops charge for injector cleaning. In any case, replacement of the injectors is usually far more effective than cleaning them.

Leaking Injectors

Remove the injectors from the intake. With the engine shut off, energize the fuel pump to run. Observe the injectors for leaking. Raise the airflow sensor plate; the injectors should spray. Drop the sensor plate; the injectors should stop spraying immediately.

If they are leaking, attempt to clean them by raising the airflow sensor plate all the way, allowing the injectors to spray at full volume for ten seconds. Retest the injectors for leaking. If they continue to leak, replace them.

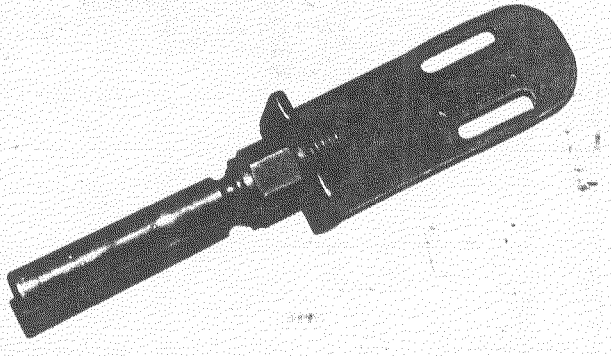
Unequal Injector Flow

Remove the injectors from the intake manifold and place each in its own graduated cylinder. Energize the fuel pump and raise the sensor plate about 1/4 in. for thirty seconds. The volume through each injector should vary by only 10 percent. If the volume is not equal, clean the injectors. If there is no improvement from cleaning, replace them.

If the flow was equal at 1/4 in., repeat the test at about half the travel of the airflow sensor plate. Again, the volumes should vary by only 10 percent.

Loss of Rest Pressure

Loss of rest pressure is one of the most common causes of one of the most common K-Jetronic symptoms. With the K-Jetronic fuel pressure gauge installed between the fuel distributor and the control pressure regulator, pressurize the system with the engine not running. Turn the valve on the fuel pressure gauge. If there now is no loss of rest pressure, replace the control pressure regulator.



To perform an unequal injector flow test, or to check for leaking injectors, it is necessary to remove the injectors from the intake manifold. Tools like this are available to make a difficult job easier.

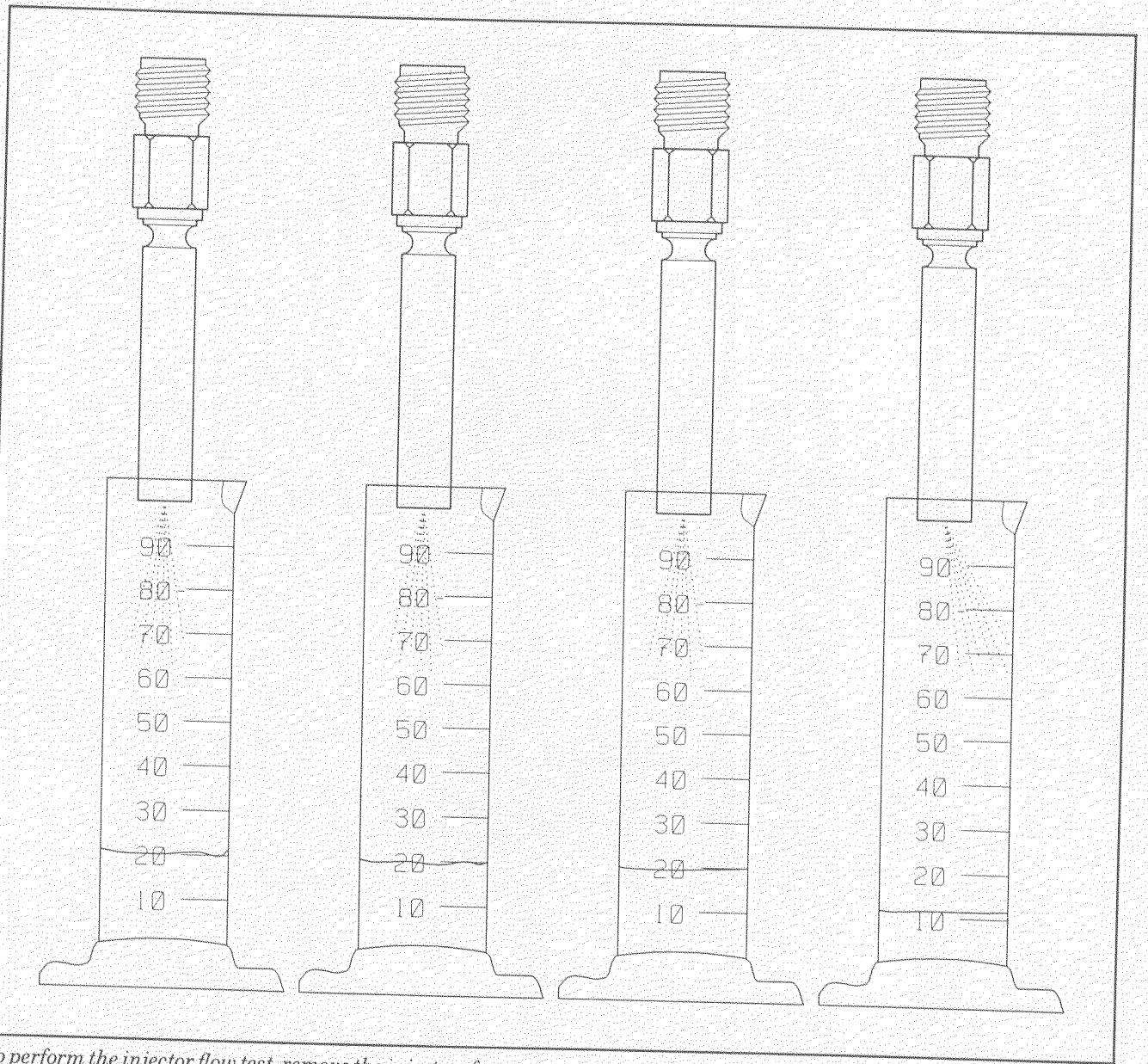
If the loss of rest pressure is not at the control pressure regulator open the valve, remove the injectors from the intake and place them in view. Remove the cold-start injector, leaving all fuel lines attached. Pressurize the system and inspect the removed components for leaking as the rest pressure drops. If there is no evidence of leaking, replace the fuel pump check valve.

Note: From personal experience, 90 percent of the time a loss of rest pressure is caused by a defective fuel pump check valve. Also, if the injectors are found to be leaking, replace the fuel distributor and retest.

Incorrect Control Pressure

High: If the system pressure is within specifications, there are only three possible causes for high control pressure: a restriction in the return line from the fuel distributor to the fuel tank, a restriction in the return line from the control pressure regulator to the fuel distributor, or a defective control pressure regulator.

Connect the K-Jetronic fuel pressure gauge with the valve in the open position so fuel can flow to the control pressure regulator. Enable the fuel pump to run with the engine not running. Carefully crack open each of the return lines (remember to use



To perform the injector flow test, remove the injectors from the intake manifold. Place each injector in a graduated cylinder. For safety, disable the primary ignition system. Energize the fuel pump by by-passing the fuel pump relay. Lift the airflow sensor plate. The flow of fuel through the injectors should be equal. If not, clean or replace the injectors.

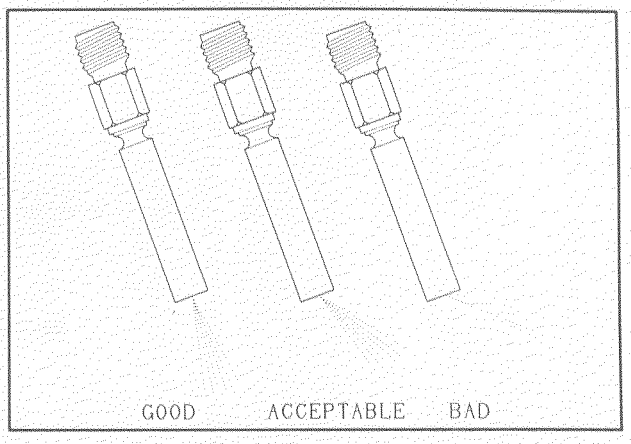
extreme caution as the fuel is highly flammable and under high pressure) and observe the control pressure. If the pressure drops, it indicates there is a restriction in that line.

If the pressure is unaffected by the opening of the return lines, replace the control pressure regulator.

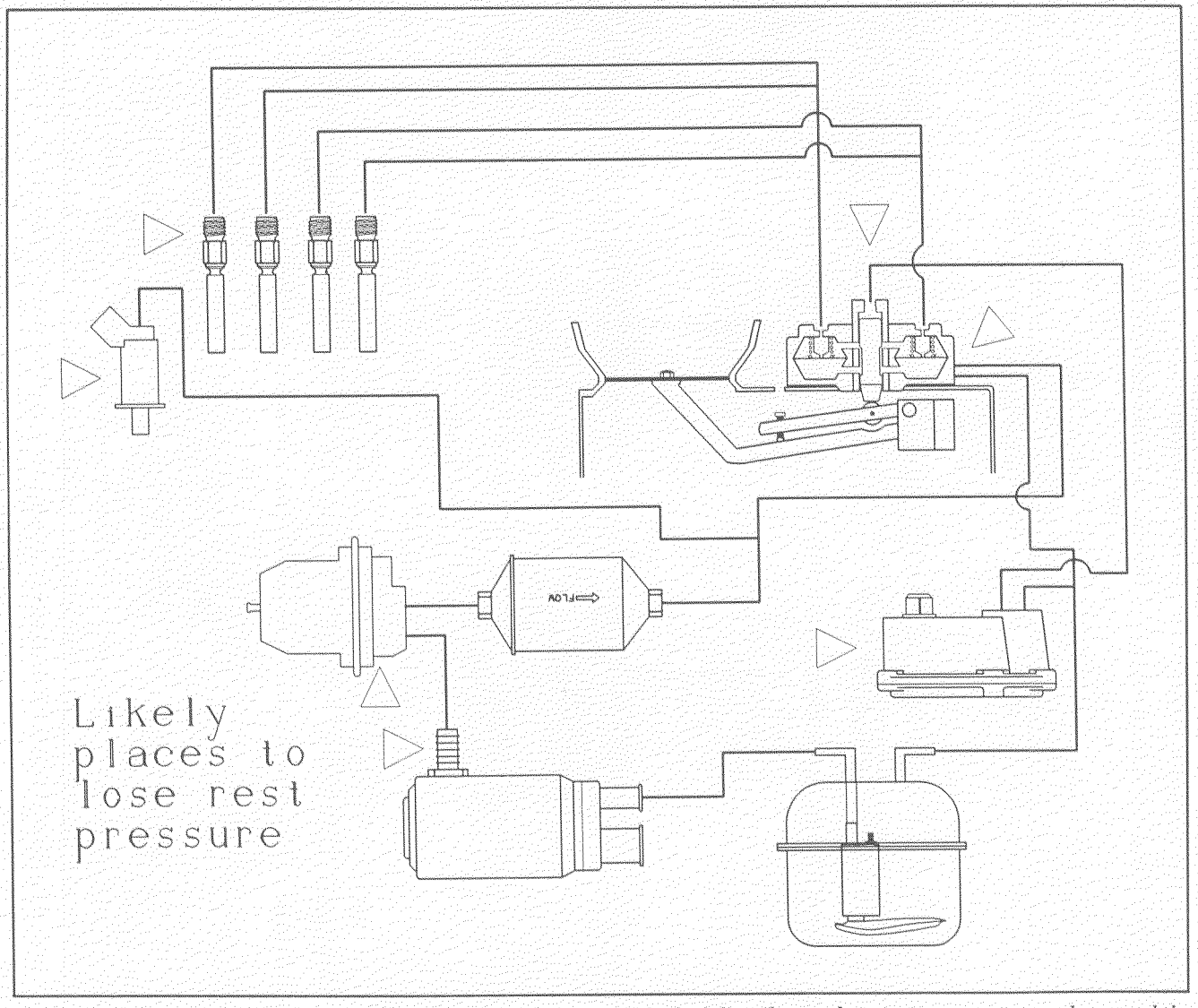
Low: If the control pressure is low, verify that the system pressure is within specification and replace the control pressure regulator.

Incorrect System Pressure

High: If the system pressure is too high, energize the fuel pump to run with the engine shut off and crack the return line loose. If the system pressure does not drop, remove the system pressure regulator from the side of the fuel distributor. Be careful not to lose any pieces. Clean the regulator compo-



Watch the spray pattern while flowing the injectors. If the spray pattern is cone shaped, then look elsewhere for the driveability problem. If the pattern is a stream, replace or clean the defective injector(s).



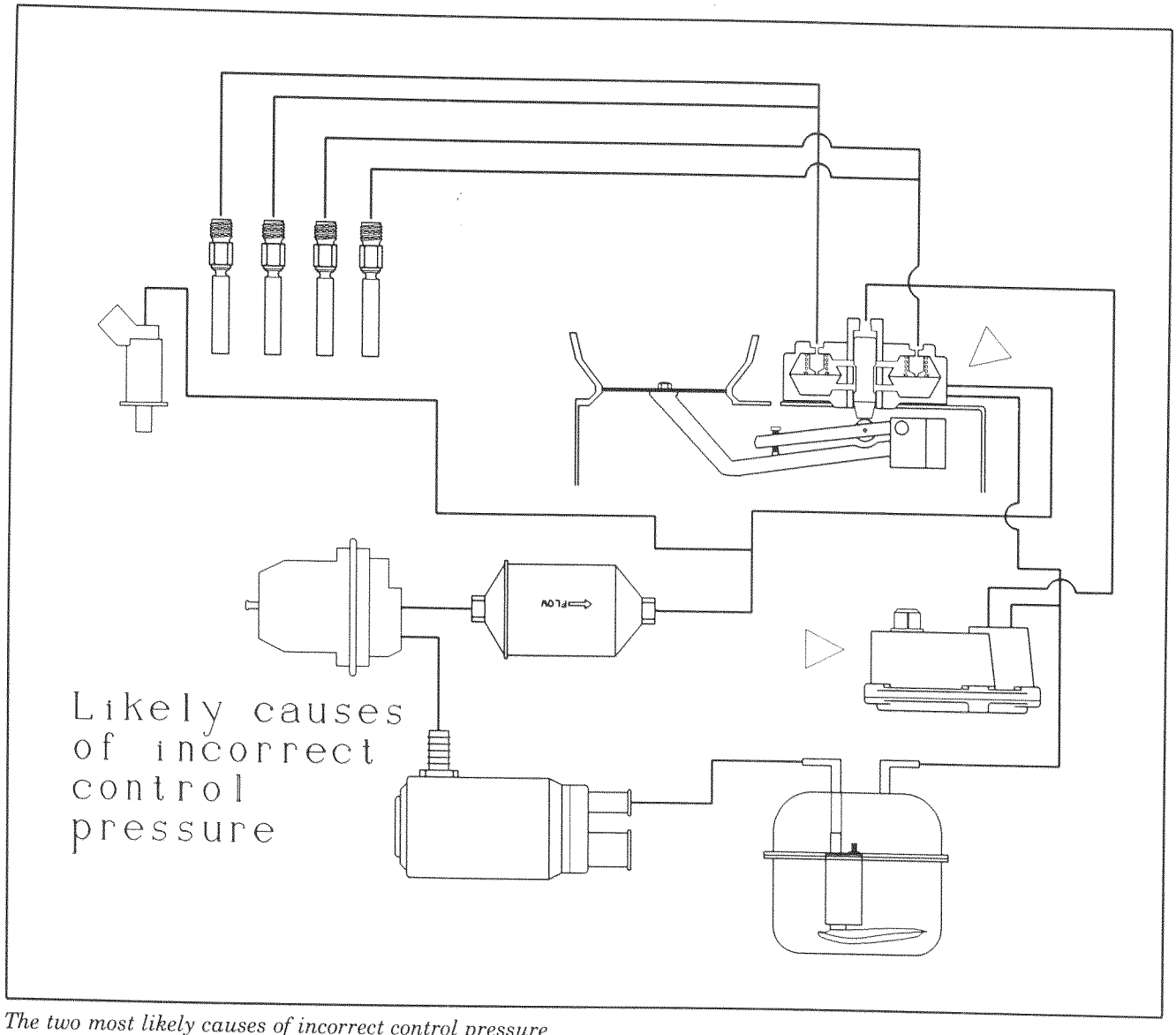
Likely places to lose rest pressure are the fuel pump check valve, the accumulator, the cold-start valve, the injectors, the fuel distributor, the system pressure regulator and the control pressure regulator.

nents with a mild solvent and reassemble. If the pressure is still high, replace the fuel distributor.

If the pressure is only a little too high, you might be able to reduce the pressure by removing adjusting shims from the system pressure regulator.

Low: If the system pressure is too low, remove the system pressure regulator from the side of the fuel distributor. Be careful not to lose any pieces. Clean the regulator components with a mild solve reassemble. If the pressure is still low, repla fuel distributor.

If the pressure is only a little too low, you m be able to increase the pressure by adding adj ing shims to the system pressure regulator. Gc luck finding anyone who stocks them!



The two most likely causes of incorrect control pressure are the system pressure regulator and the control pressure regulator.