

---

# The BMW 2002 tii Fuel Injection System

---

---

BMW of North America, Inc.





# About This Manual

Originally developed by BMW North America in the early 1980s for use in it's dealership service departments, this document provides logical diagrams, repair and adjustment information for the Kugelfischer Fuel Injection system sold with all US Model 2002tii from 1972-1974.

This manual will answer many of the commonly asked questions concerning the Kugelfischer pump and should assist Tii owners in keeping their cars running forever – the way it should be!

## Historical Note

As sustaining 2002tii's owners of the Tii Register for more than twenty years, we wish to express our appreciation to BMW North America for allowing us to originally copy and reproduce for our members their 2002tii Fuel Injection System Training Manual. The funds raised through the original reproduction of this document has greatly helped further the cause of the Tii Register and it's newsletter. And now in the 21<sup>st</sup> Century, the Tii Register Web Site continues this sharing of knowledge for Tii owners around the world.

A special thanks to Bob Murphy of Houston Texas, long time “keeper of the flame” for Tii addicts the world over. Through his acquisition of this book years ago and lobby for its wide spread distribution, many cars are still running over thirty years after they were built.

It is through his search for knowledge through the years of these legendary “ultimate driving machines” and their unique injection systems that we have most if not all the hidden documented treasures that were originally locked away in file cabinets at BMW NA and BMW AG of these cars.

## Addendum

The original printed copy of this manual which was widely distributed by BMW NA and the Tii Register contained a misprint about the adjustment of the CO on page 15. Through digital editing this has now corrected for this new electronic version. It was stated backwards originally.

**The correct adjustment has always been:**

*“Adjust CO by turning the mixture screw OUT to raise CO, or IN to lower it.”*

---

# Table of Contents

Description of System	2
Components	2
Operation	
Fuel Supply System	4
Injection System	5
Cold Start System	8
Special Tools	9
Repair Procedures	9
Adjustments	
Warm-Up Transmitter	12
Pump/Throttle Linkage	12
Full Throttle Stop	14
Accelerator Linkage	14
Throttle	14
Troubleshooting Hints	15
Cold-Starting Problems	15
Warm-Up Problems	17
Warm-Running Problems	17
Troubleshooting Chart	20
2002 tii Engine Specifications	24

---

## BMW Service Training



# Description of System

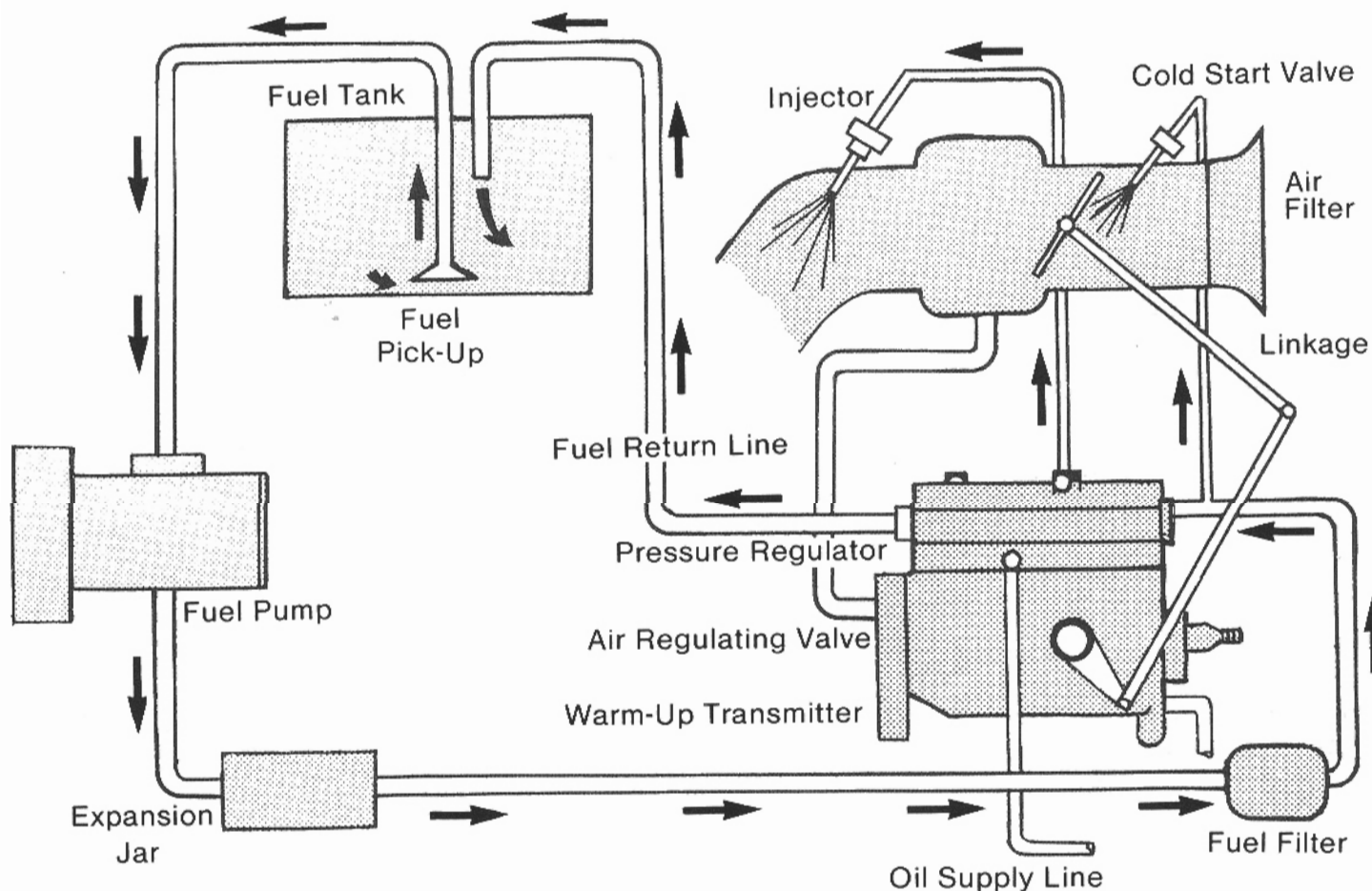
The BMW 2002 tii was introduced into the US Market in 1971. It is simply a further modification of the 2002 carbureted model, employing fuel injection as a means of getting gas to the engine.

It is basically just the same as other 2002's: the engine has a slightly higher compression ratio, the suspension system is somewhat stiffer, and the brakes are larger. The major difference is the fuel system.

This was the first year BMW featured fuel injection. The system incorporated a Kugelfischer Mechanical Fuel Injection Pump. A list of components and their operation will be found in the next section, along with a wiring diagram and schematic of the system.

## Components

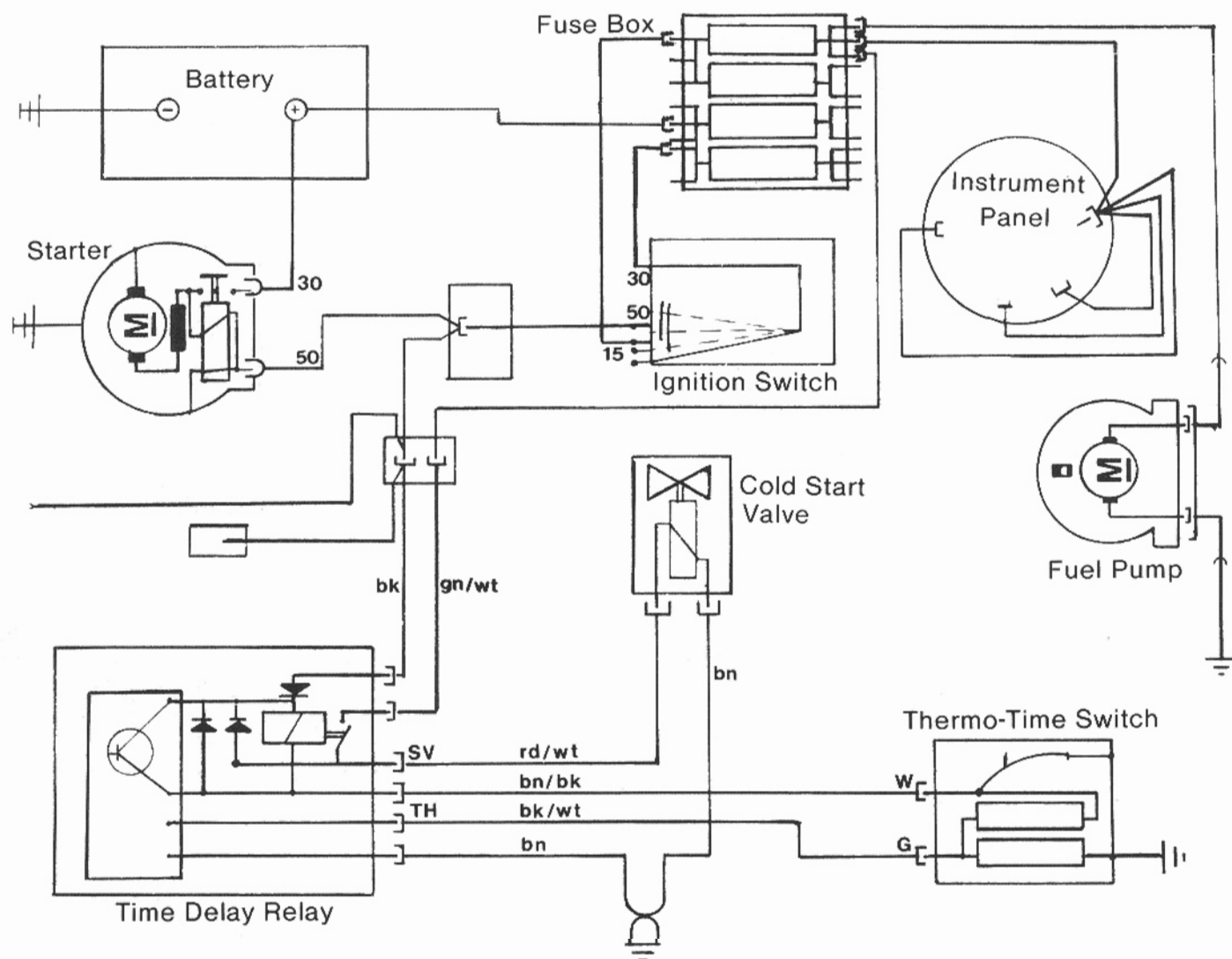
The components are: The fuel tank with a filter screen in the pick-up; a high-pressure fuel pump; an expansion jar; a fuel filter; the injection pump with a Warm-Up Transmitter and Auxilliary Air Valve; fuel delivery and return lines; the injectors; and a Cold-Start System.





The electrical components are the battery, starter fuse box, instrument panel components, fuel pump, ignition switch, and the Cold-Start System Components: the Cold-Start Valve, the Time Delay Relay, and the Thermo-Time Switch.

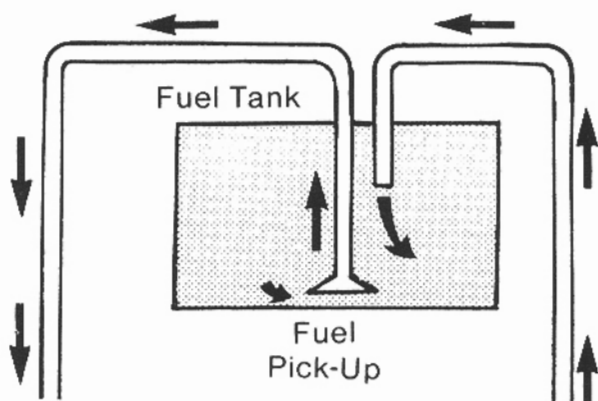
The following diagram is a schematic of the electrical system of the 2002 tii with all components labeled.



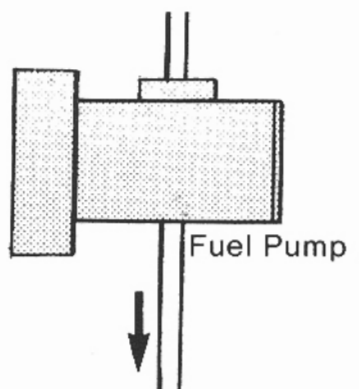
COLOR	CODE
White	wt
Green	gn
Brown	bn
Yellow	yl
Gray	gy
Blue	bu
Red	rd
Black	bk
Violet	vi

# Operation

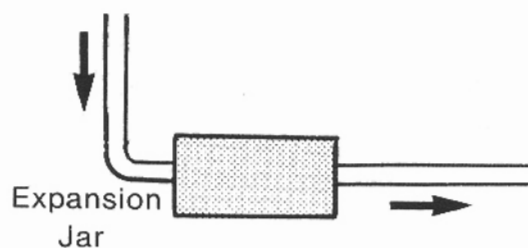
## Fuel Supply System



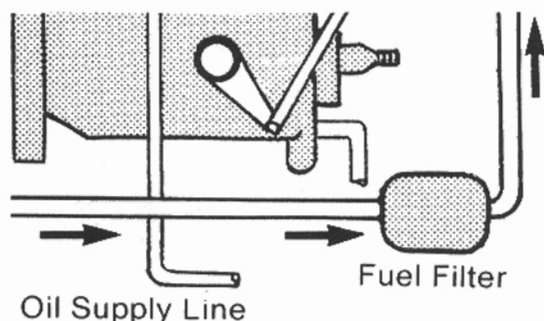
The fuel supply system begins in the fuel tank, which incorporates a separate fuel pickup and gauge float. Since fuel injection systems are very sensitive to contamination, there is a fine mesh screen in the pick-up.



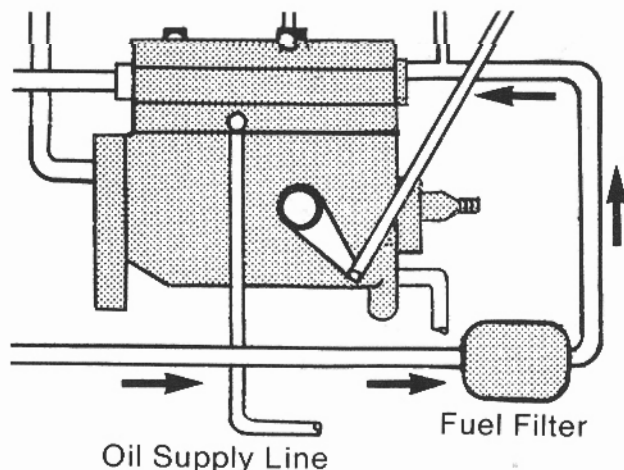
Next is the fuel pump. It is a high-pressure, 'Roller Cell' type similar to those pumps on current fuel-injected models. As soon as the ignition is turned on, the pump puts the system under full pressure - approximately 2 bar. There is also a fine mesh screen in the pump's inlet.



Next is the expansion jar, which is mounted together with the fuel pump. It acts like a muffler to dampen noise.



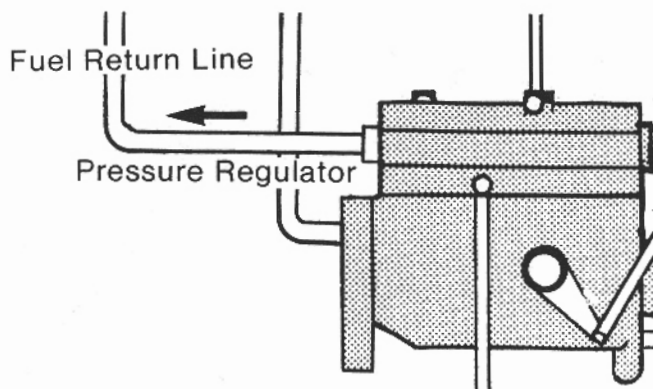
The fuel filter is mounted in the engine compartment on the left side of the radiator. It contains a paper element and a lint trap. If you have to remove this filter, make sure you put it back in the same way you took it out. It's advisable to change it during every major service.



From the fuel filter, gas flows directly into the inlet of the injection pump. There is also a fine mesh screen

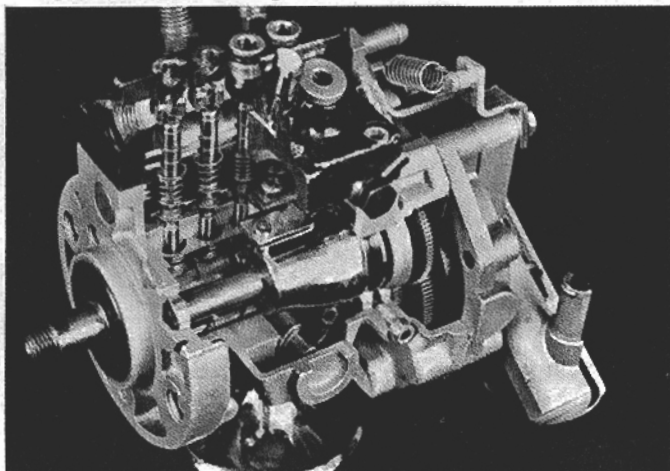


in this inlet. This screen, plus the screens in the fuel pick-up and fuel pump, should be serviced every 40,000 miles.

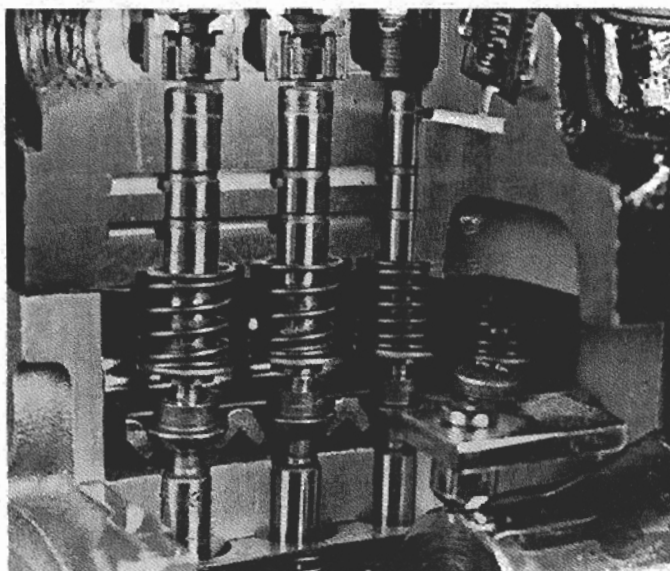


At the rear of the top of the injection pump is a pressure regulating valve. It maintains fuel pressure at approximately 2 bar, and allows excess fuel to return to the tank.

## Injection System

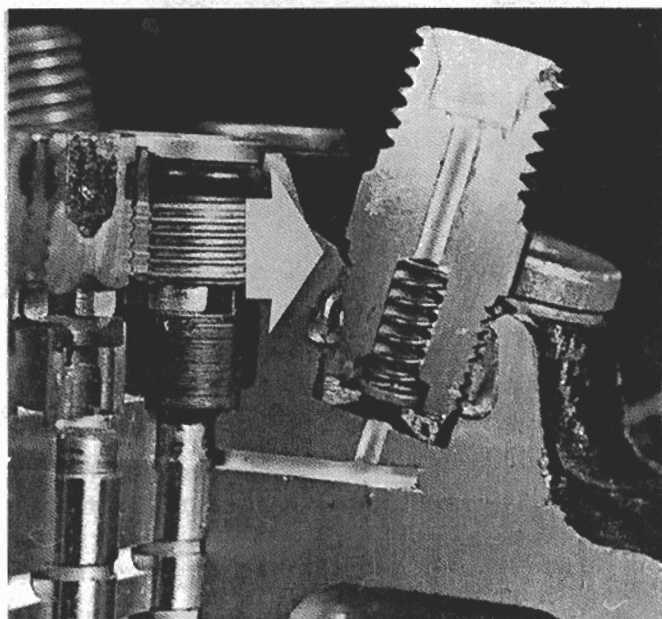


The injection pump is a Kugelfischer Model PL O Mini Pump. It's interior is very much like a small engine.

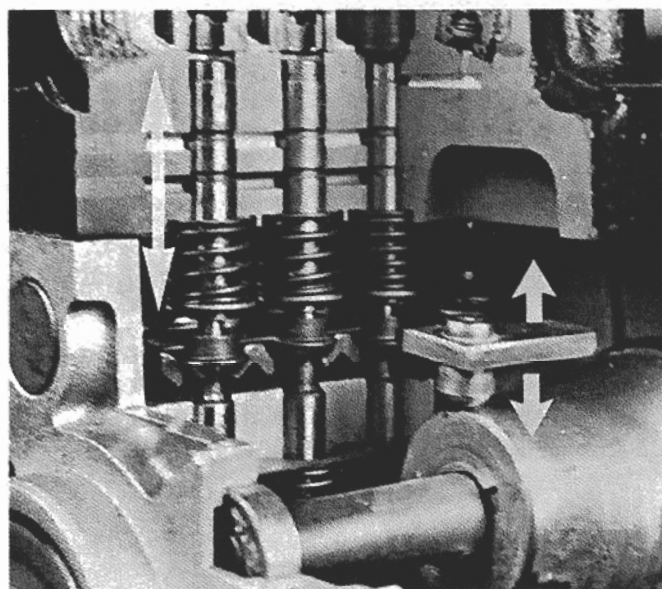


There is a camshaft which drives tappets. These, in

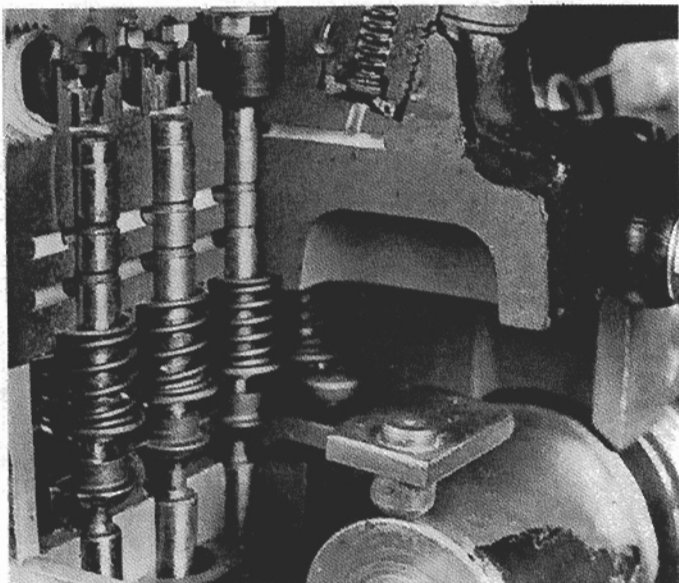
turn, drive plungers which are pushed back down by springs. When these plungers move down, suction valves are pulled open and gas is sucked into the cylinders of the pump.



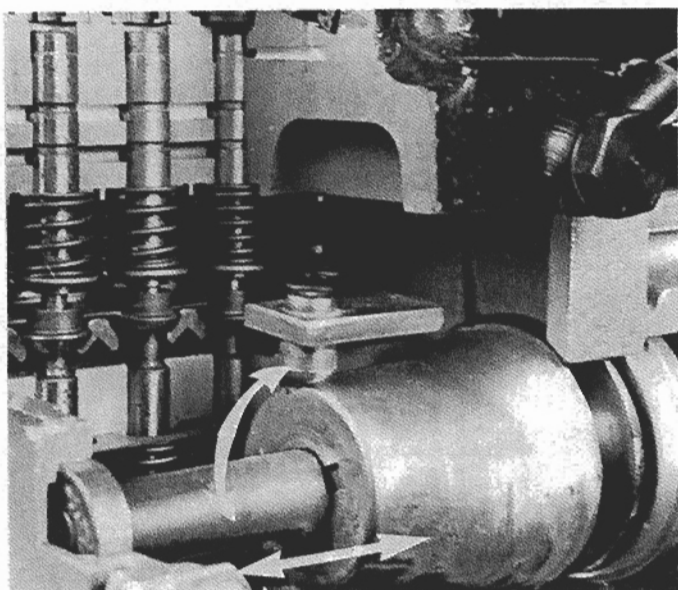
Pressure created by the upward stroke of the plungers forces the suction valves closed and the delivery valves open. Fuel is pushed out into the delivery lines and through the injectors. The pressure generated by the injection pump is quite high - 35 to 38 bar.



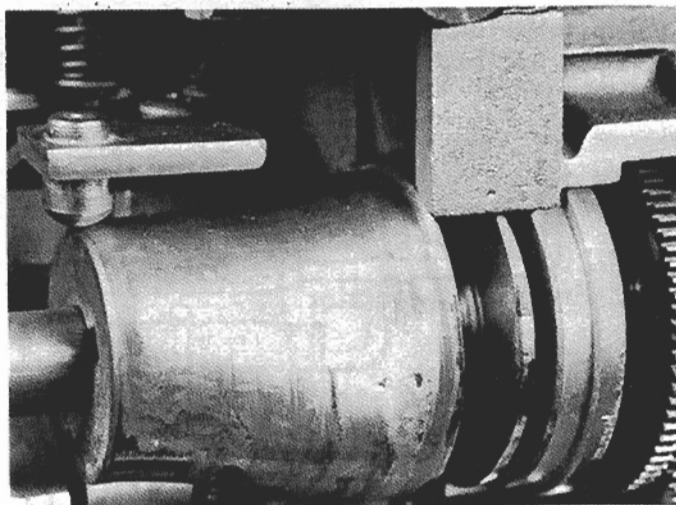
The amount of fuel injected into the engine is controlled by the stroke of the plungers. Their travel is limited by a regulating lever inside the pump. The position of this lever is controlled two ways.



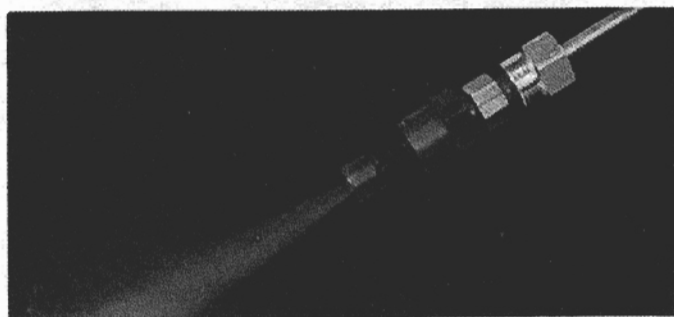
One side rides on an irregular cone; the other is mounted on an eccentric hinge which is controlled by the warm-up transmitter.



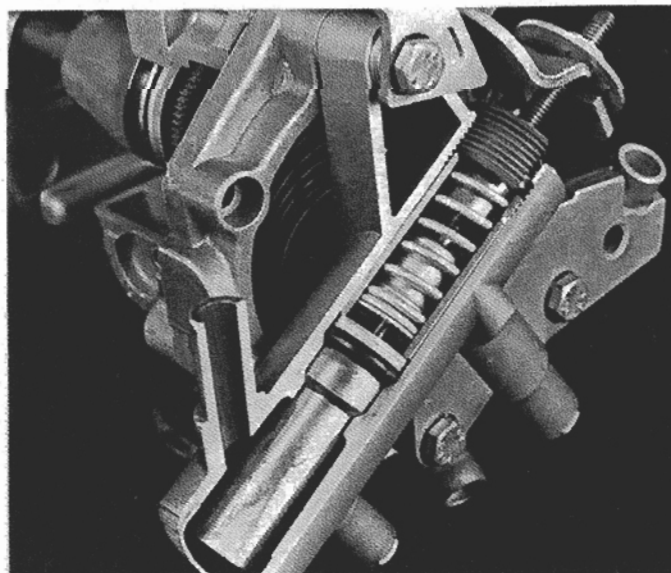
*The irregular cone controls lever movement two ways: backward and forward movement of the cone is directly connected to the throttle linkage; rotation of the cone is related to engine speed.*



A magnetic pick-up inside the pump's camshaft transmits engine speed, through a set of gears, to the cone. The cone then rotates, much like a speedometer, in time with varying camshaft speeds. These movements raise or lower the regulating lever, varying the amount of fuel injected into the engine.



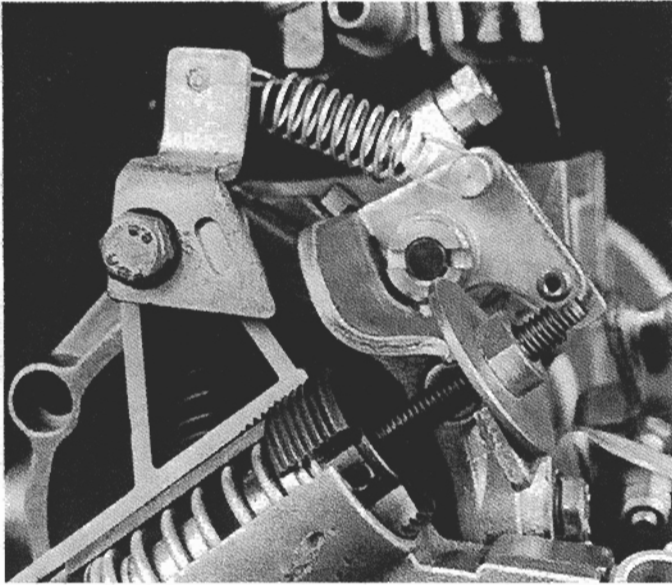
Fuel delivery lines run from the delivery, or pressure, valves on the pump to the injectors. Inside each injector is a spring-loaded valve in a tapered seat. When pressure from the injection pump reaches 35 to 38 bar, the springs are overpowered and the valves are forced open, spraying fuel into the intake.



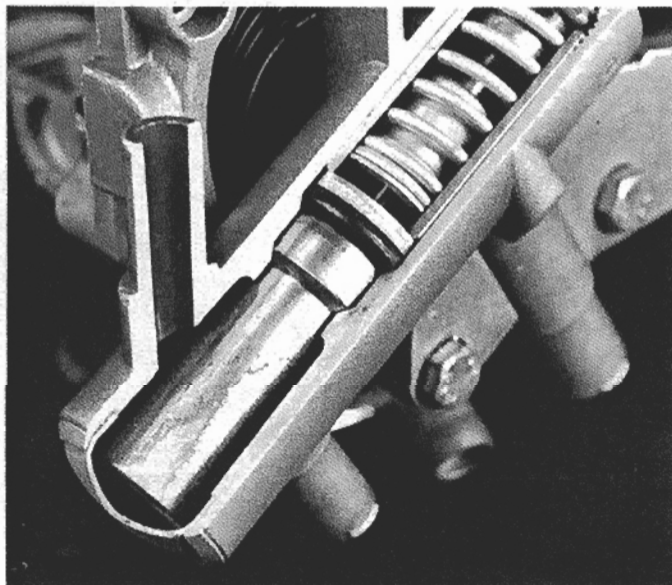
The final part of the injection system is the Warm-Up



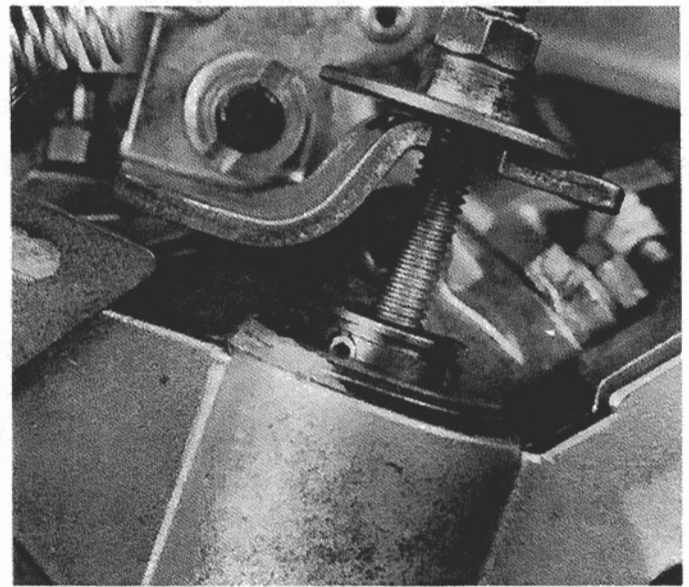
Transmitter, which incorporates an Auxilliary Air Valve. The Warm-Up Transmitter is located on the back of the pump and provides a richer mixer for warm-up.



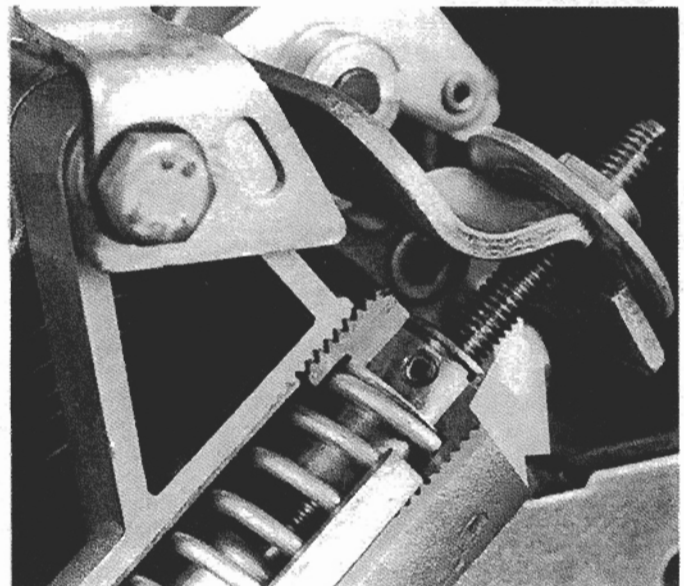
It is connected, via linkage, to the eccentric hinge on the back of the pump's regulating lever. When the engine and warm-up transmitter are cold, the hinge is rotated to its lowest position. This lowers the rear of the regulating lever and increases the amount of fuel injected.



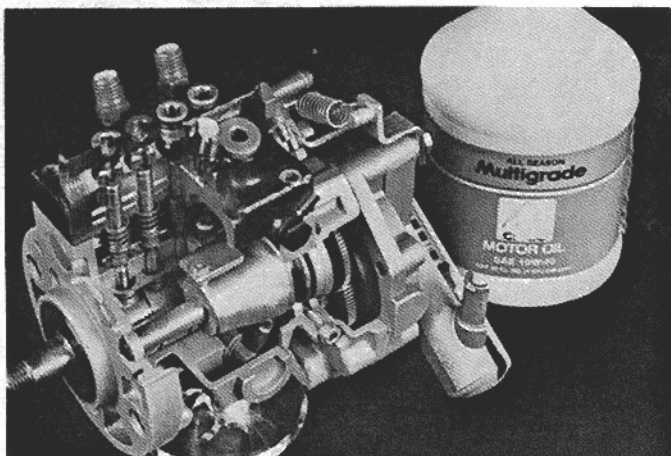
As coolant temperature increases, a heat-sensing element in the warm-up transmitter expands, pushing a rod out of the unit's housing.



As the rod extends, the eccentric hinge for the regulating lever rotates upward, gradually returning the lever to its warm-operating position and leaning off the mixture.



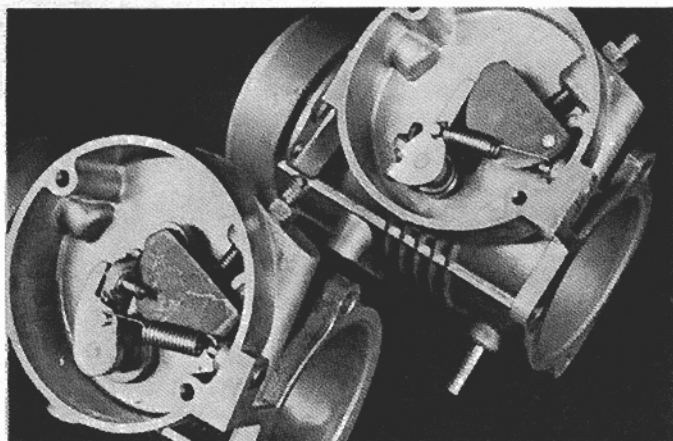
Additional air is necessary to maintain a stable idle, so an Auxilliary Air Valve is incorporated in the Warm-Up Transmitter. It is simply a valve on the upper end of the warm-up transmitter rod. A rubber hose connects this valve with the air collector on the intake manifold. As the rod extends, the valve is gradually closed, shutting off the extra supply of air to the intake.



The pump is lubricated by oil from the crankcase under pressure. Excess oil is returned through a line near the dip-stick.

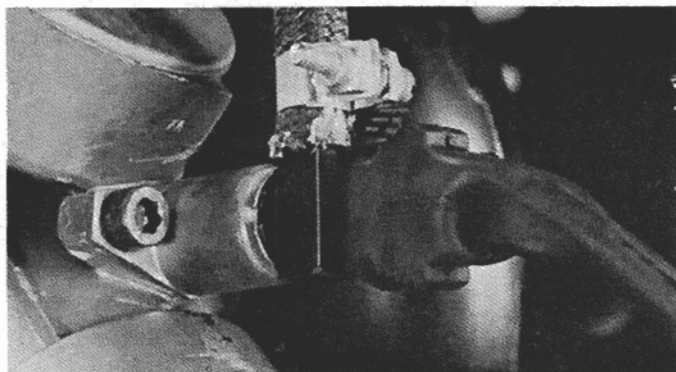
The pump comes from the factory dry, so oil must be added before the engine is started. A warning tag is attached to new or rebuilt pumps as a reminder.

Some changes were made to the pumps between the first models in 1971 and the later years up to 1974. Do NOT interchange pumps from different model years. Be sure to check the part number for the model year you're working on. Additionally, in 1974, a vacuum limiter was added to the system for deceleration control.



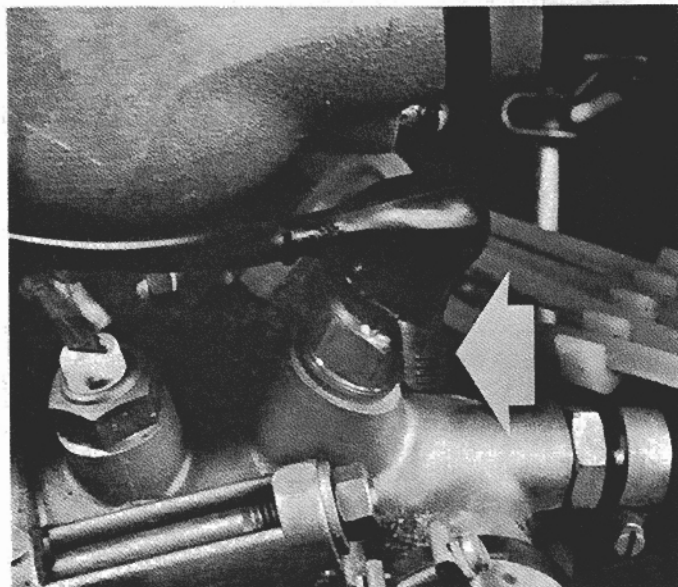
Later models had a re-designed throttle housing, which made CO adjustments much less sensitive.

## Cold-Start System



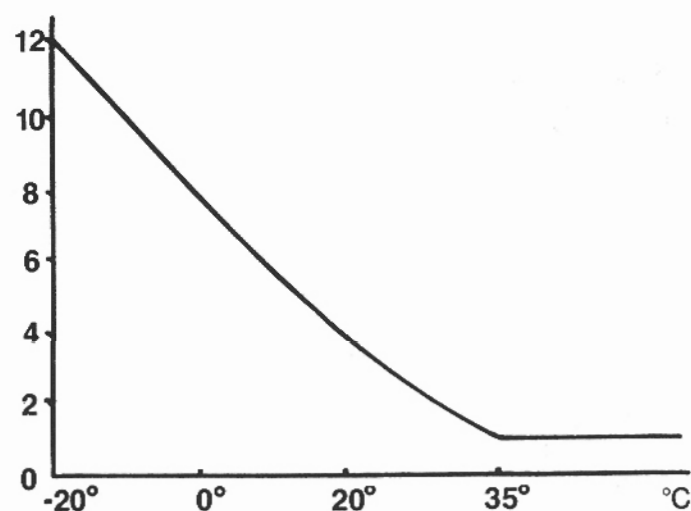
The Cold-Start Valve, which provides the additional

amount of fuel necessary for cold starting, is controlled by two electrical devices: the Cold-Start Relay and Thermo-Time Switch. When the engine is cranked, current flows through the Relay to both the valve and the Thermo-Time Switch. On a warm engine, the contacts in the switch are open, and the relay provides power to operate the valve for only one second.



On a cold engine, the bi-metallic strip in the Thermo-Time Switch causes the valve to remain powered for a longer duration, causing more injection.

Seconds

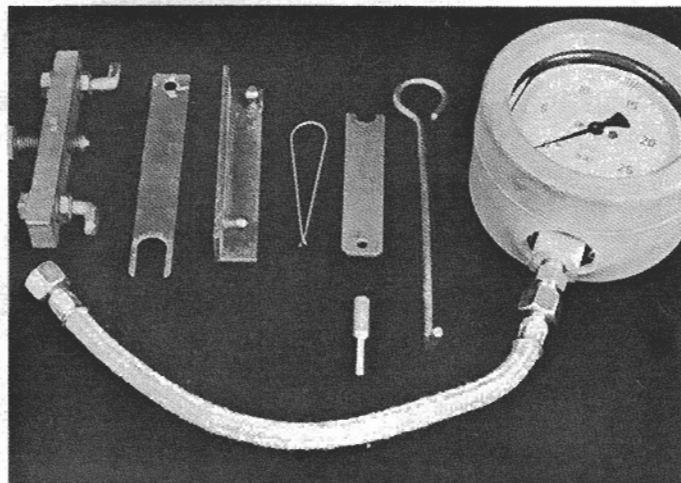


For example, injection duration is 8 seconds at 0° C, 4 seconds at 20° C, and one second at 35° C. Above 35° C, the bi-metallic strip in the Thermo-Time Switch has been heated enough to interrupt current flow; the points open and the cold-start relay loses its ground, which interrupts current flow to the valve and ends injection. But the valve will *always* inject one second of extra fuel, no matter what the coolant temperature of the engine is.



# Special Tools

The following is a list of BMW Special Tools necessary for adjustment and repair of the 2002 tii:

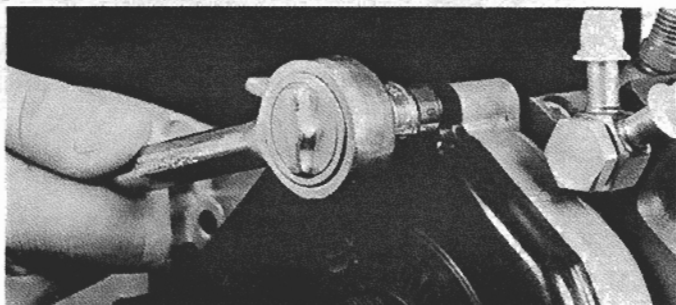


Fuel Pressure Gauge,	No. 88886133060
85mm Linkage Gauge,	No. 88886135040
5mm Hook,	No. 88886135050
4mm Throttle Adjustment Pin,	No. 88886135080
Air Regulating Cone Retainer Plate	No. 88886135140
Inlet Valve Tweezers,	No. 88886135150
Pump Pulley Puller,	No. 88886135240
Warm-Up Transmitter Feeler Gauge,	No. 88886243040

All the above parts can be ordered through your parts department.

## Repair Procedures

There are no actual repairs that can be made to the injection pump except for replacement of the suction and delivery valves or the warm-up transmitter. Should the pump itself be defective, it must be replaced.

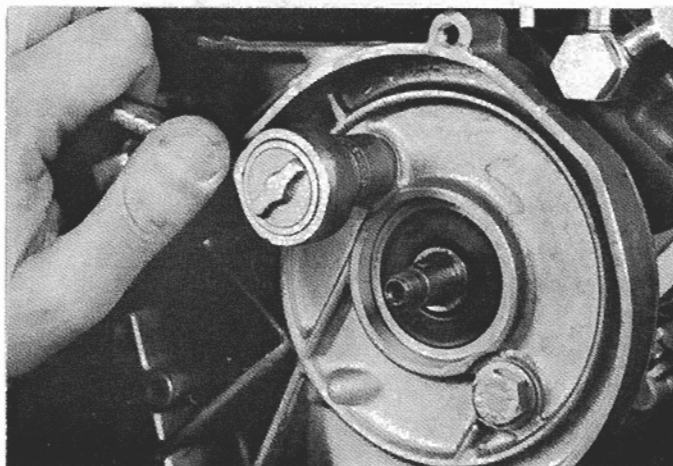


Remove the top plastic drive belt cover.

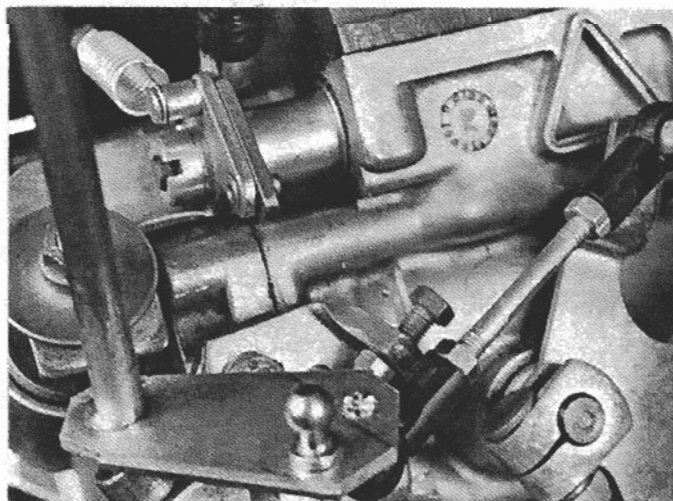


With the pulley puller remove the pulley from the pump. Do not force it. You can bend the camshaft

inside the pump.

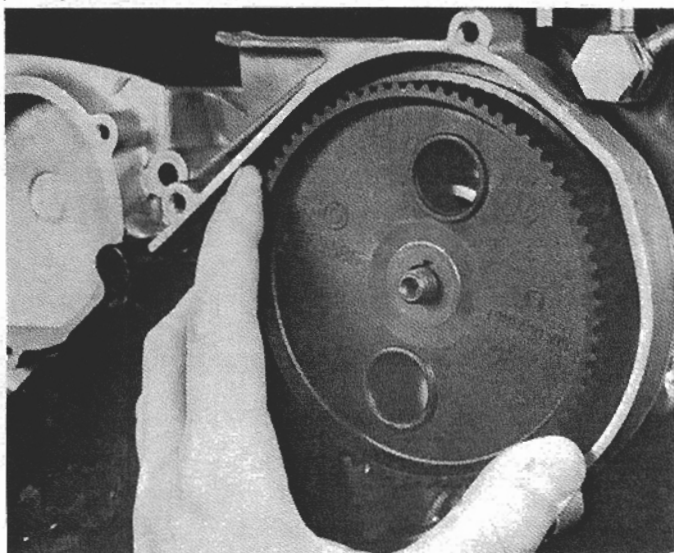


Disconnect the linkage and fuel and oil lines, and remove the pump.

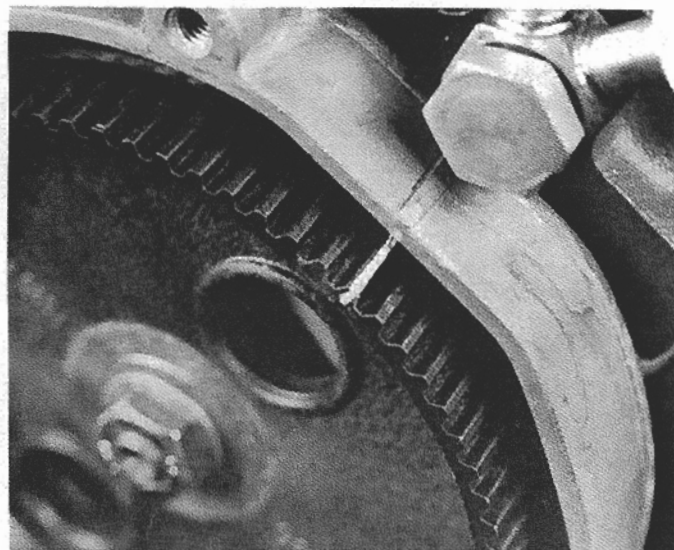


Before installing the replacement pump, check the

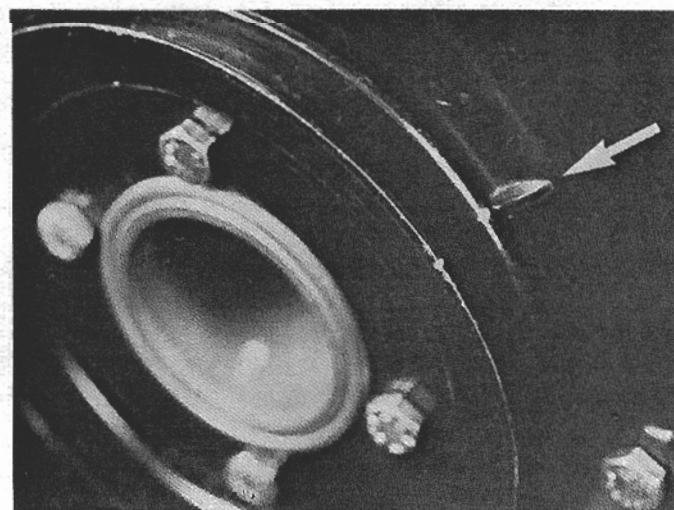
full-throttle stop screw. It's much easier when the pump is off the car.



After the replacement pump is mounted on the engine, install the keyed pulley on the pump's camshaft.

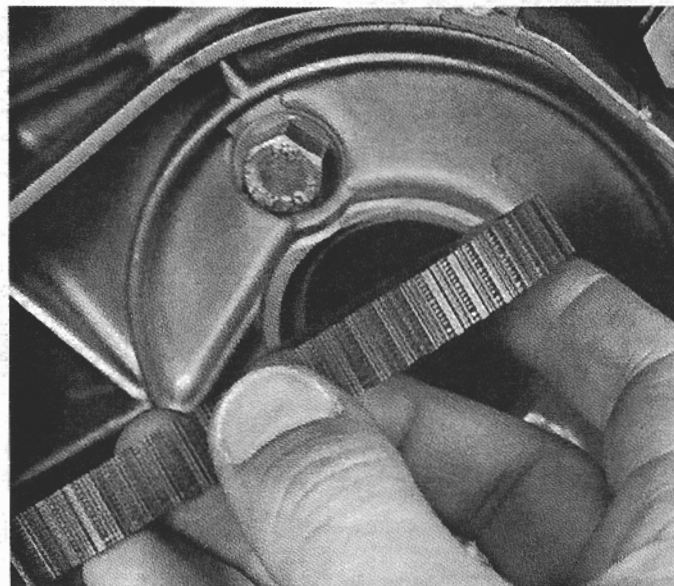


Now, line up the TDC mark on the pulley with the mark on the top front drive belt cover.



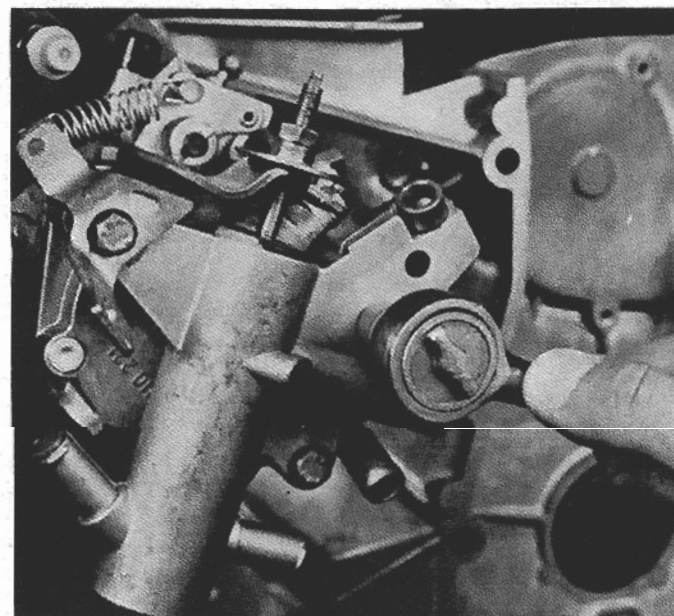
Set the engine to the number one TDC firing position.

Now, replace the drive belt.

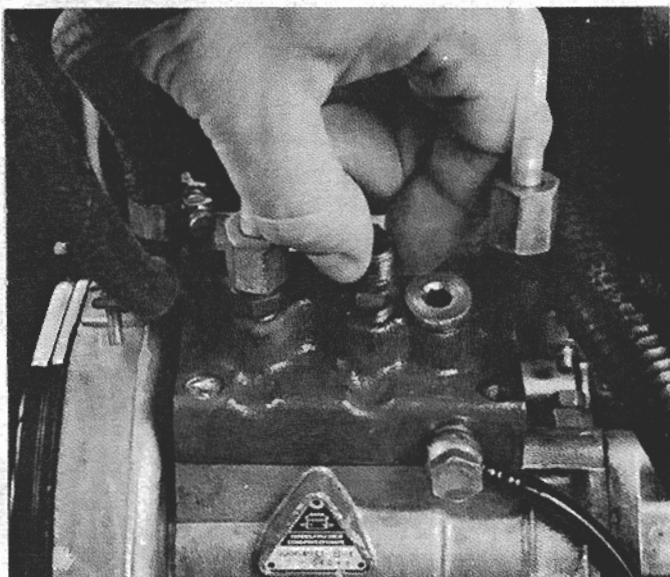


Check the condition of the belt before installation, and replace it if necessary. Now, reconnect the oil and fuel lines.

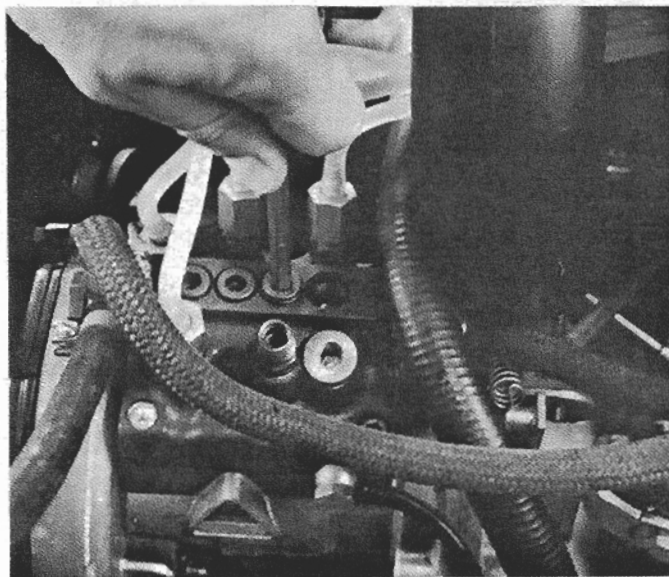
The warm-up transmitter, the suction and delivery valves, and the pressure relief valve are the only items that can be replaced on the pump.



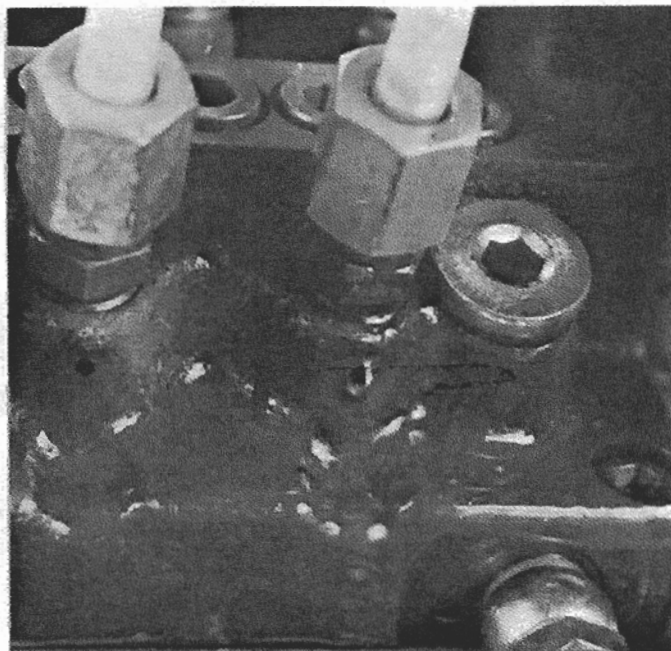
The warm-up transmitter is mounted on the rear of the pump with three screws. Disconnect the water and air hoses, remove the screws, and replace the unit. The rod will have to be adjusted after the new unit is installed.



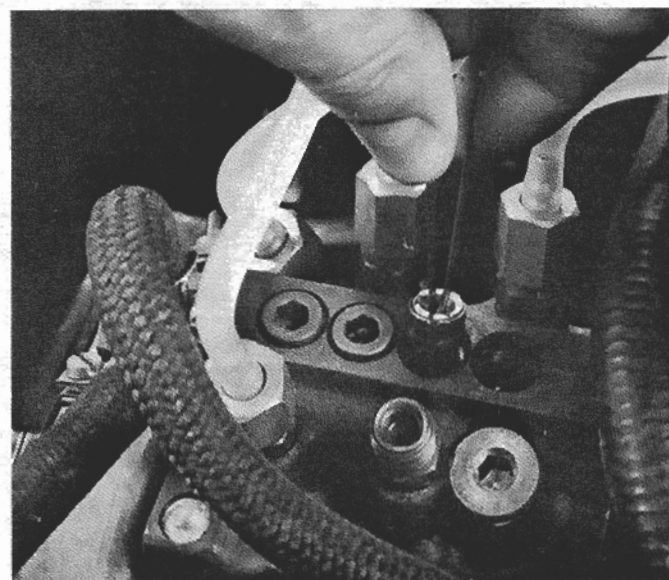
The fuel delivery valves are removed by unscrewing them with a 12mm wrench. Be careful when you replace these valves. There is a thin metal seal under each one. These seals must be properly seated to insure a proper pressure seal.



To replace the suction valves, unscrew the retaining screw with a 6mm Allen Wrench.



If, after the valve has been replaced, gasoline leaks out of the small hole below the valve, the metal seal hasn't seated properly or the fitting isn't tight enough.



Now use the brass tweezers to lift out the valves. *Do not* use a magnet to remove these valves.

The pressure relief valve on the rear of the pump is simply unscrewed with a 19mm wrench and replaced.

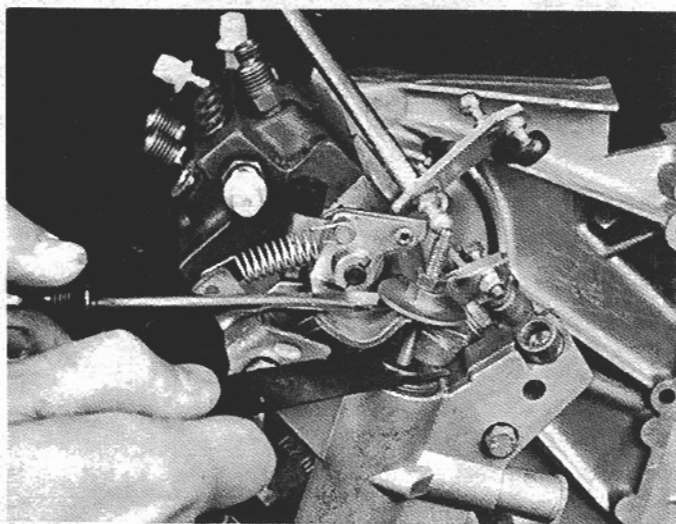


# Adjustments

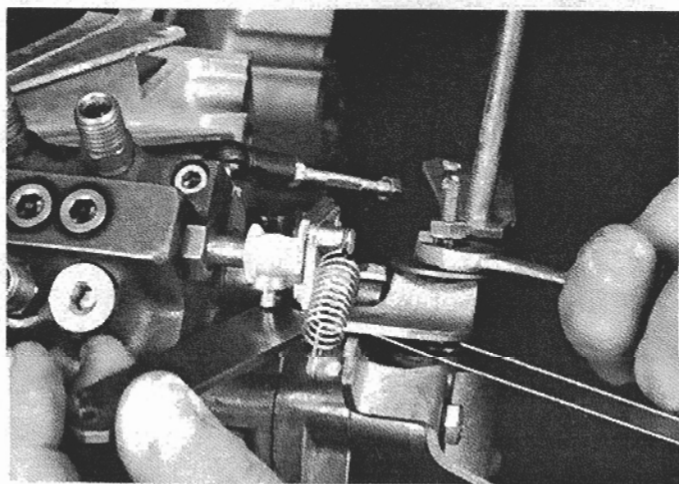
It is not always necessary to perform adjustments to the linkage of the fuel injection system. They are only necessary if a major component has been replaced or the engine will not readily meet tune-up specifications.

## Warm-Up Transmitter

This adjustment *must* be done on a *cold* engine.



Lever out the Air Regulating Cone with a screwdriver and insert the Retaining Plate.

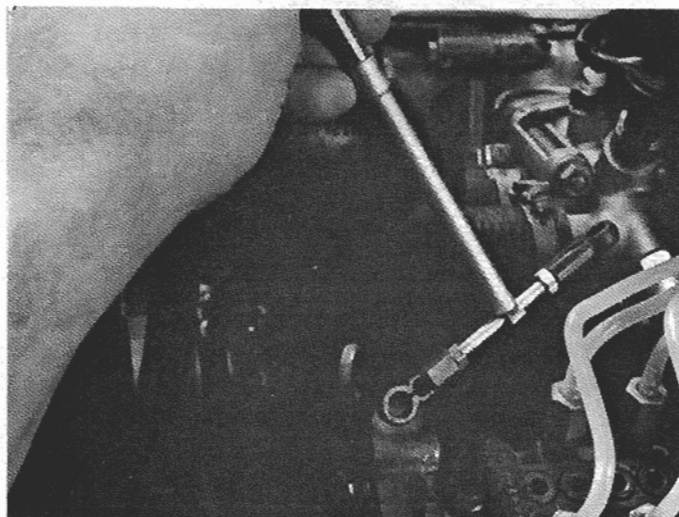


Check the distance between the screw on the enrichment lever and its stop with the Feeler Gauge. It should be 2.6mm. If it is not, loosen the lock nut on the end of the rod, and adjust the plate nut until the correct distance is obtained. Tighten the lock nut.

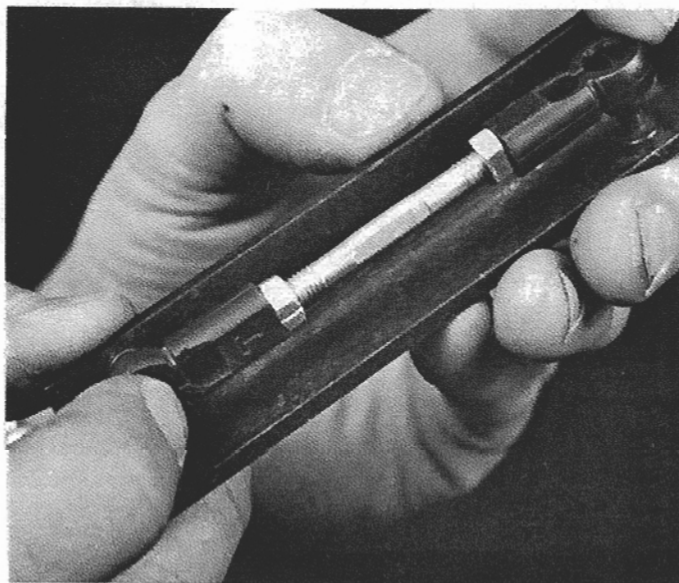
Never use the screw on the enrichment lever to set this gap. It has been set at the factory and re-adjustment will result in improper warm-up operation.

## Pump/Throttle Linkage

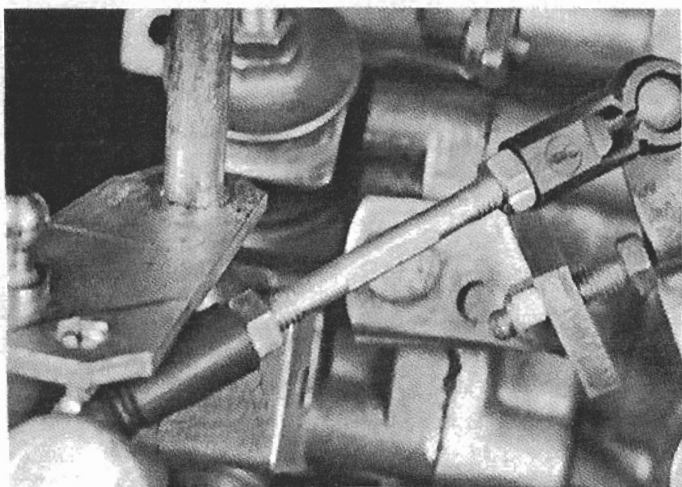
There are two parts to this linkage: one section is on the back of the pump itself, from the regulating lever to the bell crank; the other section is from the bell crank to the throttle butterfly.



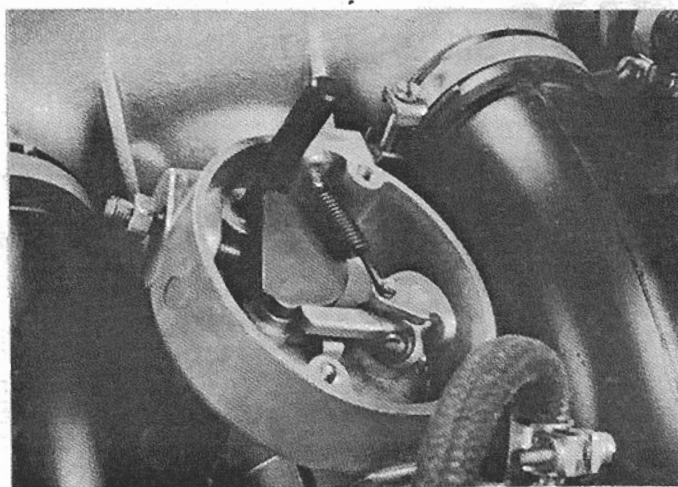
First, attach mechanical fingers to the short linkage on the back of the pump. It can easily fall down into the engine compartment and is difficult to retrieve.



Adjust the length of this linkage until it can be easily pressed onto the 85mm gauge. Once the length is set, tighten the lock nuts and reinstall the rod.

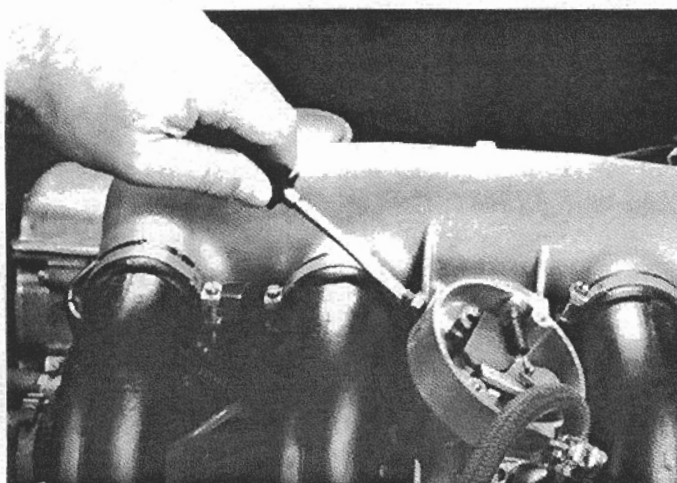


Be careful of the ends of this rod. They are plastic and can be easily damaged.

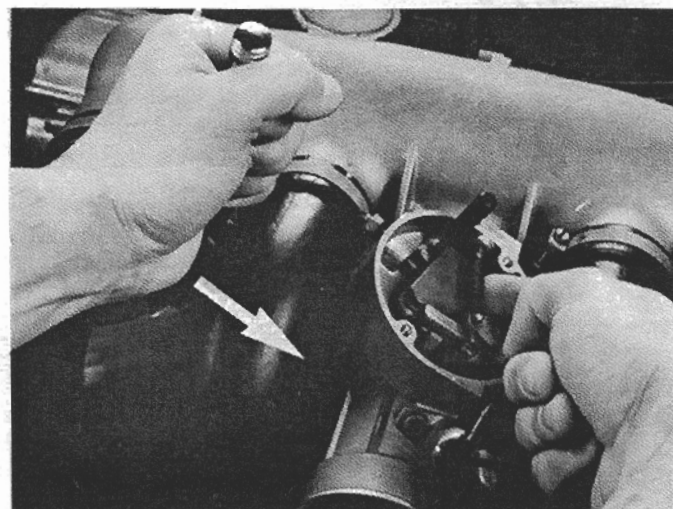


Now, insert the 4mm pin into the hole in the throttle housing. Check to see that the eccentric cam just touches the pin.

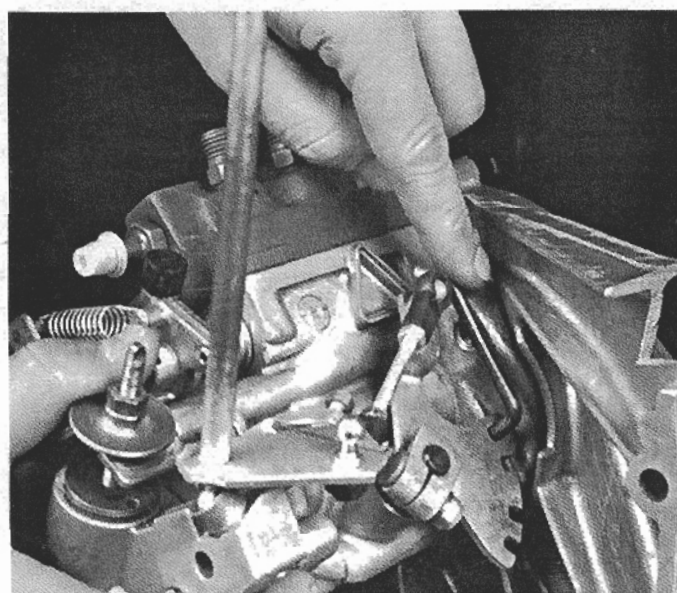
If it does not touch the pin, loosen the two screws on the linkage clamp.



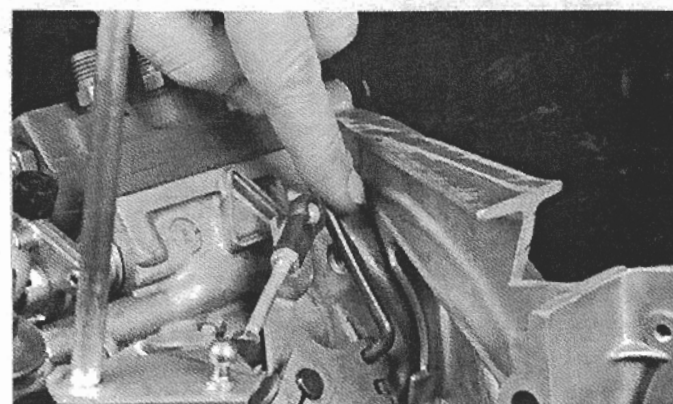
Next, remove the throttle housing cover and the air cleaner. Back off the idle adjustment screw.



With light finger pressure, push the eccentric cam against the pin, and tighten the screws on the linkage clamp.



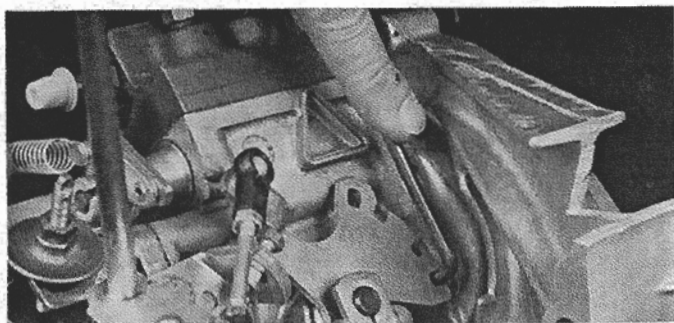
Insert the 5mm hook into the first slot on the pump's regulating lever and the hole in the pump housing. This is the correct idle position for the cone inside the pump.



Remove the 5mm hook, and open and close the throttle two or three times. With the eccentric cam against the pin, it should be easy to re-insert the 5mm hook without forcing. If it cannot be easily inserted, repeat the adjustment.

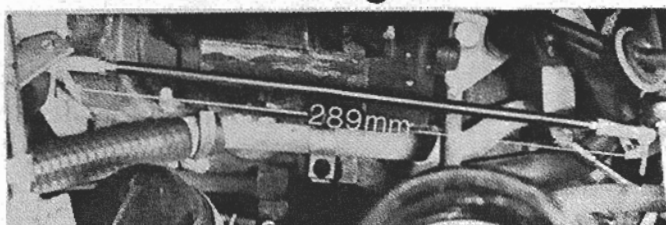


## Full Throttle Stop

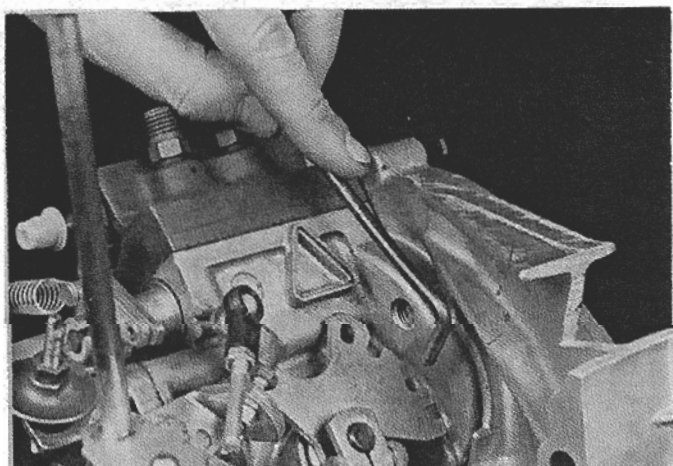


Insert the 5mm hook in the last slot on the pump regulating lever and the hole in the housing. If the lever just touches the stop screw, it is properly adjusted. If not, loosen the lock nut and adjust the stop screw. Tighten the lock nut.

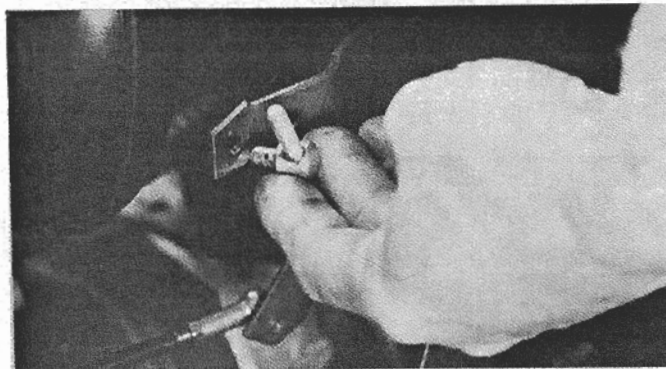
## Accelerator Linkage



Measure the distance between the ends of the connecting rod between the bell crank on the firewall and the throttle. It must be 289mm, center to center. If it is not, loosen the lock nuts and adjust the rod correctly.



Now, push the pedal to its stop. Make sure it is resting on the stop and not on the carpet. Try to insert the 5mm hook into the last slot on the regulating lever. It should go in easily. If not, disconnect the safety clip on the firewall bell crank and remove the pin. Push the gas pedal to its stop, and insert the 5mm hook into the full-throttle cut-out on the pump.

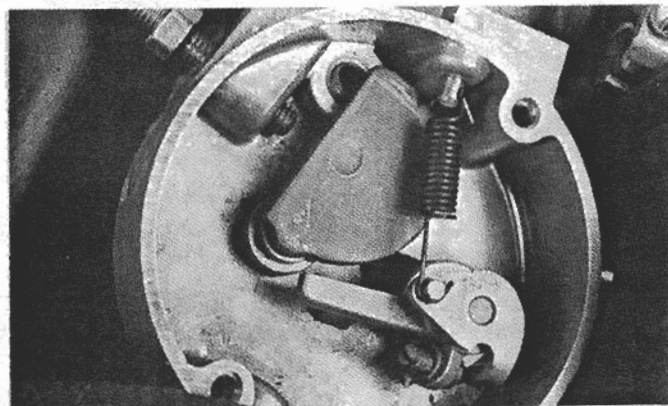


Screw the pin up or down until it fits readily into the hole in the bell crank. Replace the safety clip.

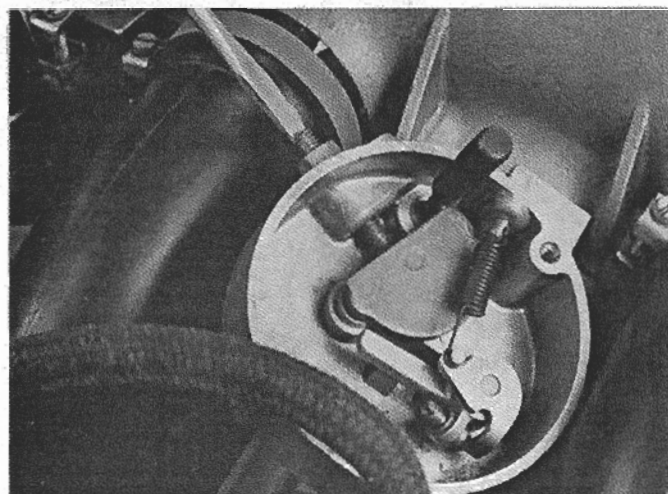
If your adjustments are correct, the gas pedal will hit its stop before the regulating lever on the injection pump reaches its stop screw.

## Throttle

These adjustments are part of the normal tune-up procedure. Normally, minor adjustments to the idle or mixture screws will bring the engine within specifications. However, if major components have been replaced or the linkage has been completely re-adjusted, the basic throttle adjustment must be done before the engine can be fine tuned.



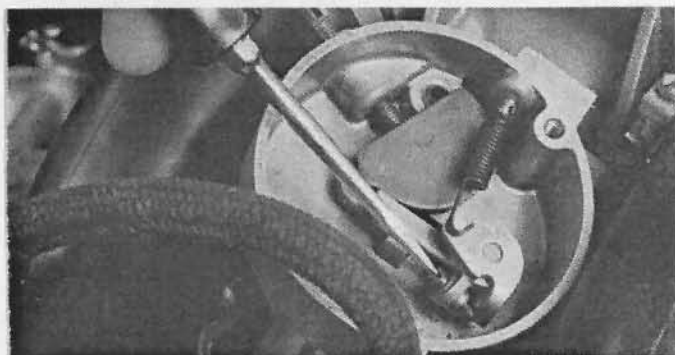
Back off both the idle adjustment screw and the mixture adjustment screw.



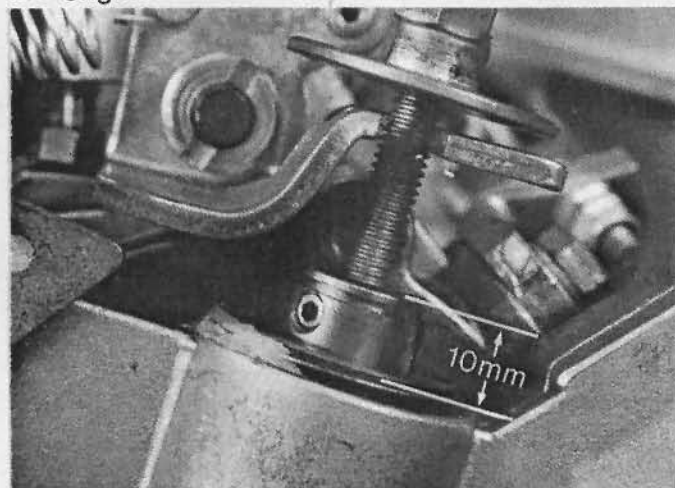
Insert the 4mm pin into the hole in the throttle



housing, and with light finger pressure, push the eccentric lever against the pin. Turn the idle adjusting screw in until it just touches the eccentric lever, and tighten the lock nut.



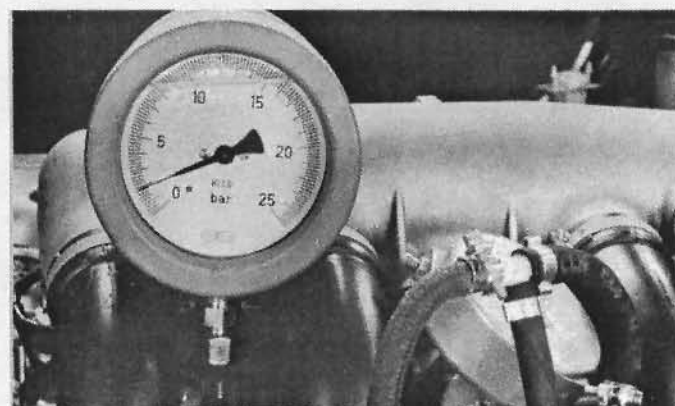
Now turn the mixture screw in until it touches the trailing lever and the trailing lever, in turn, is just touching the back of the eccentric. There will be a slight amount of play between the two lever until the screw is correctly adjusted. Once it is set, give the screw another half turn in. This will allow you to start the engine.



Let the engine warm up. To correctly set idle and

## Troubleshooting Hints

Before troubleshooting the injection system, make sure that the ignition system is functioning correctly, that there is an adequate fuel supply, and that the injection pump is correctly timed.

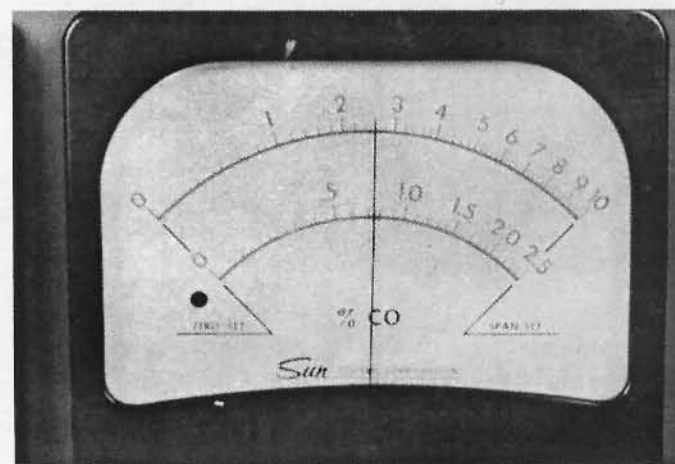


Inadequate fuel supply can cause problems in all

CO, the engine must be completely warmed up and the Air Regulating Cone must be extended to its full 10mm. If it is not, the Warm-Up Transmitter is out of adjustment or defective.



Once the engine is warm, set the idle to 850 to 1000 RPM's by turning the idle adjustment screw *in*.



Adjust CO by turning the mixture screw *OUT* to raise CO, or *IN* to lower it.

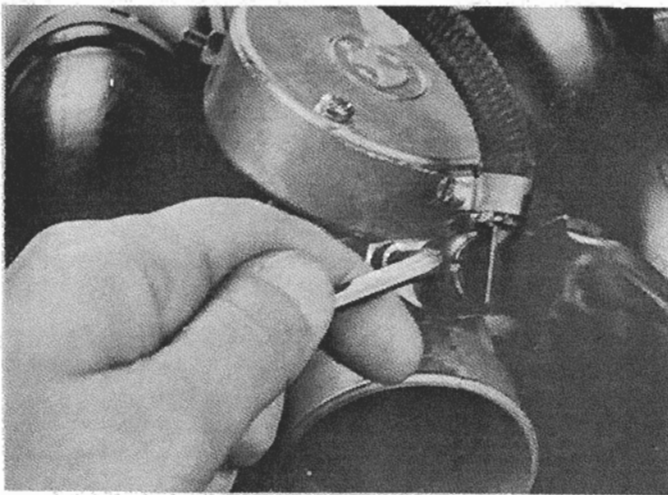
The correct setting is 2- to 3 percent.

three areas of engine operation: starting, warming up, and running. Use the BMW Special Tool, the Fuel Pressure Gauge, to make sure there is an adequate supply of fuel to the pump.

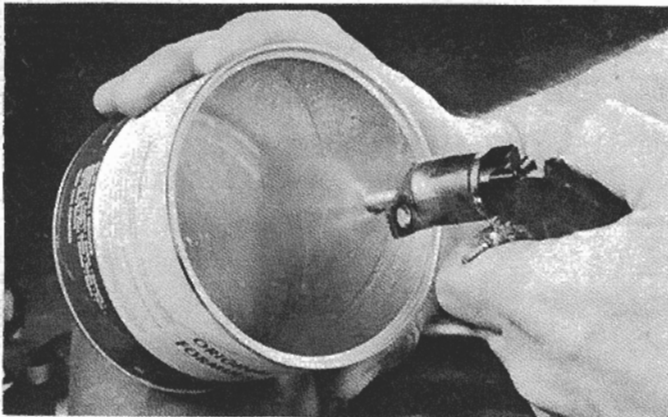
If the pump is not correctly timed, the same problems can occur. You should suspect timing problems if the operating problems began occurring after the car had been worked on.

## Cold-Starting Problems

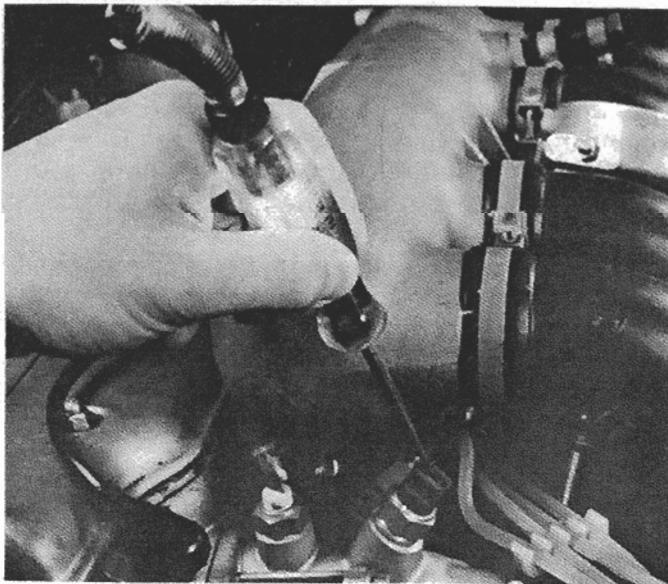
Occasionally, cold-starting problems are caused by improper starting procedures. Make sure your customer stays on the starter long enough.



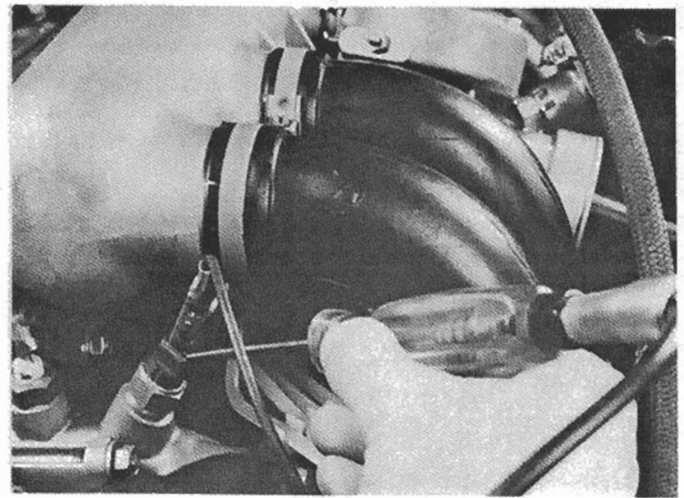
To check the Cold-Start Valve, first remove it from the intake. Place a container under the valve to catch injected fuel.



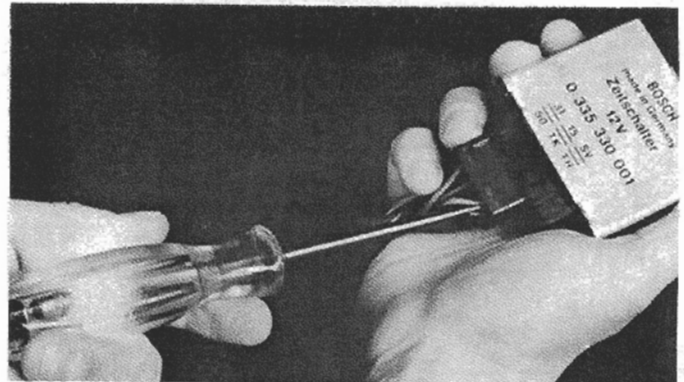
Connect a jumper wire from the positive terminal of the battery to terminal 'SV' on the Cold-Start Relay. If the valve is functioning properly, it should inject continuously.



To check the Thermo-Time Switch, first remove the connector. Connect a test light between the positive battery terminal and connection 'W' on the switch. The light should come on if the switch is cold.

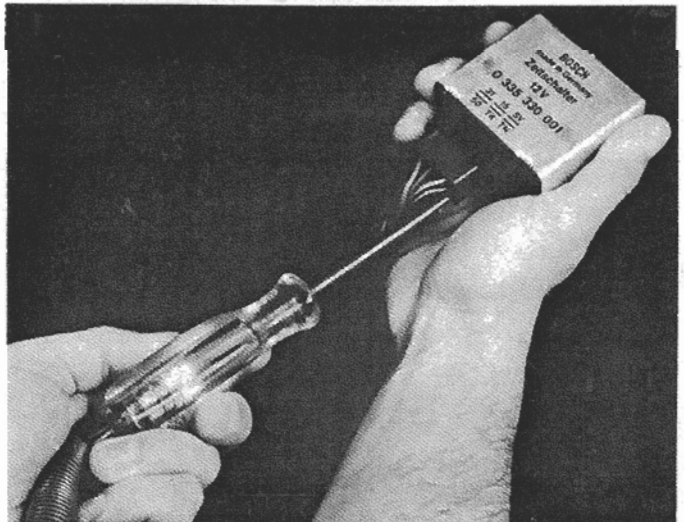


Leave the light attached, and connect a jumper wire between the positive terminal on the battery and terminal 'G'. This will heat the bi-metallic strip in the switch. The test light should go out after a few seconds.



To test the Cold-Start Relay, connect the test light between ground and terminal 'SV'. Pull the coil wire and crank the engine. The test light should come on as soon as the engine begins to turn over and go out after a few seconds.

Now disconnect the connector on the Thermo-Time Switch. The light should now go out after one second.

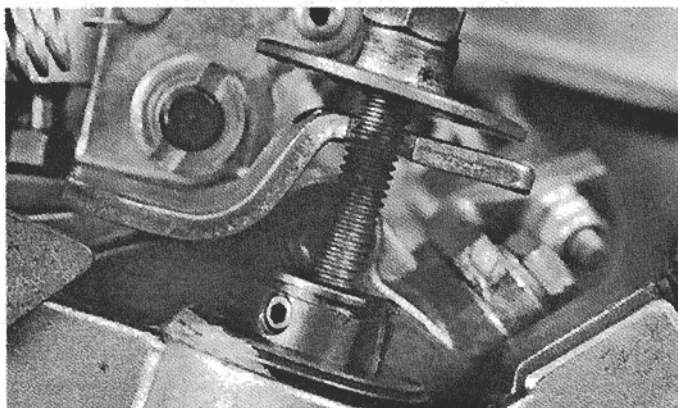


Finally, connect the test light between terminal 'TH'



and ground. The light should come on as soon as the starter is engaged, and remain on as long as the starter is powered.

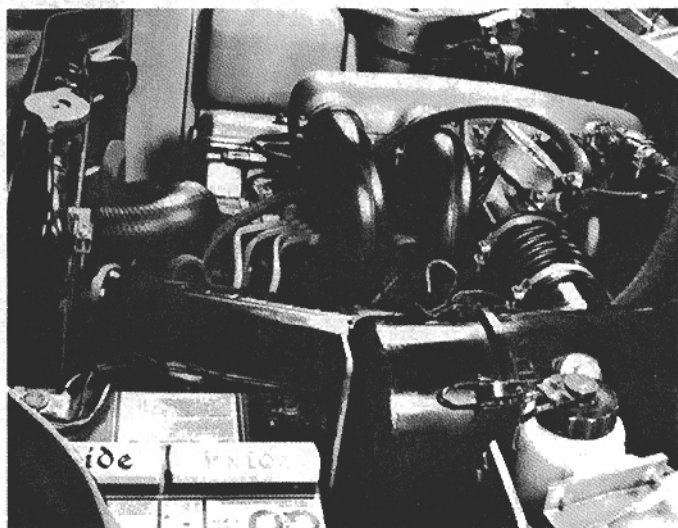
## Warm-Up Problems



Most warm-up problems are related to the Warm-Up Transmitter. Check the adjustment. If that seems all right, make sure the cone is extended the full 10mm. When the engine has completely warmed up. If not, it will have to be replaced.

## Warm-Running Problems

Most warm-running complaints are either surging or misfiring. Surging is generally caused by the improper adjustment of the injection system's components, or by worn linkages. If all the adjustments are correct, and linkages are not worn or damaged, the pump itself may be defective and will have to be replaced.

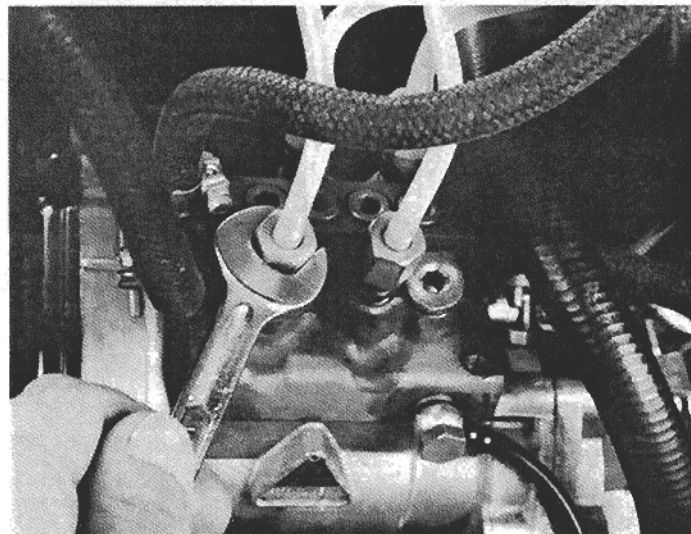


Sometimes the problem cylinder can be determined with an oscilloscope. But there's another way.

Misfiring can be caused by either ignition problems or by the injection components. Remember that this car has a conventional ignition system which should be checked with a suitable engine analyzer before working on the injection system.

An Infrared Tester can help you determine whether

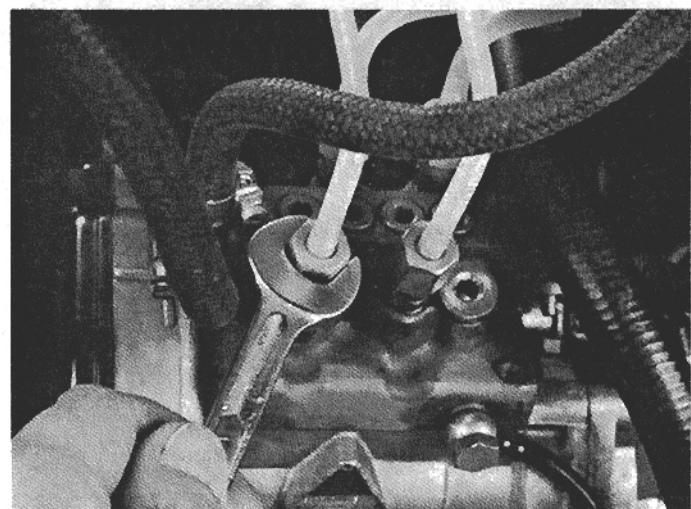
the problem is in the ignition or injection system. Excessively high HC readings generally indicate problems in the ignition system; low readings tend to indicate a problem in the injection system. If the problem is in the injection system, the first thing to do is isolate the cylinder causing the problem.



With the engine running, slightly loosen the fuel line fitting above the delivery valve for cylinder one. Don't take the fitting off, just slightly loosen it. The high pressure inside the pump will force fuel out through the loosened threads, and you should hear a noticeable difference in engine sound and speed. There will be little or no difference on the problem cylinder.

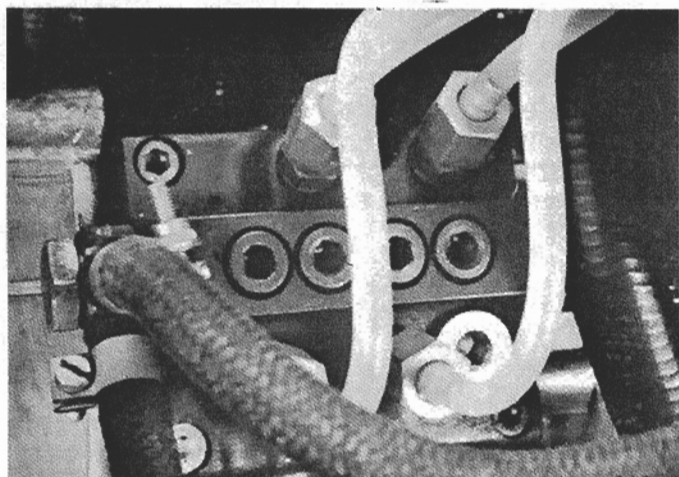
Once the cylinder with the bad fuel supply system has been located, the next thing to isolate is whether the problem is in the pump, the injector, or the suction or delivery valves.

If no gas leaked out when the fitting was loosened, the problem is probably the suction valve or the pump. If fuel did leak out, the problem is a defective delivery valve or injector.

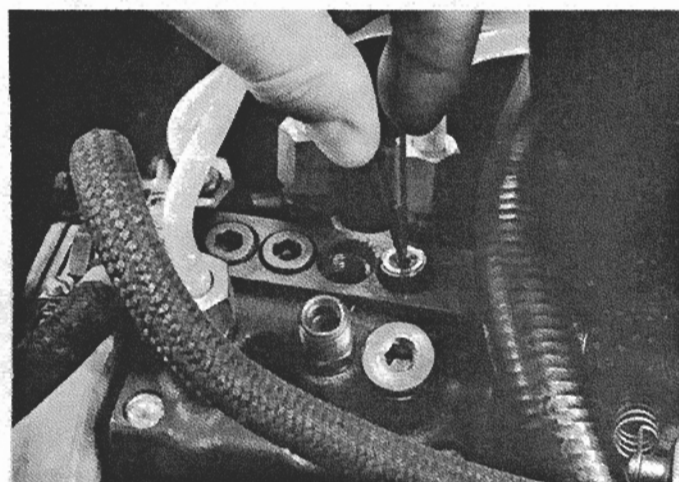


Assuming fuel did leak out, determine whether it is the valve or the injector. Switch the delivery valve with one from another cylinder.



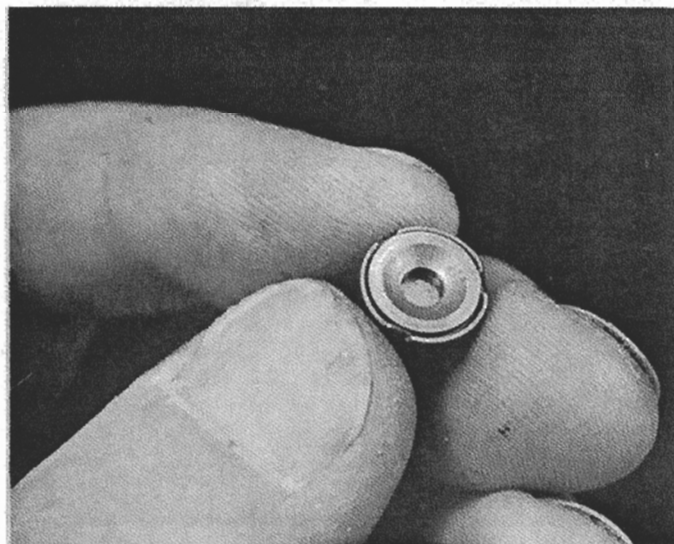


But, if fuel did *not* leak out, the problem could be the suction valve or the pump.

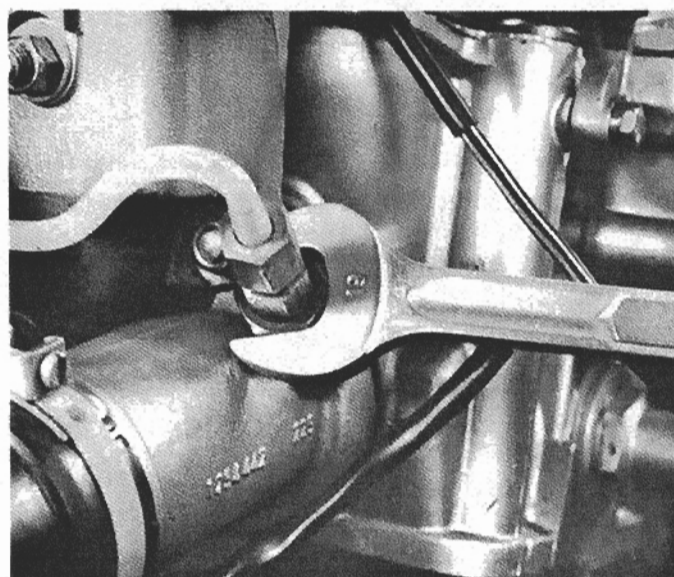


Again, exchange valves first. Remove the Allen screws on the problem cylinder and one of the remaining cylinders. With the BMW Special Tool, the *brass* tweezers, lift out both valves.

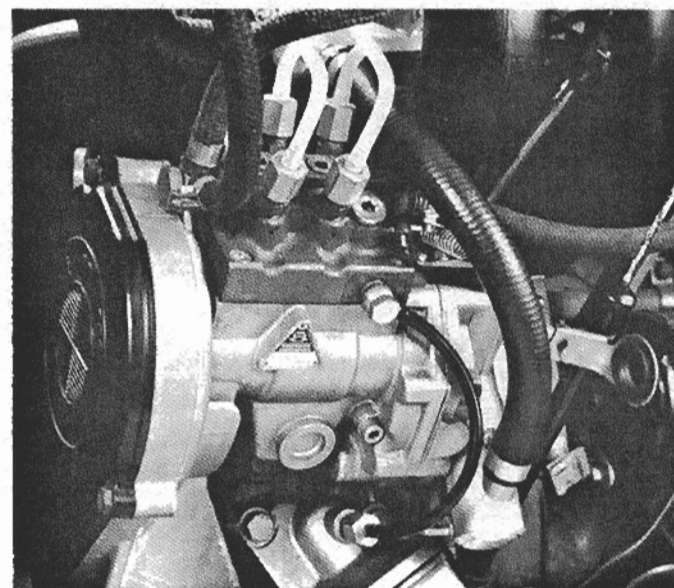
*Do Not* use a magnet. It can ruin the pump!



If the problem moves to the 'new' cylinder, the problem is the valve. If it does not, the problem is the injector.



So check the injectors. If your dealership services diesel products, you should have an injector tester on hand. If not, you'll have to repeat the same procedure: switch injectors.



If the problem is still not corrected, the problem is in the pump. Since there is nothing you can do to repair the pump, it must be replaced with a new one or rebuilt.

---

Notes:

# Troubleshooting Chart

This trouble shooting chart assumes that the following are according to specification:

1. Normal and even compression in all cylinders
2. Valve clearance correctly adjusted
3. Dwell angle and ignition timing correctly adjusted
4. All components of ignition system functioning correctly
5. Pump timing correct.

## Diagnosis

Condition	Cause	Correction
Engine will not start when cold although fuel pump is running.	<ol style="list-style-type: none"><li>1. Fuel delivery pressure too low</li><li>2. No, or too little, fuel injecting from starting valve.</li><li>3. Fouled spark plugs.</li><li>4. Fuel tank empty.</li></ol>	<ol style="list-style-type: none"><li>1. Check ground connection to fuel pump. Replace fuel pump.</li><li>2. Check all electrical connections, start valve, temperature time switch. If necessary, replace.</li><li>3. Clean plugs.</li><li>4. Fuel up.</li></ol>
Engine will not start when warm	<ol style="list-style-type: none"><li>1. Starter operated for too short a period.</li><li>2. Fuel delivery pressure too low.</li><li>3. Fuel delivery pressure too high.</li><li>4. Start valve does not cut off.</li><li>5. Fuel tank empty.</li></ol>	<ol style="list-style-type: none"><li>1. Operate the starter for a longer period.</li><li>2. Check ground connection to fuel pump, replace fuel pump.</li><li>3. If necessary, replace regulating valve. Clean return fuel line.</li><li>4. Check temperature time switch, relay, pressure valve, fuel pump pressure.</li><li>5. Fuel up.</li></ol>
Fuel pump does not work.	<ol style="list-style-type: none"><li>1. Fuse.</li><li>2. Electric wires interrupted.</li></ol>	<ol style="list-style-type: none"><li>1. Replace fuse.</li><li>2. Check all electric wires to pump, if necessary, replace.</li></ol>



# Diagnosis

Condition	Cause	Correction
Engine surging at idle, engine in warm condition.	<ol style="list-style-type: none"> <li>1. Idling too lean.</li> <li>2. Ignition advance too early.</li> <li>3. Sealing rings on intake pipes leaking.</li> <li>4. Throttle valve adjustment not matched to injection pump.</li> <li>5. Injection pump not adjusted properly.</li> <li>6. Throttle and shaft jammed.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust idle with infrared CO tester.</li> <li>2. Adjust ignition timing.</li> <li>3. Remove and replace sealing rings on intake pipes.</li> <li>4. Synchronize throttle valve to injection pump.</li> <li>5. Replace injection pump.</li> <li>6. Replace throttle body.</li> </ol>
Engine will not idle after cold start.	<ol style="list-style-type: none"> <li>1. Air regulating cone dirty.</li> <li>2. Warming up device incorrectly adjusted.</li> <li>3. Warming up device jammed.</li> </ol>	<ol style="list-style-type: none"> <li>1. Press up and clean slots in regulating cone.</li> <li>2. Adjust warming up device.</li> <li>3. Replace warming up device.</li> </ol>
Idle speed too high, engine at operating temperature.	<ol style="list-style-type: none"> <li>1. Idle adjustment incorrect.</li> <li>2. Ignition timing incorrect.</li> <li>3. Throttle valve adjustment not matched to injection pump.</li> <li>4. Injection pump not adjusted properly.</li> <li>5. Throttle and shaft jammed.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust idle with infrared CO tester.</li> <li>2. Adjust ignition timing.</li> <li>3. Synchronize throttle valve linkage to injection pump.</li> <li>4. Replace injection pump.</li> <li>5. If idle changes after stepping on accelerator, change throttle body.</li> </ol>

# Diagnosis

Condition	Cause	Correction
Idle speed too low, engine at operating temperature.	<ol style="list-style-type: none"> <li>1. Idle adjustment incorrect.</li> <li>2. Ignition timing incorrect. (Too Late.)</li> <li>3. Throttle valve adjustment not matched to injection pump.</li> <li>4. Warming up device jammed.</li> <li>5. Injection pump not adjusted properly.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust idle with infrared CO tester.</li> <li>2. Adjust ignition timing.</li> <li>3. Synchronize throttle valve to injection pump.</li> <li>4. Check hose clamp on damper valve.</li> <li>5. Replace injection pump.</li> </ol>
Engine cutting out, misfiring.	<ol style="list-style-type: none"> <li>1. Throttle valve adjustment not matched to injection pump.</li> <li>2. Defective injection valve.</li> <li>3. Piston in injection pump stuck</li> <li>4. Delivery valve leaks.</li> <li>5. Suction valve defective.</li> <li>6. Fuel pump pressure not steady.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust throttle valve linkage.</li> <li>2. Replace injection valve.</li> <li>3. Replace injection pump.</li> <li>4. Replace delivery valve.</li> <li>5. Replace suction valve.</li> <li>6. Check all electrical connections and ground connection, or replace fuel pump.</li> </ol>
Engine backfiring on deceleration.	<ol style="list-style-type: none"> <li>1. Throttle valve adjustment not matched to injection pump.</li> <li>2. Throttle does not return to idle position.</li> <li>3. Idle adjustment incorrect.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust throttle valve linkage.</li> <li>2. Replace throttle housing.</li> <li>3. Adjust idle with Infrared CO Tester.</li> </ol>
Insufficient engine/power output.	<ol style="list-style-type: none"> <li>1. Fuel pump pressure too low.</li> <li>2. Defective injection valve.</li> <li>3. Throttle valve adjustment not matched to injection pump.</li> <li>4. Throttle does not go to full throttle position.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check all electrical connections to fuel pump, or replace fuel pump.</li> <li>2. Replace injection valve.</li> <li>3. Adjust throttle valve linkage.</li> <li>4. Adjust linkage.</li> </ol>

# Diagnosis

Condition	Cause	Correction
Too high fuel consumption.	<ol style="list-style-type: none"><li>1. Warm-up regulator does not cut out.</li><li>2. Cold Start valve leaking.</li><li>3. Throttle valve adjustment not matched to injection pump.</li><li>4. Injection pump not adjusted properly.</li></ol>	<ol style="list-style-type: none"><li>1. Remove hose clamp and bleed cooling system. Replace warm-up transmitter.</li><li>2. Replace Cold Start valve.</li><li>3. Adjust throttle valve linkage.</li><li>4. Replace injection pump.</li></ol>





## ADDENDUM

The engine ignition specifications in this manual are somewhat abbreviated, so I've taken the liberty to add a section covering detailed ignition specs for the U.S. Tii's and the Turbo. The data is excerpted from a set of detailed ignition spec sheets given to me by a factory service engineer in Munich during a visit in 1977. I have similar data for other models which is not included here but I would be happy to supply same to those who are interested.

The page lay out has been arranged so that the footnotes and definitions are on the left when the spec sheet is visible on the right.

### DEFINITIONS & FOOTNOTES

- A. Crankshaft degrees with engine cold.
  - B. Crankshaft degrees with engine running at normal operating temperature, vacuum hose detached from distributor, measured at flywheel mark.
  - C. Crankshaft degrees.
  - D. Crankshaft degrees before TDC.
  - E. Crankshaft degrees with vacuum hose detached from distributor.
  - F. Vacuum measured in millimeters of mercury.
- 
- 1) Settings valid only with 0 231 180 013 distributor, E 12 cylinder head and 9: 1 compression ratio.
  - 2) Distributor 0 231 151 008 replaced distributor 0 231 129 037. This distributor was previously supplied as 0 231 151 003. The 008 distributor is supplied with a speed limiting rotor.
  - 3) Ignition advance angles are to be checked at an idle speed of 800 - 950 RPM, not at 1000 RPM. Note that as an exception for this vehicle only, the distributor vacuum hose must be reconnected when measuring advance at this idle speed (800-950 RPM)



BMW MODEL	FOOTNOTE No.	2002 Tii	2002 Tii <sup>1)</sup>	2002
		USA 1972-73	USA 1974	TURBO
Distributor		2)		
Bosch No.		0 231 151 008	0 231 180 013	0 231 180 014
BMW No.		12 11 1 355 273	12 11 1 357 771	12 11 1 356 336
Static Ignition Timing	A	TDC	TDC	TDC
Dynamic Ignition Timing	B	25° b TDC @ 2700	25° b TDC @ 2700	25° b TDC @ 2500
Dwell Angle	C	59° - 65°	59° - 65°	59° - 65°
Centrifugal Advance	D			3)
1000		0° - 4°	4° - 9°	-2° -- -8°
1500		10° - 14°	10° - 15°	23° - 27° END
2000		15° - 20°	17° - 22°	
2500		21° - 26°	22° - 27°	
2700		---	---	
3000		25° - 30°	26° - 30°	
3800		27° - 32° END	27° - 31° END	
4000				
Max. Ignition Advance	E	30° ± 2°	29° ± 2°	25° ± 2°
Vacuum Action	F	NONE	RETARD	RETARD
Start in mm Hg		--	50 - 76	188 - 221
End in mm Hg		--	84 - 103	308 - 312
Adjustment Range		--	7° - 9°	8° - 12°