KUGELFISCHER FUEL INJECTION

BMW 2002 tii (1972-73)

DESCRIPTION

Kugelfischer fuel injection is of the mechanical type. The operation of the pump and other components enables the air-/fuel ratio to be controlled and kept within limits for exhaust emission requirements so that additional equipment for control of emissions is not required. System consists of an in-line injection pump, air supply and distribution manifold, injection nozzles, solenoid controlled cold start valve, connecting pipes for the components, and the necessary throttle linkage.

OPERATION

FUEL INJECTION PUMP

Fuel fed to the pump is kept under pressure and enters high pressure chamber during downward travel of injection plunger. When plunger is at lowest point a valve prevents further entry of fuel. When plunger travels upward, pressure is increased and opens a spring loaded delivery valve. A passage to the injectors is opened and fuel is delivered. The injector opens at an exact opening pressure and fuel is injected into the engine.

OIL CIRCULATION

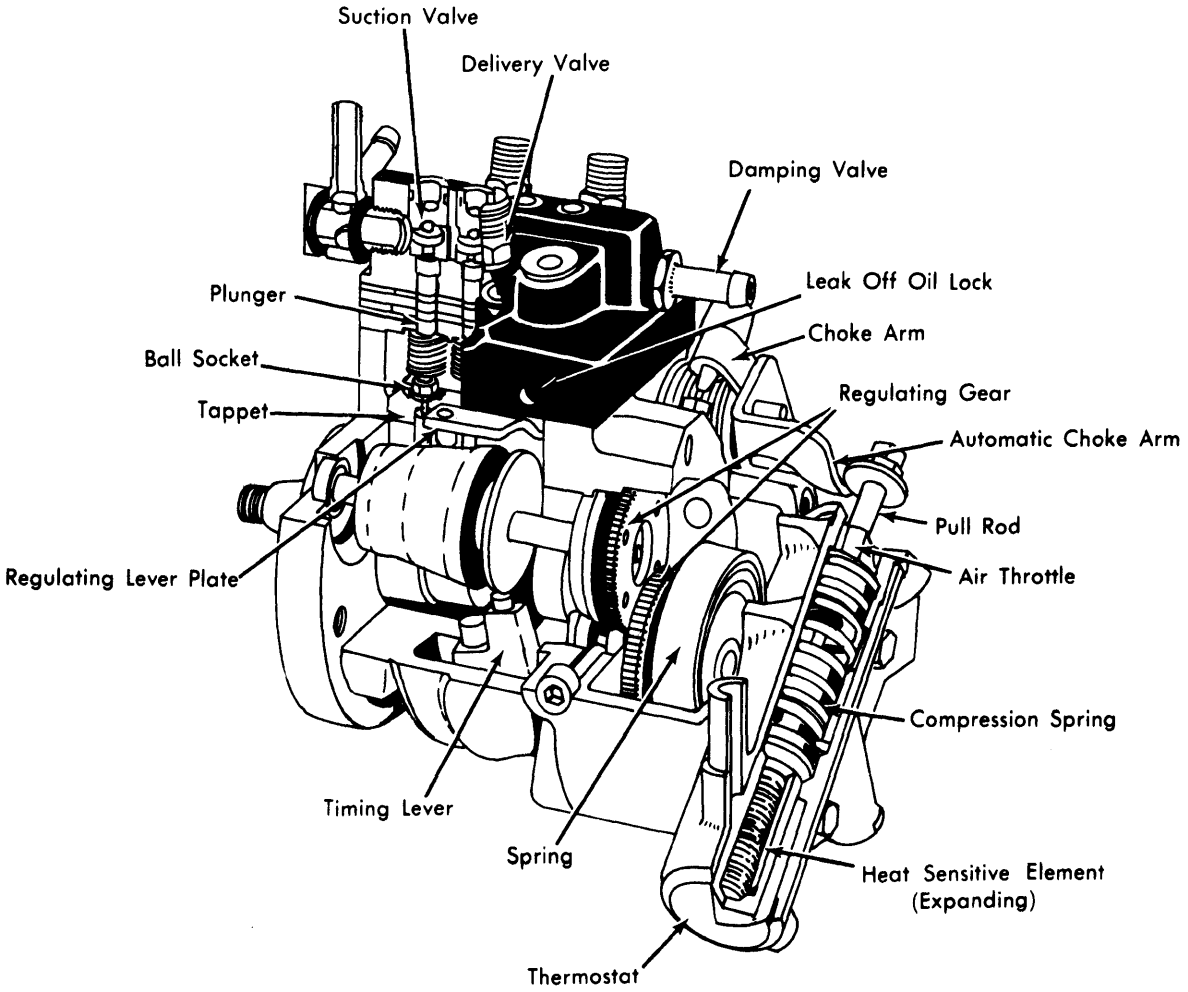
The injection pump is lubricated directly from the engine lubrication system. The oil lubricates the pump drive gear and blocks fuel leakage from the plungers. Excess oil is returned to the crankcase.

COLD STARTING DEVICE

A solenoid valve is used to inject the additional amounts of fuel required for cold starting. The valve is connected to the fuel supply system behind the fuel filter and opens when the starter motor is operated.

AUTOMATIC CHOKE

Control of additional fuel and air quantity during warm up of engine is by a heat sensitive expanding element which is warmed or cooled by engine coolant. As coolant temperature decreases, the injected fuel quantity increases; and as temperature increases, the fuel quantity decreases. The expanding element does this by changing the position of an eccentric shaft which acts on the control cam actuated rocker. The air supply is reduced accordingly with the aid of an air regulating cone.

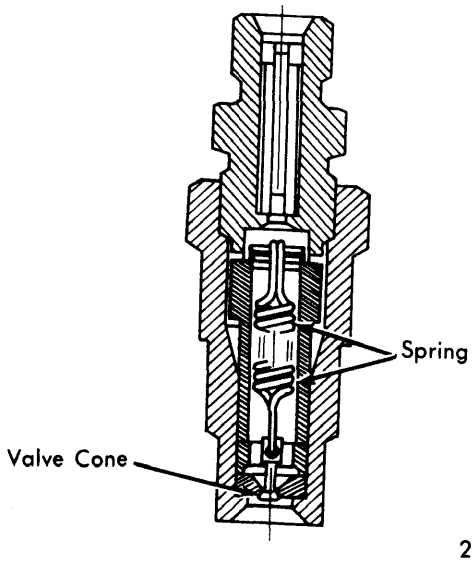


INJECTION PUMP

KUGELFISCHER FUEL INJECTION (Cont.)

CONE

Cone valve type which opens towards the combustion chamber. Valve cone is drawn into the valve seat by a double tension spring. The angle of the cone and the tension of the spring determine angle of spray and the opening pressure.

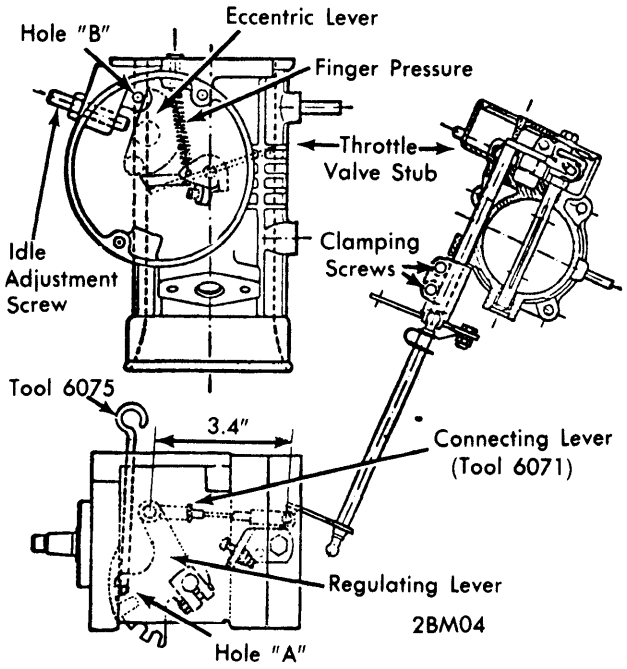


INJECTOR

ADJUSTMENT

LINKAGE BETWEEN PUMP AND THROTTLE VALVE

1) Remove air filter and cover. Back off adjustment screw until it does not touch eccentric lever and then loosen screw on clamp.



PUMP & THROTTLE VALVE LINKAGE ADJUSTMENT

2) Remove connecting rod and check or adjust with special tool gauge (Tool 6071) until connecting rod measures 3.34" (85 mm) from centerline of one connector to centerline of other connector. Reinstall connecting rod.

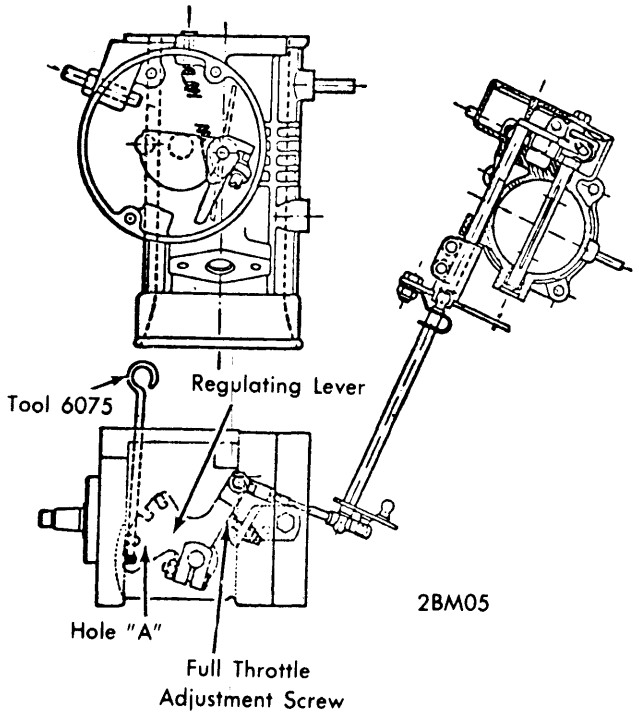
3) Insert a .20" (5 mm) diameter hook (Tool 6075) through cutout of pump regulating lever and into hole "A" of pump housing. Then insert .157" (4 mm) gauge (Tool 6070) in hole of "B" of housing.

4) With light pressure, press eccentric lever with its straight edge against the 4 mm pin. The idle adjusting screw should not touch eccentric lever. Press shaft of eccentric down and tighten screws on clamp.

5) Remove 5 mm hook (Tool 6075), press eccentric lightly against 4 mm pin. Now you should be able to insert 5 mm hook without tension into hole of pump regulating lever. If not, repeat adjustment.

FULL THROTTLE ADJUSTMENT

Loosen nut on full throttle adjustment screw and turn adjustment screw in. Align cutout at pump lever regulating lever at full throttle with 5 mm hook (Tool 6065). Turn full throttle adjustment screw out until it touches pump regulating lever, and lock with nut.



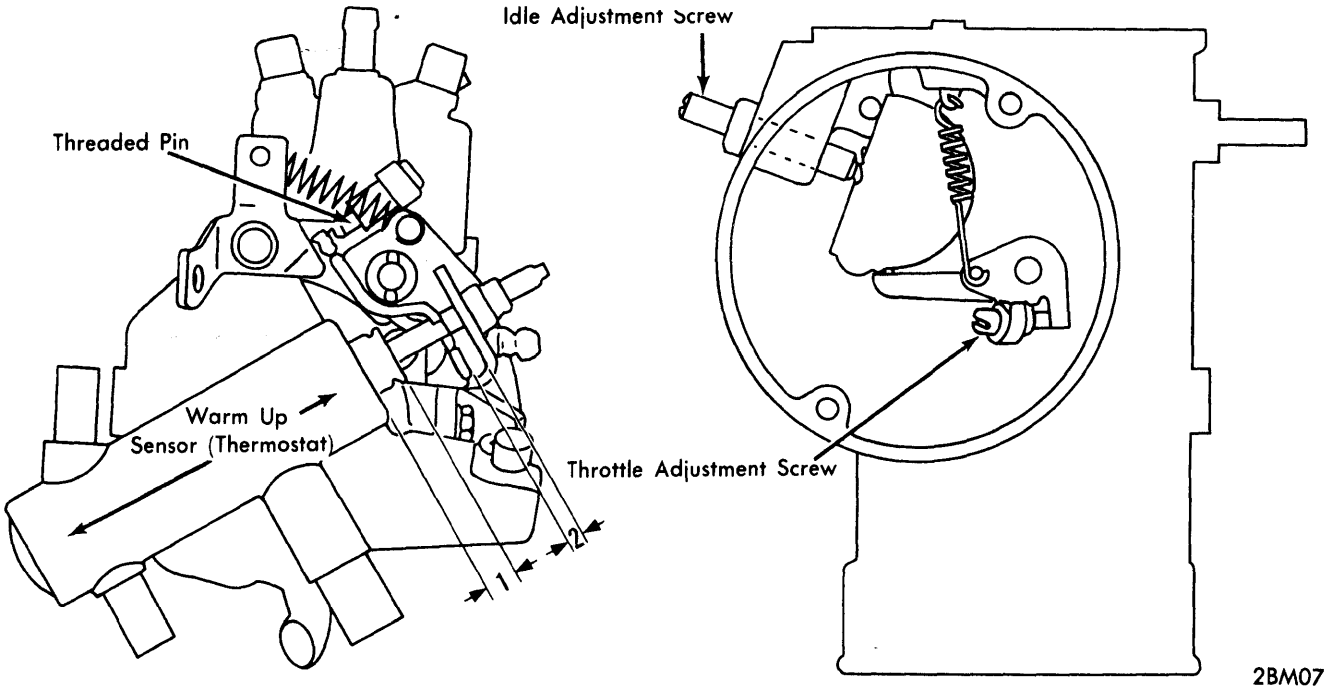
FULL THROTTLE ADJUSTMENT

IDLE ADJUSTMENT

1) With engine at normal operating temperature and making sure that clearance "1" in illustration is between .35-.39" (9-10 mm) and clearance "2" in illustration is .16" (4 mm), check that threaded pin on enrichment lever just touches stop screw.

2) Turn idle adjustment screw to adjust idle to 900±50 RPM. With throttle screw, adjust CO% at idle to 2-3%. Accelerate engine 1 or 2 times and check RPM. If RPM changed, readjust idle and CO%. Repeat until idle RPM and CO% are stable at specifications.

KUGELFISCHER FUEL INJECTION (Cont.)



(Rear Of Injection Pump) (Throttle Valve Stub)

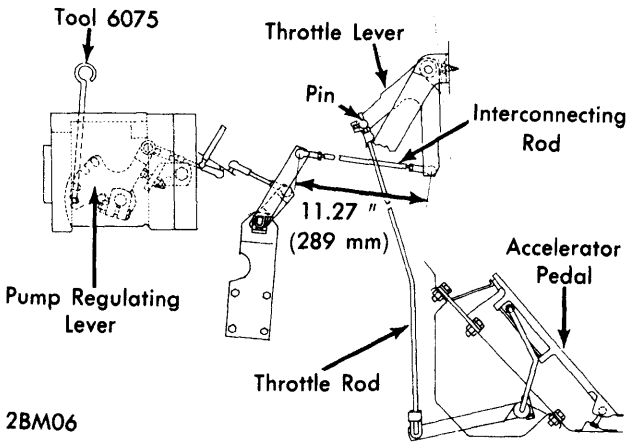
IDLE ADJUSTMENT

ACCELERATOR LINKAGE ADJUSTMENT

Remove pin from throttle lever on injection pump and adjust interconnecting rod to a length of 11.27" (289 mm) between centerlines. Insert .20" (5 mm) hook (Tool 6075) in pump regulating lever at full throttle position. Press aceelerator pedal to full throttle position and adjust pin on throttle rod until it lines up without tension with hole in throttle lever. Insert pin and install safety lock, remove hook (Tool 6076). Full throttle stop position should be reached by the accelerator pedal before full throttle is reached on injection pump to prevent stress on pump components.

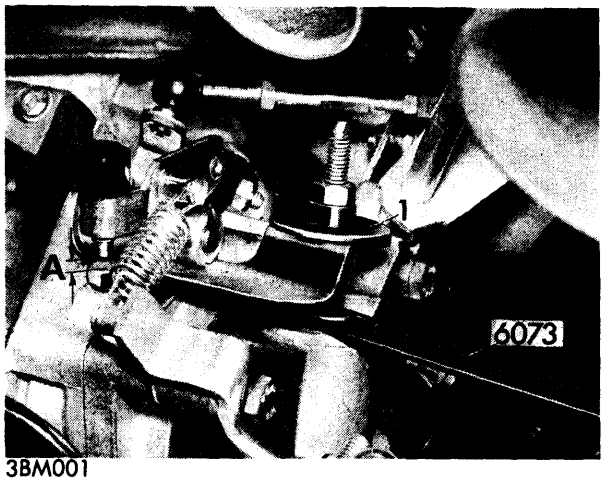
WARM-UP SENSOR ADJUSTMENT

1) *NOTE — Adjustment must be made when engine is cold.* Remove air cleaner housing. Press out the air regulating cone, using a screwdriver, until retaining plate (Tool 6073) may be inserted into groove in air regulating cone (see illustration). Distance marked "A" must be .102±.012" (2.6±.3 mm). Make adjustment for this measurement with plate nut "1". Adjust idle speed.



(Two Door & Touring)

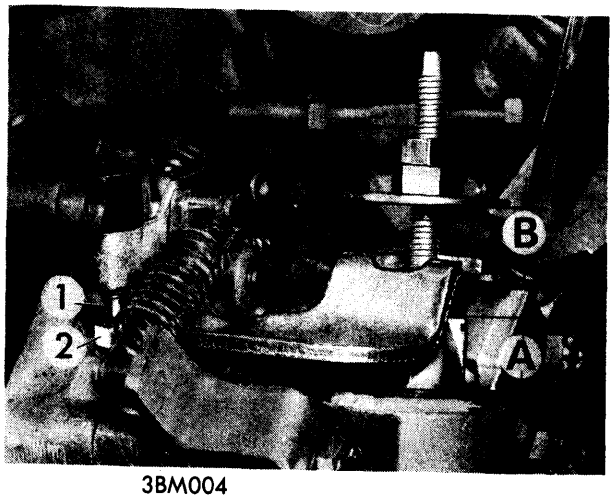
ACCELERATOR LINKAGE ADJUSTMENT



WARM-UP SENSOR ADJUSTMENT (ENGINE COLD)

KUGELFISCHER FUEL INJECTION (Cont.)

2) *NOTE — Next checking sequence is made with engine at normal operating temperature.* Air regulating cone must project ("A") by .035-.39" (9-10 mm). Distance "B" should be .157" (4 mm). Grub screw ("1") must be in full contact with stop screw ("2"). If these values are not reached, the thermo-element is defective and the warm-up sensor must be replaced. *CAUTION — Never loosen closure nut ("4") or the sensor sleeve will turn, causing air slot and outlet bore to misalign, resulting in lack of auxiliary air to engine during warm up.*



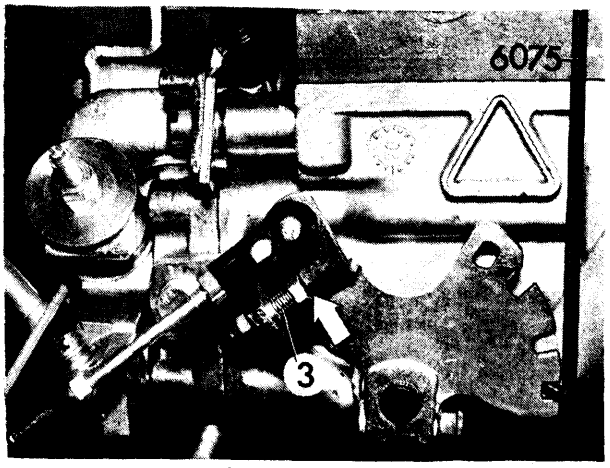
3BM004

SETTING REGULATING LEVER

SYNCHRONIZING THROTTLE VALVE WITH INJECTION PUMP

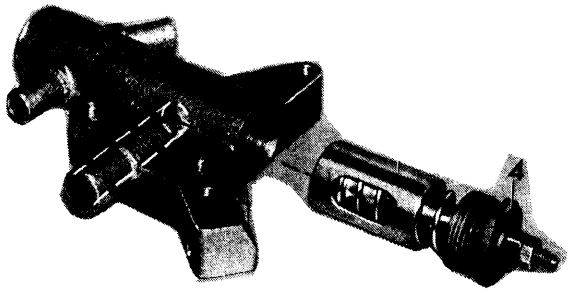
1) The basic setting is made by adjusting the connecting rod to 3.346" (85 mm). To synchronize, detach cover from throttle valve. Turn out adjusting screw in side of throttle valve until it is no longer in contact with the eccentric.

2) Loosen clamp screws on linkage below throttle valve. Using a suitable tool (pull hook 6075), secure regulating lever in bore in pump housing through upper slotted hole.



MAKING FULL LOAD SETTING 3BM005

3) Insert holding pin in bore in throttle valve housing, set eccentric against pin, push down on eccentric, and tighten clamp screws. Remove holding pin and pull hook. Synchronization is correct when eccentric partially overlaps bore in which holding pin was inserted. Readjust idle speed with screw on side of throttle valve housing to 850-950 RPM.

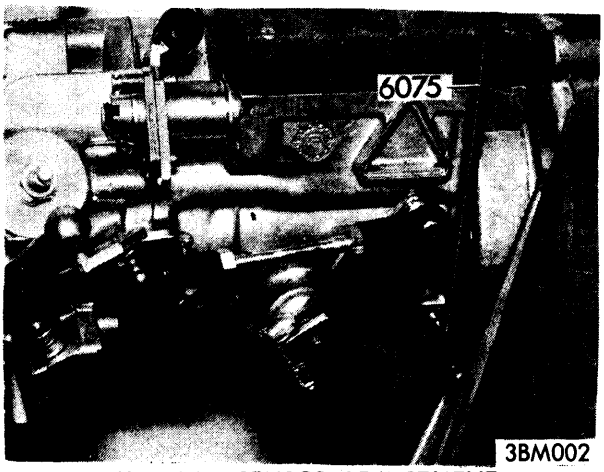


3BM003

WARM-UP SENSOR DISASSEMBLED

FULL LOAD SETTING

Detach induction (resonator) pipe from No. 1 cylinder. Secure regulating lever in lowest slotted hole in pump housing, using pull hook. Adjust stop screw until pump lever is just contacted.



3BM002

WARM-UP SENSOR ADJUSTMENT (ENGINE WARM)

REMOVAL & INSTALLATION

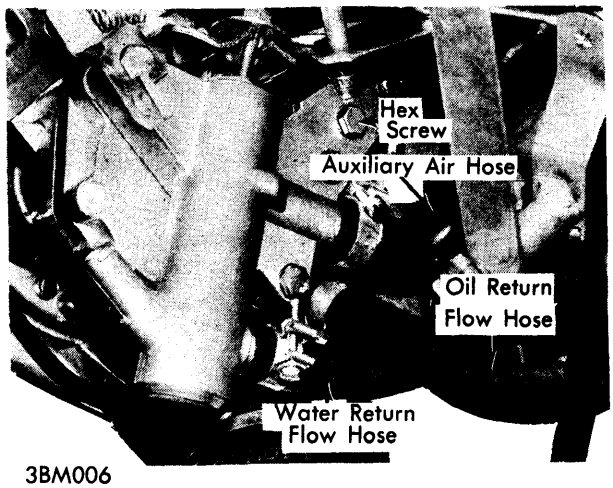
INJECTION PUMP

Removal — 1) Drain coolant. Remove air cleaner assembly. Detach all injection lines and fitting ring piece for fuel hoses. Note location of all gaskets, install dust caps on pressure valves when fittings are removed, and note sequence of valve connections.

2) Detach fuel reflow hose from rear of injection pump, oil feed line from fitting on side (near water hose) of pump, water inlet hose, and mounting for oil dipstick with eye for starter cable. *CAUTION — Keep clamp at fuel reflow inlet positioned vertically, otherwise protective cap may be blocked by enrichment lever.*

KUGELFISCHER FUEL INJECTION (Cont.)

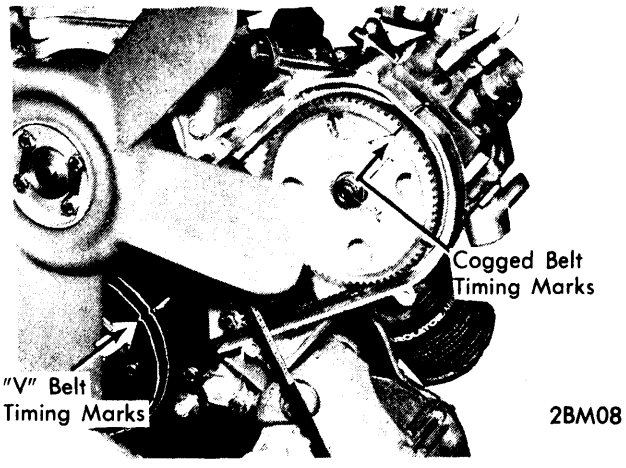
3) Detach water return flow hose, oil return flow hose, and hose for auxiliary air. Turn out hex screw near top of warm-up sensor (see illustration).



3BM006

HOSE REMOVAL

4) Detach connecting link from pump lever (above injection pump). Remove timing case front cover. Set No. 1 cylinder to TDC. Notch in "V" belt pulley must be in line with nose on lower section of timing cover, and notch in cogged belt pulley must be in line with notch in front of injection pump (see illustration). Slacken adjustment nut in cogged belt pulley.



2BM08

ALIGNING PULLEY MARKS

5) Pull off cogged pump drive pulley, using suitable puller (6078). Remove cogged belt. Note position of woodruff key in cone. Remove two injection pump retaining screws from inside of timing case.

6) Pull injection pump from timing case cover until the intermediate shaft can be lifted out of warm-up sensor housing. Withdraw injection pump.

INSTALLATION

To install, reverse procedure.

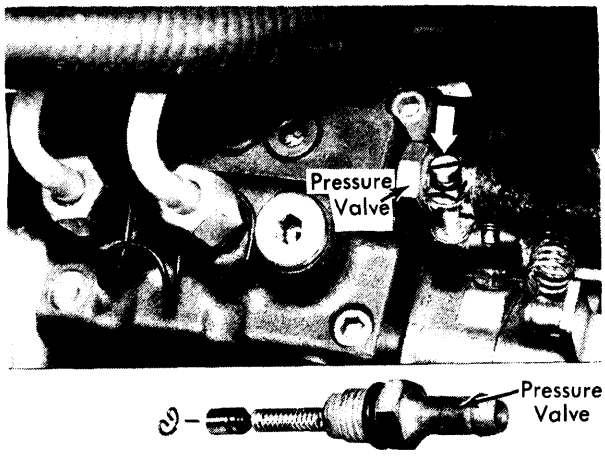
COGGED TIMING BELT

Removal – 1) Remove front air filter hood. Detach timing case front cover. Set No. 1 cylinder to TDC. Notch in "V" belt pulley must be in line with nose on lower section of timing case cover, and notch in cogged belt pulley must be in line with notch in front of injection pump (see illustration).

2) Loosen alternator. Remove "V" belt and detach pulley from hub. *CAUTION – Do not turn engine with pulley removed as it fits when offset by 180°; therefore, mark pulley location on hub.*

3) Slacken bolt at top of lower timing cover section (behind fan pulley). Unscrew all other retaining bolts from lower section of timing cover. Slip off cogged belt. Pull timing cover forward and pull cogged belt out between hub and cover.

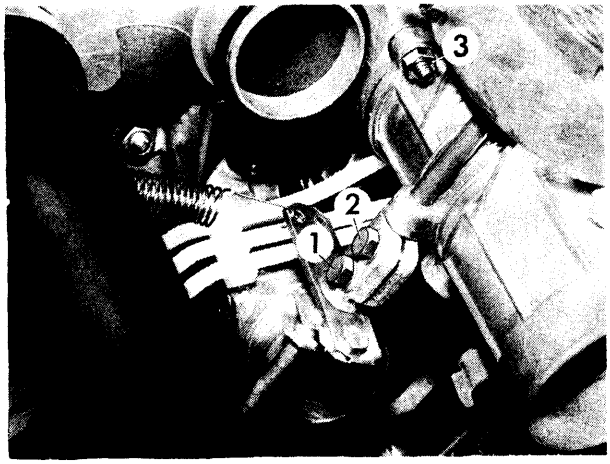
Installation – To install, reverse removal procedure.



PRESSURE MAINTENANCE VALVE 2BM09

THROTTLE VALVE STUB

Removal – Remove complete air cleaner assembly. Detach start valve (check and replace "O" ring on stem if necessary). Loosen clamp screws ("1" & "2") and slacken nut ("3"). Pull off vacuum hose from below throttle valve. Slacken bracket screws (forward of vacuum hose), and remove nuts retaining throttle valve housing to engine. Turn intermediate shaft clockwise and pull off throttle valve stub.



3BM007 **THROTTLE VALVE STUB REMOVAL**

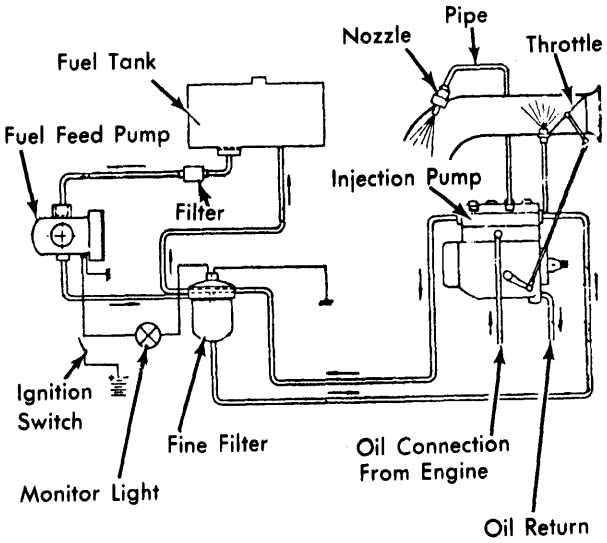
KUGELFISCHER FUEL INJECTION (Cont.)

Installation – To install, reverse removal procedure, noting the following: Replace throttle valve housing gasket. Synchronize throttle valve with injection pump (see Adjustments).

TROUBLESHOOTING

Engine Idle Speed Varies at Normal Operating Temperature – Idle mixture misadjusted. Centrifugal advance starts too early. Intake air pipe leaking. Injection pump out of adjustment. Throttle valve sticking.

Engine Does Not Run Smoothly Under Partial Load – Throttle butterfly sticking or misadjusted. Spherical shell for intermediate shaft in warm-up sensor loose or out of position. Connection rod between pump and intermediate shaft too long. Injection pump misadjusted.



2BM02

FUEL SYSTEM