

FUEL INJECTION SYSTEM - DIESEL

1986 Isuzu Trooper II

1986 Diesel Fuel Injection
ISUZU

P'UP, Trooper II

DESCRIPTION

The fuel injection system includes a combination injection pump and fuel distributor, 4 injection nozzles, and fuel filter assembly. The filter assembly contains a fuel filter, integral priming pump and water separator. The injectors use a needle type valve at each nozzle end.

The thermal glow plug system includes a controller, relays, thermo switch, dropping resistor, sensing resistor and glow plugs. Instrument cluster warning lights indicate when glow plugs are operating or fuel filter is filled with water.

OPERATION

FUEL INJECTION PUMP

The injection pump is located on the engine lower right side and driven by a toothed belt. The pump draws fuel from the tank, pressurizes it and sends a specific quantity to each cylinder at the proper time. Excess fuel is returned from the injectors and sent back to the tank.

A fast idle system is used when coolant is below a specified temperature. A vacuum unit actuates the throttle and increases idle speed. A fuel cut solenoid is actuated by the ignition switch and stops fuel flow at the pump so the engine can be shut down. The injection pump is also equipped with an altitude compensator for proper fuel delivery at high altitudes.

INJECTION NOZZLES

The injection nozzles spray fuel into a prechamber on each compression stroke. A fuel return line connects all injectors and returns excess fuel to the pump. If spray patterns are incorrect, nozzles can be overhauled. Injector opening pressures are adjustable. An adjustment screw is used in the injector nozzle.

FUEL FILTER & WATER WARNING SYSTEM

The diesel injection system uses an integral fuel filter and water separator. A water sensor is fitted into the bottom of a fuel filter cartridge and lights a warning lamp when water accumulates in the filter. The filter housing has a built in hand pump to prime the injection pump after filter replacement.

GLOW PLUGS

The glow plug system uses 4 glow plugs to assist in cold starting. When engine coolant is below 122°F (50°C), No. 1 relay supplies battery voltage to heat glow plugs quickly.

When glow plugs reach maximum temperature, relay No. 1 is turned off and relay No. 2 provides a lower voltage to maintain glow plug temperature. When engine starts, glow plug system is turned off. When engine coolant is above 122°F (50°C), only relay No. 2 is

operated. This operation provides easy starting but does not drain battery or overheat glow plugs.

TROUBLE SHOOTING

HARD STARTING

Check fuel delivery, injection pump timing and nozzle opening pressures. Check fuel cut solenoid and fuel restrictions. Check for air leaks.

ROUGH IDLE

Check for fuel contamination or sticking delivery valve in pump. Adjust idle speed, injection timing and nozzle opening pressure.

LACK OF POWER

Check for air cleaner or exhaust restriction. Check for fuel contamination or restriction. Adjust accelerator linkage and injection timing.

EXHAUST SMOKE

Check for air cleaner restrictions or contaminated fuel. Check injection timing and nozzle opening pressure.

GLOW PLUG INDICATOR INOPERATIVE

Check for burned out bulb, blown fuse or fusible link, or bad connections at controller. Check if controller or ignition switch is defective.

IMPROPER OPERATION OF GLOW PLUGS

Thermal sensor or glow plugs defective. Controller or relays inoperative. Ignition switch "R" circuit open or intermittent.

TESTING

INJECTION NOZZLES

Spray Pattern

Remove nozzles and mount on injection nozzle tester. Pump tester lever about 4-6 times a second to observe spray pattern. See Fig. 1. If spray is faulty, clean or replace injector.

Opening Pressure

1) Pump pressure up slowly to note opening pressure. Nozzle opening pressure is 1493 psi (105 kg/cm²) on non-turbo models and 1920 psi (135 kg/cm²) on turbo models.

2) Check injector nozzles for leakage by installing in tester and maintaining 284 psi (20 kg/cm²) pressure. If any leakage is evident, injector must be cleaned or replaced.

GLOW PLUG SYSTEM

Glow Plug Relays

There should be no continuity across terminals "C" and "D". With battery voltage applied to terminal "A", and terminal "B"

grounded, there should be continuity across terminals "C" and "D". If not, replace relay. See Fig. 2.

Dropping Resistor

Check for continuity across terminals of resistor. If there is no continuity, replace resistor. Resistor is located on right front fender near battery.

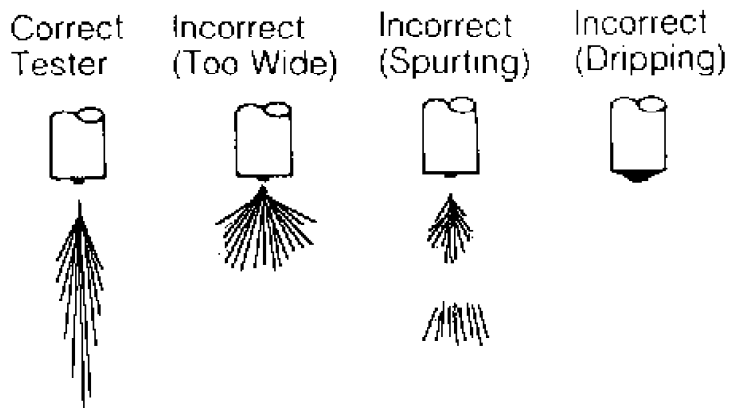
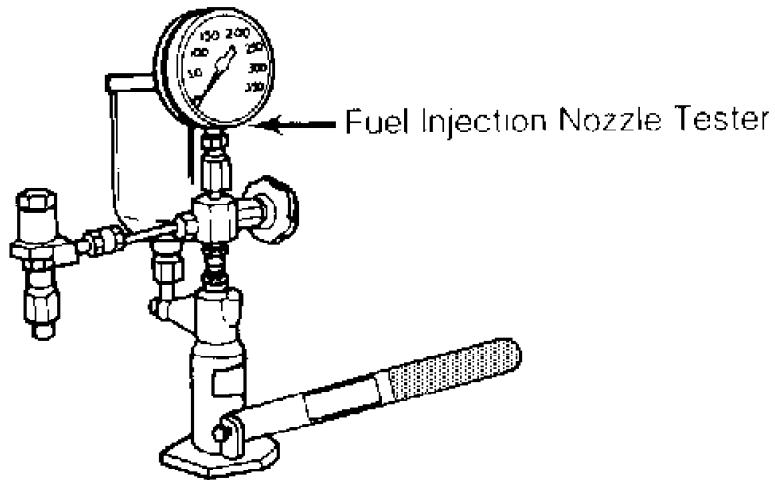


Fig. 1: Injection Nozzle Spray Patterns

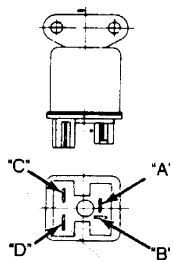
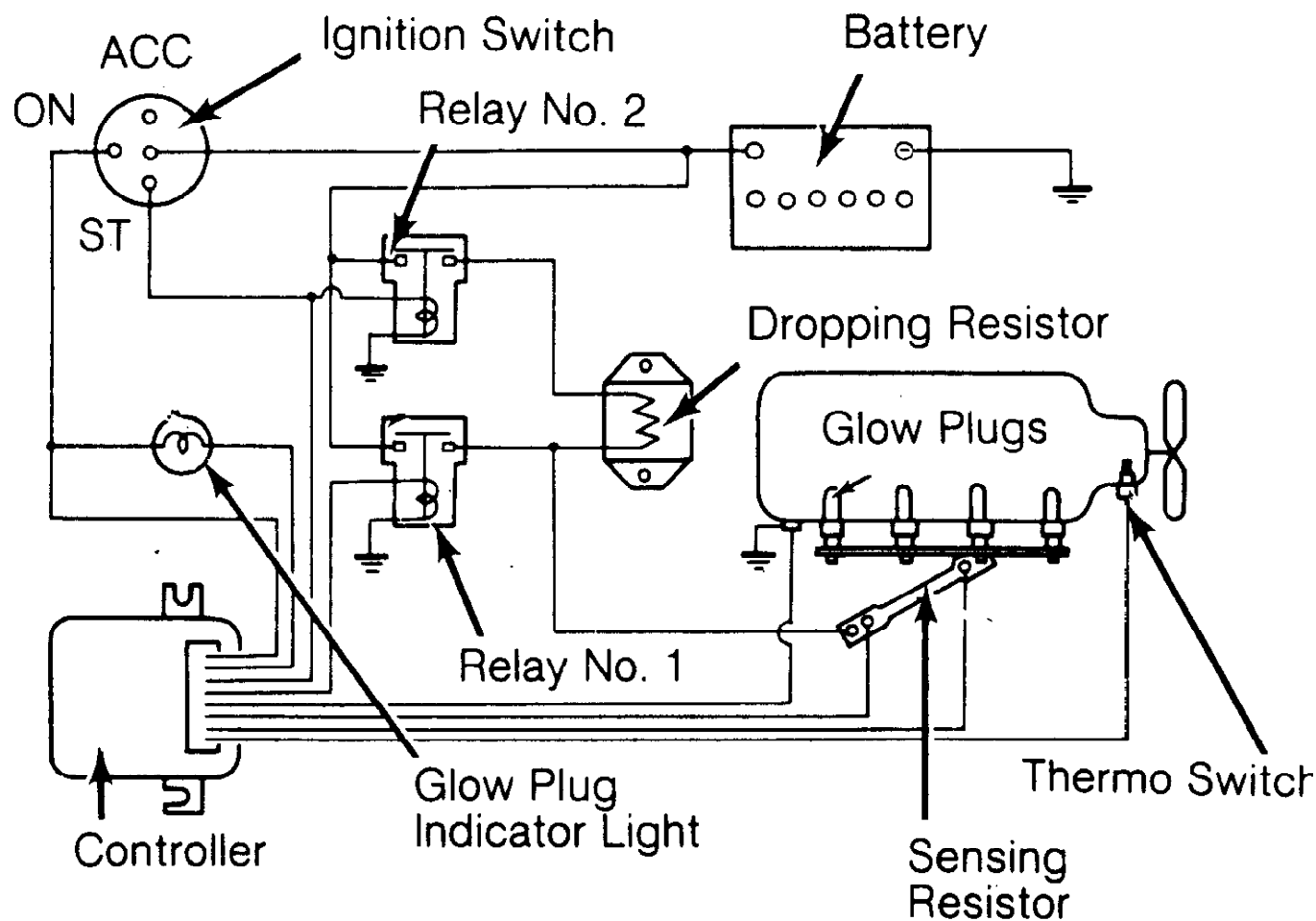


Fig. 2: Glow Plug Relay Testing



34638
Fig. 3: Glow Plug System Wiring Diagram

Glow Plugs

There should be continuity between plug end terminal and body. If not, replace glow plugs.

Thermo Switch

Continuity should exist when switch temperature is lower than 122°F (50°C). No continuity should exist when above 122°F (50°C). If switch does not operate properly, replace it.

REMOVAL & INSTALLATION

INJECTION PUMP & TIMING BELT

NOTE: When timing belt is loosened or removed, it must be replaced. Do not reinstall a used timing belt.

Removal

1) Remove battery. Remove panel under engine, drain cooling system, disconnect coolant hoses and remove fan and shroud.

2) Remove fan belts, A/C compressor and crankshaft pulley. Remove both timing belt covers. Remove tension spring (do not distort spring) and timing belt tension pulley. Remove timing belt.

3) Remove accelerator cable and wiring from injection pump. Remove fuel lines and injection pipes from pump. Install bolt (6 mm x 1.25 pitch) through injection pump pulley hole into pulley housing threaded hole. Remove pulley bolts. Use gear puller to remove injection pump pulley.

4) Check position of injection pump scribe line relative to mark on front bracket. Remove bolts and injection pump.

Installation

1) Install injection pump, aligning marks on flange and front bracket. Install injection pump pulley, using holding bolt to keep pulley from turning. Set No. 1 cylinder at TDC of compression stroke.

2) Align pulleys so marks are together. See Fig. 5. Install timing belt on crankshaft pulley, camshaft pulley and injection pump pulley in order. Position belt so slack is near idler pulley.

3) Install idler pulley, ensuring base is aligned against 2 pins on timing pulley housing. Hand-tighten pulley nut. Install spring and tighten nut to 22-36 ft. lbs. (30-49 N.m.). Turn crankshaft 2 revolutions, then 90° more beyond TDC.

CAUTION: Always turn engine in firing rotation. Do not rotate in reverse direction.

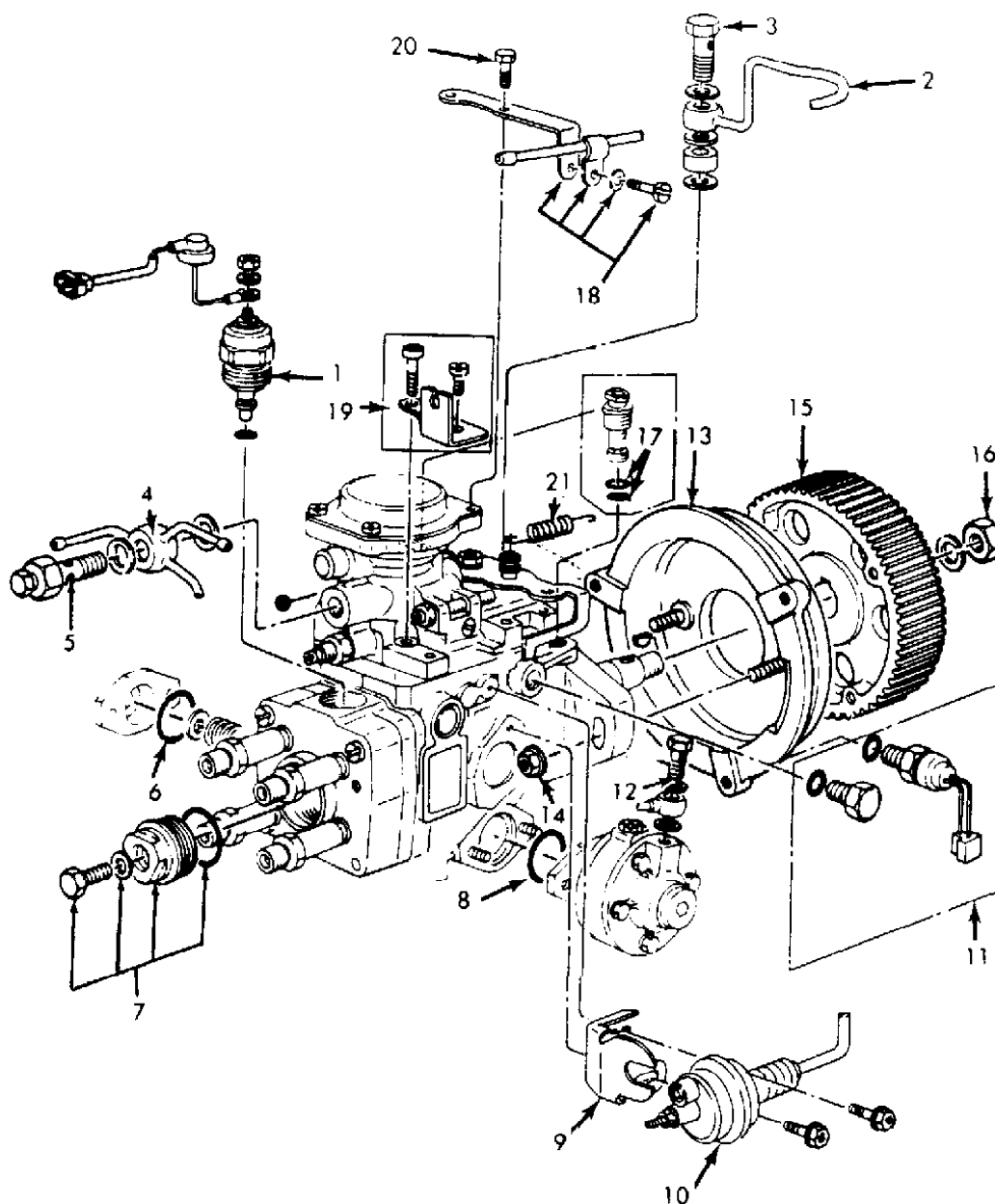
4) Loosen tension pulley nut so pulley can take up belt slack. Tighten pulley nut to specifications. Install injection pump pulley flange so flange hole aligns with camshaft pulley mark. Turn engine 3 revolutions and check that marks are still aligned when No. 1 cylinder is at TDC of compression stroke.

5) Belt tension between injection pump pulley and crankshaft pulley should be 33-55 lbs. (15-25 kg) when measured with tension gauge. To complete installation, reverse removal procedure. Adjust injection timing.

FUEL FILTER

Removal & Installation

1) Disconnect water sensor wiring at connector. Remove filter cartridge and pour out fuel. Remove water sensor. Install sensor on new filter cartridge.



- | | |
|---|-----------------------------------|
| 1. Fuel Cut Solenoid Valve Assembly | 12. Advancer Joint Bolt |
| 2. Fuel Pipe | 13. Front Bracket |
| 3. Fuel Pipe Joint Bolt | 14. Front Bracket Nut |
| 4. Overflow Pipe | 15. Timing Pulley |
| 5. Overflow Pipe Bolt | 16. Timing Pulley Nut |
| 6. Timer "O" Ring | 17. Regulating Valve "O" Ring |
| 7. High Pressure Plug Assembly | 18. Fuel Pipe Bracket Assembly |
| 8. CSD "O" Ring | 19. Actuator to Head Bracket |
| 9. Actuator Bracket | 20. Boost Compensator Cover Screw |
| 10. Fast Idle Actuator | 21. Lever Spring |
| 11. Tachometer Pick-Up or Plug and "O" Ring | |

36054

Fig. 4: Exploded View of Injection Pump Assembly

2) Lubricate gasket of new cartridge with fuel and install.
Start engine and check for leaks.

Draining Water

Place container under drain hose. Loosen drain plug about 5 turns. Operate priming pump about 10 times, or until all water is removed from filter. Tighten drain plug and operate pump several times until pressure builds up. Start engine and check for leaks. Ensure "FILTER" lamp on dashboard is off.

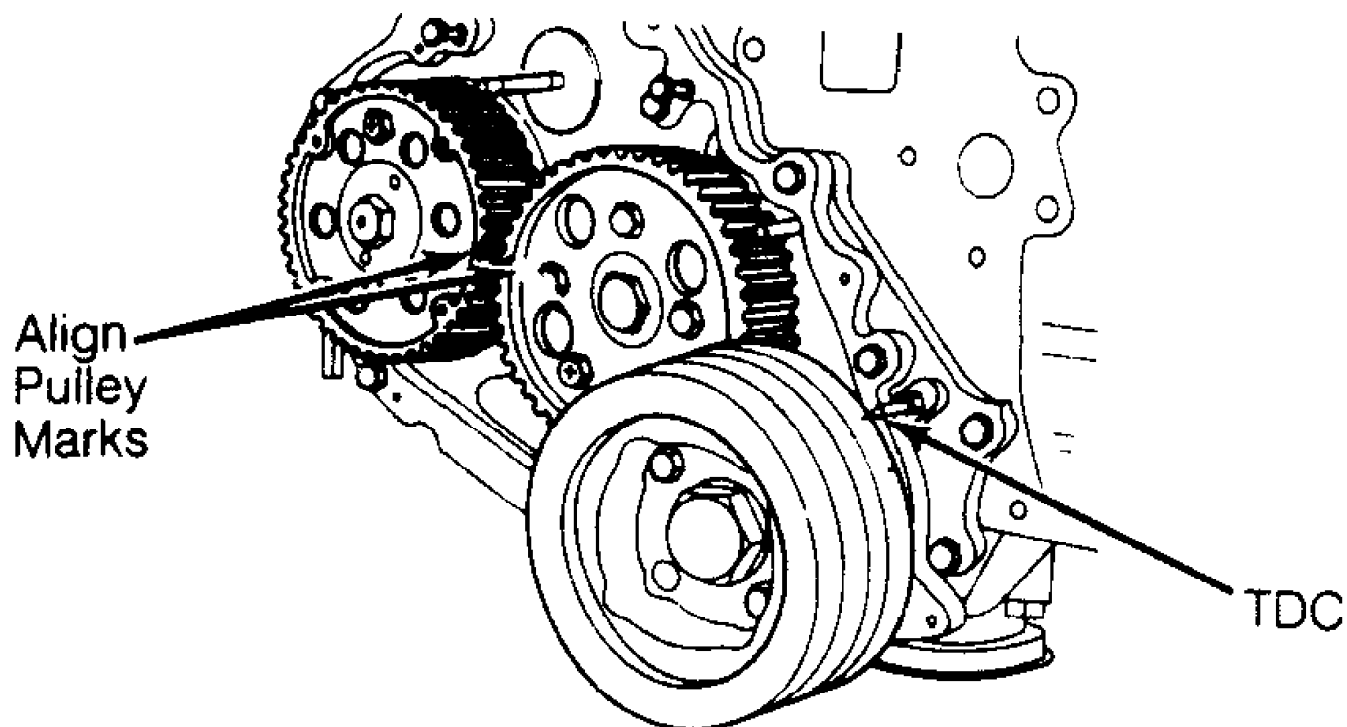
COMPONENT DISASSEMBLY & REASSEMBLY

INJECTOR NOZZLES

NOTE: Injector nozzles can be damaged quite easily and require care when handling.

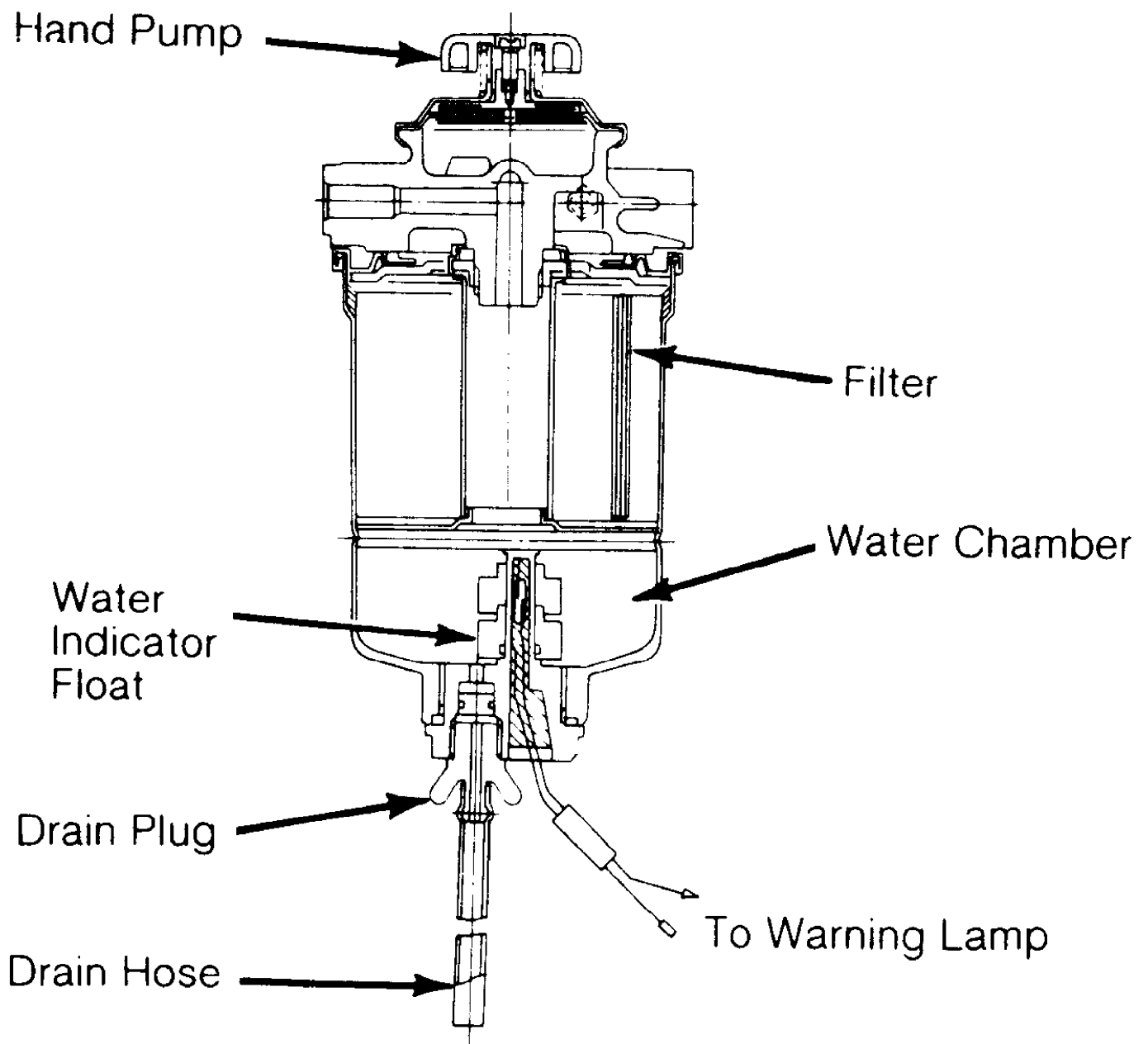
Disassembly

1) Begin by removing in sequence eye bolt, gasket, cap nut, gasket, adjusting screw, nozzle spring and push rod.



34970

Fig. 5: Timing Belt Pulley Alignment



34642

Fig. 6: Fuel Filter & Water Separator

2) Clamp the hexagonal portion of the nozzle body holder in a vise, loosen the retaining nut, and then remove it. Next remove the nozzle setting screw and the nozzle holder. See Fig. 7.

Cleaning

1) Having drawn out the needle valve from the nozzle body, remove carbon from the nozzle body outside with a brush. Clean all but the lapped surface, especially around the injection hole.

2) Clean the interior cavity of the nozzle body with Brass Bar (J-28826-2). Clean the nozzle seat portion of the nozzle body

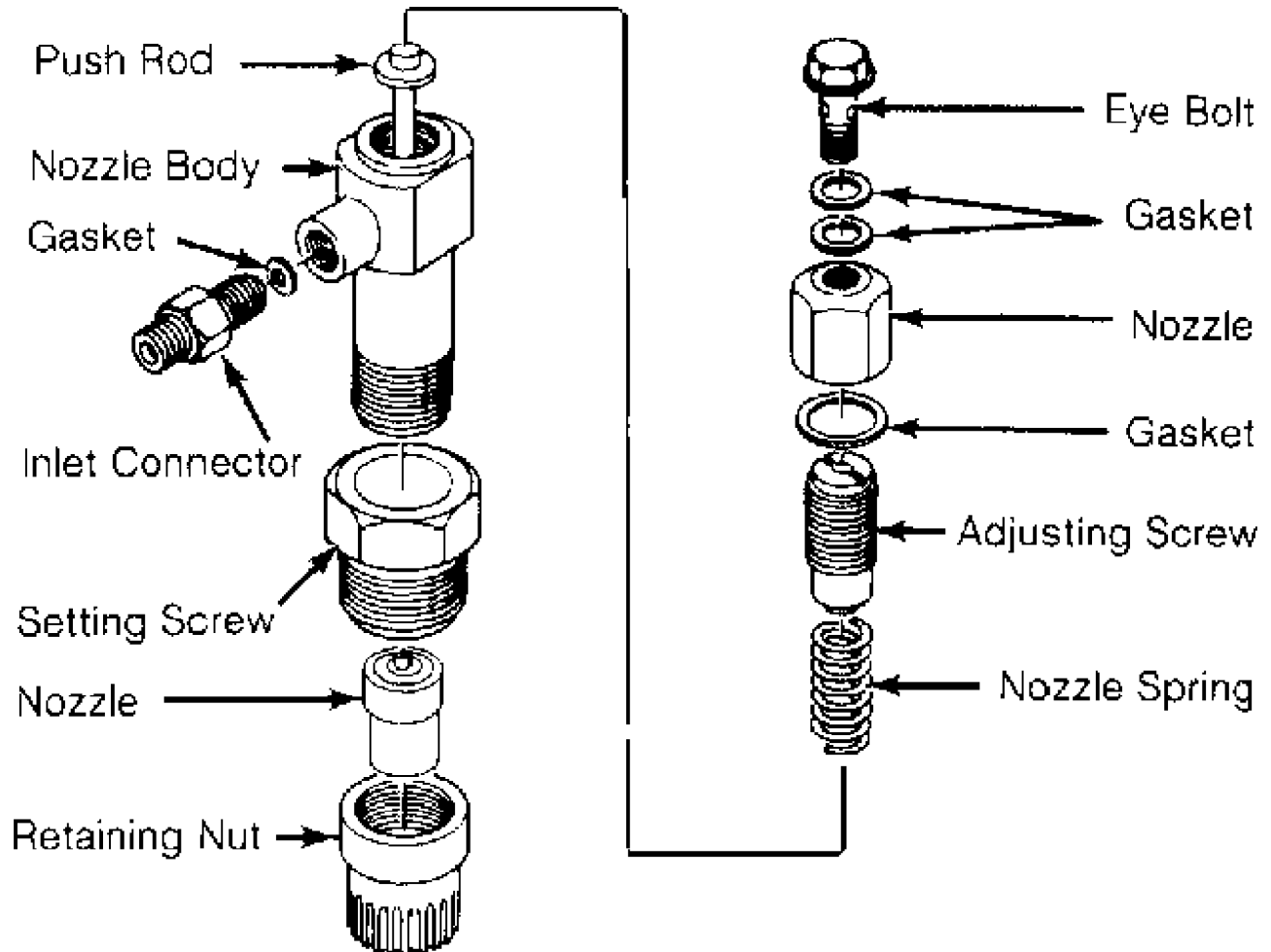
with a Cleaning Nozzle (J-28826-3).

3) To clean injection hole of nozzle body, couple a Brass Bar (J-28826-4) with another Brass Bar (J-28826-5) together. Use this for cleaning the needle sliding portion. Use a Cleaning Bar (J-28826-6) made of beech wood to remove carbon from the end of the needle.

Reassembly

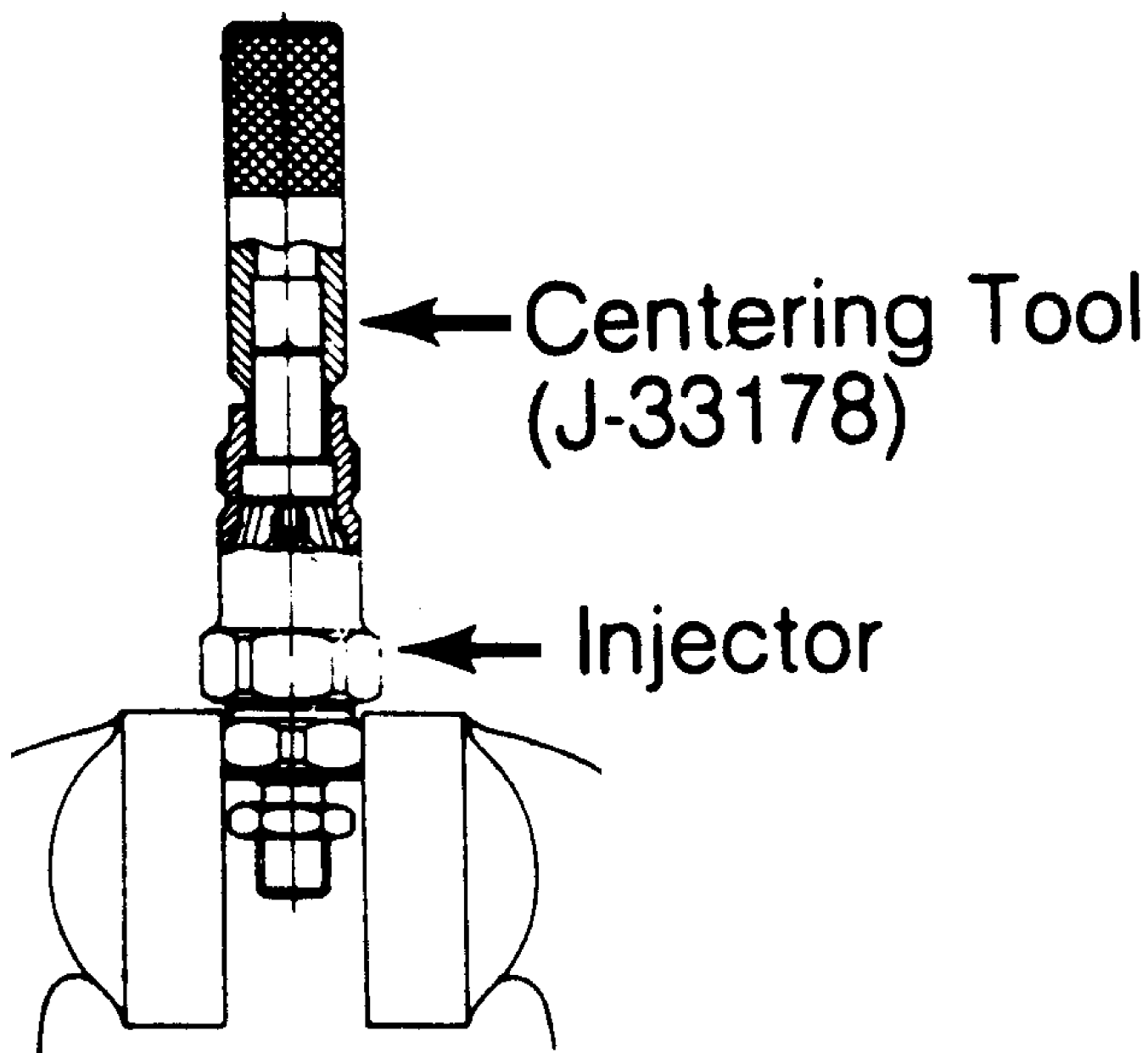
NOTE: Thoroughly clean all the disassembled parts with light clean oil. The needle must slide smoothly in the nozzle body. When the nozzle body is held vertically, and the needle is drawn out about 1/3 of the way and then released, it should fall down to the seat with its own weight.

To reassemble reverse disassembly procedures except when tightening the retaining nut. Tighten the retaining nut to 65 ft. lbs. (88 N.m). Then finish reassembly.



34634

Fig. 7: Exploded View of Injection Nozzle



34633

Fig. 8: Centering Injector Nozzle

ADJUSTMENTS

INJECTOR OPENING PRESSURE

Install injection nozzle and nozzle holder assembly to nozzle tester. Adjust the nozzle opening pressure by turning the pressure adjusting screw until the desired pressure of 1493 psi (105 kg/cm²) is obtained. Tighten the cap nut to 22-29 ft. lbs (30-39 N.m).

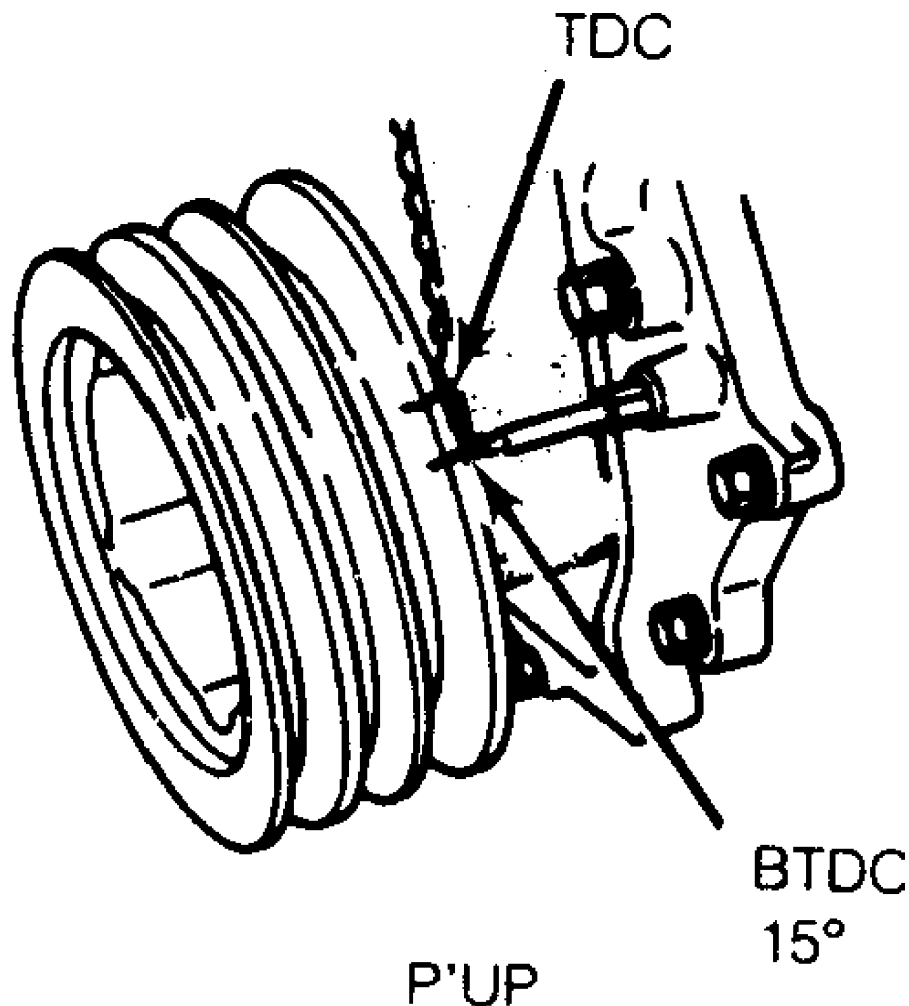
INJECTION PUMP TIMING

1) Check that notch in pump flange is in line with notched line on front plate. Set No. 1 cylinder at TDC of compression stroke. Remove injection pump pulley cover (right half of timing belt cover) to ensure timing marks are aligned. See Fig. 5.

2) Disconnect injection pipe from pump (using back-up wrench) and remove distributor head screw. Install Timing Gauge Tool (J-29763 or J-28827) and set lift approximately .04" (1 mm) from plunger.

3) Turn engine until No. 1 cylinder is 45-60° BTDC. Calibrate dial indicator to zero. Turn crankshaft pulley slightly in both directions and make sure zero reading does not change.

4) Turn crankshaft in normal direction of rotation until timing mark (15° BTDC on Federal P'UP, 13° BTDC on Trooper II) on crankshaft pulley is in line with indicator. See Fig. 9. Dial indicator should show .020" (0.5 mm). If not, loosen pump bolts and rotate pump slightly to obtain proper timing.



34646

Fig. 9: P'UP Timing Mark Identification

IDLE SPEED ADJUSTMENT

1) Set parking brake and block drive wheels. Place

transmission in Neutral. Start engine and bring engine coolant to above 176°F (80°C).

2) The air conditioning should be "OFF".

Using Engine Tachometer (J-28885) check engine idle RPM. The idle adjust screw must be in contact with accelerator lever. Adjust screw to obtain proper setting.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Injection Pump Pulley Nut	42-52 (57-71)
Injection Nozzles	51-58 (69-79)