TOYOTA DIESEL FUEL INJECTION – PICKUP

Pickup

DESCRIPTION

The diesel injection system includes a fuel injection pump, injection nozzles, fuel filter, fuel sediment and water separator/warning device, fuel lines and glow plug system. The glow plug system has a pre-heating timer (behind left kick panel), 2 glow plug relays (one on each fenderwell), a current sensor, register resistor and water temperature sensor.

OPERATION

FUEL INJECTION PUMP

The injection pump is driven by a belt at the front of the engine. If draws fuel from the tank, pressurizes it, and injects a specific quantity to each cylinder at the proper time. Excess fuel is returned to the tank through another line. The injection pump is not serviceable and should not be disassembled.

NOTE – *Air conditioned vehicles have a vacuum unit that increases idle speed when the air conditioning is on.*

INJECTION NOZZLES

The injection nozzles spray fuel into a prechamber as each compression stroke occurs. Each nozzle has a fuel supply and return line. Nozzles can be disassembled, cleaned and adjusted to correct defective spray patterns. Shims are used to correct nozzle opening pressures, and are available in 20 sizes from .039-.076" (1.0-1.95 mm) in increments of .002" (.05 mm). Changing one size nozzle shim will change injection pressure by 71 psi (5 kg/cm²).

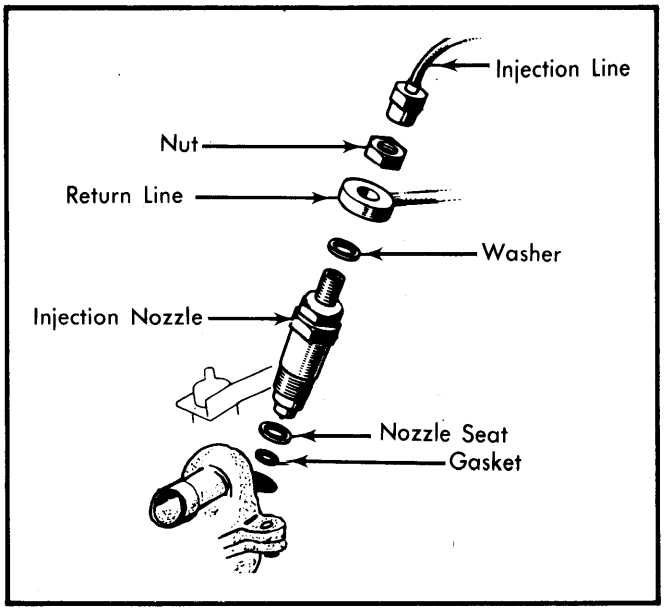

Fig. 2 Fuel Injection Nozzle Installation

FUEL FILTER

The fuel filter is a sealed cartridge type, located on the firewall. The cartridge should be changed at regular intervals and when replaced, should be installed by hand, never with a wrench.

WATER-IN-FUEL WARNING SYSTEM

The fuel injection system includes a water and sediment filter in addition to the sealed cartridge filter. This unit traps water which may be present in the fuel system and holds it,

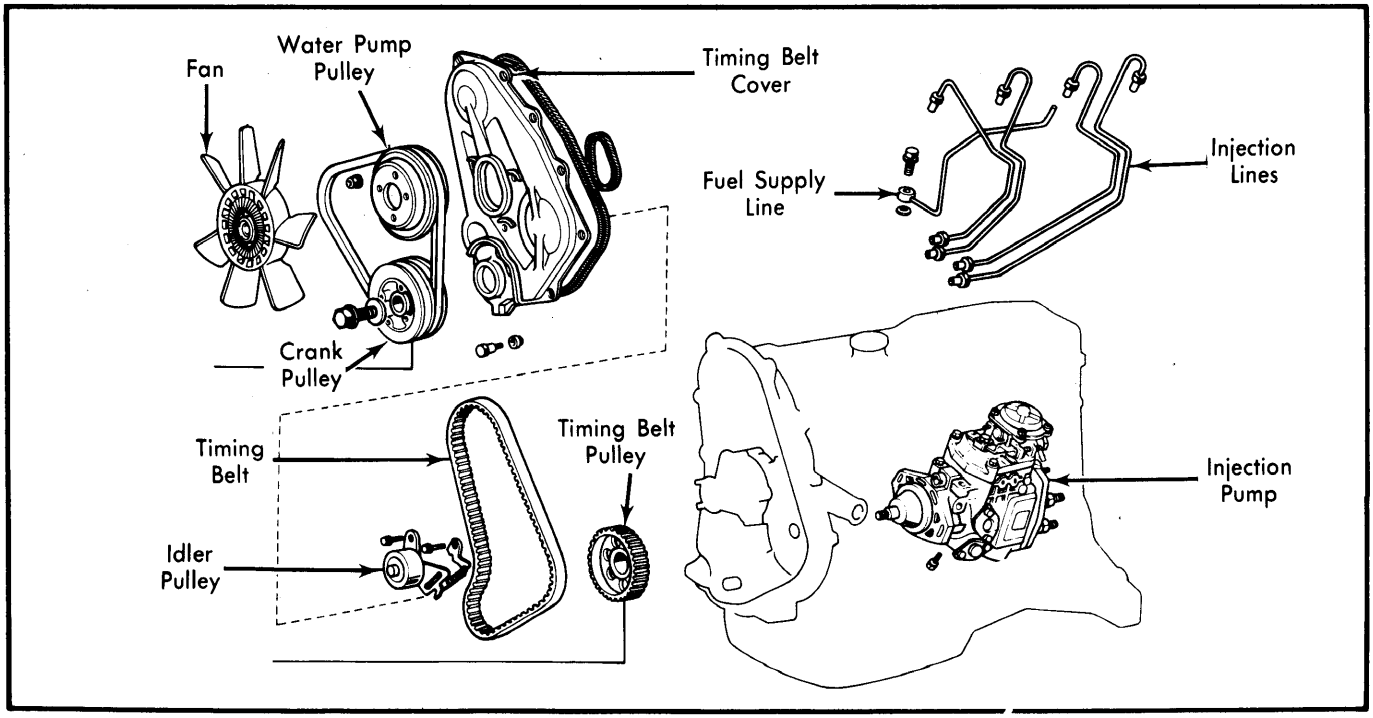

Fig. 1 Toyota Diesel Fuel Injection Components

TOYOTA DIESEL FUEL INJECTION – PICKUP (Cont.)

preventing damage to the injection pump. A warning light and buzzer signal when the water level is high enough to require draining. A float is lifted by the water level, causing a magnetic switch to close and provide continuity to the warning light and buzzer circuit. A small hand pump is provided so the water separator and filter can be purged of air.

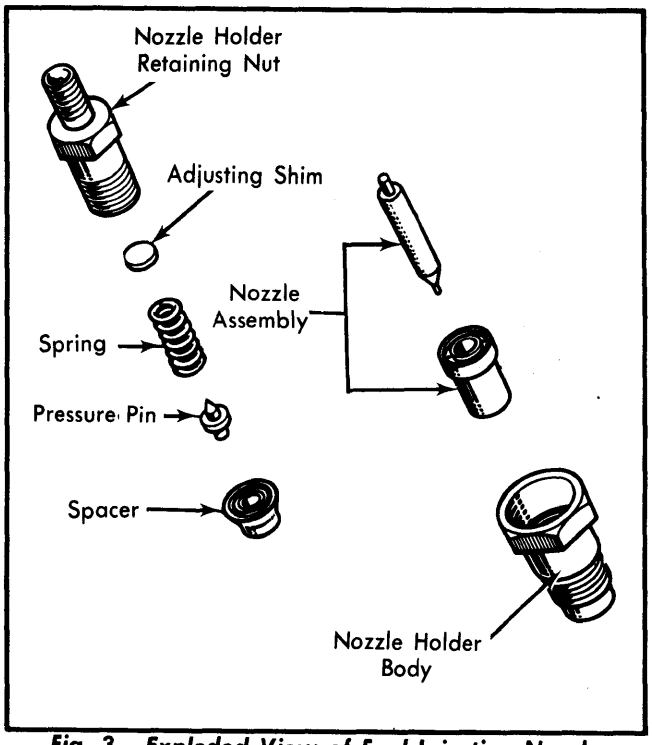

Fig. 3 Exploded View of Fuel Injection Nozzle

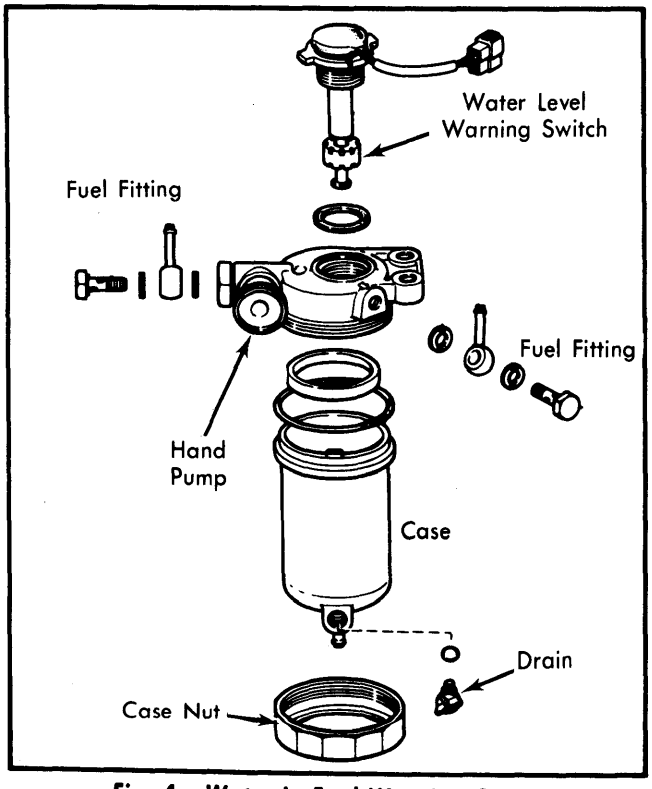

Fig. 4 Water-In-Fuel Warning System

GLOW PLUGS

The glow plug system uses a pre-heating timer and 2 relays to control glow plug current. The glow plugs enable the engine to start easily in cold weather and run smoothly during warm-up. Current is applied to the glow plugs for a specific time which is determined by engine coolant temperature. When the ignition is turned on, a glow plug light operates for 4.5 seconds if coolant is below 104° F (40° C), or .5 second if coolant is above 104° F (40° C).

TIMING BELT WARNING SYSTEM

The timing belt which drives the injection pump must be replaced at 50,000 mile intervals. To ensure maintenance is done at the proper time, the vehicle is equipped with a maintenance warning system. An instrument panel lamp is controlled by a speedometer switch and lights when maintenance is due. After the timing belt is replaced, the lamp is turned off by depressing a reset button (behind grommet in speedometer bezel).

TROUBLE SHOOTING

NO FUEL AT NOZZLES

Check fuel cut solenoid. Inspect fuel lines, drain water and replace filter. Bleed fuel system. Replace injection pump.

ROUGH IDLE

Adjust accelerator cable. Adjust idle speed. Check for fuel or air leaks. Correct injection pump timing. Check injection nozzle opening pressures and adjust or clean nozzles.

LACK OF POWER

Adjust accelerator cable and stop screw. Adjust maximum RPM speed. Check fuel return line fitting on injection pump — it must be marked "OUT". Check fuel filter and injection pump timing.

EXCESSIVE SMOKE

Black smoke indicates advanced timing, white smoke indicates retarded injection timing. Clogged fuel filter or nozzles.

EXCESSIVE FUEL CONSUMPTION

Fuel leakage. Check idle and maximum speed adjustments. Adjust injection timing. Check injection nozzle operation.

ENGINE NOISE WHEN WARM

Coolant temperature too low, check thermostat. Adjust injection timing and nozzle opening pressure.

ENGINE WILL NOT STOP

Disconnect fuel cut solenoid connector. Check for foreign material in fuel cut solenoid or faulty ignition switch.

TOYOTA DIESEL FUEL INJECTION – PICKUP (Cont.)

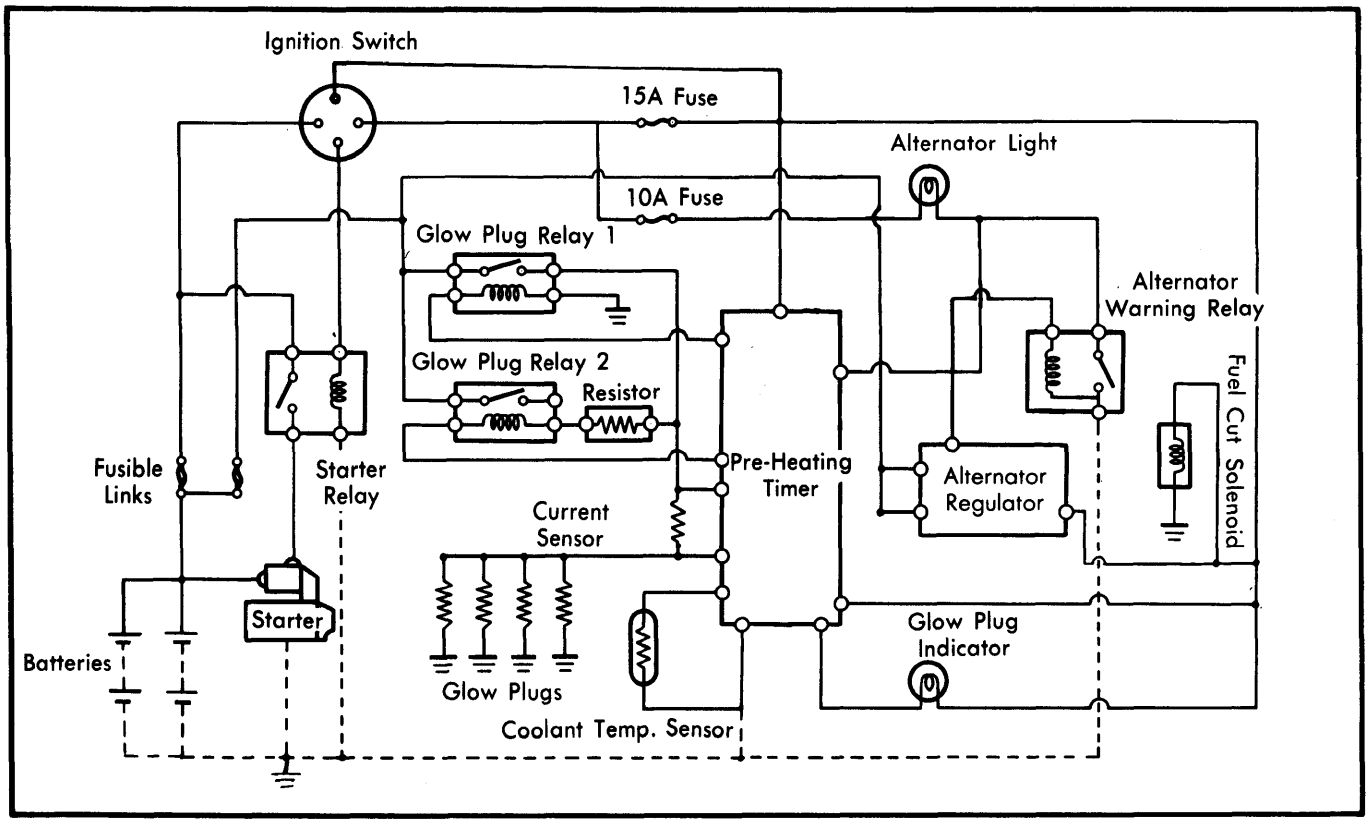

Fig. 5 Glow Plug System Wiring Diagram

TESTING

INJECTION NOZZLES

Opening Pressure – 1) Blow out any dirt around injection nozzles, then remove fuel lines and nozzles. Mark nozzles for correct installation.

2) Install nozzle on pressure tester. Bleed air out, then pump as hard as possible several times to clean out nozzle. Pump up pressure slowly and note when nozzle opens.

3) If pressure is not within 1495-1780 psi (105-125 kg/cm²), disassemble and clean nozzle. Change shims as necessary to obtain opening pressure of 1635-1780 psi (115-125 kg/cm²).

NOTE – *Shims are available in 20 thicknesses in increments of .002" (.05 mm). One size change will adjust pressure 71 psi (5 kg/cm²).*

4) Test nozzle again to ensure opening pressure is correct, then check for leakage.

Leakage Test – Pump pressure slowly until about 142-284 psi (10-20 kg/cm²) BELOW nozzle opening pressure. Hold pressure for at least 10 seconds; no dripping should occur. If nozzle drips, disassemble and clean, or replace. Check spray pattern.

Spray Pattern – Increase pumping speed to between 15 and 60 times per minute. At certain speeds, nozzle should "shudder" when spraying. Check spray pattern at this speed. If pattern is not correct, clean or replace nozzle. See *Fig. 6*.

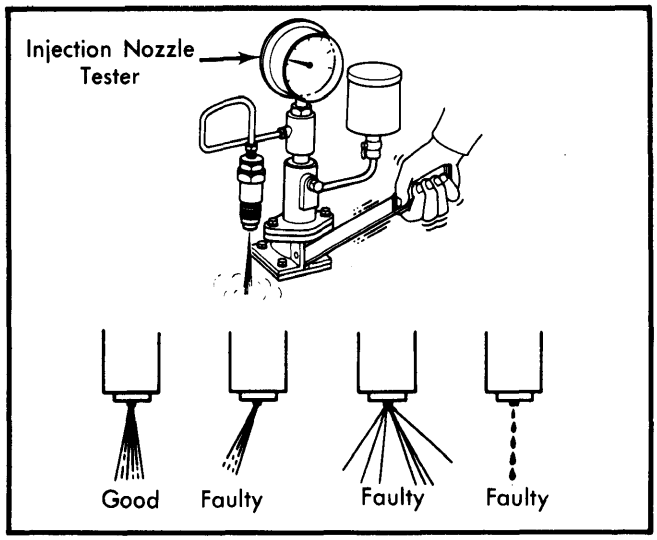

Fig. 6 Injection Nozzle Spray Patterns

Nozzle Cleaning – 1) Disassemble nozzle holder. Wash parts in clean diesel fuel, using a wooden stick and soft brass brush to remove deposits. DO NOT touch nozzle tip with fingers.

2) Inspect nozzle seat and needle tip for damage or corrosion. Replace if either is found.

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3) Hold nozzle body at about 60° to vertical and insert needle. Pull needle up about one-third its length and allow to slide back down. Repeat several times, rotating needle between test. If needle does not slide down smoothly, replace nozzle.

NOTE – *Injection nozzle seat gasket must be installed with concave side up when nozzle is replaced in head.*

GLOW PLUG SYSTEM

Indicator Lamp – 1) Indicator lamp should light for 4.5 seconds when coolant is below 104° F (40° C) and for .5 second when coolant is above this temperature. If not, check 15A fuse and indicator bulb. Repair or replace as necessary.

2) If fuse and bulb are okay, check for battery voltage at terminal 7 (Black/White wire) of pre-heating timer. If voltage is not present, repair wiring. If present, replace pre-heating timer.

System Check – 1) Check for battery voltage at terminal 2 (Green/White wire) of pre-heating timer with ignition on. If no voltage is present, check for 1 volt at terminal 3 (Brown) and terminal 9 (White). If not present, replace current sensor. If voltage is present, replace pre-heating timer.

2) Check that voltage at terminal 2 (Green/White) is no longer present after engine starts. If voltage is still present, disconnect alternator warning relay and retest. If okay with relay disconnected, repair charging system. If not, replace pre-heating timer.

3) Turn ignition off and stop engine. Turn ignition on again and check that current flow to terminal 8 (Green/Red) at timer is present according to temperature chart. See *Fig. 7*.

4) If no voltage is present, replace timer. If voltage is present for wrong time, disconnect temperature sensor. Voltage should be present for 150 seconds, or 7 seconds with sensor lead grounded. If voltage is present as described, replace water temperature sensor. If time is still incorrect, replace timer.

5) If voltage was present for correct period of time, check for voltage at terminal 8 (Green/Red) with ignition at "START" position. If no voltage, replace timer. If voltage is present, turn ignition off.

6) Turn ignition on again. Check for voltage at glow plugs a few seconds later. If no voltage, check for battery voltage at positive side of current sensor (above No. 3 cylinder). If present, replace sensor. If not, replace No. 1 glow plug relay.

7) Voltage at glow plugs should drop from 12 to 6 volts after a few seconds of operation. If not, check for battery voltage at positive side of ballast resistor (below intake manifold). If present, replace resistor. If not, replace No. 2 glow plug relay.

8) If all voltage measurements are correct, measure glow plug resistance. Resistance should be close to zero. If infinity, replace glow plug.

FUEL CUT SOLENOID

Solenoid Check – 1) Turn ignition on. Repeatdly connect and disconnect wire at fuel cut solenoid. If a clicking noise is heard, solenoid is okay.

2) If no noise is heard, check 15A fuse. If blown, repair short and replace fuse. If fuse is good, apply battery voltage to solenoid and check for noise.

3) If no clicking sound, replace solenoid. If sound is heard, check wiring harness and ignition switch.

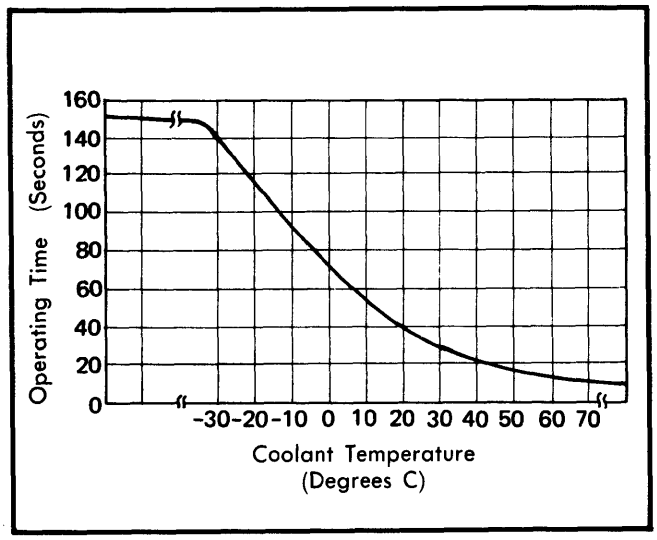

Fig. 7 Pre-heating Time/Temperature Chart

REMOVAL & INSTALLATION

INJECTION PUMP & TIMING BELT

Removal – 1) Drain coolant and disconnect battery ground cable. Remove radiator, shroud and hoses. Remove drive belts, fan and water pump pulley. If equipped with air conditioning, remove compressor and bracket without disconnecting hoses.

2) Pull off crankshaft pulley, then remove timing belt cover and guide. Turn engine to align timing belt pulleys at each position. See *Fig. 8*.

3) Remove tension spring from idler pulley, loosen pulley bolts and remove timing belt. Use puller to remove injection pump pulley.

NOTE – *Pulley will spring off so use care to prevent damage.*

4) Check scribe marks on pump and engine to ensure correct alignment during installation. Remove injection lines, then fuel feed and return lines. Disconnect fuel cut solenoid wire and vacuum hose (if present), then remove mounting bolts and injection pump.

Installation – 1) Install injection pump and connect fuel lines, wiring and vacuum hose (if equipped). Leave mounting bolts loose. Install injection pump pulley.

2) Align pulleys with marks, but place injection pump pulley mark one tooth clockwise from alignment mark. Install timing belt to camshaft gear, then injection pump gear.

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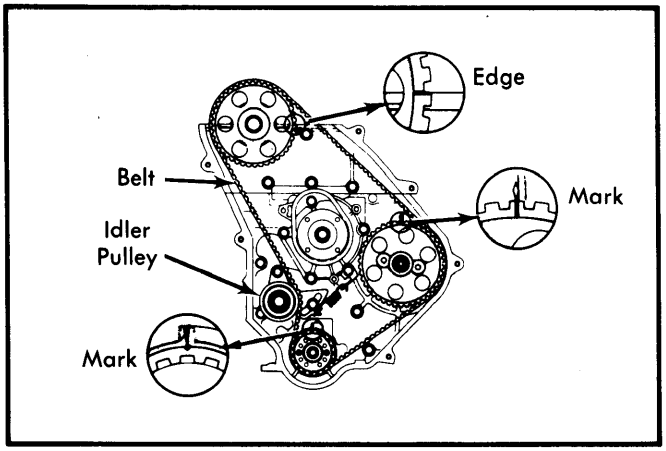

Fig. 8 Injection Pump Pulley Alignment

3) Install timing belt on crankshaft gear. Loosen idler pulley bolts and install spring. Temporarily install crankshaft pulley bolt and turn engine clockwise 2 revolutions to TDC.

4) Check that all alignment marks are in correct position. If not, remove belt and repeat procedure. Tighten idler pulley bolts without moving bracket. Install timing belt guide, cover and crankshaft pulley.

5) Install compressor (if equipped), pulleys, fan and drive belts. Install hoses, radiator and shroud. Connect batteries and refill cooling system, then reset maintenance switch by removing grommet in speedometer bezel and depressing switch button.

NOTE – *Switch will reset only after light has come on. If belt is replaced before light comes on, switch can be reset by removing speedometer and readjusting switch.*

6) Align injection pump with marks made before disassembly, then check injection timing.

FUEL FILTER & WATER SEPARATOR

Removal & Installation – 1) Place a container under water separator drain and open drain valve 2 turns. Turn priming pump knob counterclockwise to loosen, then pump until all water is discharged. Close drain valve.

2) Remove fuel filter, using filter wrench if necessary. Apply a thin film of fuel on new filter gasket and install filter by hand.

3) Pump priming pump 30-40 times to force all air our of filter and separator. Check for fuel leaks, then turn knob clockwise to lock in position.

ADJUSTMENTS

INJECTION PUMP TIMING

1) Remove distributive head bolt on injection pump. Install special alignment tool (Toyota Part No. 09275-54010) and dial indicator to distributive head plug.

2) Set No. 1 or No. 4 cylinder to 45° BTDC on compression stroke. Set dial indicator at zero. Check to see that indicator stays at zero when crankshaft pulley is rocked slightly to left and right.

3) Turn pulley until No. 1 or No. 4 cylinder is at TDC. Dial indicator should read .0394" (1.00 mm). If not, loosen injection pump bolts and all fuel connections. Tilt pump body slightly and recheck injection pump stroke. When correct, tighten bolts and fuel lines, then remove tools and install distributive head bolt and washer.

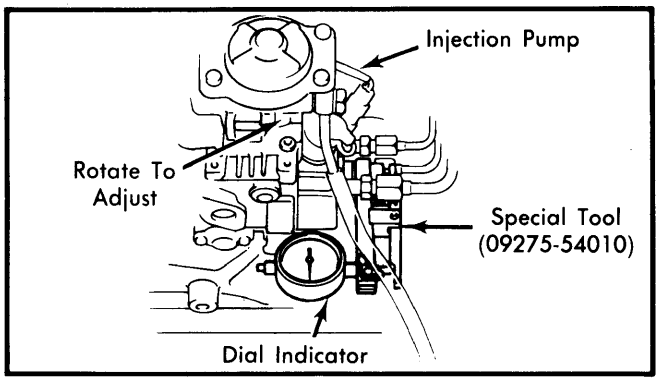

Fig. 9 Injection Pump Timing

IDLE & MAXIMUM SPEED

1) Warm engine to normal operating temperature and turn all accessories off. Check to ensure throttle lever touches full throttle stop screw when accelerator pedal is fully depressed.

2) Install tachometer and check slow idle. Adjust to 700 RPM by turning idle stop screw. Accelerate engine and quickly check maximum speed. Adjust to 4900 RPM with full throttle stop screw. Tighten lock nuts and remove test equipment.

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Nozzle Holder-to-Nozzle Body	44-57 (60-78)
Injection Nozzle-to-Cylinder Head	44-57 (60-78)
Injection Pump Pulley Bolt	44-50 (60-68)
Idler Pulley Bolts	11-15 (15-20)
Injection Pump Bolts	11-15 (15-20)