

Apply a generous coat of lubriplate to the drive shaft seals and slide seals into grooves (Fig. 8-52). The seals MUST face on opposite directions to separate external lubricants from fuel in the pump. Apply Lubriplate liberally around the shaft between the two seals.

Install gear on drive shaft using key and keyway to locate gear on shaft. Tighten hex nut to 35 ft.-lbs. (47 Nm) torque.

#### Installation and Timing of Injection Pump

(1) Install injection pump drive gear and shaft (if removed) on engine front plate. Refer to page for proper method of timing injection pump drive gear.

(2) If engine has not been set on TDC (No. 1 cylinder on compression stroke) rotate engine in direction of rotation until No. 1 cylinder is on the compression stroke. Continue to rotate engine until timing pin engages hole in flywheel.

(3) Install pump over shaft. Be sure that reference mark on drive shaft tangs is aligned with the reference mark on the slot end of the distributor rotor in the pump.

**IMPORTANT:** Incorrect assembly of shaft into pump will result in timing error of 180°.

(4) Compress seals on shaft and slide pump into place. Install hex nuts and tighten finger tight. Rotate pump, first in the direction of rotation and then in the opposite direction, and again register timing marks to take up all backlash (Fig. 8-53). Tighten mounting nuts securely.

**IMPORTANT:** Use care not to turn seals over while installing. If resistance is felt, stop and check position of seal. If seal has been forced back, replace the seal.

(5) Continue to turn the engine until timing pin again engages flywheel. Check the alignment of injection pump timing marks. If pump timing is not correct, repeat the above procedure until the exact timing is obtained.

**IMPORTANT:** The normal backlash of gears is enough to cause the pump timing to be off by several degrees, resulting in poor engine performance. Therefore, it is very important that the timing of the pump be checked again after it has been installed.

(6) Remove caps from injection pump and fuel pipe openings.

(7) Connect the injection pump-to-nozzle pipes. Make reference to figure 8-49, connect No. 1 outlet first and continue around the pump head in a counterclockwise direction, attaching pipes in order of engine firing (1-3-4-2).

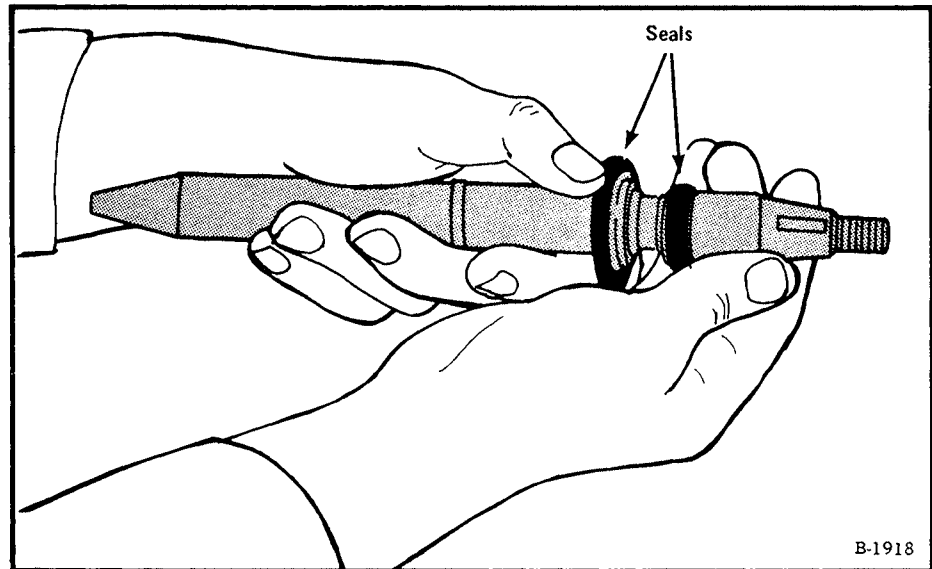


Fig. 8-52 Installing Shaft Seals

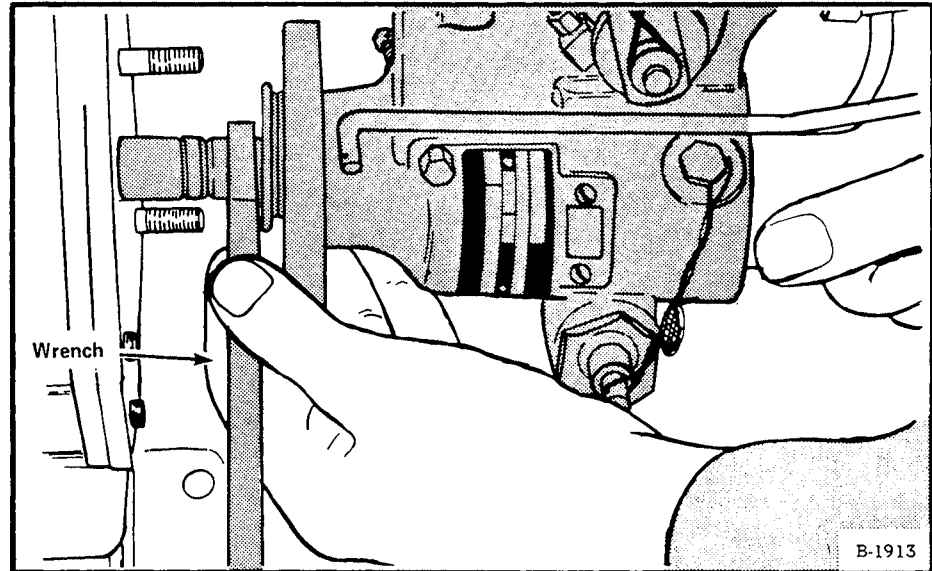


Fig. 8-53 Injection Pump Alignment

(8) Connect the speed control rod, fuel inlet pipe, fuel return pipe and shut-off rod to the injection pump.

(9) Install injection pump timing window.

(10) To vent air from the fuel system, see page 1-13.

(11) After vent of the fuel system, the automatic speed advance should be checked for proper adjustment.

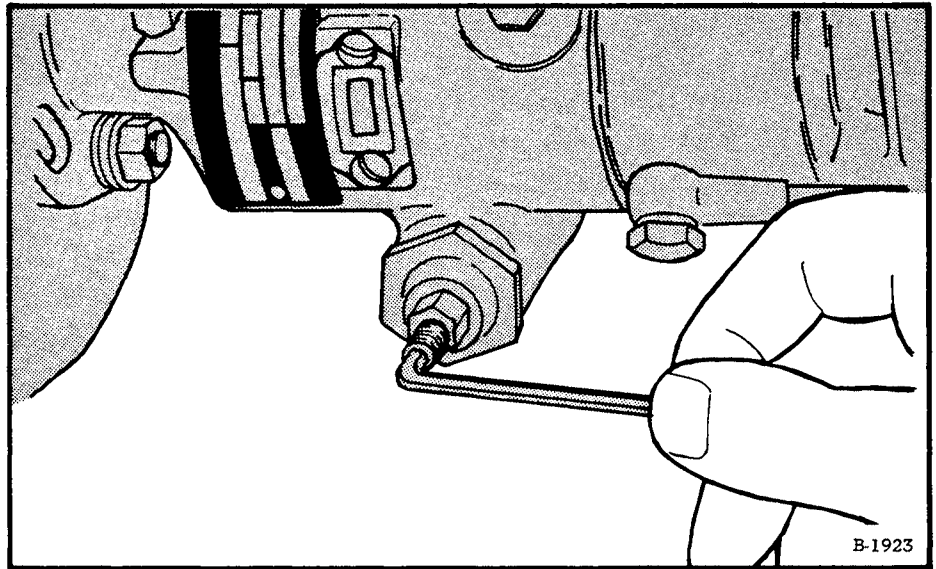


Fig. 8-54 Speed Advance Adjustment

#### Automatic Speed Advance Adjustment

The purpose of the automatic speed advance (Fig. 8-54) is to insure maximum combustion for maximum power at higher engine speeds. This is done by advancing or retarding the start of fuel injection in response to changes in engine speed. As engine speed increases, the movement of the cam ring also increases to a maximum of  $8^{\circ} \pm 1/2^{\circ}$  degrees. As engine speed decreases, the cam ring is forced to return to a retarded position.

The cam ring is activated by the hydraulic pressure of fuel under pressure from the transfer pump. Fuel is directed to an advance piston which rotates the cam ring against the direction of rotor rotation. An opposite force to piston movement is a spring that is preloaded by an adjusting screw, called a trimmer screw.

Before adjusting the speed advance, be sure the injection pump is correctly static-timed. See "Installation" on page

Start the engine and bring to operating temperature. Connect an accurate tachometer to engine.

Remove the sealing wire and seal cap from the side of injection pump. Loosen the lock nut (Fig. 8-54), and turn the advance trimmer screw IN to retard, and OUT to advance. Each mark on the timing window represents 2 degrees. Select one of the speed and load conditions given in the table below (preferably the 1900 rpm,  $6^{\circ}$  advance at full load setting), and adjust the speed advance.

Engine RPM	Degrees Advance	
	Full Load	No Load
1100	—	$4^{\circ}$
1900	$6^{\circ}$	—
2500	$7-1/2^{\circ}$ Min.	$7-1/2^{\circ}$ Min.

After making adjustment of the speed advance, tighten the lock nut and install seal cap and sealing wire.

Remove timing window, and install timing hole cover.

If the automatic speed advance cannot be adjusted to specifications, remove the pump, and adjust on test stand.

When timing is correct, remove timing window and install cover plate. Tighten trimmer screw lock nut, and install seal cap and sealing wire.

Check fast idle and slow idle speeds with the speed control linkage disconnected. Correct slow idle speed is 800 rpm and correct fast idle speed is 2650 rpm.

## 8-19.2 Fuel Injection Nozzles

Fuel injection nozzles are of the inward opening, hydraulically operated, multi-spray-hole type.

Refer to CAUTION on page 1-13 before working with injection nozzles.

### Diagnosing Malfunctions

Injection nozzles should not be removed from the engine as a routine maintenance procedure. Experience has shown that it is best to remove the assembly only after engine performance indicates that overhaul is necessary.

The following symptoms may indicate faulty nozzle performance:

- Engine starts hard or won't start.
- Erratic engine operation.
- Engine idles poorly.
- Engine does not develop full power.
- Engine smokes black, blue or white.

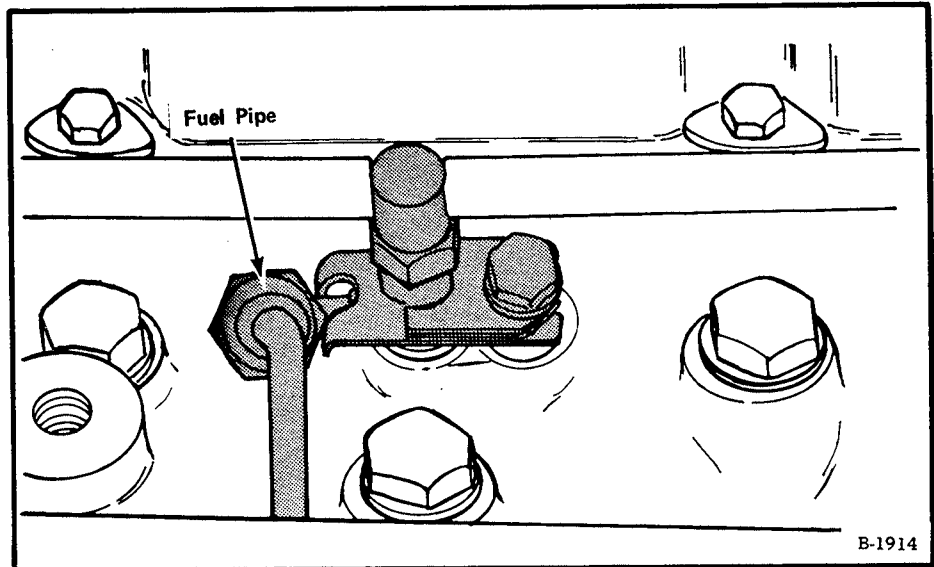


Fig. 8-55 Injector Installed

### Removal of Injection Nozzles

- (1) Disconnect nozzle from fuel pipe at connector, using two wrenches (Fig. 8-55).
- (2) Disconnect leak-off pipe from nozzle, by pulling off hose connectors.
- (3) Remove nozzle hold-down bolts, washer clamp and spacer.
- (4) Remove injection nozzle (Fig. 8-56).

**IMPORTANT:** Do not use a screwdriver or similar tool to pry injection nozzles from cylinder head. Doing so may cause distortion and permanent damage to the nozzles.

### Repair of Injection Nozzles

**IMPORTANT:** Do not attempt to test or disassemble nozzle unless the proper service tools are available.

- (1) Remove carbon seal and seal washer (Fig. 8-57) from nozzle.

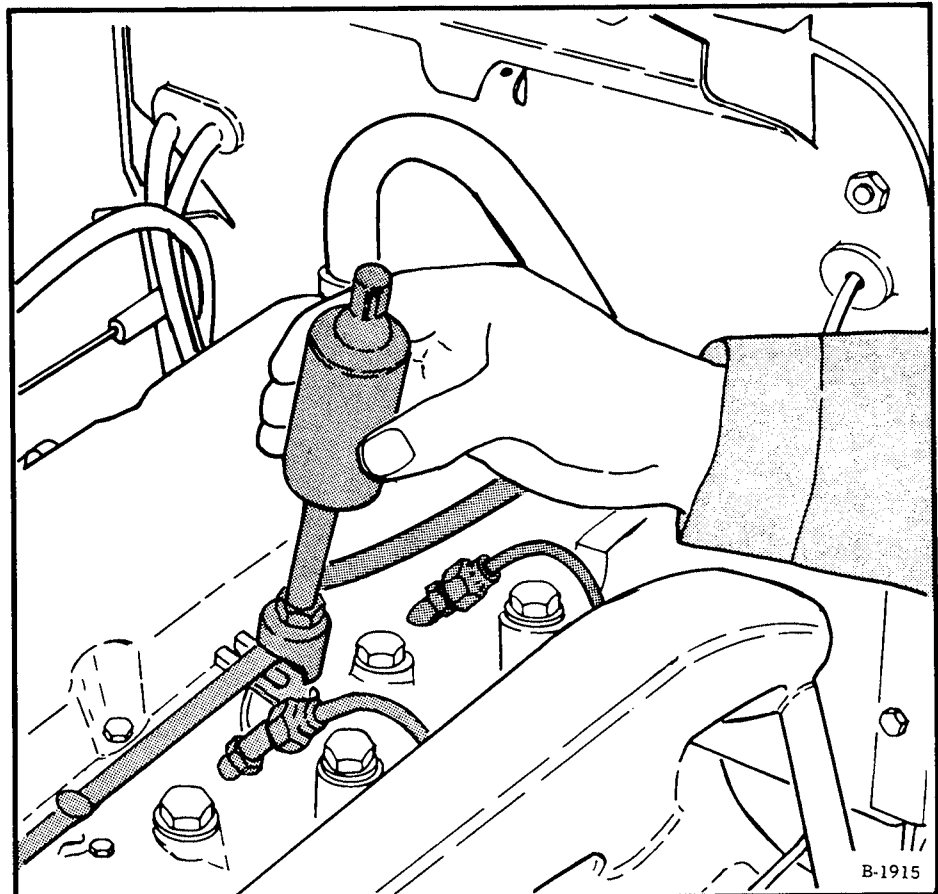


Fig. 8-56 Removing injector

- (2) Clean the exterior of nozzle by soaking in clean solvent or diesel fuel. Then clean the spray tip using a brass wire brush.

**IMPORTANT:** Do not scrape or otherwise damage the Teflon coating on the nozzle body above the carbon seal groove. This coating will become discolored during normal service, but this is not harmful. Do not use a motor-driven brush to clean the nozzle body.

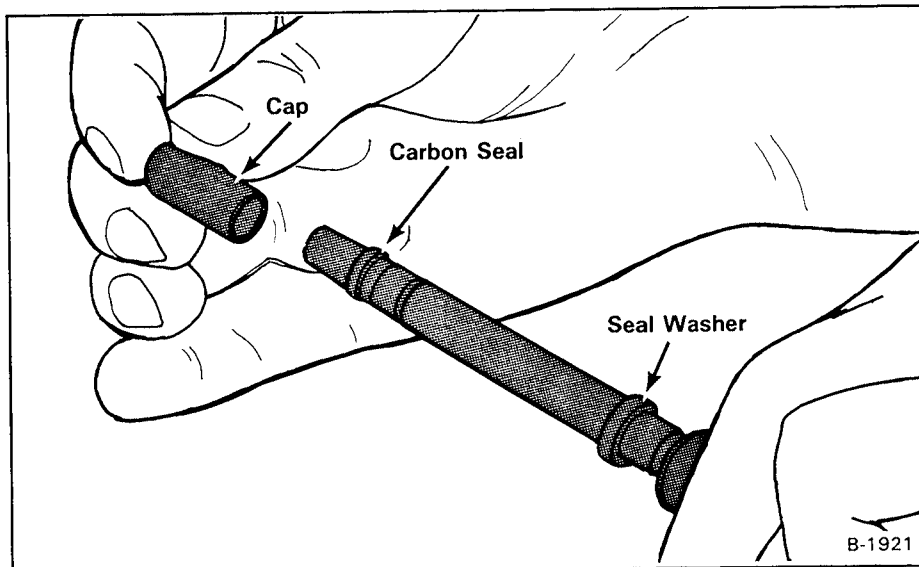


Fig. 8-57 Injector Seals

- (3) Install a new seal washer and new carbon seal.

#### Installation of Injection Nozzle

- (1) Clean nozzle bore in engine cylinder head.
- (2) Insert nozzle using a twisting motion.
- (3) Install nozzle hold-down spacer, clamp, washer and bolt. Hand-tighten bolts.
- (4) Connect fuel pipe to nozzle inlet and hand-tighten.
- (5) Install leak-off pipe.
- (6) Tighten nozzle hold-down bolt to 20 ft.-lbs. torque and tighten inlet connector to 35 ft.-lbs. torque.
- (7) Vent the fuel system (Page 1-13).

#### 8-20 SPECIAL TOOLS

The tools needed to overhaul the 4.276 engine can be ordered from the Clark Equipment, Melroe Division Service tools and shop equipment catalog.

