# 1965-71 FORD DIESEL 4-CYLINDER FUEL INJECTION

## DESCRIPTION

A fuel lift pump of diaphragm type, driven by eccentric on engine camshaft, draws fuel from fuel tank. After passing through a replaceable element type filter to the injection pump, fuel is passed at high pressure to the four hole, long stem, injectors mounted in cylinder head. Injectors are lubricated by fuel oil leaking back past needle valve stems. This fuel is then returned to fuel tank by a "leak-off" pipe.

## OPERATION

### INJECTION PUMP

A single acting pump which contains one pump element, consisting of a cylinder and plunger, for each cylinder. Pump plungers have a constant stroke, and are operated, through roller tappets, by a camshaft in pump assembly. Pump camshaft is driven at half engine speed by a gear in mesh with engine camshaft gear. Lower end of each plunger engages fork on control rod which is connected to governor. Movement of governor is transmitted to each plunger, causing them to turn in their cylinders. This action changes position of helical groove, machined in each plunger, relative to ports in cylinder, thus controlling fuel delivery.

### DELIVERY VALVE

Delivery valve closes off top of pressure space and relieves pipe line pressure. This is necessary to allow fast closing of injector nozzle needle and to prevent dribbling of fuel into combustion chamber.

### GOVERNOR

Centrifugal governor controls engine speed in relation to accelerator position, load and vehicle speed. This is accomplished through the counter-balancing action of springs and governor weights. Engine speed is, at all times, directly proportional to governor spring load, enabling accurate speed control to be maintained throughout engine speed range.

### EXCESS FUEL DEVICE & STOP CONTROL

Excess Fuel Device is used to keep injection plungers in maximum fuel position for starting engine. When engine starts, governor action will disengage excess fuel device, thus allowing injection pump to function normally. Stop Control is manually operated lever which, when turned in clockwise direction, pushes control rod forward until no delivery position is reached. Engine will then stop.

### INJECTION NOZZLE

Fuel from injection pump enters injector inlet adapter through injector body before reaching needle valve seat. Needle valve is held on seat by spring pressure. When fuel pressure overcomes needle valve spring pressure, needle valve is forced open and fuel is shot into cylinder, through four holes in nozzle tip, in highly atomized state. A small quantity of fuel leaks past needle valve stem to provide lubrication, and is returned to fuel tank by "leak-off" pipe.

### INJECTION PIPES

After prolonged usage, it may be found that pipes have closed up slightly, thus reducing the bore. This condition will affect fuel delivery, and if found, pipes should be renewed.

### FUEL LIFT PUMP

Diaphragm type fuel lift pump is mounted at rear of engine block on same side as injection pump and is driven by eccentric on engine camshaft. Fuel is drawn from fuel tank and forced, through filter, to injection pump.

## MAINTENANCE

### INJECTION PUMP

Drain and refill injection pump and governor housing every 100 operating hours, using suitable grade and quantity of engine oil.

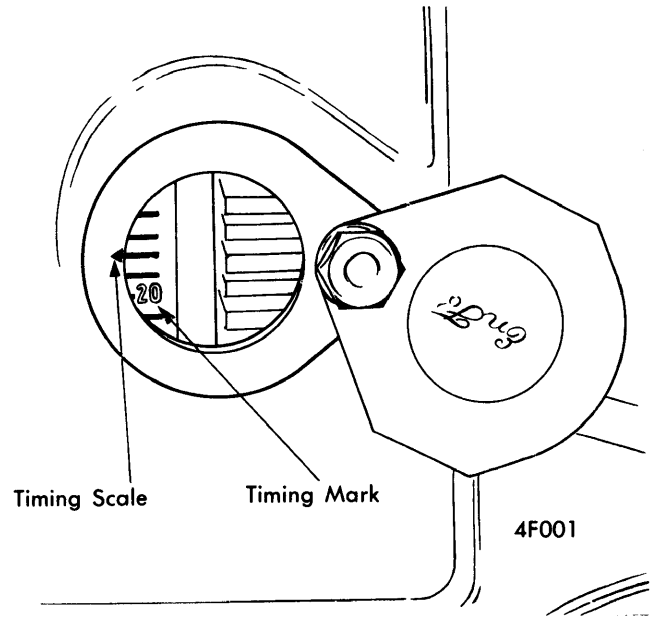
### AIR CLEANER (OIL BATH)

Remove air cleaner element and wash housing and element in suitable solvent. Refill oil bath and refit element. Air filter should be serviced every 6000 miles.

## ADJUSTMENT

### INJECTOR TIMING

1) Rotate engine until number one cylinder on compression stroke is 22°BTDC. Flywheel 22° mark will be aligned with notch in flywheel housing opening. A timing mark on rear face of camshaft gear will be visible in injection pump opening.




INJECTION TIMING MARKS

2) Remove plug in mounting flange of injection pump, and insert suitable tool (C.9077). Rotate gear until spring loaded plunger drops into center punch mark in rear face of gear. Release plunger and turn gear 5/8" counterclockwise. Install new "O" ring to front face of injection pump.

3) Install pump and gear to engine, keeping stud in center of slotted mounting hole. Turn pump until plunger re-engages with timing mark. Tighten attaching bolts and nut. Remove timing tool and reinstall plug.

4) If any doubt as to accuracy of timing marks on pump or cam gear exists, fuel pump should be spill timed to engine. With engine set at 22°BTDC on number one cylinder compres-

## 1965-71 FORD DIESEL 4-CYLINDER FUEL INJECTION (Cont.)

sion stroke, disconnect number one injector pipe, remove delivery valve holder and extract volume reducer, delivery valve and spring. Replace delivery valve holder to injector pump body.

5) Install suitable spill pipe tube (CT-9023) to delivery valve holder. Loosen attaching nuts and fully retard pump. Operate hand primer on supply pump. Fuel should run from end of spill tube. Slowly advance injection pump until flow of fuel from spill tube just ceases. Tighten attaching nuts. Reinstall delivery valve, spring, volume reducer and reconnect injection pipe.

### IDLE RPM

With engine at normal operating temperature, adjust idle speed stop screw on governor back plate to specifications. Tap accelerator pedal to insure a consistent return to this setting.

**Idle RPM**

| Application | RPM |
|---|---|
| 1965-70 | 500-550 |
| 1971 | 500-625 |

### NO-LOAD RPM

With engine at normal operating temperature, transission in neutral and governor control lever against maximum speed stop, adjust stop to give specified no-load speed. Tighten lock nut and seal adjusting screw.

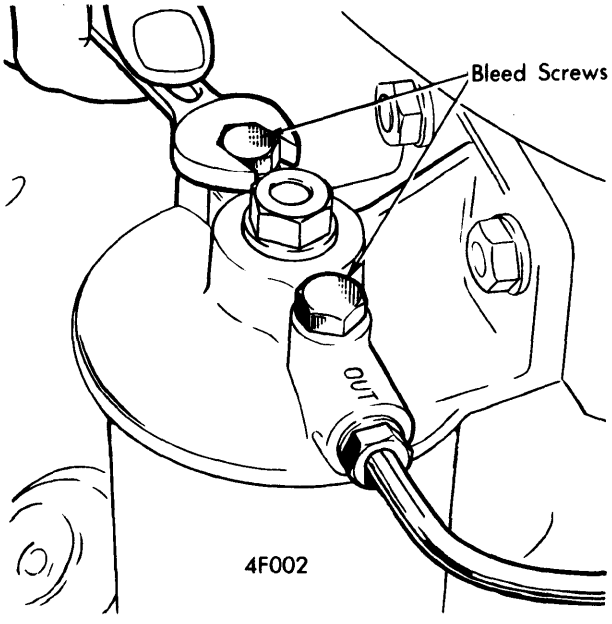
**Maximum No-Load Speed**

| Application | RPM |
|---|---|
| 1965-66 | 2700 |
| 1967-71 | 3090 |

### BLEEDING FUEL SYSTEM

*NOTE — If air has been allowed to enter fuel system for any reason, it will be necessary to bleed system to remove all air.*

1) Check that all fuel line connections are tight and there is sufficient fuel in tank. Loosen two bleed screws on top of filter two or three turns and operate priming lever on fuel supply pump. Continue pumping until a stream of fuel, free of bubbles, issues from filter.



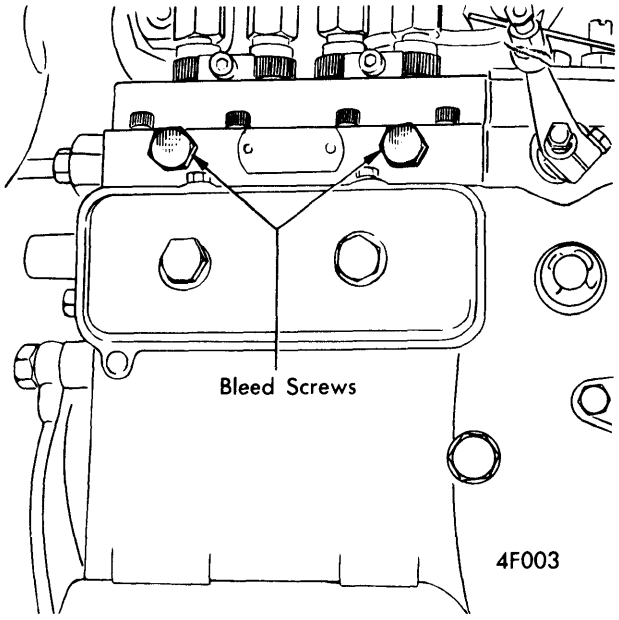

**BLEEDING FUEL FILTER**

*NOTE — If eccentric on injection pump is on maximum lift, it will render fuel pump priming lever inoperative. If this occurs, rotate engine until priming lever can be operated.*

2) First tighten inlet, and then outlet bleed screws on filter as priming lever returns to its downward position.

3) Loosen bleed screws on injection pump body approximately two or three turns and operate primer as before. When fuel free from bubbles issues from bleed screws, tighten screw farthest from inlet connection first and then other bleed screw second. Wipe all excess fuel from filter and pump.

*NOTE — Never lever injection pump plungers up or down to prime injector tubes or test injectors, as plunger arms may be seriously damaged.*




**BLEEDING INJECTION PUMP**

## REMOVAL & REPLACEMENT

### INJECTION PUMP

**Removal** — 1) Remove fuel pipe and flexible line from fuel lift pump. Disconnect pipe from fuel filter at front of injection pump and remove filter. Disconnect injection pipes from delivery valve holders and remove stop control cable and accelerator linkage.

2) Disconnect exhauster union banjo bolt and drain pipe from side of injection pump. Remove injection pump and exhauster. Slacken injection pump coupling flange clamp and slide it, together with fiber coupling, forward on auxiliary shaft. Separate injection pump and exhauster and remove exhauster oil seal.

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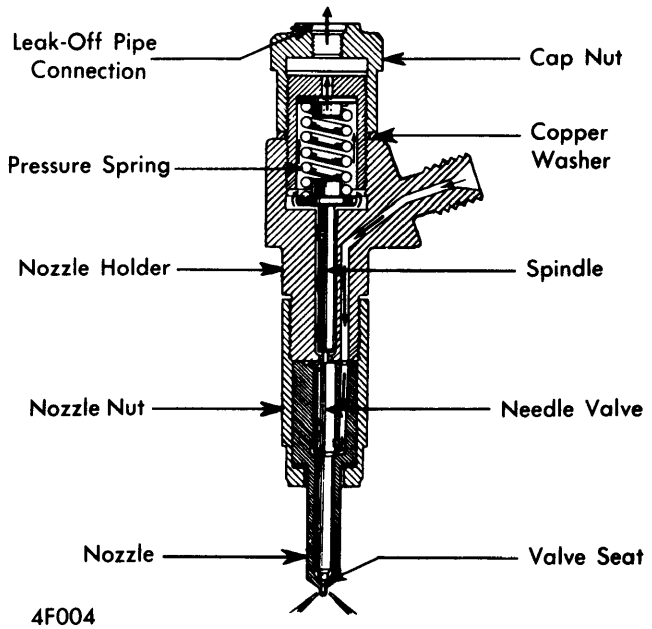
**Replacement** – Begin replacement by performing operation outlined under Injector Timing (see Adjustments). Connect injector pipes, pipe from filter to injection pump, drain pipe and fiber washers. Install throttle linkage, excess fuel device remote control and stop control. *NOTE – Stop control lever must be in OFF position when cable is installed.* Install air cleaner, bleed fuel system and adjust idling and maximum speeds.

### INJECTOR NOZZLES

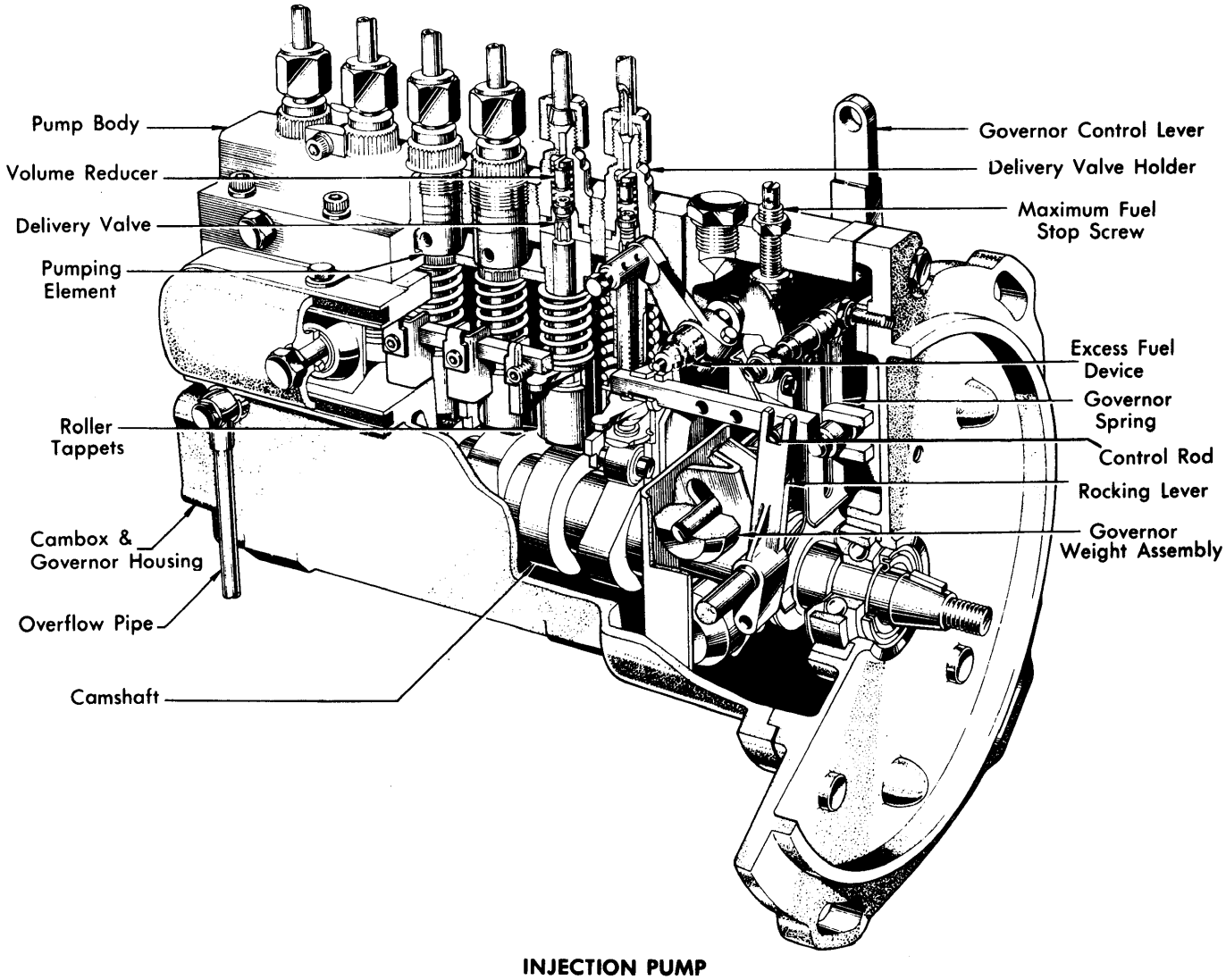
**Removal** – 1) Remove air cleaner, rocker cover, leak-off pipe and injection pipes. Loosen inlet adapter seal nuts and remove adapter from injector. Fit appropriate blanking plugs and caps to injectors and injection pipes.

2) Remove bolts holding injectors in cylinder head and remove injectors. *NOTE – If injector is tight in its housing, it may be necessary to use suitable injector removal bar (E1ADDN-17098) to remove injector.* Remove copper seating washer from housing.

**Replacement** – Reverse removal procedure using new seals, copper washers and gaskets. Tighten injector retaining bolts to 15 ft. lbs. and ensure system is free from leaks.




**INJECTOR NOZZLE**




**INJECTION PUMP**