

## IHC DIESEL 6-CYLINDER FUEL INJECTION

### DESCRIPTION

A piston-type fuel feed pump, driven by fuel injection pump, draws fuel from tank. After passing through a constant volume filter, fuel is delivered to injection pump. Pressurized fuel is then forced to injectors mounted in cylinder head. The injectors are lubricated by fuel leaking back past needle valve stems. Fuel used for lubrication is then returned to fuel tank by a "leak-off" pipe. Engine control is maintained by either a diaphragm or mechanical-type governor.

### OPERATION

#### INJECTION PUMP

This system uses a Bosch Type A fuel injection pump. Through action of a governor and timer, the pump feeds pressurized fuel to the engine. Pump transfers fuel from the tank, through the filter, to the plunger assembly. Plunger then forces fuel, in correct amounts, to the injector nozzles.

Pump has one plunger and one delivery valve for each cylinder. An automatic timer is mounted on the drive end of pump housing. Governor is on opposite end. Pump housing contains the camshaft, tappet, plunger, control sleeve and control rack assemblies.

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 meshed with engine camshaft gear. Lower end of each plunger engages fork on control rod which is connected to governor. Governor movement is transmitted to each plunger, causing them to turn in their cylinders. This turning action changes position of helical groove machined in each plunger in relation to cylinder ports. Fuel delivery is controlled by this change in groove-to-port positions.

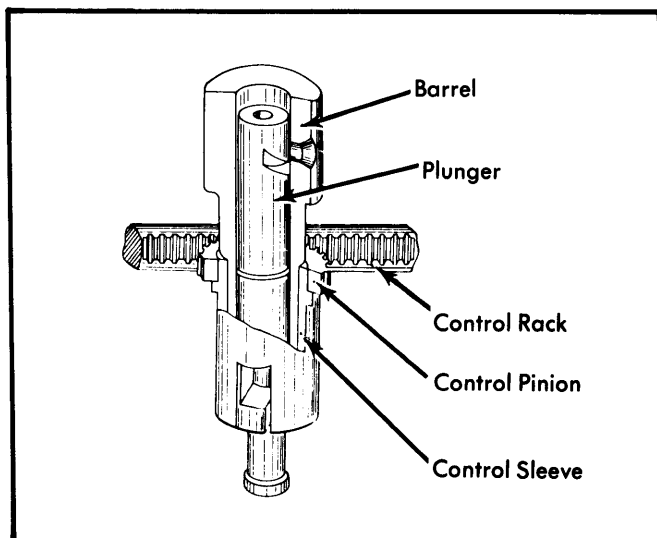


Fig. 1 Pump Plunger and Control Rack

#### DELIVERY VALVE

As plunger pressure becomes high enough to force fuel into delivery valve, valve opens and fuel is delivered to the injector

nozzle. A spring maintains closing pressure in the valve. When correct amount of fuel has been delivered, spring pressure closes valve. A piston in the bottom of the delivery valve, instantly restricts fuel passage through valve. This prevents fuel seepage at the injector and maintains better fuel control.

Delivery valve is located directly above the plunger assembly inside the pump housing. Fuel line to injector nozzle is attached above the delivery valve.

#### GOVERNOR

An RVS mechanical type governor is used in all applications. The 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.

#### INJECTION NOZZLE

Fuel from injection pump is delivered to nozzle, under high pressure, which injects fuel into a swirl chamber in cylinder head. A pintle throttle type of nozzle with a single orifice is used. This pintle projects from orifice in nozzle body and is designed so that when the pintle is lifted slightly, at beginning of injection, a fine spray mist is injected. As pintle is lifted further full injection is provided (see Fig. 2).

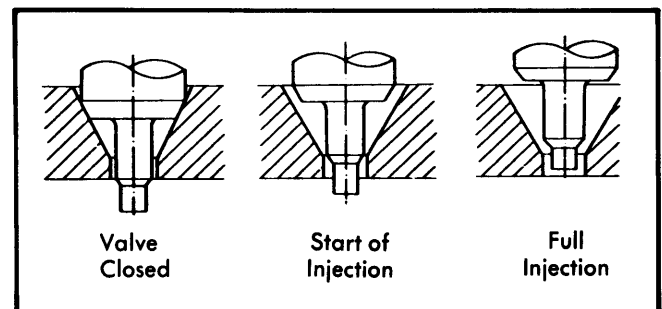


Fig. 2 Injection Nozzle Operation

#### FUEL FEED PUMP

A piston-type fuel feed pump is mounted to side of injection pump and is cam-driven. Feed pump is equipped with a smaller priming pump. By manually operating priming pump, fuel can be brought from tank to injection pump with engine stopped. With engine operating, feed pump maintains fuel pressure to injection pump between 28.5-42.7 psi (2-3 kg/cm<sup>2</sup>).

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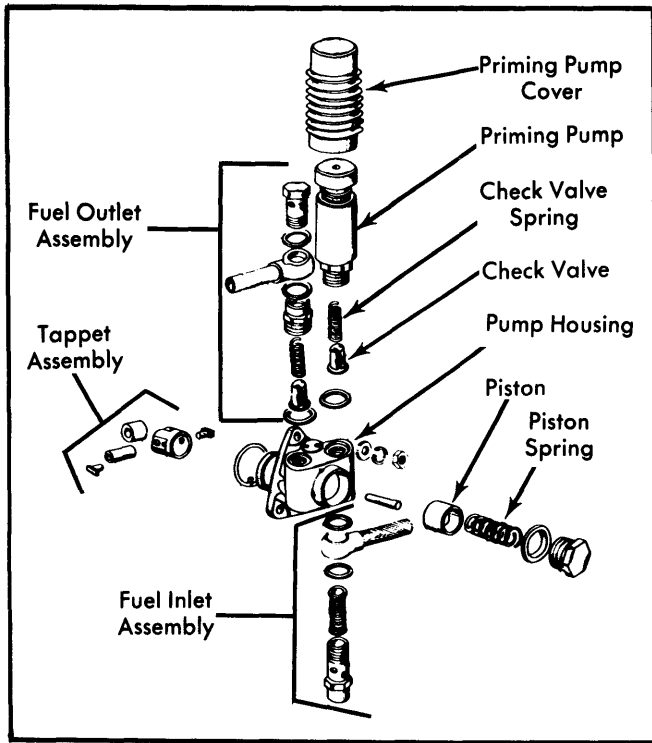


Fig. 3 Exploded View of Feed Pump

### AUTOMATIC TIMER

Automatic timer uses weight and spring to automatically change injection timing in accordance with engine speed. Timer employs centrifugal force on weights to advance injection timing when engine speed increases and to retard injection timing when engine speed decreases.

### ADJUSTMENT

**NOTE** — Fuel injection pump adjustments are made with pump removed from engine and mounted on test stand. See Removal & Installation near end of this article for pump removal.

### INJECTION PUMP

**Start of Injection** — 1) Install pump on tester and attach tester coupling to timer end of pump and secure with round nut. Connect coupling to tester drive shaft. Connect tester hose to nozzle tube on pump. Remove cap and connect tester dial to pump camshaft for rotating angle measurement.

**NOTE** — Injection tester supplies fuel to nozzle tube at 427-498 psi (30-35 kg/cm<sup>2</sup>) for checking start of injection.

2) Attach a tappet lift gauge to the first plunger (see Fig. 4). Position pump cam so that plunger tappet is at lowest point (BDC of cam). Zero dial gauge. Loosen pump bleeder screw and bleed pump. Loosen ball valve of nozzle holder.

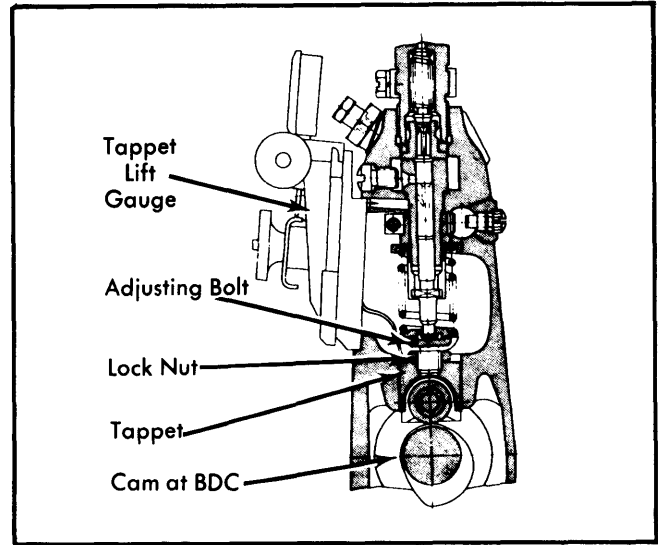


Fig. 4 Installation of Tappet Lift Gauge

3) With a test nozzle connected to pump, feed fuel to pump so that fuel flows from test nozzle then turn pump cam shaft by hand (turn tester coupling) in same direction as engine would turn pump. Turn cam slowly until fuel just stops flowing from nozzle. This point is start of injection. Check dial gauge, reading should be  $.091 \pm .002$ " ( $2.3 \pm .05$  mm). This is tappet lift from BDC.

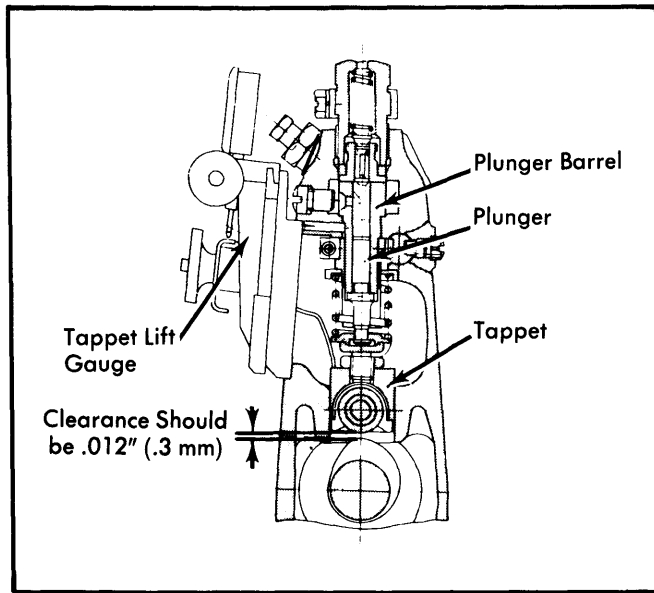
4) If fuel continues to flow past this point turn adjusting nut on tappet, counterclockwise to raise plunger. If fuel flow stops before this point, turn adjusting nut clockwise to lower plunger.

5) With the first plunger correctly set, repeat the procedure on the next plunger in firing order sequence (1-4-2-6-3-5) by turning the cam  $60^\circ$  for each plunger.

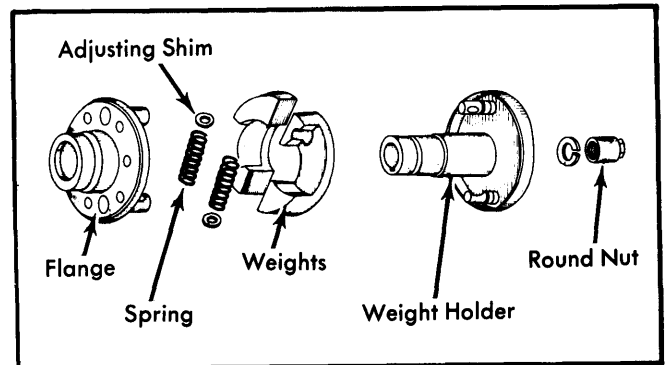
**Tappet Clearance** — 1) With start of injection set, turn cam so that first plunger is at TDC. Attach dial gauge to first tappet as done in Start of Injection setting. With tappet at highest point on cam, insert screw driver under adjusting nut and pry tappet up.

2) When tappet is pryed up, measure clearance between cam and tappet. Clearance reading should be  $.012$ " (.3 mm). If clearance is incorrect, check tappet and cam for excessive wear or damage, replace as necessary. Also recheck Start of Injection adjustment.

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**Fig. 5 Measuring Tappet to Cam Clearance**



**Fig. 6 Exploded View of Fuel Injection Timer**

**Injection Volume – 1)** On mechanical governor injection pump, use governor linkage to pull rack all the way to left side of pump (governor end). With rack in this position, install a measuring device (on right or drive end) so that right end of rack is at zero mark on measuring device. With measuring device set up, remove rack guide screw and install the lock screw that will hold rack in position specified. Set fuel feed pressure, on tester, at 21.3-22.8 psi (1.5-1.6 kg/cm<sup>2</sup>).

**2)** On the first volume measurement test, push rack toward full throttle position .551" (14 mm) and tighten lock screw so that rack will not move. **NOTE** – Do not over tighten lock screw or rack will be bent and have to be replaced.

**3)** With rack set in correct position, run pump at 750 RPM for 1000 plunger strokes; volume should be 34.4±1 cc. Repeat procedure with rack set at .472" (12 mm) from zero mark and run pump at 750 RPM for 1000 strokes; volume should be 21.1±.9 cc. Repeat procedure again with rack .393" (10 mm) from zero mark and run pump at 300 RPM; volume should be 7.5±1.1 cc.

**4)** If injection volume is not to specifications, loosen set screw securing the control pinion. Insert a pin or rod, of adequate length, into the hole of the control sleeve. With pin inserted, rotate control sleeve little by little, repeating volume tests, until correct volume is attained.

### TIMER

**1)** Using a suitable strobe light and synchronizer (5783-001), install the synchronizer to pump housing so that synchronizer lever is in contact with plunger tappet. Position strobe light so degree wheel on tester will be illuminated when light is turned on.

**2)** Operate pump at different speeds (see Timer Specifications Chart) and record degrees advance. If advance is not to specifications, disassemble timer and adjust spring force by increasing or decreasing the thickness of adjusting shims, or replace spring.

### Timer Specifications

Application	Degree Advance
Base .....	7.5°(15°⊙)
Starting .....	(20°⊙) BTDC
High Speed .....	(35°⊙) BTDC

⊙ – Engine crankshaft angle.

## REMOVAL & INSTALLATION

### INJECTION PUMP

**Removal – 1)** Disconnect fuel line and fuel filter hoses from fuel feed pump. Disconnect linkage from governor. Disconnect injection lines from delivery valves on injection pump.

**2)** Remove fan, fan pulley and water pump. Remove crankshaft pulley, timing cover and oil seal. Remove timing gear case and oil slinger.

**3)** Remove tachometer driver support nuts. Lock flywheel and remove timer round nut. Thread timer extractor (57926-581), or other suitable puller, into timer weight holder and remove timer. Remove the four nuts securing injection pump to front end plate and remove pump.

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### INJECTION PUMP VOLUME SPECIFICATIONS

Test Application	Rack Position	Pump RPM	Mean Injection Volume (Fluid Ounces)	Plunger Strokes
Test 1	.551"	750	1.130-1.197	1000
Test 2	.472"	750	.6833-.7441	1000
Test 3	.394"	300	.2164-.2909	1000

**Installation** – Replace pump in reverse order of removal making sure all surfaces and fuel lines are free of dirt and other contaminating materials.

**Installation** – Replace delivery valve, plunger and plunger barrel in reverse order of removal. Make sure all components are completely free from dirt or other contaminating materials. Lightly coat plunger and barrel with fuel.

### DELIVERY VALVE

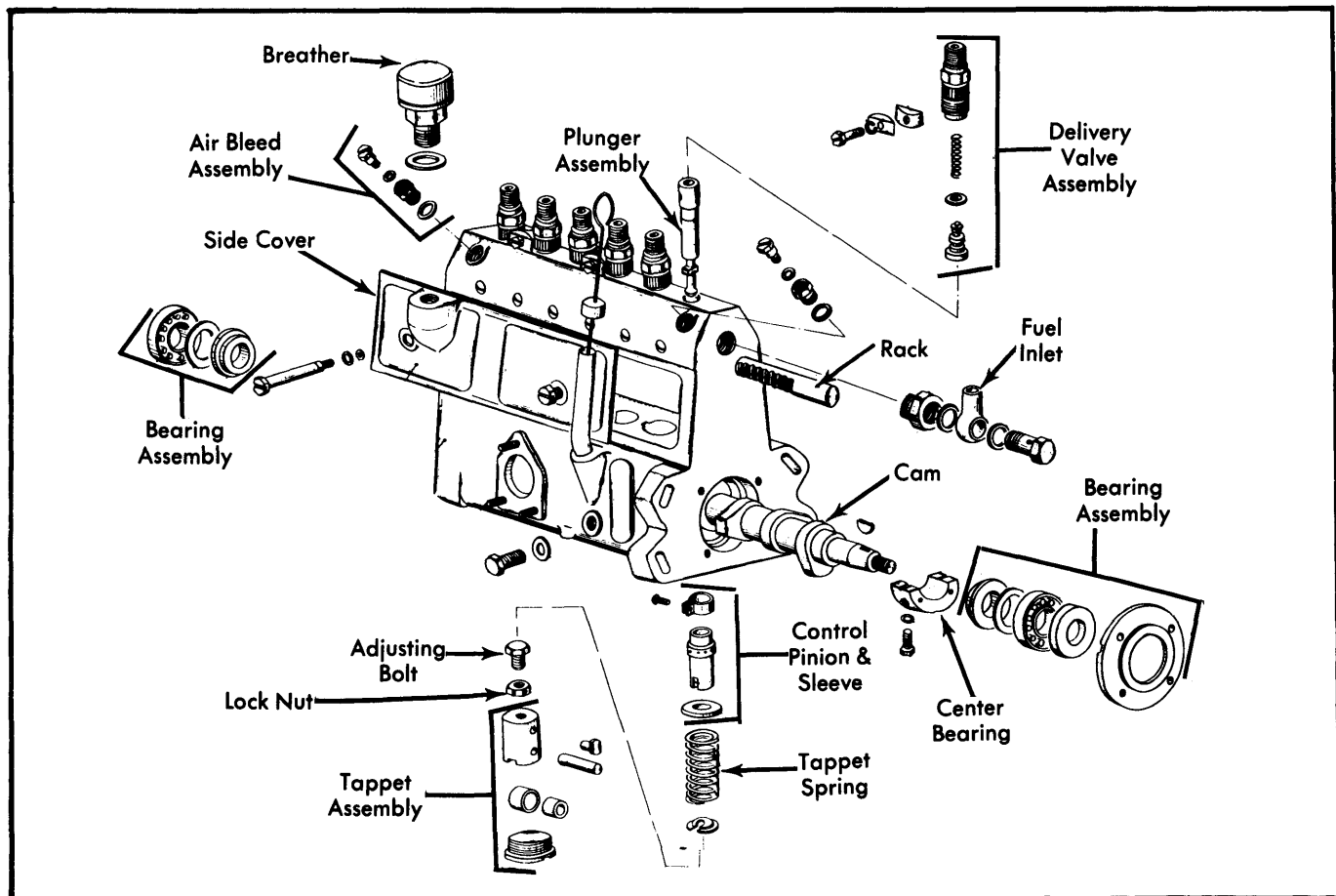
**Removal** – 1) Disconnect and cap fuel lines to injectors. Remove lock plates holding delivery valves in place. Loosen delivery valve holder then remove delivery valve holder with delivery valve spring.

2) Thread delivery valve extractor (57920-032) into valve and remove delivery valve and gasket. Push plunger barrels from below and remove them from top of pump housing.

### INJECTORS

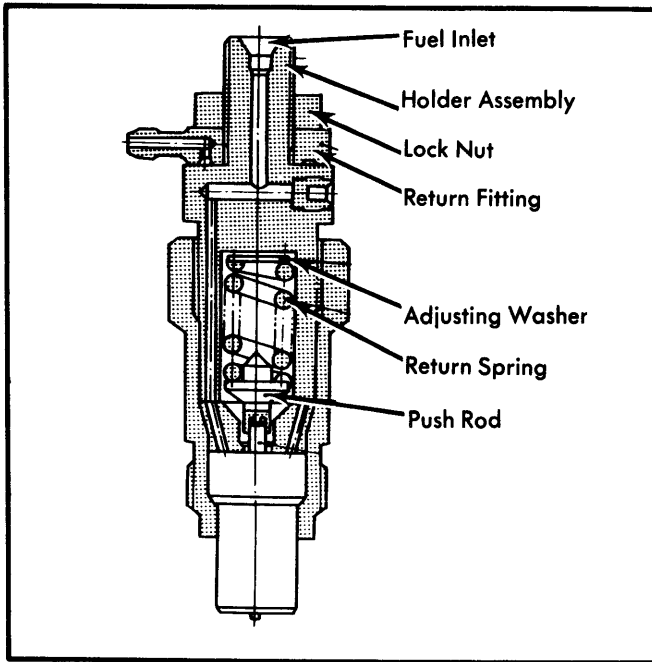
**Removal** – Disconnect fuel lines and cap, both fuel lines and injectors. Remove fuel injectors from cylinder head and injector hole in cylinder head with rag or other suitable object.

**Installation** – Replace fuel injectors in reverse order of removal making sure all fuel connections are free from dirt or any other contaminating materials.



**Fig. 7 Exploded View of Fuel Injection Pump**

## IHC DIESEL 6-CYLINDER FUEL INJECTION (Cont.)



**Fig. 8** Cutaway View of Fuel Injection Nozzle

### INJECTION PUMP SPECIFICATIONS

Pump Oil Capacity .....	6.09 fl. oz.
Governor Oil Capacity	
Vacuum .....	3-4 Drops
Mechanical .....	6.76 fl. oz.
Injector Opening Pressure .....	1422.5 psi
Feed Pump Pressure .....	25.6 psi

### TIGHTENING SPECIFICATIONS

Application	Ft. Lbs.
Injection Pump	
Delivery Valve Holder .....	22-25
Air Bleed Screw .....	15-22
Tappet Lock Nut .....	43-51
Timer	
Round Nut .....	43-51
Lock Nut .....	72-130
Nozzle	
Nozzle Nut .....	72-87
Nozzle Holder Nut .....	51-58