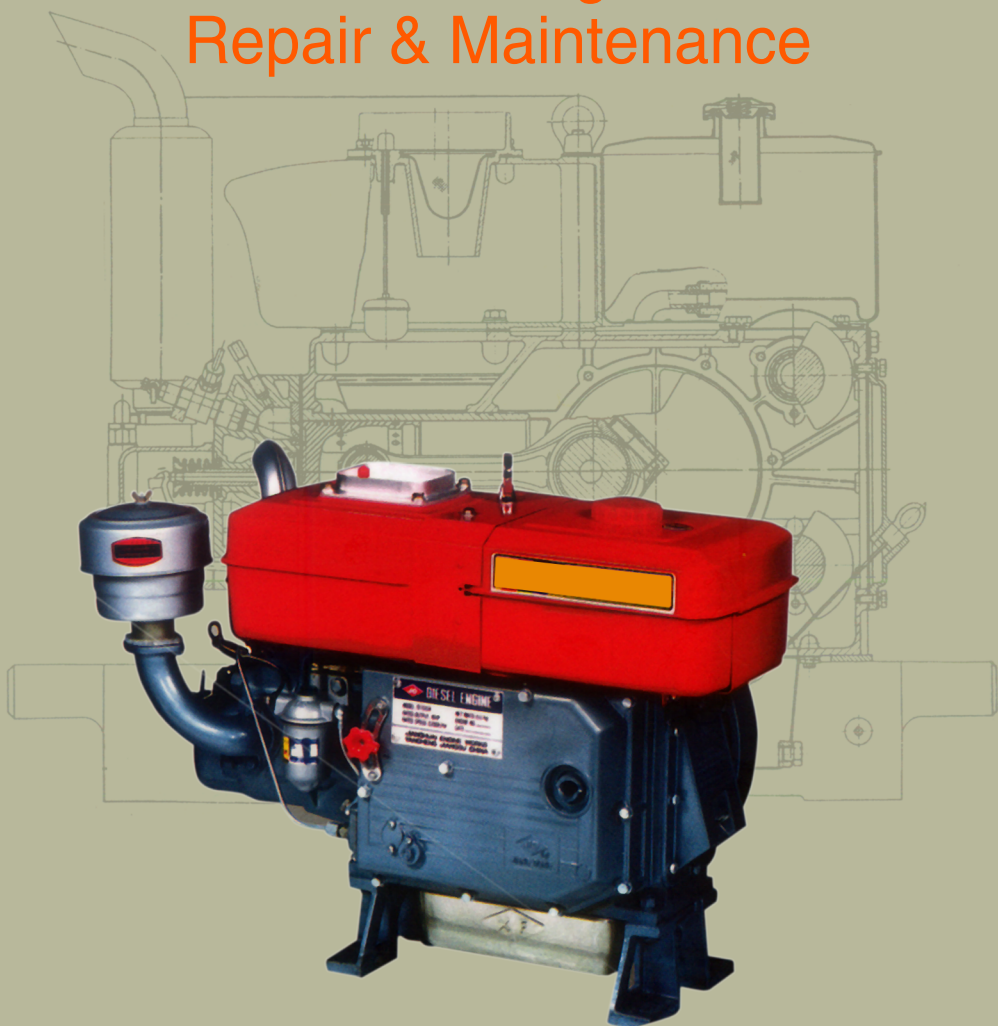


# Diesel Engine Repair & Maintenance



**Farm Machinery Adaptation & Dissemination**  
**Practical Action Bangladesh**

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## **Preface**

Proper utilization of resource for poverty reduction is one of the main objectives of present government and has taken up special program to make agriculture mechanized. To achieve mechanized agriculture, diesel engine has various uses. Diesel engine can run irrigation pump, power tiller, power thrasher, seed drill machine etc. In addition diesel can also run vehicle, rice husking machine, break breaker etc.

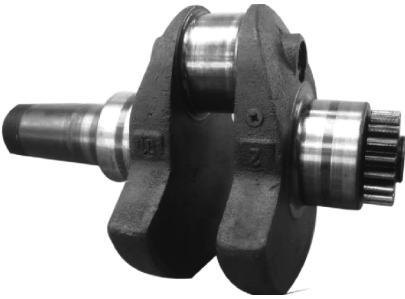
It is very important to ensure proper and effective use of diesel engine. Only a skill person can do so. In our country usually diesel engine operators/mechanics do not have any institutional education. They learn diesel engine operation and maintenance through the process of "learning by doing". Keeping these realities in mind, Practical Action Bangladesh is publishing this booklet in a simple manner. This booklet depicted the details of diesel engine and how it works with figure and diagram. It also describes the "problems and solving" of various parts of a diesel engine might have. Reader would get knowledge on how to repair and maintain a diesel engine from this booklet.

Previously Practical Action Bangladesh has published a booklet on "Diesel engine repair & maintenance" This booklet is more informative and easy communicative than the previous one. We hope this booklet would serve the people working with diesel engine.

**Veena Khaleque**

Country Director

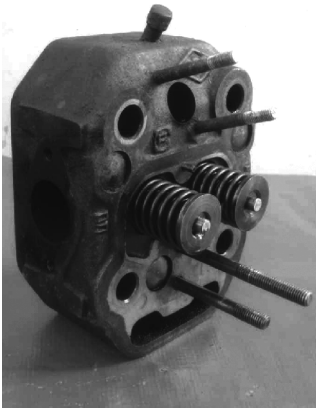
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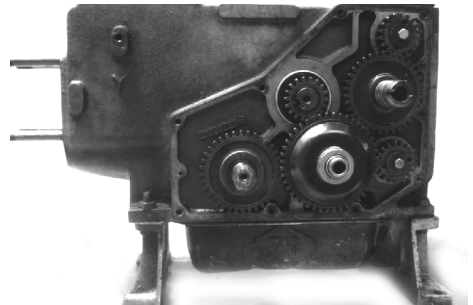
**Crank Shaft**



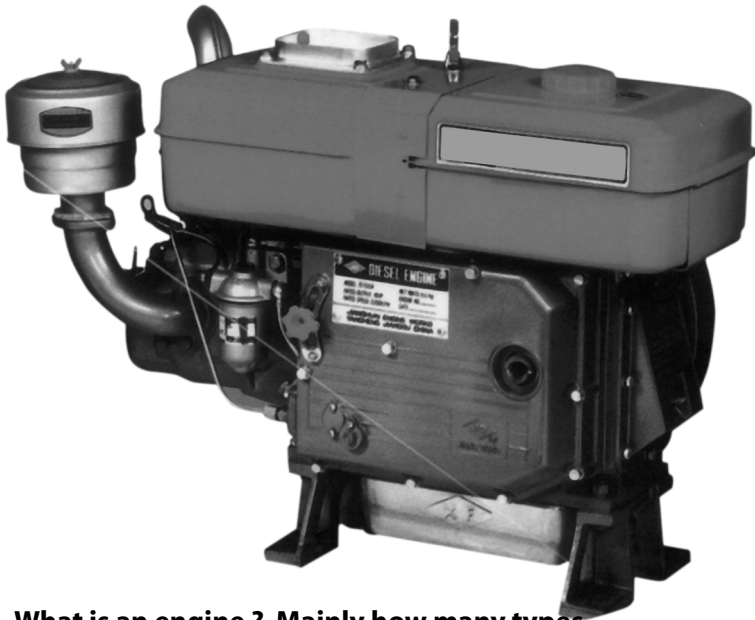
**Conecting Rod & Piston**



**Engine Head**



**Engine Block & Timing**



## **1. What is an engine ? Mainly how many types**

Engine is a mechanical system by which it transforms heat energy to mechanical energy using a fuel

### **Engine mainly- 2 types**

#### **1.1 Internal combustion engine**

#### **1.2 External combustion engine**

### **1.1 Internal combustion engines are divided based on the following**

- 1 Based on type of fuel- diesel engine, petrol engine and gas engine
- 2 Based on stroke- four stroke and two stroke
- 3 Based on cylinder numbers- single and multiple cylinders
- 4 Based on cooling system

## **2. What is a diesel engine ?**

The diesel engine is a type of internal combustion engine; more specifically, a compression ignition engine, in which the fuel is ignited by the high temperature of a compressed gas, rather than a separate source of energy (such as a spark plug).



## How diesel engines work

When a gas is compressed, its temperature rises, a diesel engine uses this property to ignite the fuel. Air is drawn into the cylinder of a diesel engine and compressed by the rising piston, at a much higher compression ratio than for a spark-ignition engine. At the top of the piston stroke, diesel fuel is injected into the combustion chamber at high pressure, through an atomising nozzle, mixing with the hot, high-pressure air. The resulting mixture ignites and burns very rapidly. This contained explosion causes the gas in the chamber to expand, driving the piston down with considerable force and creating power in a vertical direction. The connecting rod transmits this motion to the crankshaft which is forced to turn, delivering rotary power at the output end of the crankshaft. Scavenging (pushing the exhausted gas-charge out of the cylinder, and drawing in a fresh draught of air) of the engine is done either by ports or valves.

A vital component of any diesel engine system is the governor, which limits the speed of the engine by controlling the rate of fuel delivery.

### Diesel engine working principles

- Suction stroke
- Compression stroke
- Power stroke
- Exhaust stroke

### Fuel and fluid characteristics

Diesel fuel is a product of crude oil, although other oils can be burned inside an adapted engine. Good quality diesel fuel can be synthesised from vegetable fat and alcohol.

Diesel engines can work on thicker, heavier oil, or oil with higher viscosity, as long as it is heated to ease pumping and injection. These fuels are cheaper than clean, refined diesel oil, although they are dirtier.

Diesel fuel is more difficult to ignite than gasoline because of its higher flash point, but once burning, a diesel fire can be extremely fierce.

The use of low-grade fuels can lead to serious maintenance problems.

### 3. Diesel engine supporting systems

A number of systems are in place for proper operation of an engine

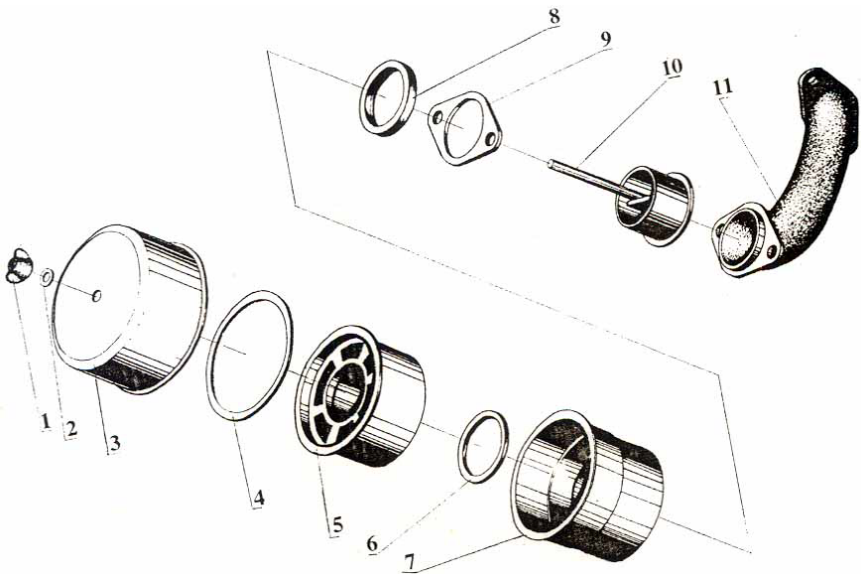
- Intake and exhaust system
- Starting system
- Fuel system
- Cooling system
- Lubricating system

#### 3.1 Intake system and exhaust system

- The function of this system is to allow the purified air to the cylinder

##### Components :

- The system is composed of Air cleaner,
- Intake manifold,
- Intake valve,
- Super charger etc.



1. Wing Nut
2. Washer
3. Air Filter Cover
4. Rubber Packing
5. Air Filter Cartridge
6. Rubber Packing
7. Air Filter Body
8. Rubber Packing
9. Air Filter Flange
10. Air Filter Sleeve
11. Intake Pipe

## Faults and remedies

Faults	remedies
1) Air cleaner jammed with dirt	Change
2) Internal manifold cracked	Change
3) Cage --- and bent stem of intake valve	Repair or change
4) Super charger not working properly	Repair or change

**Exhaust system:-** Exhaust takes out burnt gas from the cylinder

### Components:

- The system is composed of exhaust manifold
- Silencer pipe,
- silencer box and
- tail pipe



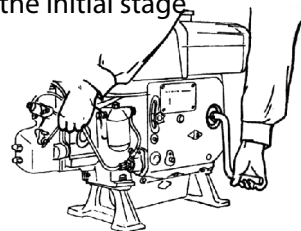
## Faults and remedies

Faults	remedies
1) Exhaust manifold broken/cracked	Change
2) Silencer pipe cracked	Change or repair
3) Silencer box jammed due to carbon leaked or burned	Repair or change
4) Tail pipe leaked or cracked	Repair or change

## 3.2 S tarting system

The system starts the engine by moving it at the initial stage

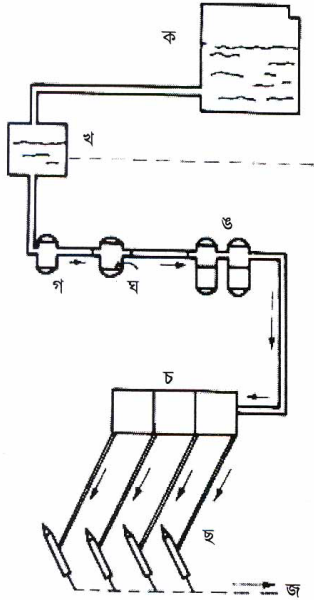
- Hand starting system
- Self starting system
- Rope starting system
- Pedal starting system





### 3.2.1 Hand starting system:

Hand starting system is generally used in one cylinder diesel engine. There is no fault in this system, one handle is used for starting. (Water, lubricant and fuel must be checked before starting)



### 3.3 Fuel system

Engine fuel system is very important through which the fuel is taken out of the fuel tank for combustion.

#### Essential components:

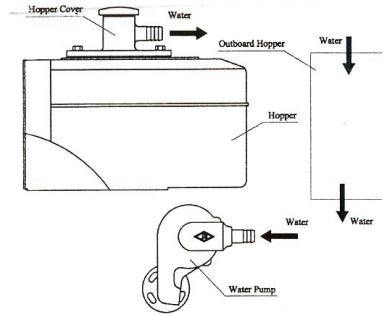
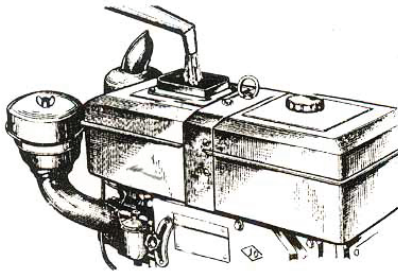
- Fuel tank
- fuel line
- fuel filter
- low pressure feed pump
- high pressure fuel pump and Injector/atomizer

### Faults and remedies

Faults	remedies
1) Fuel tank leaked/cracked	Repair or change
2) Fuel line leaked/cracked	Change
3) Filter jammed due to dirt	Change
4) Low pressure/feed pump faulty	Repair or change after checking
5) High pressure fuel pump faulty	Repair or change after checking
6) Injector faulty	Repair or change after checking

### 3.4 Cooling system

Engine cooling system enables the engine to maintain at a specific working temperature during operation



It is of two types

- Water cooling system
- Air cooling system

### 3.5 Lubricating system

Lubrication system prevents wear and tear of moving components using lubricant. It also enables faster moving of the components.

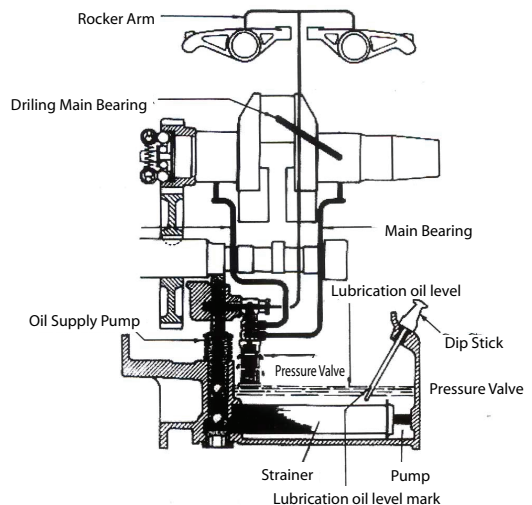
This system works as three agents

- Cooling agent
- Sealing agent
- Cleaning agent

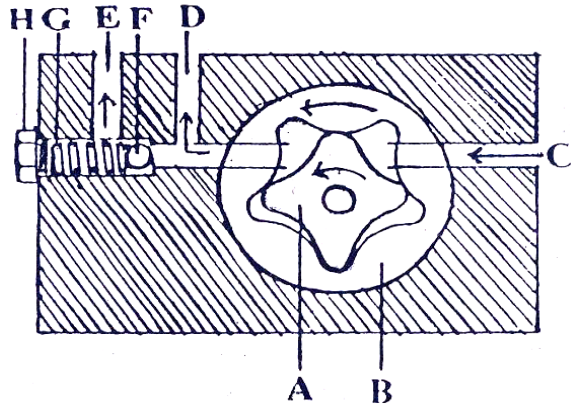
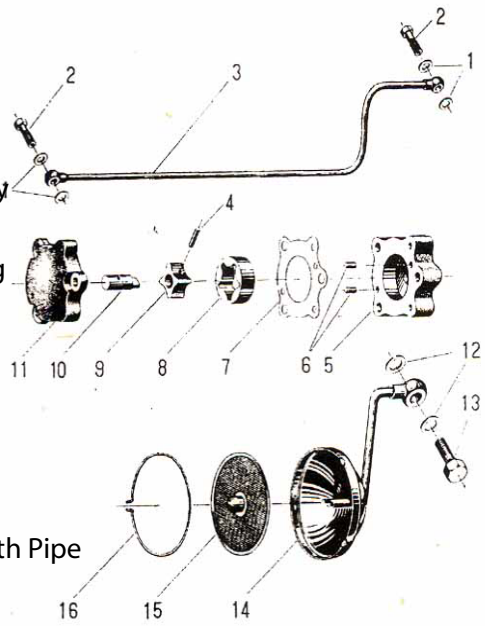
Components:

- Strainer
- Oil pump
- Oil filter
- Oil pressure gauge
- Oil passage etc

Different Parts of Lubricating Systems



1. Copper Washer
2. Pipe Connection Bolt
3. Oil Pipe
4. Cylindrical Pin
5. Lubricating Oil Pump Body
6. Locating Pin
7. Lubricating Oil Pump Packing
8. Outer Rotor
9. Inner Rotor
10. Oil Shaft
11. Oil Pump Cover
12. Copper Washer
13. Pipe Connection Bolt
14. Oil Strainer Body Section with Pipe
15. Oil Strainer Screen
16. Circlip



**Faults and remedies**

Faults	remedies
1) Strainer may be damaged	Change
2) Pump may not work After check	Repair or change
3) Oil filter jammed due to dirt	Change
4) Oil pressure gauge faulty	After check repair or change
5) Oil passage jammed	Clean

## **4 Faults during engine operation**

### **Five faults are observed during engine operation**

- Abnormal heat of engine
- Engine vibrations
- Excessive fuel consumption
- Excessive lubrication consumption
- Excessive sound during engine operation

### **4.5 Possible reasons of abnormal heat of engine**

- 1 Low water quantity in radiator/water tank
- 2 Ignition starts after specified time
- 3 Fan belt lose/torn
- 4 Water jacket jammed
- 5 Faulty water pump
- 6 Low quantity of lubricating oil
- 7 Faulty lub oil pump
- 8 Broken fan blade
- 9 Engine operates over load
- 10 Engine operates at a higher speed for long time



### **4.6 Possible reasons of engine vibrations**

- 1 Vibration damper and counter weight used with engine not working
- 2 Detonation and auto ignition
- 3 Loosening of engine main bearing, smaller end bearing of connecting rod, thrust bearing.

### **4.7 Possible reasons of excessive fuel consumption**

- 1 Repeated start and stop during operation
- 2 Leak in fuel delivery line

## 5 What is the function of fuel injection pump

Fuel injection pump sprays higher pressure diesel in the cylinder

## 6. How fuel enters into the fuel pump

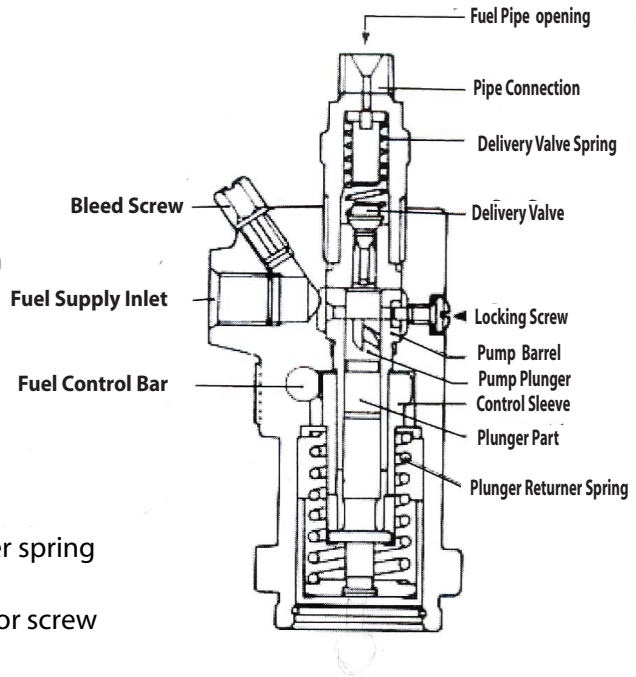
Fuel enters fuel pump by two methods

- By gravity feed system
- Pressure feed system



**7. Name with picture of different parts of in line high pressure pump of one cylinder engine**

- Outlet nipple
- Delivery valve spring
- Delivery valve
- Valve support
- Barrel
- Fuel chamber
- Toothed pinion
- Control rack
- Plunger
- Control sleeve
- Plunger retainer spring
- Adjusting bolt or screw
- Lock nut
- Cam roller



- 3 Leak in fuel tank
- 4 Air cleaner jammed
- 5 Engine operation during waiting time
- 6 Improper valve timing
- 7 Over loaded engine

#### **4.8 Possible reasons of excessive lubrication consumption**

- 1 Piston not fitted properly
- 2 Piston and connecting rod alignment not right
- 3 Oil ring not placed at specified oil ring groove
- 4 More gap between piston and cylinder
- 5 Lower tension of oil ring
- 6 Too much wearing of Big end bearing
- 7 Main oil seal cracked and damaged
- 8 Intake valve guide fitted wrongly
- 9 Due to over wearing of cylinder taper and out/round
- 10 Engine head gasket cracked and damaged

#### **4.9 Possible reasons of excessive sound during engine operation**

- 1 Wear and improper adjustment of engine parts
- 2 Abnormal condition due to detonation and auto ignition
- 3 Lower quality fuel
- 4 Loose connecting rod

## **8. Reasons of less fuel in the fuel pump**

- Less fuel in fuel tank
- Filter jammed by dirt
- Less oil delivery by fuel transfer pump
- Air lock in fuel line

## **9 What is above plunger**

- Vertical channel or slot
- Helical channel groove
- Annular groove

## **10 What are types of non return valve**

- Suction non return valve
- Delivery non return valve

## **11 How fuel pump delivery affects from leak of non return valve**

- When too much leak pump will not have enough pressure and also there will not be spray by the injector
- With less leak the pump pressure will be right but less fuel will be sprayed through the injector
- With less leak the pump will be retarded and the fuel spray will be delayed.

## **12 What is the pressure of fuel pump**

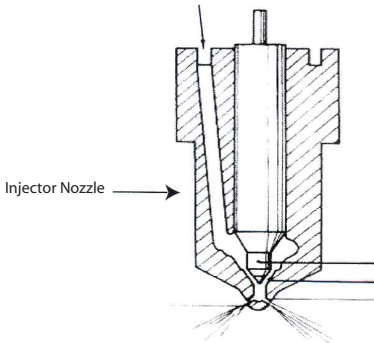
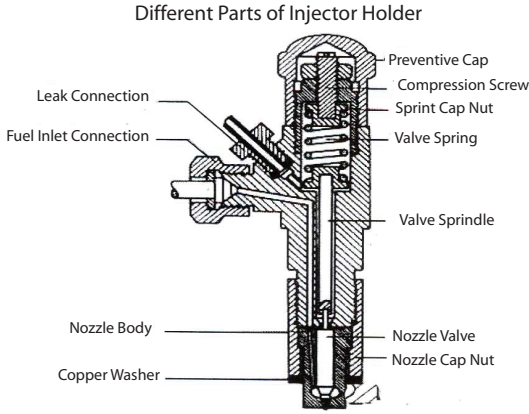
Fuel pump delivers 240-700 Kg/cm<sup>2</sup> ( 4000-10,000 Psi)

## **13 What are parts damaged in a fuel pump**

- Wear of plunger
- Wear of plunger bush
- Less tension in plunger retaining spring
- Plunger retaining spring broken
- Wear of bush and ball bearing
- Wear above tappet and bottom of plunger
- Wear of roller and fan



# 14. Name of different Parts & Servicing of Nozzle with Picture Nozzle Injector Holder



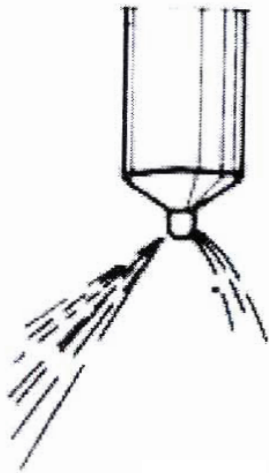
Due to Injector Fault huge blacksmook will exit from the Exhaust Pipe



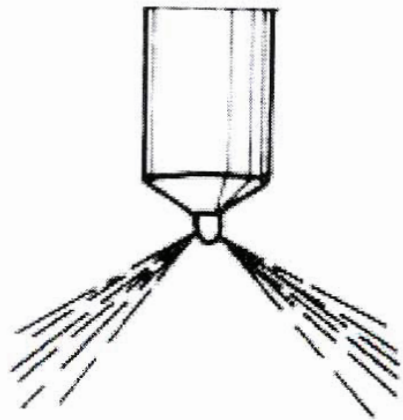


## 14 Nozzle Servicing

- Open faulty nozzle to clean carbon and check whether nozzle moves freely
- Check delicate parts
- Check nozzle valve and body
- Nozzle valve and body to be immersed in clear diesel oil to remove carbon
- Carbon to be cleaned with copper wire brush and not with steel brush
- Fuel bore to be cleaned with fine drill



Wrong



Wright

## **15 Air bleeding of diesel fuel system**

Right method of air bleeding in the fuel system is explained below

- Fill up the fuel tank with new diesel oil
- Open valve of the tank
- Loosen bleeding plug of the fuel filter and pump till fuel flow is continuous
- Tighten the plug
- Loosen injection line nut and crank the engine till fuel is flowing without foam
- Close the injection line and check for any leak.



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