

## Cooling and Lubrication

### NECESSITY OF COOLING SYSTEM:

The cooling system is provided in the IC engine for the following reasons:

- The temperature of the burning gases in the engine cylinder reaches up to 1500 to 2000°C, which is above the melting point of the material of the cylinder body and head of the engine. (Platinum, a metal which has one of the highest melting points, melts at 1750 °C, iron at 1530°C and aluminium at 657°C.) Therefore, if the heat is not dissipated, it will result in the failure of the cylinder material.
- Due to very high temperatures, the film of the lubricating oil will get oxidized, thus producing carbon deposits on the surface. This will result in piston seizure.
- Due to overheating, large temperature differences may lead to a distortion of the engine components due to the thermal stresses set up. This makes it necessary for, the temperature variation to be kept to a minimum.
- Higher temperatures also lower the volumetric efficiency of the engine.

### Defects of engine cooling and its remedies:

#### **Loss of coolant:**

Water leakage and water evaporation are the main cause of water loss from the cooling system.

#### **Cause:**

Water leakage may occur due to a faulty head gasket or loose cylinder head. It also may be due to the cracked head or engine block, loosening of hose clamps and radiator pipe leaks.

#### **Remedy:**

So, to stop such a leakage, head gasket may be replaced, hose clamp may be tightened and radiator pipe soldering. Filling the water at the correct level in the radiator will compensate the loss of water.

## **Overheating of coolant:**

### **Cause:**

This is caused due to rusting or sealing of water jackets and radiator. The other reasons are defective hose, defective water pump, a defective thermostat, slipping of fan belt, blocking of the air passage in the radiator and loss of cooling water. The heat transfer from the wall of the cylinder to the coolant is mostly affected due to rusting and scaling takes place on the walls.

### **Remedy:**

This may be removed by washing the cavities with some chemical and reverse flushing.

## **Overcooling of coolant:**

### **Cause:**

Over Cooling is generally caused by a thermostat that opens too early or remains open at all times. In some cases, there is no thermostat employed or missing. If By-Pass valve remains open at all time, it results in the overcooling of water.

### **Remedy:**

The defective thermostat must be replaced. Action should be taken to close the By-Pass valve.

## **Function of lubrication:**

(a) **Reducing frictional effect:** The primary purpose of the lubrication is to reduce friction and wear between two rubbing surfaces. Two rubbing surfaces always produce friction. The continuous friction produce heat which causes wearing of parts and loss of power. In order to avoid friction, the contact of two sliding surfaces must be reduced as far a possible. This can be done by proper lubrication only. Lubrication forms an oil film between two moving surfaces. Lubrication also reduces noise produced by the movement of two metal surfaces over each other.

(b) **Cooling effect:** The heat, generated by piston, cylinder, and bearings is removed by lubrication to a great extent. Lubrication creates cooling effect on the engine parts.

(c) **Sealing effect:** The lubricant enters into the gap between the cylinder liner, piston and piston rings. Thus, it prevents leakage of gases from the engine cylinder.

(d) **Cleaning effect:** Lubrication keeps the engine clean by removing dirt or carbon from inside of the engine along with the oil.

### **ENGINE LUBRICATING SYSTEM :**

The lubricating system of an engine is an arrangement of mechanism and devices which maintains supply of lubricating oil to the rubbing surface of an engine at correct pressure and temperature.

The parts which require lubrication are:

- (i) cylinder walls and piston
- (ii) piston pin
- (iii) crankshaft and connecting rod bearings
- (iv) camshaft bearings
- (v) valves and valve operating mechanism
- (vi) cooling fan
- (vii) water pump and
- (viii) ignition mechanism.

There are three common systems of lubrication used in automobiles:

- (i) Splash system
- (ii) Forced feed system
- (iii) Combination of splash and forced feed system.

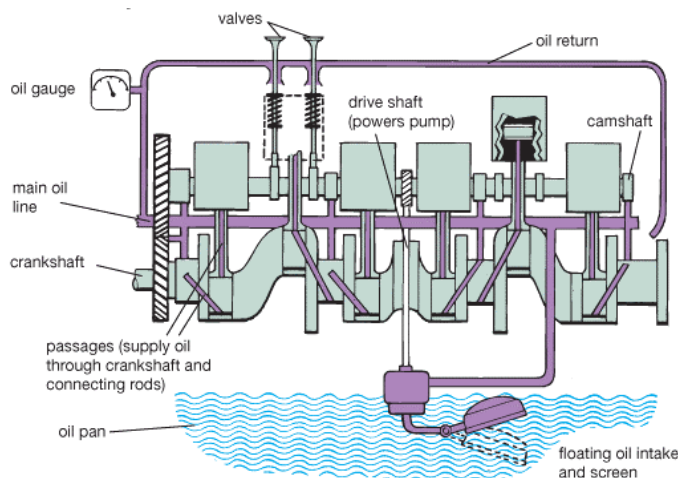
#### **Splash system:**

In this system, there is an oil trough, provided below the connecting rod. Oil is maintained at a uniform level in the oil trough. This is obtained by maintaining a continuous flow of oil from the oil sump or reservoir into a splash pan, which has a depression or a trough like arrangement under each connecting rod. This pan receives its oil supply from the oil sump either by means of a gear pump or by gravity. A dipper is provided at the lower end of the connecting rod. This dipper dips into oil trough and splashes oil out of the pan. The splashing action of oil maintains a fog or mist of oil that drenches the inner parts of the engine such as bearings, cylinder walls, pistons, piston pins, timing gears etc.



This system is usually used on single cylinder engine with closed crankcase. For effective functioning of the engine, proper level of oil maintained in the oil pan. Lubrication depends largely upon the size of oil holes and clearances. This system is very effective if the oil is clean and undiluted. Its disadvantages are that lubrication is not very uniform and when the rings are worn, the oil passes the piston into combustion chamber, causing carbon deposition, blue smoke and spoiling the plugs. There is every possibility that oil may become very thin through crankcase dilution. The worn metal, dust and carbon may be collected in the oil chamber and be carried to different parts of the engine, causing wear and tear.

### Forced feed system:



In this system, the oil is pumped directly to the crankshaft, connecting rod, piston pin, timing gears and camshaft of the engine through suitable paths of oil. Usually

the oil first enters the main gallery, which may be a pipe or a channel in the crankcase casting. From this pipe, it goes to each of the main bearings through holes. From main bearings, it goes to big end bearings of connecting rod through drilled holes in the crankshaft. From there, it goes to lubricate the walls, pistons and rings. There is separate oil gallery to lubricate timing gears. Lubricating oil pump is a positive displacement pump, usually gear type or vane type. The oil also goes to valve stem and rocker arm shaft under pressure through an oil gallery. The excess oil comes back from the cylinder head to the crankcase. The pump discharges oil into oil pipes, oil galleries or ducts, leading different parts of the engine. This system is commonly used on high speed multi-cylinder engine in tractors, trucks and automobiles.

**COMBINATION OF SPLASH AND FORCED FEED SYSTEM:**

In this system, the engine component, which are subjected to very heavy load are lubricated under forced pressure, such as main bearing, connecting rod bearing and camshaft bearing. The rest of the parts like cylinder liners, cams, tappets etc are lubricated by splashed oil.