

UNIT - 4

LUBRICATION SYSTEMS

4.0 Introduction:

In order to ensure of smooth running of the Engine, various Engine parts are to be lubricated to reduce friction. It provides a film of oil between the moving parts and their bearing surfaces. It avoids direct friction by keeping the parts of floating upon oil film. This enables the parts to work longer time resulting in longer.

Types of Lubricants:

The lubricants are three types.

1. Solid Lubricants : Graphite, Mica, Soap stone or Steatite.
2. Semi-Solid Lubricants : Grease.
3. Liquid Lubricants : Mineral oil, Vegetable oil, Animal oil etc.

Properties of Lubricants:

Viscosity:

Viscosity is the resistance of lubricating oil to flow. The viscosity of the lubricating oil should be sufficient to ensure hydrodynamic lubrication.

Physical Stability:

The lubricating oil must be stable physically at the lowest and highest temperatures.

Chemical Stability:

At higher temperatures oil should remain chemically stable. It should not have any tendency for oxide formation. It should not form carbon.

Resistant against Corrosion:

The oil should not have any tendency to corrode the pipe lines, crank case and other Engine parts.

Pour Point:

The minimum temperature at which the oil will pour is called pour point.

Flash Point:

The flash point of the oil should be sufficient high so as to avoid flashing of oil vapours at temperatures occurring in common use.

Cleanliness:

The oil should be clean and stable itself so that crank case and oil liners are kept clean.

Resistance against extreme pressure:

In modern automobile Engines, lubricating oil is with stand to very high pressures, particularly in bearings and valve activating mechanism.

Dilution:

During the combustion, Petrol vapour may escape from piston rings. If the rings are broken to dilute the oil crank case oil is mixed with it.

Oiliness:

Any liquid is said to be oil when it has oiliness. Then property is highly desirable in helping the lubricant to adhere to the cylinder walls.

Requirements of Lubricants for Automobiles:

1. To reduce friction between moving parts.
2. To reduce wear of the moving parts.
3. To provide cooling effect.
4. To provide cushioning effect.
5. To provide cleaning action.
6. To provide sealing action.

SAE Number:

The Society of Automotive Engineers has recommended SAE Viscosity Number for Lubricating Oil.

5 Watts, 10 Watts and 20 Watts:

SAE number lubricating oil are used for winter.

20 Watts, 30 Watts and 40 Watts:

SAE number lubricating oil are used for summer.

Lubrication Systems:

The various systems adopted for the lubrication of automobile Engines are

1. Petrol system
2. Splash system
3. Pressure system
4. Dry-sump system

1. Petrol System:

This is used for small two stroke Engines like scooters and motor cycle Engines. It is the simplest of all types of Engine lubrication systems. Certain amount of lubricating oil is mixed with the Petrol. The used ratio is 2% to 3% of oil. If it is less, there is a danger of oil starvation or insufficient lubrication causing damage to the Engine. If it is more, excessive carbon deposits in the cylinder head and Engine will give dark smoke.

2. Splash Lubrication System:

This was employed for the Engines of early motor cycles. It is one of the cheapest method of Engine lubrication. A scoop is made in the lowest part of the connecting rod and the oil is stored in the oil through. It is pumped from the crank case oil jump. When the Engine runs, the scoop causes the oil to splash on the cylinder walls. Thus affects the lubrication of Engine walls, gudgeon pin, main crank shaft bearings, big end bearings.

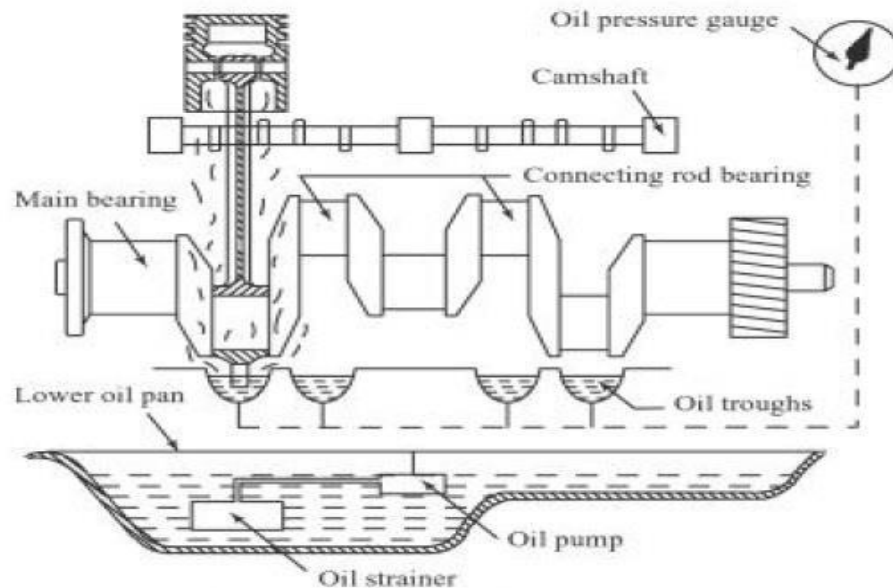


Fig 4.1 Splash Lubricating System

3. Pressure (or) Forced feed Lubrication System:

This system is used almost universally in modern car Engines. In this system car oil pump takes the oil from the wet pump through a strainer and deliver through a filter to the main oil gallery. The oil pressure is controlled by means of pressure-relief valve. There is one main gallery in case of inline Engines. Whereas V-Engines use two main galleries or one main gallery and valve tappet galleries.

From the main gallery, the oil goes through the drilled passages to the main bearings. Some of the oil after lubricating the main bearings falls back to the pump. Some is splashed to lubricate cylinder walls. The oil goes through a hole to the crank pins and connecting rod web and to the gudgeon pin and to the ring lubrication. The oil then falls on the cylinder walls and drains back into the oil pan. For camshaft and timing gears, lubricating oil is lead through separate oil lines from the oil gallery. The valve tappets are lubricated by connecting the main oil gallery to the tappet guide surface through drilled holes. During its circulation, the oil gains heat from various Engine parts, which is given out to the pump walls.

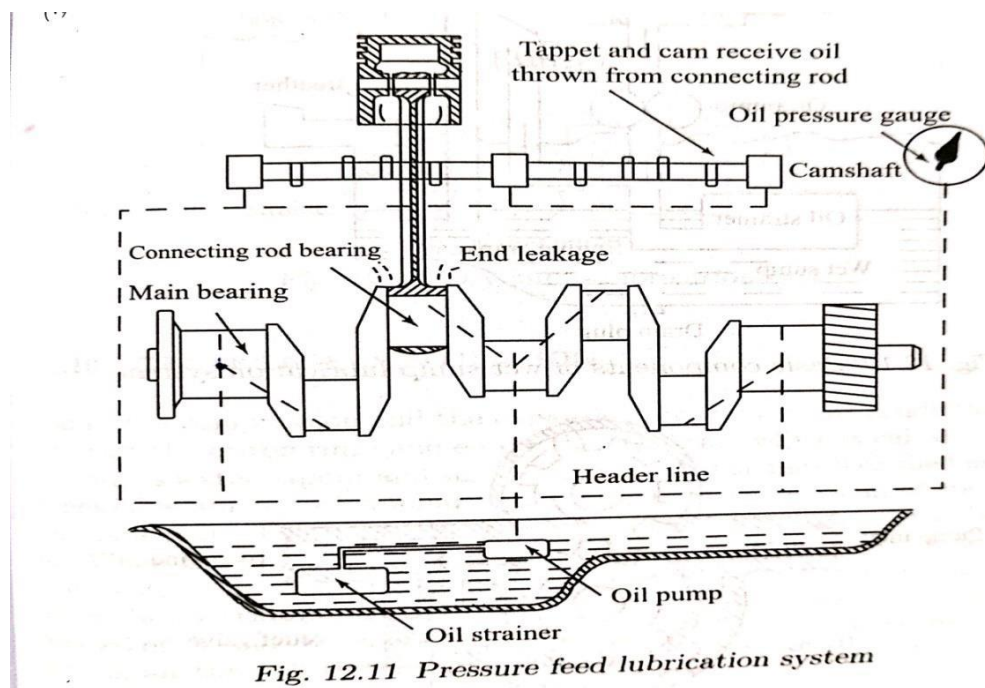


Fig 4.2 Pressure Feed Lubricating System

4. Dry Sump System:

This system is employed in some racing car Engines. In dry sump lubrication system two pumps are used. The scavenge pump is installed in the crank case portion which is the lowest. It pumps oil to a separate reservoir, from where the pressure pump. The pump send the oil to filter. Then goes to the cylinder bearings. The oil pressure is maintained at

400-500kpa for main and big end bearings about 50-100kpa pressure is used for timing gears and cam shaft bearings.

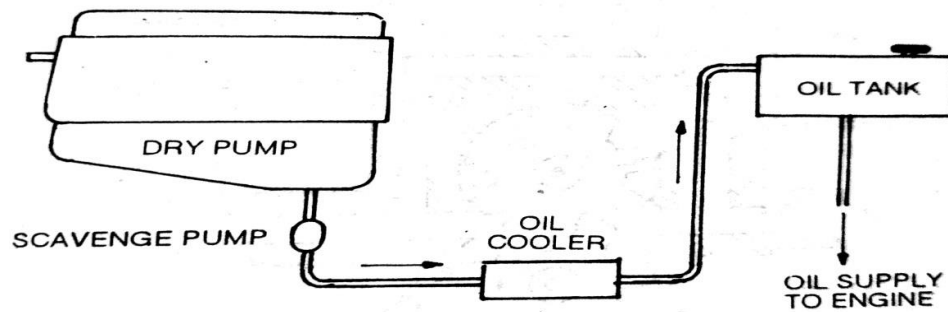


Fig 4.3 Dry Sump System

Oil Filters:

Oil filters used in Engine lubricating system to filter out the dirt particles from the oil.

Types of Oil Filtering Systems:

- a) By-pass system
- b) Full flow system.

a. By-pass System:

In by-pass system the whole of the oil does not pass through the filter at the same time. Most of the oil without being filtered goes to the bearings where as the rest passing through the filter is cleaned out and is returned to the sump.

b. Full-flow System:

In this system all the oil which goes to the bearings must pass through the filter first. If any time filter is blocked in the system, the bearings would be starved. To avoid this a spring loaded relief valve is incorporated in the filter. It by pass the unfiltered oil to the bearings to saving from starvation.

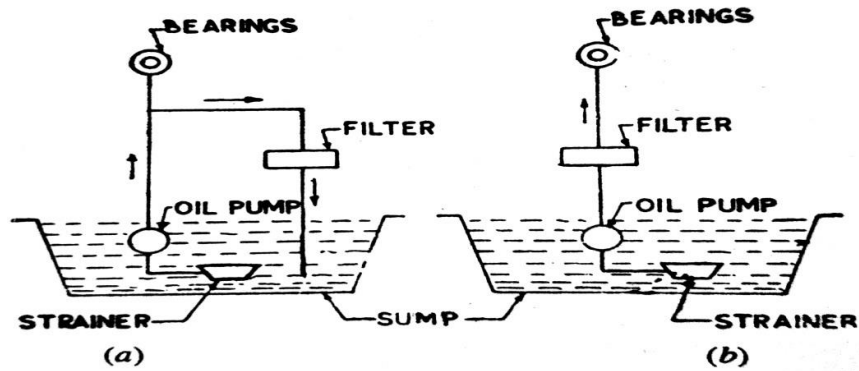


Fig 4.4 Oil Filter

Types of Oil Filters:

1. Cartridge type oil filter:

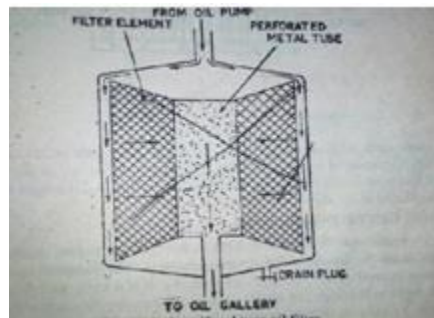


Fig 4.5 Catridge Type Oil Filter

It consists a filtering element placed in the metallic casing. The impure oil pass through the filtering element which takes all the impurities. The oil enters the filter at the top and passes through the filter element. The pure oil then goes to the porous metallic tube from where it goes to the out let for circulation. A drain plug is also provided.

2. Stack or Edge type oil filter:

In this the oil is pass through a number of closely spaced discs. The alternate discs are mounted over a central spindle, while the discs in between these are attached to a separate spindle. The oil is made to flow through the spaces between the discs. The impurities are left on the peripheries. The impurities are removed by operating the central knob.

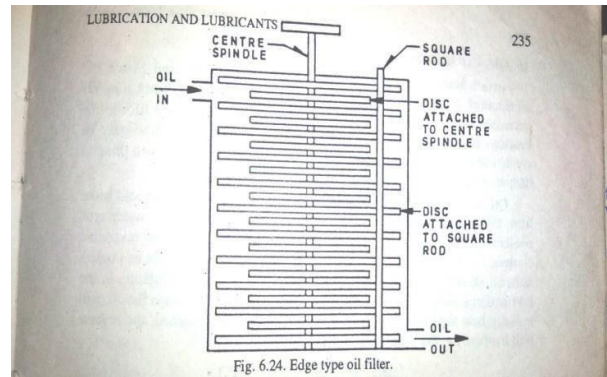


Fig 4.5 Edge type Oil Filter

3. Centrifugal type Oil Filter:

In this the impure oil enters the hollow central spindle having holes around its periphery. The dirty oil comes out of these holes and fills the rotor casing. After oil passes down the tubes A at the ends which jets are attached. The oil under pressure passes through these jets, the reaction of which gives the motion to the rotor casing in the opposite direction so that it starts rotating. The impurities are retained and clean oil falls below from where it is taken out.

Positive Crank Case Ventilation:

During combustion, fuel and water particles from the combustion chamber into the crank chamber which dilute the lubricating oil. The oil loses its viscosity. The water particles causes rusting of Engine parts. In order to save the Engine from the harmful effects of fuel, water and sulphur particles must be removed out of Engine. Crank case ventilation removes these particles from the Engine.

Air from the atmosphere enters the crank chamber through air cleaner and goes out through the outlet passage carrying along with fuel, water and sulphur particles. In order to make the best utility of the Petrol and oil particles. Positive crank case ventilation outlet is connected with the Engine manifold. So that useful gases may go into the combustion chamber along with fresh charge.

Sludge formation Effect:

Sludge is a thick, creamy and block substance. It is a mixture of oil water and combustion products. It clogs the oil lines and galleries. It is caused by the condensation of water in the Engine crank case. A vehicle which runs mostly in traffic, running slow and stopping intermittently are the causes for sludge formation. This can be remedied by adjusting its cooling system so that the Engine remains at a reasonable high temperature.

Short Answer Questions

1. Write the necessity of providing a lubrication system.
2. Explain various types of lubricants.
3. Write various types of lubricating systems.
4. Draw the line diagram of dry sump lubrication system.

Long Answer Questions

1. What is lubricant & explain the properties of lubricants.
2. With a neat sketch, explain splash lubrication system.
3. Explain pressure or forced feed lubricating system with a neat sketch.