

# LUBRICANTS

The substance capable of reducing the friction bet<sup>n</sup> two surfaces which are sliding over each other is called Lubricant. The main characteristics of a Lubricant is -

- i) it does not allow the direct contact bet<sup>n</sup> the rubbing surfaces by keeping its own film in bet<sup>n</sup> the rubbing surfaces.
- ii) it acts as a coolant or heat transfer medium by removing the frictional heat generated due to rubbing of surfaces.
- iii) it acts as a seal in internal combustion engine by sealing the piston and cylinder wall at the compression rings so that there is no leakage of gases at high pressure in the combustion chamber.
- iv) power loss is reduced by lubrication in internal combustion engines.

## Properties of Lubricants :-

- i) viscosity and viscosity index :- The Lubricant should have appreciably high coefficient of viscosity and the variation of viscosity of an Lubricant with temp. should be minimum. This property is known as viscosity index.

An oil has low V.I. if its viscosity decreases with rise in temp. Under running condition due to rise in temp., viscosity

2

will decrease and if this decrease is excessive, lubricant will be poor causing damage of the engine. The lubricant should show only a small change in viscosity with temp. The V.I. improvers are high polymers like poly butene. V.I. is measured by Redwood viscometer.

2) Flash pt. and fire pt. :- Flash point is defined as the lowest temp. at which the oil gives off sufficient vapours to produce a combustible mixture which will flash over the whole surface of the sample. After the flash pt. is reached at which the emission of inflammable vapour occurs rapidly enough to support a flame. A good lubricant should have high flash pt. and fire point. So it stipulates the safe guard temp. against the risk of fire.

3. Pour Point and Cloud Point :- Pour point of a sample of lubricating oil is defined as the lowest temp. at which the oil will pour or flow when it is chilled without disturbance under definite condition like gravity. Cloud pt. is defined as the temp. at which paraffin wax or other solid substances begin to separate from the solution when the oil is chilled. A sample of lubricant should have low pour point and cloud point.



4) Aniline Point :- It indicates the temp. at which the possible deterioration of oil in contact with rubber sealings or packing etc.

5) Emulsification :- This is the property of oil to get intimately mixed with water, forming a mixture called emulsion. It is a undesirable property for the lubricating oil. A good lubricant should not form emulsion under working condition.

6) Oiliness :- The capacity of a lubricant to stick on to the surface under pressure or load is called oiliness. Vegetable oils have high oiliness.

7) Corrosion stability and carbon residue :-

A lubricant should have sufficient corrosion stability at optimum temp. It should not corrode or tarnish the surface of a metal.

A good lubricant should deposit least amount of carbon when used in an internal combustion engine because the formation of carbon from decomposition of oil decreases the efficiency of the engine.

8) Volatility and ash content :- A good lubricating oil should possess low volatility, otherwise heavy machines working at very high temp. undergo volatilization leaving behind a residue which has low or different lubricating properties.

## 9) Acid value and specific gravity:-

The acidity of lubricating oil should be less than 0.1, otherwise it may lead to corrosion, besides gum and sludge formation.

The specific gravity helps in identifying the crude from which the lubricant has been prepared.

## Classification of Lubricants:-

The lubricants are usually classified into -

- (a) Liquid lubricants (Lubricating oil)
- (b) Semi-solid lubricants (Grease)
- (c) Solid lubricants (graphite)

(a) Liq. lubricants:- It reduce friction and wear between two sliding metallic surfaces. They act as cooling medium, sealing agent and corrosion preventer. It may be of two types -

i) Animal and vegetable oils:- They are rarely used and if used, they are used as additives to the mineral lubricating oil for desired effects.

ii) Mineral or Petroleum oil:- They are mainly obtained from the residues left behind in crude petroleum distillation. There are two types of residues eg. - paraffinic residues and asphaltic residues. All the mineral lubricating oil contain



paraffinic wax, resin, asphalt and thio derivatives as impurities. So different techniques are applied to remove the impurities, eg. dewaxing - by treating with suitable solvent like propylene dichloro ethylene etc. and then centrifuging it. The oil is then subjected to acid refining for removing naphthalene, asphalt etc. by treating with  $H_2SO_4$  etc. then with  $NaOH$ .

The lubricating properties in most of the mineral oil is increased by adding different additives like -

- i) Pour point depressing additives (eg. phenol)
- ii) Viscosity index improvers (eg. luccanol)
- iii) Thickener for increasing viscosity (eg. polyethylene, polyester etc.)
- iv) Antioxidants like aromatic phenolic and amino compounds.
- v) Corrosion preventers :- like compounds of P and Sb.
- vi) Antifoaming agent eg. glycol, glycerol.
- vii) Emulsifiers :- eg. Na-salts of sulphuric acid.

1) Semi solid lubricants :- It is a semi solid, consisting of soap dispersed through out a liquid lubricating oil. They are generally petroleum fractions and may be synthetic agents like silicones and fluorocarbons. It is prepared by dissolving fatty acid in lubricating oil and then the mixture is dehydrated upto desired level. It is very much consistent in action except at low temp.



(C) Solid Lubricants :- These are mostly graphite and molybdenum disulphide. They possess a layered structure which is the main criterion for their lubricating action. Mixed with oil known as oil dag, it finds use in internal combustion engine. Both are stable upto a temp. of  $375^{\circ}\text{C}$ , above which ~~get~~ they get oxidised.

SYNTHETIC LUBRICANTS :- Mineral lubricants with additives cannot be used at abnormal condition like very high temp., then synthetic lubricants are generally used. These are prepared from hydrocarbons, poly glycols, silicones etc. They possess high flash point, viscosity index, thermal stability. They are chemically stable and non-inflammable eg. polymerised hydrocarbons - poly ethylene, poly propylene, poly butylene, poly glycols etc. They can be used from  $-50^{\circ}\text{C}$  to  $+250^{\circ}\text{C}$ . Silicones are very useful for low temp. lubrication of small parts (for below  $250^{\circ}\text{C}$  use).

CUTTING FLUIDS :- The liquids which are used to cool as well as lubricate, are called cutting fluids. Emulsion of oil in water are generally used as cutting fluids. The important characteristics of it are - good lubricating property, low viscosity, chemical and thermal stability etc.