Lubricants and lubrication

Objectives : At the end of this lesson you shall be able to
- **state the purpose of using lubricants**
- **state the properties of lubricants**
- **state the qualities of a good lubricant.**

With the movement of two mating parts of the machine, heat is generated. If it is not controlled the temperature may rise resulting in total damage of the mating parts. Therefore a film of cooling medium with high viscocity is applied between the mating parts which is known as a 'lubricant'.

A 'lubricant' is a substance having an oily property available in the form of fluid, semi-fluid, or solid state. It is the lifeblood of the machine, keeping the vital parts in perfect condition and prolonging the life of the machine. It saves the machine and its parts from corrosion, wear and tear, and it minimises friction.

Purposes of using lubricants

- Reduces friction.
- Prevents wear.
- Prevents adhesion.
- Aids in distributing the load.
- Cools the moving elements.
- Prevents corrosion.
- Improves machine efficiency.

Properties of lubricants

Viscosity

It is the fluidity of an oil by which it can withstand high pressure or load without squeezing out from the bearing surface.

Oiliness

Oiliness refers to a combination of wettability, surface tension and slipperiness. (The capacity of the oil to leave an oily skin on the metal.)

Flash point

It is the temperature at which the vapour is given off from the oil (it decomposes under pressure soon).

Fire point

It is the temperature at which the oil catches fire and continues to be in flame.

Pour point

The temperature at which the lubricant is able to flow when poured.

Emulsification and de-emulsibility

Emulsification indicates the tendency of an oil to mix intimately with water to form a more or less stable emulsion. De-emulsibility indicates the readiness with which subsequent separation will occur.

Film of oil formed in journal bearing

In a sliding contact bearing, the journal is directly inserted into the bearing. This results in direct metal to metal contact between them. As a consequence the friction is higher between the inner surface of the bearing and the outer surface of journal, if there is no lubricating film present in between them. Bearings can be lubricated with three kinds of lubricants, viz. Liquids like mineral oil or vegetable oils, semi - solids like grease, and solids like graphite or molybdenum di-sulfide. These lubricants are used to reduce friction and wear, dissipate the frictional heat and to protect against corrosion. There are two basic modes of lubrication: (a) thick film and (b) thin film lubrication.

Thick film lubrication

In thick film lubrication, two surfaces of bearing in relative motion, (Viz., the journal and the bearing inner surface) are completely separated by a fluid film. The resistance to relative motion arises from the viscous resistance of the fluid. This does not depend on the structure of jurnal surface and bearing inner surface as they are not in contact with each other. Thick film lubrication is classified into: hydrodynamic and hydrostatic lubrication.

Hydrodynamic lubrication

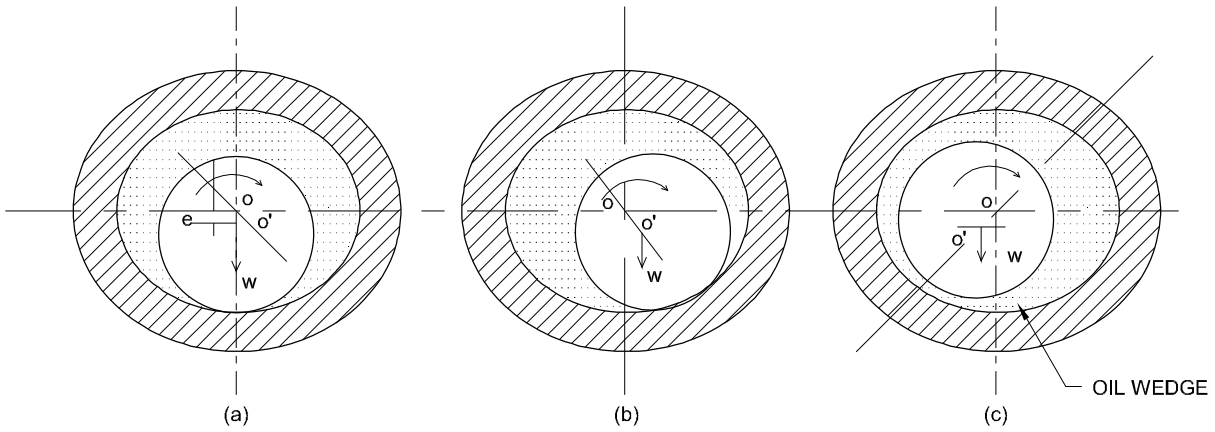
Hydrodynamic lubrication is defined as a system of lubrication in which the load supporting fluid film is created by the shape and relative motion of the slideing elements. The principle of hydrodynamic lubrication in journal bearing is shown in Fig 1

Hydrodynamic lubrication (a) Journal at rest (b) journal starts to rotate (c) journal at full speed

When the shaft (Centered at o') is at rest, it goes to the bottom of bearing (centered at O) under the action of load W. This load is due to the weights of shaft and various elements (gears, pulleys) supported by the shaft. The outer surface of journal and inner surface of bearing touch each other during rest, with no clearance at the bottom. The letter 'e' denotes the eccentricity, the offset between the axes of the journal and the bearing.

As the journal starts to rotate, it will climb bearing surface. When the speed is increased further, it forces the fluid into the wedge-shaped region between the journal and bearing. As more and more fluid is forced into the wedge shaped region, pressure is generated within the fluid as shown in Fig.1 This fluid pressure generated in the clearance space supports the external load (W). It can be seen that the pressure distribution around journal varies greatly. Hydrodynamic lubrication does not need a supply of lubricants at high pressure from external soruce (pumps), as enough fluid pressure is, generated within the system. Bearings that use 'hydrodynamic lubrication' are called 'Hydrodynamic bearings'.

Fig 1



INDUSTRIAL LUBRICATING OILS **Annexure I**

Product	Kinematic viscosity Cst at 40°C.	VI	Flash point COC°C	Description/Application
General Purpose Machinery Oils				
Lubrex 57	54.60	..	160	Lubrex oils are low viscosity index straight mineral
Lubrex 68	64.72	..	160	lubricants having good inherent oxidation stability; they protect machine elements from excessive wear and provide economical lubrication. These oils are recommended for lubrication of bearings, open gears, lightly loaded slides and guideways of machine tools.
Flushing Oil				
Lubrex Flush 22	19.22	..	150	Lubrex Flush 22 is a light coloured, low viscosity, straight mineral oil specially developed for slushing of automotive and industrial equipment. The characteristics of Lubrex Flush 22 make it possible to easily clean all inacessible internal surfaces of various equipments.
Circulating and Hydraulics Oils (Anti-wear Type)				
Servosystem 32	29.33	95	196	Servosystem oils are blended from highly refined
Servosystem 57	55.60	95	210	base stocks and carefully selected anti-oxidant,
Servosystem 68	64.72	95	210	anti-wear,anti-rust and anti-foam additives.These
Servosystem 81	78-86	90	210	oils have long service life, and are recommended
Servosystem 100	95-105	90	210	for hydraulic systems and a wid of circulation

Servosystem 150	145-155	90	230	systems of industrial and automotive equipment. These oils are also used for compressor crank case lubrication, but are not recommended for lubrication of turbines and equipment having silver coated components.
Spindle Oils				
Servospin 2	2.0-2.4	..	70	Servospin oils are low viscosity lubricants containing anti-wear, anti-oxidant, anti-rust and anti-foam additives. These oils are recommended for lubrication of textile and machine tool spindle bearings, timing gears, positive displacement blowers, and for tracer mechanism and hydraulic systems of certain high precision machine tools.
Servospin 5	4.5-5.0	..	70	
Servospin 12	11-14	90	144	
Machinery Oils				
Servoline 32	29.33	..	152	Servoline oils provide good oiliness for general lubrication even under boundary lubrication conditions, protect parts against rust and corrosion and maintain thin film strength and anti-rust additives. Servoline oils are general purpose lubricants for all loss lubrication systems of textile mills, paper mills, machine tools.
Servoline 46	42.50	..	164	
Servoline 68	64-72	..	176	
Gear Oils				
Servomesh 68	64-72	90	204	Servomesh oils are industrial gear oils blended with lead and sulphur compounds. These oils provide resistance to deposit formation, protect metal components against rust and corrosion, separate easily from water and are non-corrosive to ferrous and non-ferrous metals. Servomesh oils are recommended for lubrication of industrial gears, plain and anti-friction bearings subjected to shock and heavy loads and should be used in systems were operating tem
Servomesh 150	145-155	90	204	
Servomesh 257	250-280	90	232	