TE 4225

Lubrication

Lubrication

Lubrication may be defined as:- “The reduction of friction and wear between two relatively moving surface, by the interposition of some other substances between the surface & the substance introduced is known as lubricant”.

Functions of Lubrication

- Reduces friction and wear between moving parts
- Transfers heat away from engine parts
- Cleans the inside of the engine
- Cuts power loss and increases fuel economy
- Absorbs shock between moving parts
- Improves efficiency
- Reduces wear
- Decreases running cost
- Removes wear particles
- Prevents corrosion

Properties of Lubricants

(Short Notes)

- Viscosity
- Viscosity Index (VI)
- Flash Point
- Pour Point
- Per cent sulfated ash
- Per cent zinc.

Properties of Lubricants

Viscosity:

- Measure of the "flow ability“
- Property –
  - Resistance to flow
  - Shearing stress
- High viscosity - thick oils
  - Too high viscosity may not reach all parts
- Low viscosity – thin oil
  - Too low viscosity may not provide enough strength to keep parts from wearing

Properties of Lubricants

- **Viscosity index:**
- The measure of an oil's ability to resist changes in viscosity when subjected to changes in temperature.

  - As temperature increases viscosity decreases.
  - Low temperatures – High viscosity
  - High temperature – Low viscosity

Properties of Lubricants

- **Flash point:**

Temperature at which an oil vaporizes sufficiently to sustain momentary ignition when exposed to a flame under atmospheric conditions

- **Fire point:**

Temperature at which an oil will sustain ignition continually when exposed to a flame under atmospheric conditions

Properties of Lubricants

- **Pour point:**

Lowest temperature at which an oil will flow when tested under certain specified conditions

- **Percent Sulfated Ash** :
  - how much solid material is left when the oil burns.
  - A high ash content will tend to form more sludge and deposits in the engine.
  - Low ash content also seems to promote long valve life. Look for oils with a low ash content.

Properties of Lubricants

- Percent zinc
  - the amount of zinc used as an extreme pressure, anti-wear additive.
  - The zinc is only used when there is actual metal to metal contact in the engine. Hopefully the oil will do its job and this will rarely occur, but if it does, the zinc compounds react with the metal to prevent scuffing and wear.
  - A level of 0.11% is enough to protect an automobile engine for the extended oil drain interval, under normal use.

Types of Lubrication

1. **Boundary Lubrication:** When two surface slide relative to each other with only a partial thin lubrication film between them, boundary lubrication is said to be exist.
2. **Hydrodynamic Lubrication:** It means that the load carrying surfaces of the bearings are separated by relatively thick film of lubricant so as to prevent metal to metal contact.

Types of Lubrication

3. **Elastohydrodynamic Lubrication:** It is prevalent in situations involving high contact stresses which are in rolling contact such as mating gears, cams etc.

4. **Solid film Lubrication:** When bearings are operated at extreme temperature, a solid film of lubricant is used.

5. **Mixed film Lubrications:** When fluid film thickness drops below critical level due to low speed or very high temperature or under high loads, mixed film lubrication is preferable.

Methods of lubrication

1. Fresh lubrication
2. Circulating lubrication

Fresh Lubrication (Previous)

a) **Manual Lubrication:** Applying oils by oil can or greasing in bearings by grease gun through grease nipples etc.
b) **Cotton wick Lubrication:** Uses the capillary effect of a cotton wick to keep the oil topped up.
c) **Drip Lubrication:** A drip supply of oil to point is used so that the quantity remains visible and adjustable.
d) **Mechanical Lubrication:** Lubrication is applied by a pump.
e) **Mixed Lubrication:** Used in certain two stroke engines where the crank case with bearings serves as a pump.

Circulating Lubrication

(Previous)

In this method, lubricant flows abundantly from a reservoir and then returns to the reservoir.

a) **Bath Lubrication:** Lubrication surfaces are to be placed in an oil bath filled with lubricants.

b) **Splash Lubrication:** Splash discs rotate in the oil bath and oil is splashed upwards so that bearings are lubricated.

c) **Ring Lubrication:** A ring rotates in the oil and carries it up to the surfaces to be lubricated.

d) **Forced feed circulating Lubrication:** Lubricating oil is conveyed to the points by a pump. In this mechanism cooling and cleaning are also included.

Required Features of Lubricants

- Lubricants must resist oxidation
- Lubricants must resist carbon formation
- Lubricants must resist rust formation on iron
- Lubricants must possess good viscosity
- Lubricants must resist corrosion
- Lubricants must act as cleaning agent
- Lubricants must resist foaming
- Lubricants must resist extreme pressure

Additives used with lubricants

- Additive+ Base oil = Lubricants
  - Viscosity index improver
  - Foam inhibitors
  - Pour-point dispersants
  - Antifriction modifiers
  - Resistance creation to carbon formation
  - Oxidation inhibitors
  - Extreme pressure agent

Lubricating Schedule

- The following symbols may be used to indicate lubricating schedule-

Lubricating Schedule	Symbol
Daily	D
Weekly	◯
Monthly topping up	☐

Grading of Lubricants

- The grades of some lubricants may be as below which are represented by color codes-

Grades of lubricants	Color code
DTE light/ Spindle oil	Yellow
DTE Heavy/ Medium	Brown
DTE Heavy/ Extra Heavy	Red (Post office red)
Grease	Orange

Routine check of lubricants

- Quantity wise: Oil tank should be checked and if necessary, should be filled up.
- Quality wise: The followings are to be checked time to time-
  - pH
  - Viscosity
  - Water contamination
  - Presence of foreign materials
  - Aging
  - Foaming

Storing of Lubricants

- Outdoor storage
- Indoor storage

Outdoor storage

- Barrels should be stored on oil resistance base.
- Barrels should be stored to keep seals airtight.
- FIFO policy should be adopted.
- Store should not be situated is a dusty or corrosive atmosphere.

Indoor Storage

- Easy access for trolley and forklift.
- FIFO policy should be adopted.
- Good ventilation.
- Store should be built of fireproof materials.
- Smooth, level and oil resistant floor.
- Heating is useful to keep viscous oils fluid.

Lubricating oil purification method

1. By Filtering: There might be some solid contaminants in lubricants. So continuous filtering is necessary to remove any solid particles. Filters should be regularly checked, cleaned and replaced if necessary.
2. By centrifuging: Dirty oil is rotated rapidly in the centrifuge so that dirt are separated from the oil.

Type of Filtration	Description	Examples
Media Based Filtration	These systems use either a Full Flow or Depth filter cartridge to purify the oil.	1. Offline or Side Stream Systems permanently installed on Equipment 2. Filter Carts 3. Filter Skids
Magnets	These systems use magnets to attract and hold ferrous contamination	1. Inline magnets installed in the fluid stream 2. Magnet cartridges 3. Magnetic reservoir plugs
Coalescing Systems	These systems use some method to bring water molecules together with each other in order for gravity to separate the water from the oil and allow for draining the water off of the system. They utilize full flow or depth media to aid in purifying the oil.	1. Stand Alone Coalescing Chamber 2. Coalescing Chamber added to a filter cart. 3. Coalescing Skid for high volume (Up to 400 gpm)
Centrifugal Systems	These systems use a spinning bowl or disc to separate both water and solid contamination from the oil. They utilize heat and full flow media to aid in purifying the oil.	1. Centrifugal Skids or Trailers. These systems tend to be very large and are operated by contract firms that come on-site to spot clean the oil.
Vacuum Dehydration	These systems use vacuum to remove water from oil. They are useful for not only removing free and emulsified water, but also can remove dissolved water. They utilize heat and full flow or depth media to aid in purifying the oil	1. Vacuum dehydration Skids. These systems will be from 3 gpm small cart systems up to 50 gpm and larger skid systems