Lubrication − The Silent Component of Machinery

By Thomas Yoon

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The function of a lubrication medium is:

1. To form a film between moving bearing components so that metal to metal contact is prevented.
2. To reduce friction and eliminate wear
3. To protect against corrosion
4. To seal against impurities like dust, dirt, water.

In order for the oil film to be formed between the moving bearing components, the film must be sufficiently thick even under heavy load, high temperatures or vibrations.

Some sleeve bearings that has very heavy loads, like in the crosshead bearings of diesel engines, usually have provisions for injecting pressurized oil to float the shafts. This method is called hydrostatic lubrication.

However, the most common method of lubrication for sleeve bearings is by the hydrodynamic method. When the two surfaces of a bearing and shaft move rapidly relative to one another, the oil is carried along the shaft to fill the gap between shaft and bearing. When the moving components become completely separated by a cohesive film of lubricant, hydrodynamic lubrication occurs. Hydrodynamic lubrication prevents wear in moving parts, as there is no metallic contact between them. The bearing metals can last for a long time.

During starting time, the rotating shaft does not have sufficient speed to pick up the lubricant. The film separating the moving surfaces is very thin − with only the thickness of a molecule. This

is a condition called boundary−layer lubrication. With this condition, friction losses increases, producing heat, which raises the temperature of the lubricant, thereby reducing its viscosity so that the load−carrying capacity of the film is even lower. In worst case conditions, the surfaces can even seize together.

For rolling contact bearings like ball bearings, a condition called elasto−hydrodynamic lubrication occurs. At the point of contact, the ball deflects and flattens out slightly for a moment under the high pressure. When the ball rolls on, the contact surfaces return to their original shape. However, the lubricant is not forced away from the point of contact due to the dramatic increase in viscosity.

When the ball has passed, the viscosity falls back again.

When grease is used for lubricating ball bearings, they also act as protection against impurities like dust, dirt and water that will cause wear down and corrosion.

More about oils and grease for lubrication could be the subject of the next topic.

Until next time...

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Additives that Improve Lubrication Oils

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Mechanical machines need lubrication. No machines can run for long without lubrication of its moving parts. At best, the

moving parts may wear out faster. At worst, entire machines can seize up and develop cracks. In severe conditions, the heat built up can even cause explosions and loss of lives.

So lubrication is no small matter in machine operation.

Lubrication oil can last for a very long time in normal machine operation. By determining the properties of lubrication oil, many machine operators will be able to know whether the oil can still be used.

Some of the important properties to watch for when buying or replacing lubrication oil is as follows:

Viscosity
Viscosity Index
Pour Point
Oxidation Resistance
Flash Point, Fire Point
Alkalinity
Additives

Some of the additives that are put into the lubrication oil include the following:

Anti Oxidant − Amines, Phenols
Corrosion Inhibitor
Detergent and Dispersant − Ca, Ba, Compounds, Soaps
Alkalinity − Ca, Ba Hydroxides
Anti Bacterial − Biocides
Oiliness or Wetting Agents − fatty oils, chlorinated wax
Extreme Pressure Agents − organic compounds of Cl, S, P (for hydraulic, gear oil)
Pour Point Depressant − Organic polymers (alkyl naphthalene) (for steering gear, refrigerator)
Anti foam − Silicones
Viscosity Index Improvers − organic polymers
Emulsifying Agent − Polar Compounds (emulsifying but do not lose lubricating property)

With large machines that use large amounts of lubrication oil the engineer has to determine when to change the oil. This is because the change can be a very expensive affair.

The correct thing to do is to determine whether the oil can

still be used without changing. The engineer must know exactly when to change the oil. He will take measurements of various parameters to help him decide.

That could be a subject for another coming facworld ezine article.

The contents of this page are part of a page from my e−book "General Engineering Knowledge Notes" that will help candidates prepare for the Marine Certificate of Competency Examinations. This e−book is available for FREE downloading at

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