

Tech Talk

Rolling Bearings - Oil Lubrication Fundamentals Part 1

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Proper lubrication of rolling bearings is critical to bearing life. We will use the term rolling bearings to include roller bearings and ball bearings.

What are the primary functions of oil lubrication?

1. Friction control - to lubricate all true rolling contacts elasto-hydrodynamically – separates moving surfaces (Figure 1).
2. To lubricate that part of the contact between the raceways and rolling elements which is not true rolling.
3. To lubricate the sliding contact which exists between the retainer and other parts of the bearing.
4. Corrosion control - to protect the highly finished surfaces of the roller elements and rings from corrosion. Including the bearing housing(s) and oil sumps.
5. Temperature control - provide a heat transfer medium (cooling).

How is oil formed? To start a base oil stock is used, which may be mineral or synthetic. Mineral stock is crude oil, from nature, with random oil molecules. Synthetic is man-made, scientifically/chemically manufactured and has structured molecules. To the base oil stock additives are blended. The most common additives are anti-wear (AW, EP), anti-foaming, anti-oxidants and corrosion inhibitors.

For rolling bearings viscosity (Kinematic) and viscosity index are the two (2) most important properties of oil.

Viscosity is defined as an oil's resistance to flow by the forces of gravity measured in centistokes (cSt), usually labeled as ISO VG (International Standards Organization Viscosity Grade). Other viscosity equivalents AGMA grades (American Gear Manufacturers Association), SAE grades (Society of Automotive Engineers) and SUS (Saybolt Universal Seconds). All grades are measured and set, based on a predetermined temperature. Figure 2 – Viscosity Equivalents chart shows the relationship between the various grades. The greater the number the higher viscosity (thicker more resistance to flow).

Viscosity index (VI) oil's change in viscosity with respect to change in temperature. The larger the VI, the smaller the change in viscosity with temperature increases. A VI between 60-100 is

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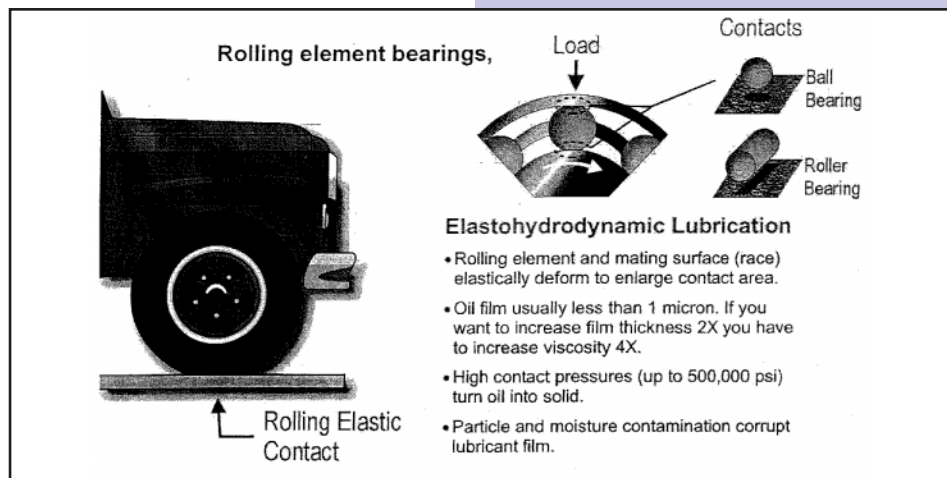


Figure 1. Rolling Contact Lubrication.

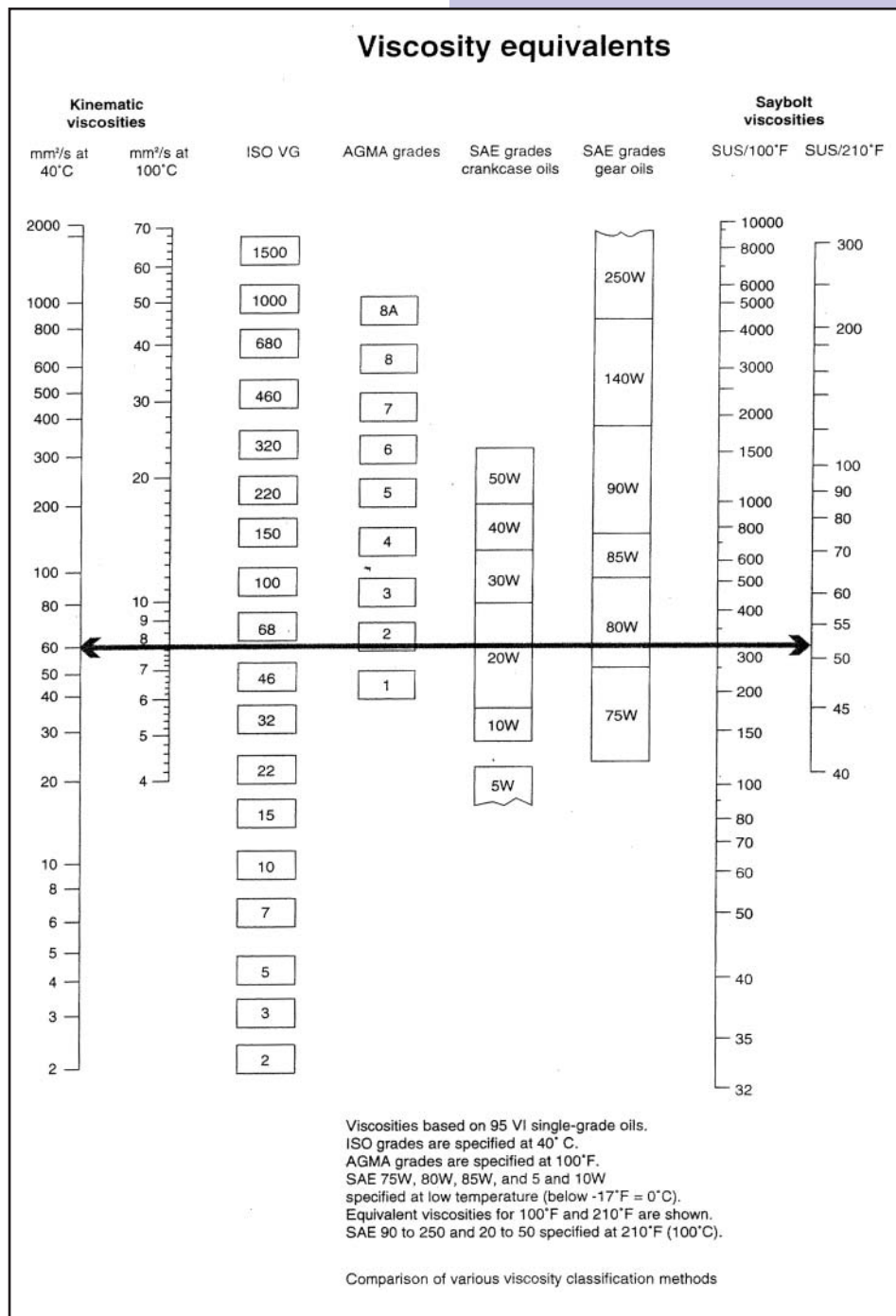


Figure 2. Viscosity Equivalents.

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normal for most mineral oils and 100-200 for synthetics and VI improved mineral oils.

Using the incorrect viscosity oil can reduce oil and bearing life. Viscosity decrease with the increasing temperatures, as shown in figure 3.

Viscosity too High

- Increase heat generation which can cause oxidation, varnish and sludge (paste like material), basically breaking down the oil additive package.
- Inadequate flow to the bearings
- Poor cold start circulation
- Cavitation and foaming may occur in oil sump
- Increase energy consumption

Viscosity too Low

- Oil film is lost or reduced causing excessive wear.
- High mechanical friction increase energy consumption.
- High mechanical friction producing heat

which can cause oxidation, varnish and sludge (paste like material), breaking down the oil additive package.

- Potential increase in oil film failures at high temperatures and/or high loads.
- Depending on seal and gasket designs increase of oil leakage.

Each Goulds/ITT model IOM gives the recommended oil viscosity. Note, in some applications the pumpage temperature may effect the operating temperature of the bearings. When determining operating temperature, of the oil, usually it is found to be 5 to 20F higher then the bearing housing and/or frame, depending on design.

As an example the Goulds/ITT Model 3196 ANSI Pump IOM specifies the following, when the pumpage temperature is below 375°F :

- ISO Grade VG68 - SSU of 300
- Kinematic Viscosity of 68

Specific brand oils are also listed. It is important to follow these requirements and specifications. Note, 'No-name' brand oils may not have the additives as the known brand oils. ■

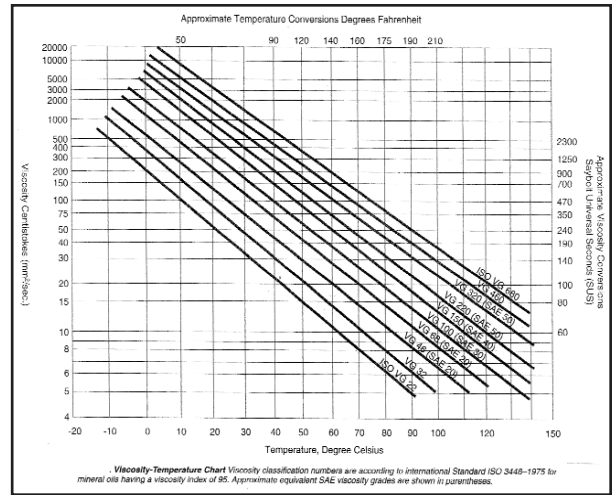


Figure 3. Viscosity Temperature Chart.

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If different, name and location of the plant using the equipment or service. _____

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Are there photos available of the installation? yes no

If no, can permission be obtained to take photographs? yes no

What product is manufactured at the plant? _____

Installation details? _____

Describe the application and the problem solved. _____

Quantify the benefits. (Life Cycle Cost savings, labor, maintenance, ROI, safety, environmental health, etc.) _____

Send this form to: John J. Beca Director – Communications ITT IPG 240 Fall Street Seneca Falls, NY 13148 or Fax: 315-569-7759 or E-mail: jbeca@fluids.ittind.com.

If you have any questions, please call me at 315-568-7122.

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