Oil Viscosity Selection

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The selection of the proper Oil or Grease is essential in achieving the maximum life of a bearing. The viscosity of the lubrication plays one of the most important roles in the selection of lubricants. Viscosity is defined as the property of a fluid that resists internal flow by releasing counteracting forces. The viscosity of a lubricant is generally measured at 40 degrees Celsius in CentiStokes (cSt) or equivalent mm^2/s units. In most applications a middle of the road viscosity of roughly 100 cSt at 40 degrees Celsius will suffice. In cases of extreme speed or temperature, either high or low, it becomes critical to select a lubricant with the proper viscosity. Below are the steps needed to determine the required viscosity of a lubricant.

Required Information

1. Identify the Type of Bearing i.e.: Ball or Roller
2. Calculate the Mean Bearing Dia.: dm = (D+d)/2
3. Determine the Operating RPM(n)
4. Determine the Operating Temperature in Celsius
5. Determine the Kappa Value: K = Operating viscosity(v)/Rated Viscosity(v_1)

- K = 1 For Ball Bearings
- K = 2 For Spherical and Tapered Roller Bearings
- K = 2.5 For Slow Turning Applications or when Ndm < 10,000

Once the above information is known the required viscosity of a lubricant can be determined using the following diagrams. Below an Example is given.

Fan Application Example:

A 22220 Spherical Roller Bearing rotating at 2,000 RPM has an operating temperature of 90° Celsius.

Step #1 Identify the Type of Bearing: 22220 Spherical Roller Bearing

Step #2 Calculate the Mean Bearing Diameter:

dm = (D+d)/2 Where D= O.D. of bearing in mm

dm = (180 + 100)/2 d= I.D. of bearing in mm

dm = 140mm

Step 3 & 4 Determine Operating RPM and Temperature

Given: Operating RPM (n) = 2000

Temperature = 90° C

Step 5 Determine the Kappa Value (K)

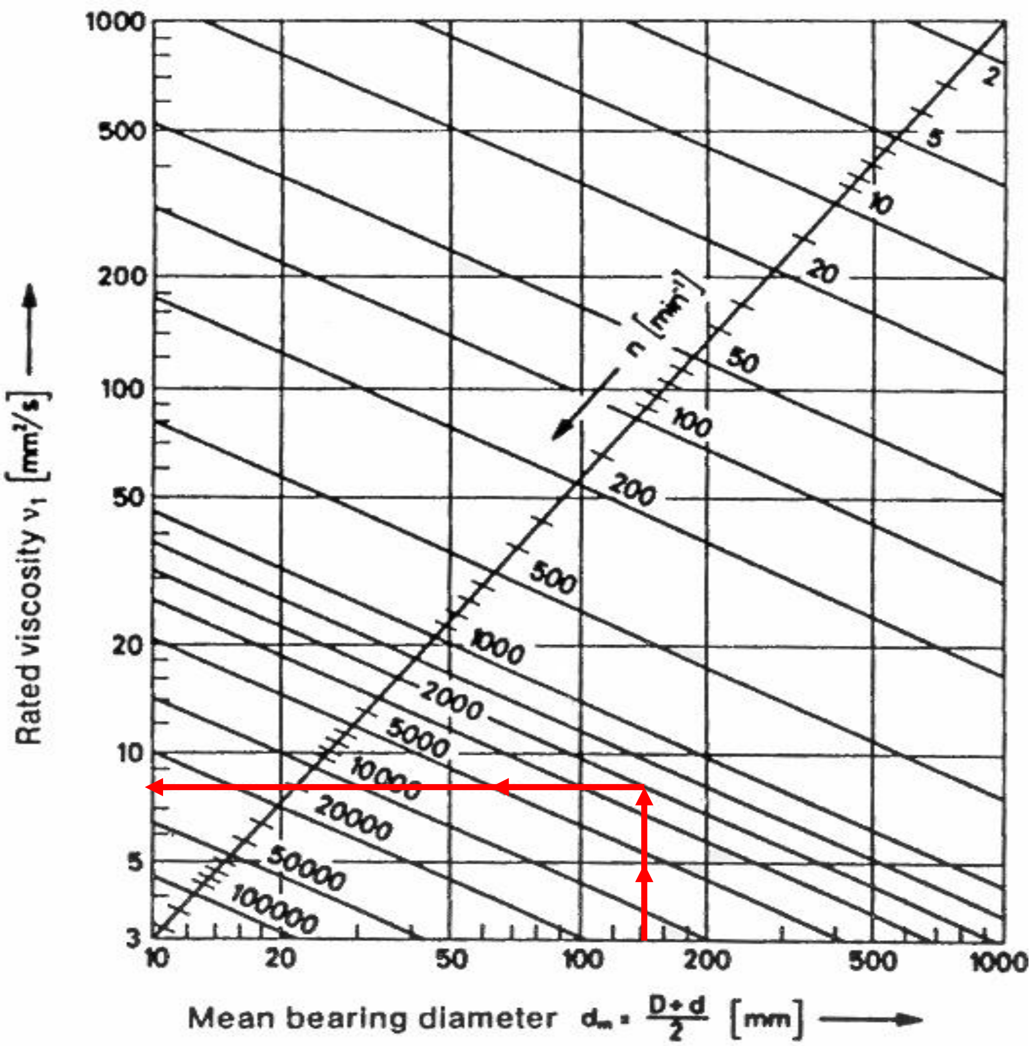
Given: Spherical Roller Bearing

Therefore K = 2

You now have all the information you need to use the Figure 1 and Figure 2, and determine the required viscosity of a lubricant.

First draw a vertical line from the 140mm mean diameter axis until you intersect the 2000 diagonal RPM (n) line. From this intersection draw a horizontal line until you intersect with the rated viscosity (v_1) axis. Record this value, Rated Viscosity (v_1) = 8 mm^2/s, because you will need to use it for Figure 2.

Figure 1: Rated Viscosity (v1)



Solve for the Operating Viscosity (v) by taking the Rated Viscosity (v_1), determined from the previous diagram, and plugging it into the following equation.

Kappa (K) = Operating Viscosity (v) / Rated viscosity (v_1)

2 = Operating Viscosity (v) / 8 mm^2/s

Operating Viscosity (v) = 16 mm^2/s

Find 16 mm²/s on the Operating Viscosity (v) axis, and draw a vertical line until it intersects the Operating Temperature of 90° Celsius. Compare this intersection point to the diagonal Required Viscosity lines. The intersection point falls between the 100 and 150 diagonal Required Viscosity lines. Scaling the diagram shows that the minimum required viscosity is 125 mm²/s. Therefore when selecting a lubricant for this application you would choose one with a minimum viscosity of 125 mm²/s.

Figure 2: Operating Viscosity (v)