



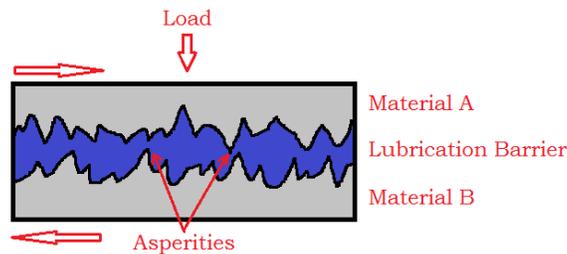
Issue 19: How Does Contamination Affect Bearing Clearance and Bearing Life?

Note from Author: I wrote this article back in 2013 and it was only seen by those receiving our mailings. Now that we have gone digital with email and posting on our website we felt it was time to roll out all of my older articles. They are still relevant and I hope you enjoy! --Bud

In my years of dealing with bearing failures I have discussed contamination thousands of times; normally I can answer the questions without any deep thought. Just a few weeks ago I heard the same old question formulated in a way that made me stop and think! We all agree contamination is a bad thing but how does it affect bearing clearance and bearing life?

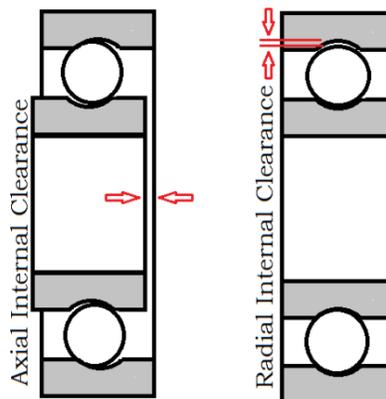
I feel to best answer I need to start with some loosely defined terms:

Hydrodynamic Lubrication is the theory of a lubricant maintaining a lubrication barrier between sliding surfaces. This is seen in bushings and plain bearings.



Pic 1: Visual representation of EHD

Elastohydrodynamic Lubrication (EHD) is the theory of opposing surfaces being separated but there is an interaction between the material peaks (asperities.) Elastic deformation is caused resulting in a higher ability to carry load.



Pic 2: Internal Clearance

Internal Clearance is the distance one ring can be moved while the other ring is fixed. The internal clearance can be measured in the radial or axial direction.

My attempt to answer the question!

A bearing out of the box starts with a particular amount of internal clearance based on the size and type of the bearing. After the bearing is mounted the clearance is reduced to what is called residual internal clearance. The amount of reduction is due to the recommended interference between the bearing rings and the shaft and the housing bore.

We now have to make an assumption that the residual internal clearance in most industrial applications is somewhere around 0.00004-0.00040 inches. It is important to remember this clearance measurement is at the highest point and will be smaller as you move around the bearing.

My second assumption is that the lubrication barrier is somewhere around 0.00002-0.00004 inches. So how much space is that? I went to the internet and researched the thickness of some possible industrial contaminations:

Industrial smoke	0.0002 in.
Finger print	0.0005 in.
Dust particle	0.0010 in.
Grain of sand	0.0013 in.
Human hair	0.0030 in.
Standard paper	0.0037 in.
Contact lens	0.0039 in.

Chart 1: Random material thicknesses

In general bearing steel varies from 57-64 HRC. Contamination, regardless of hardness, can cause severe damage to the bearing. Once contamination finds its way into the bearing it can get between the rolling elements and the raceway causing dents, scratches or skidding. It can also break down the lubrication barrier causing metal to metal contact.

Conclusion:

The original question was; how does contamination affect bearing clearance and bearing life? In general the contamination interferes with the lubrication barrier or elastohydrodynamic lubrication resulting in a reduction of clearance. It is impossible to answer the second part of the question. We know that contamination negatively affects the bearing life but there are so many variables that we cannot put a value on the percent loss.

If any further explanation is required feel free to contact me or Midpoint Bearing for assistance.

