Bearing Design and Troubleshooting

STLE Houston Section

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Primary Functions of Fluid Film Bearings:

- Maintain Rotor Position
- Minimize Friction
- Provide Damping
- Sacrificial Component
Three Requirements for FF Development

- Viscous Fluid
- Relative Motion
- Converging Flow Area
Three Requirements for FF Development

Viscosity ($\mu$)

A materials resistance to a change in form – a measure of internal friction
Three Requirements for FF Development

- Relative Motion

\[ V_{avg} = \frac{U}{2} \]

\[ V1 = U \]

\[ V2 = 0 \]
Three Requirements for FF Development

- Converging Flow Area
$Z = \text{Dynamic Viscosity of Lubricant at Supply Temperature (cp)}; \ N = \text{Rotational Speed (rpm)}; \ P = \text{Specific Load on the Bearing (psi)}$
Fluid Film Development
Three Requirements for FF Development
Problem: Misalignment

- Most Common Cause of Bearing Failure
- Easiest Problem to Identify
- Often the Hardest to Correct
Fluid Film Development

200 PSI

200 PSI

185 F

Peak Pressure 3 to 4 Times Projected Load
Misalignement

200 PSI

Peak Pressure
10 to 12 Times
Projected Load

220 F
Bearing Maximum Capacity is a Function of Temperature and Pressure

ASTM B-23 Gr2 Yield Strength vs. Temperature

Temperature (F)

Yield Strength (psi)
Misalignment
Misalignment

Babbitt Extrusion Due to Edge Loading

TC on Unloaded End
Uneven Wear Pattern Evidence of Misalignment
Misalignment
Correct Unit Alignment

Install Bearing Designed to Compensate for Misalignment
Loose Babbitt: Fatigue vs. Bad Bond

What is the Difference?
Babbitt Fatigue

Base Metal

Bond Line/Tin

Babbitt
Babbitt Fatigue
Bad Bond

Base Metal

Bond Line/Tin

Babbitt
Loose Babbitt: Fatigue vs. Bad Bond

What is the Difference?

Fatigue – Bond Intact; Tin/Babbitt Still Attached

Bad Bond – Bare Metal; No Tin/Babbitt Attached