Bearing Design and Troubleshooting

STLE Houston Section

November 7, 2012

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

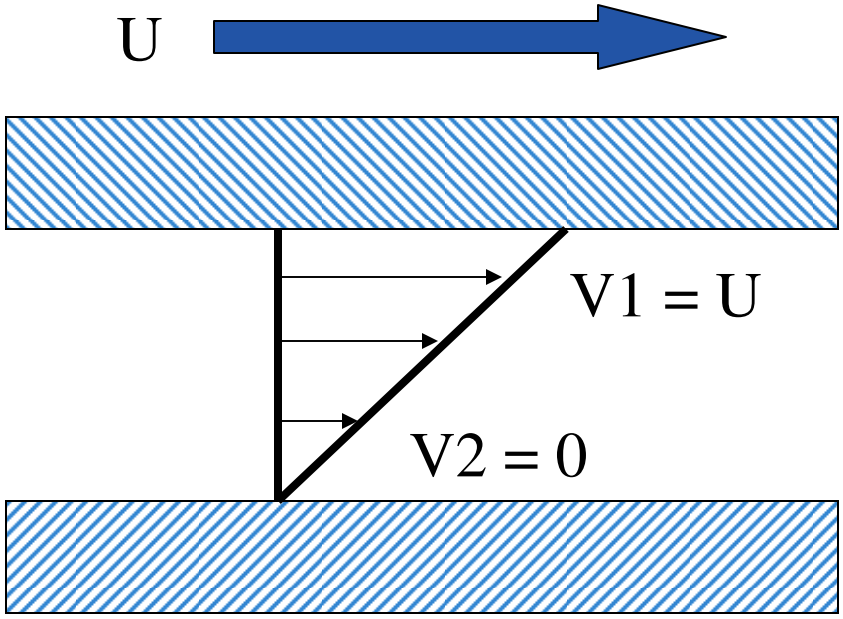
Three Requirements for FF Development

Viscosity (μ)

A materials resistance to a change in form – a measure of internal friction

Three Requirements for FF Development

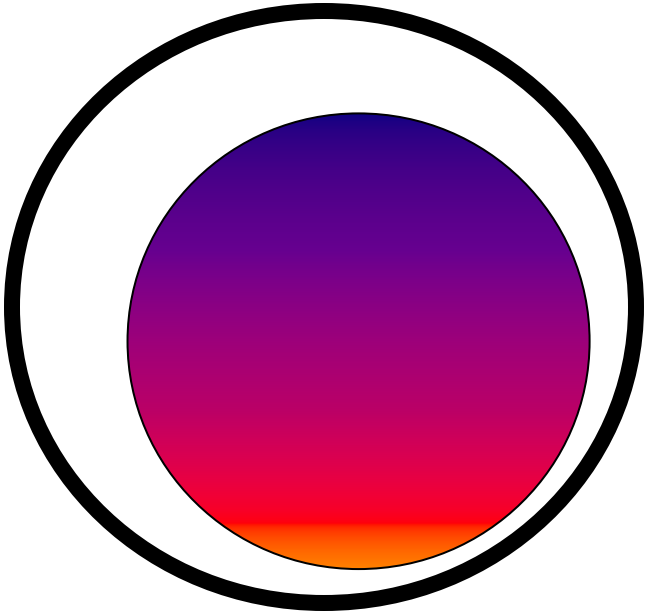
- Relative Motion

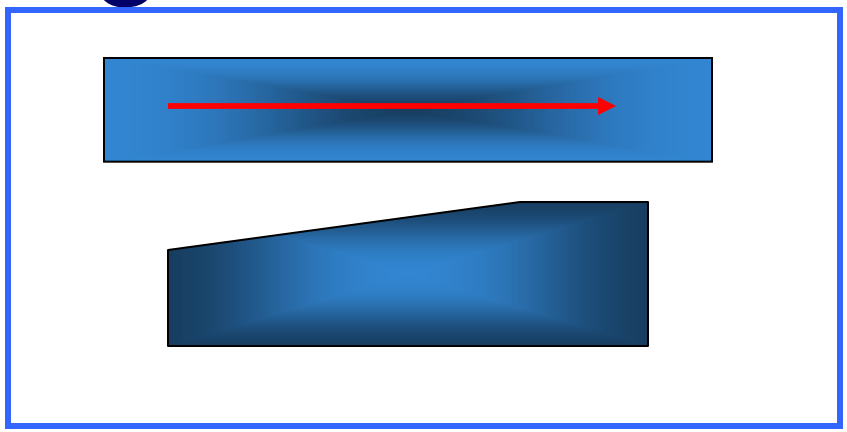


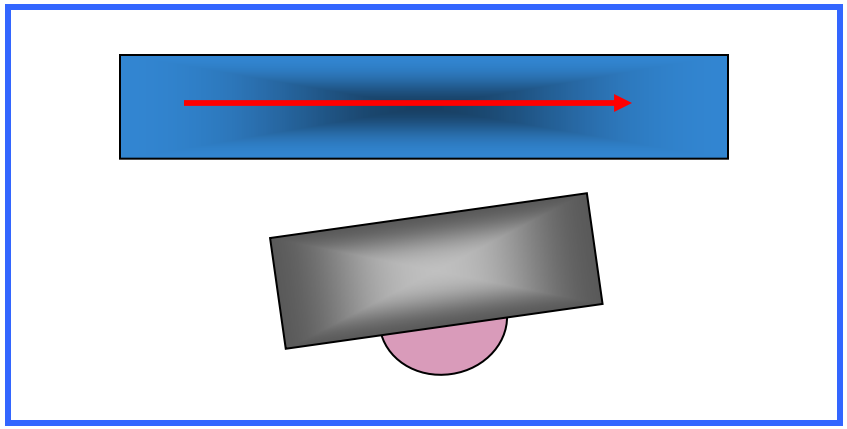
$$V_{avg} = U/2$$

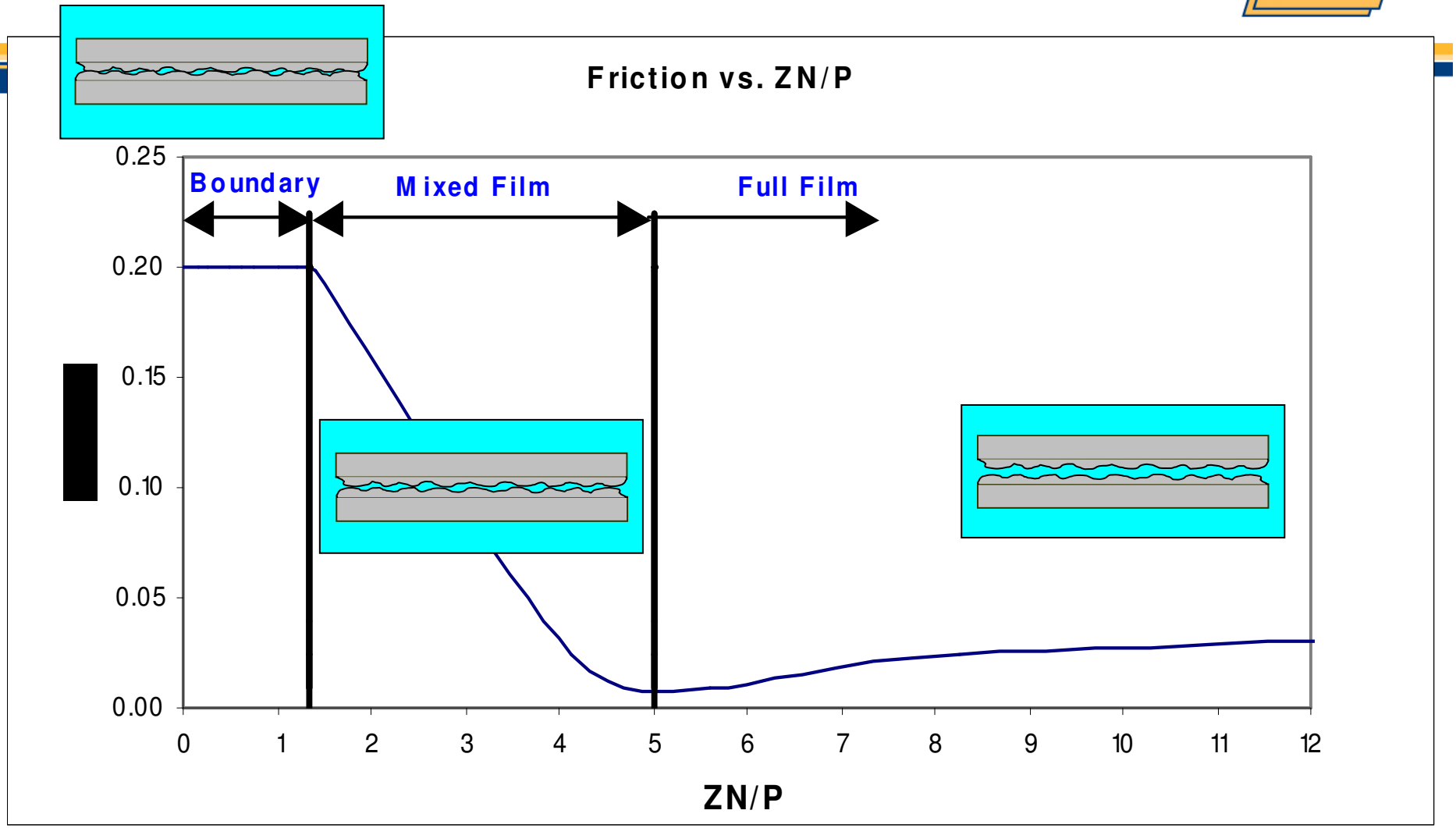
Three Requirements for FF Development

- Converging Flow Area



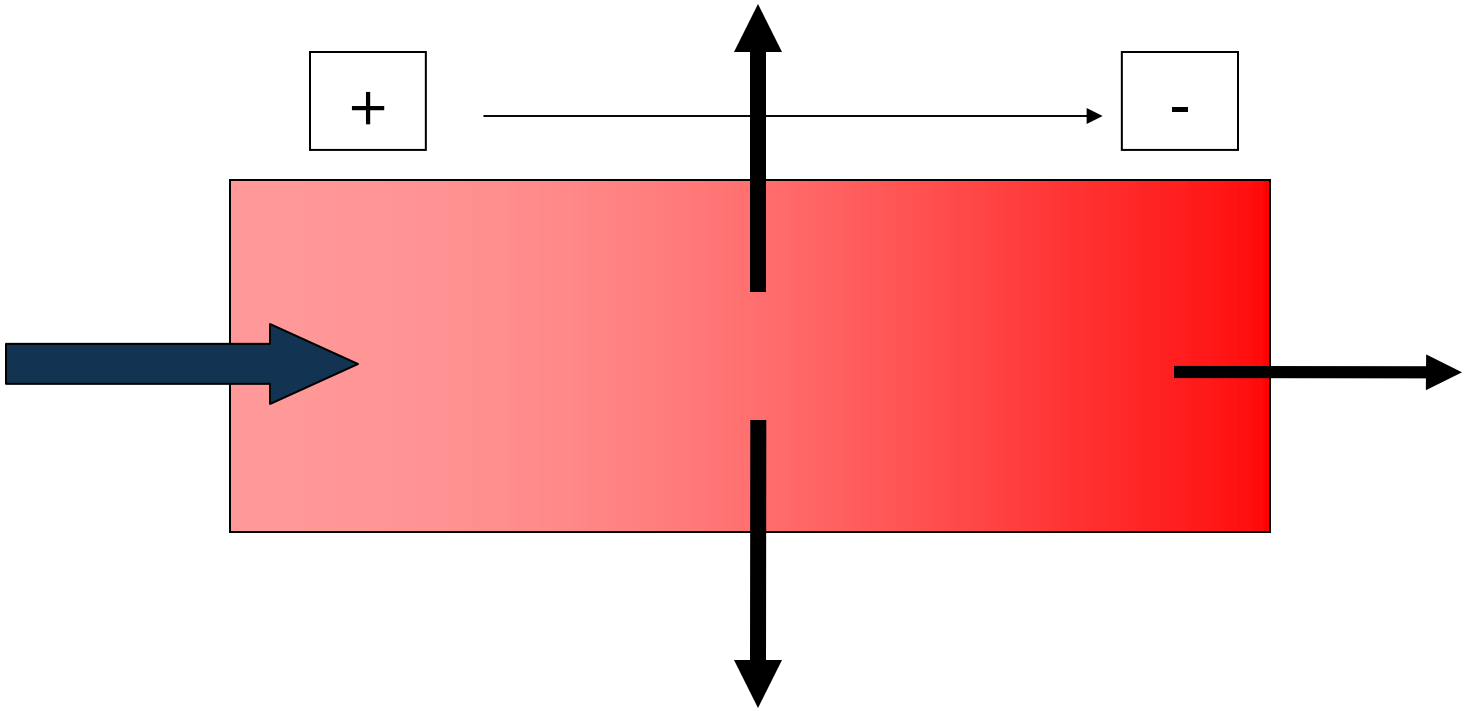




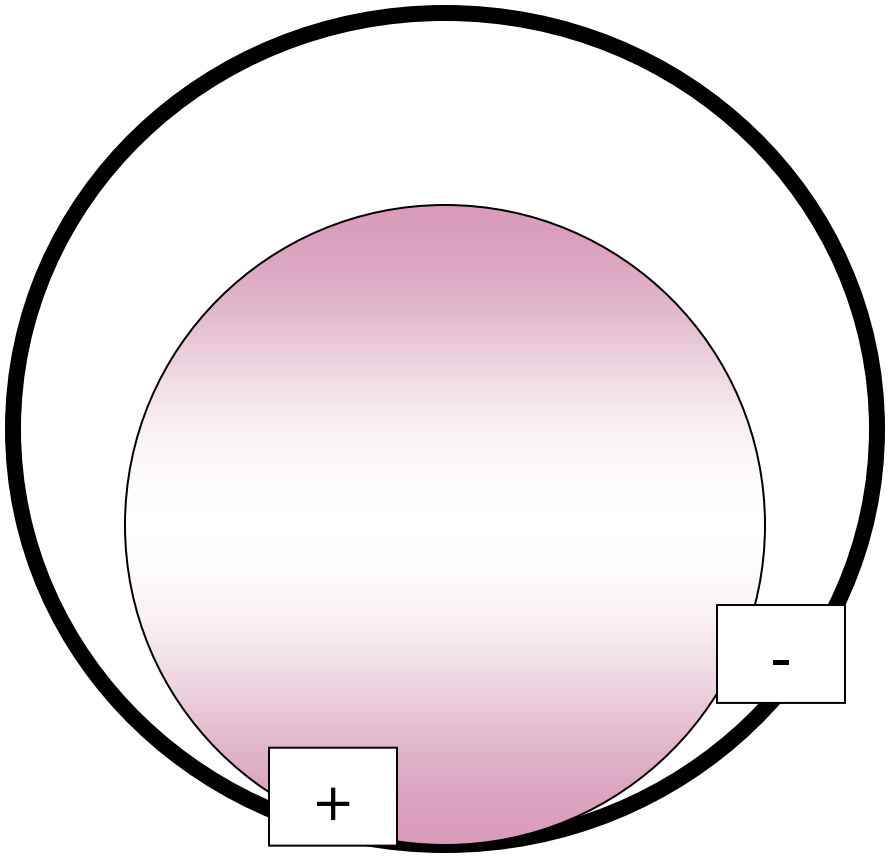


Z = Dynamic Viscosity of Lubricant at Supply Temperature (cp); N = Rotational Speed (rpm); P = Specific Load on the Bearing (psi)

Fluid Film Development



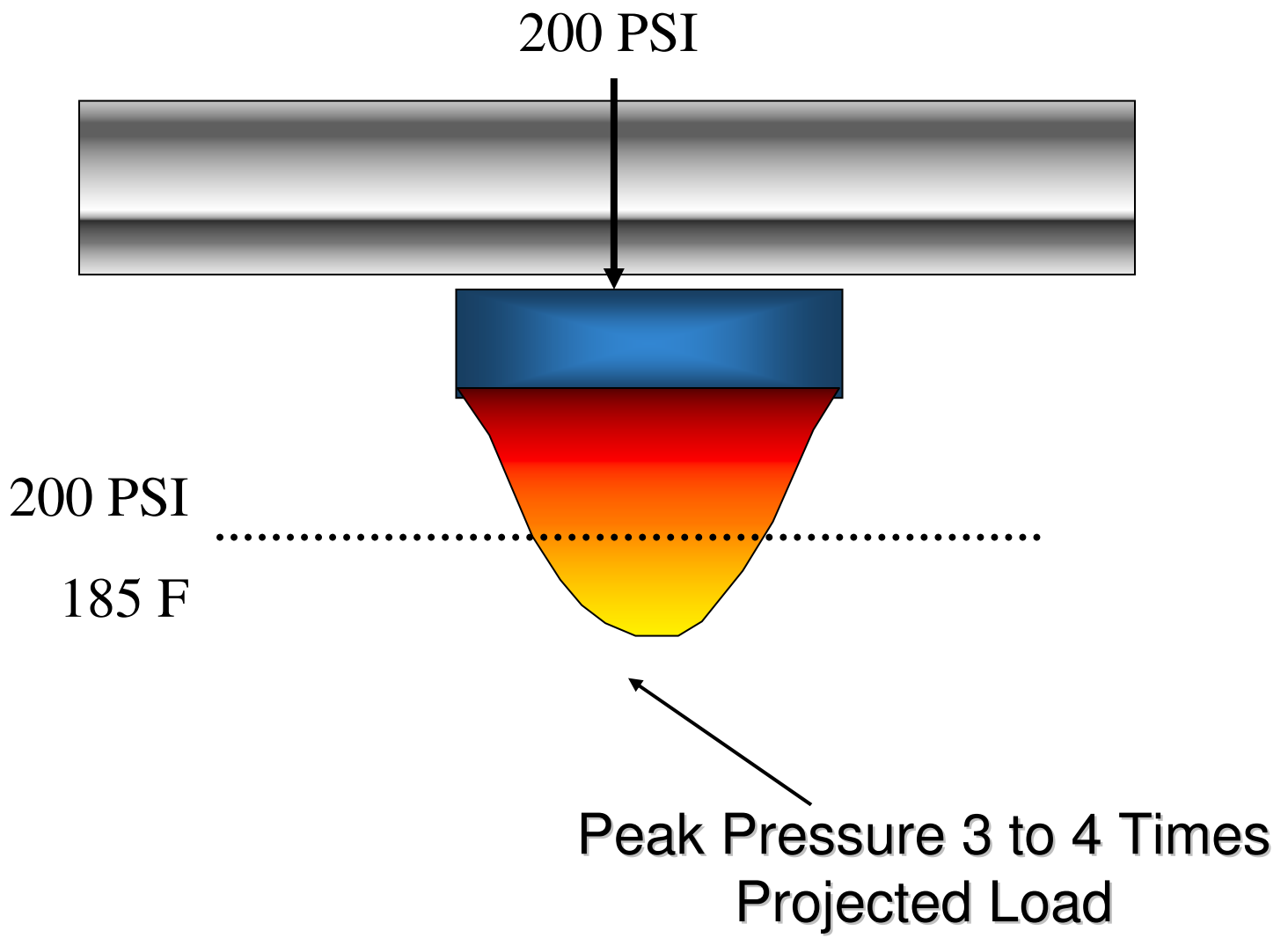
Three Requirements for FF Development



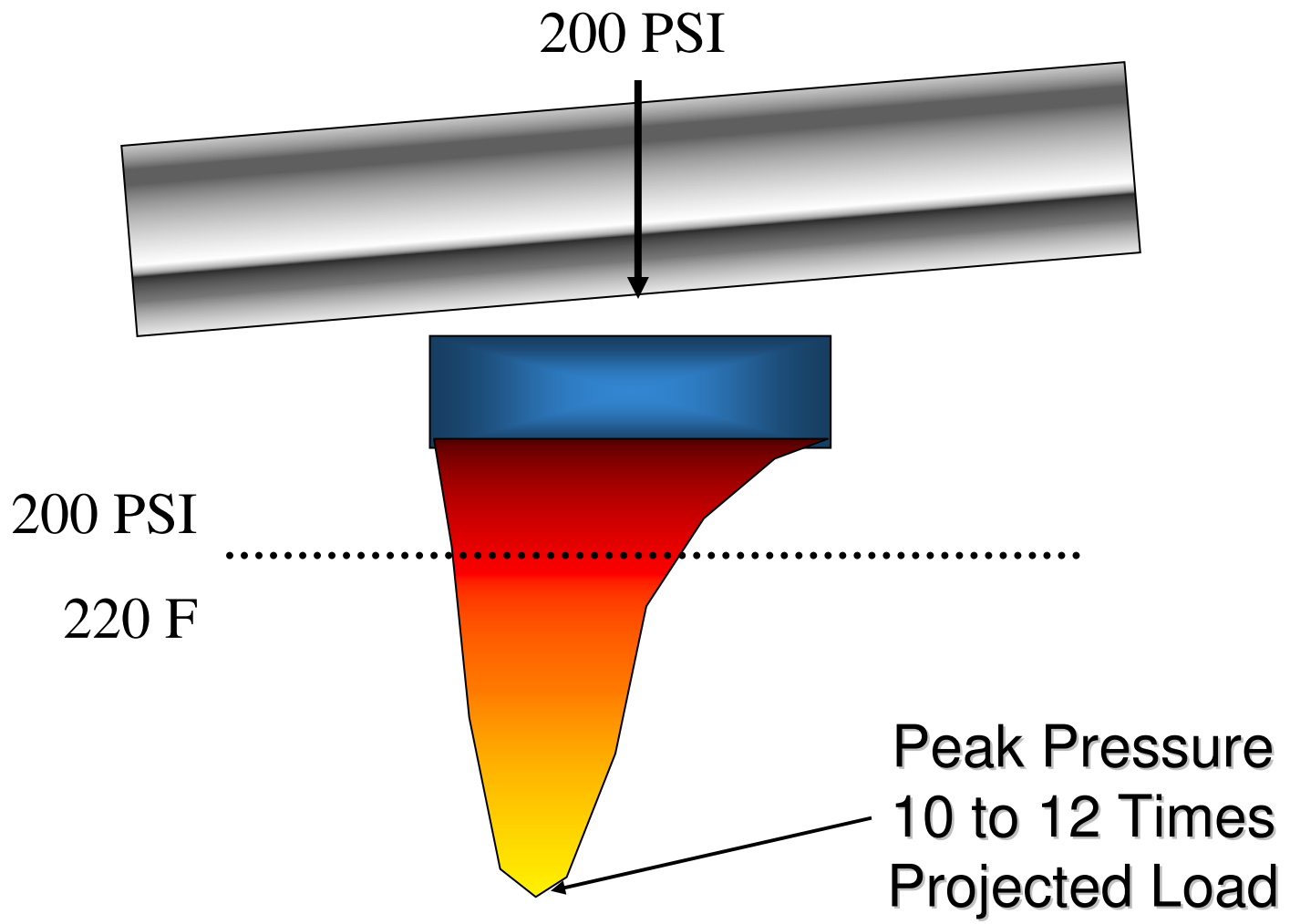
Problem: Misalignment

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

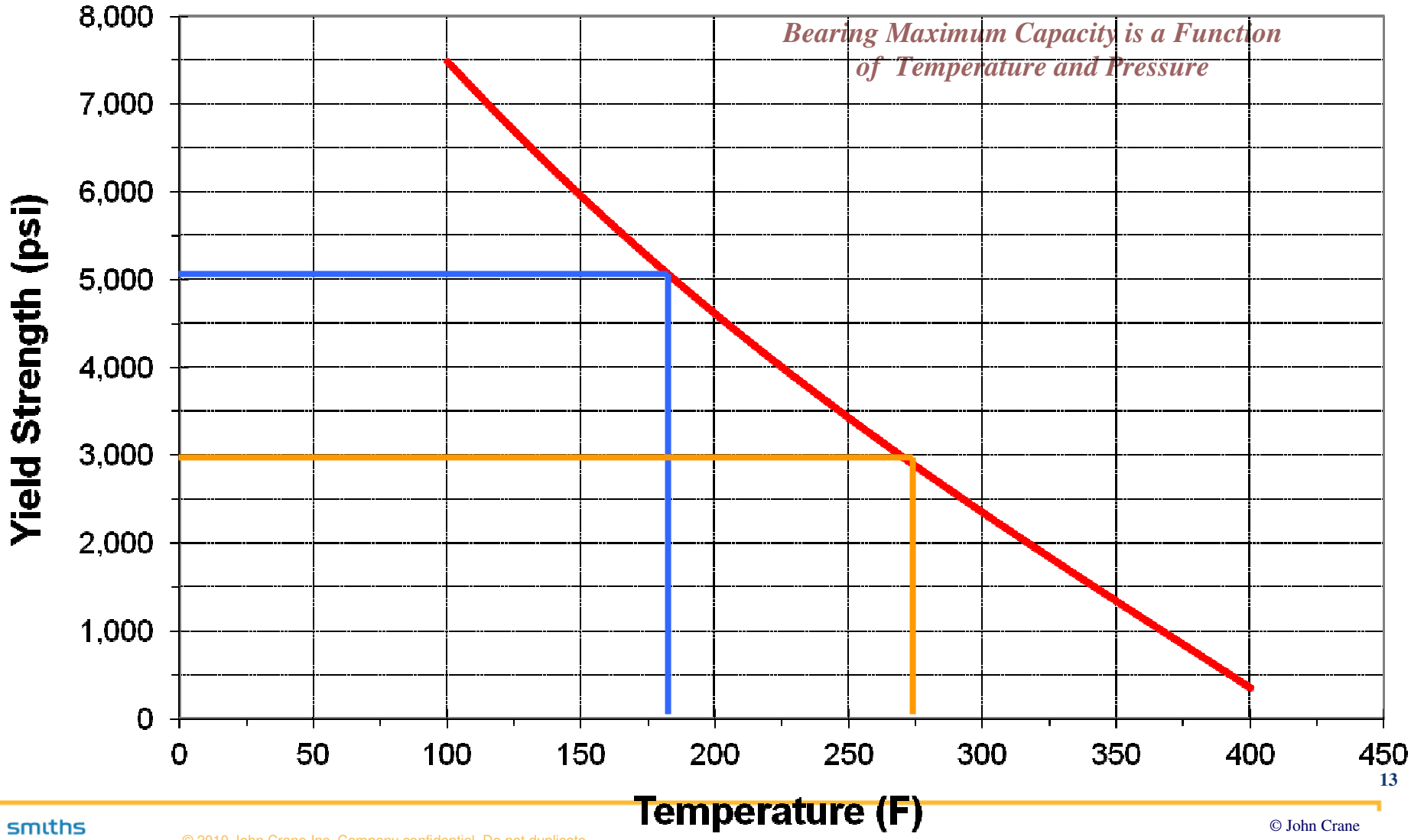
Fluid Film Development



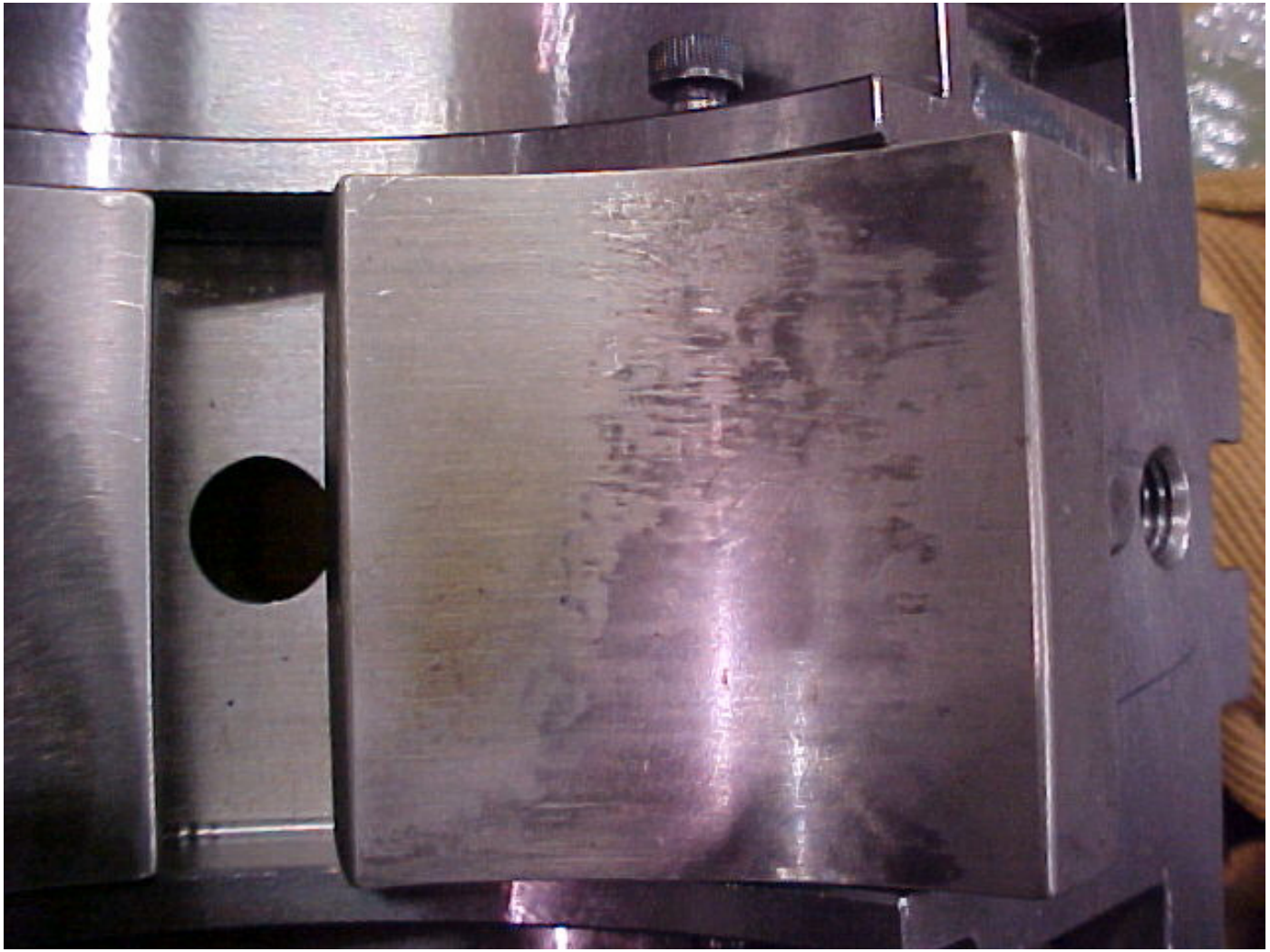
Misalignement



ASTM B-23 Gr2 Yield Strength vs. Temperature



Misalignment

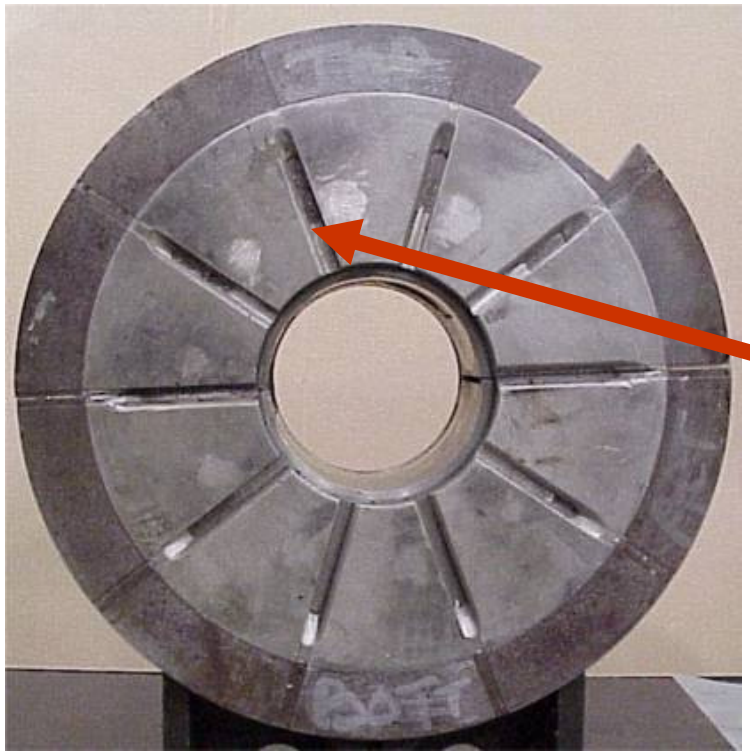


Misalignment

Babbitt Extrusion Due to Edge Loading

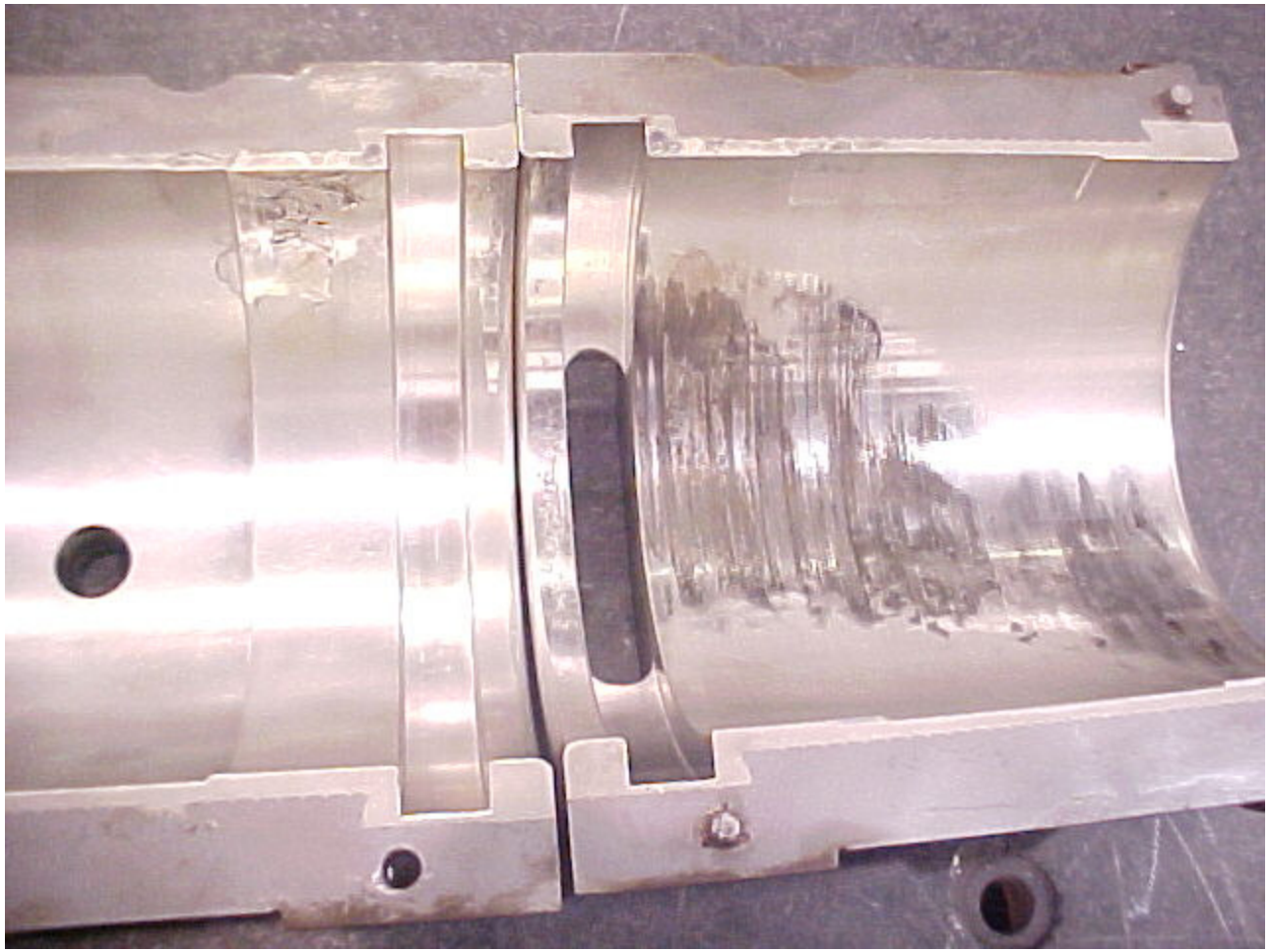
TC on Unloaded End

Misalignment



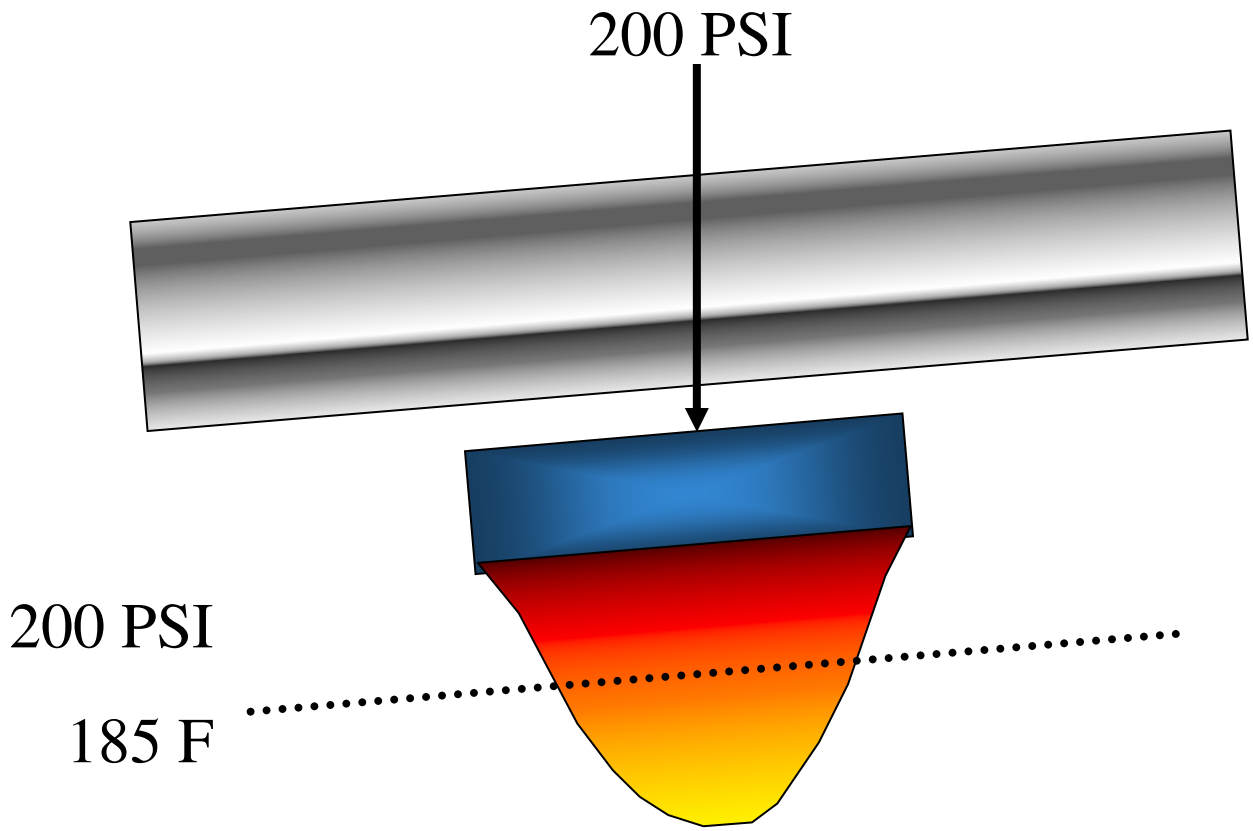
Uneven Wear Pattern
Evidence of Misalignment

Misalignment



Misalignment

- Correct Unit Alignment

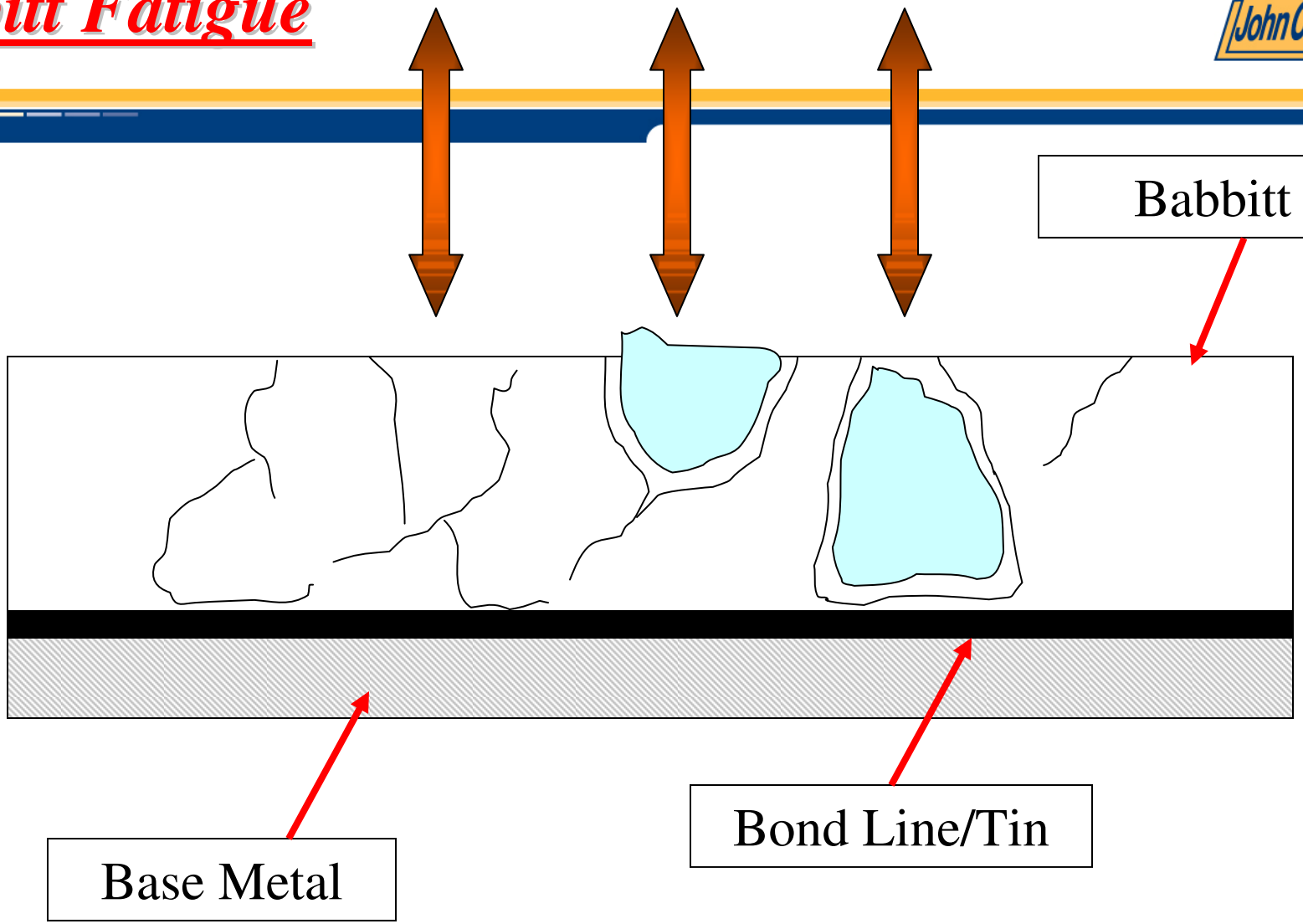


Install Bearing Designed to Compensate for Misalignment

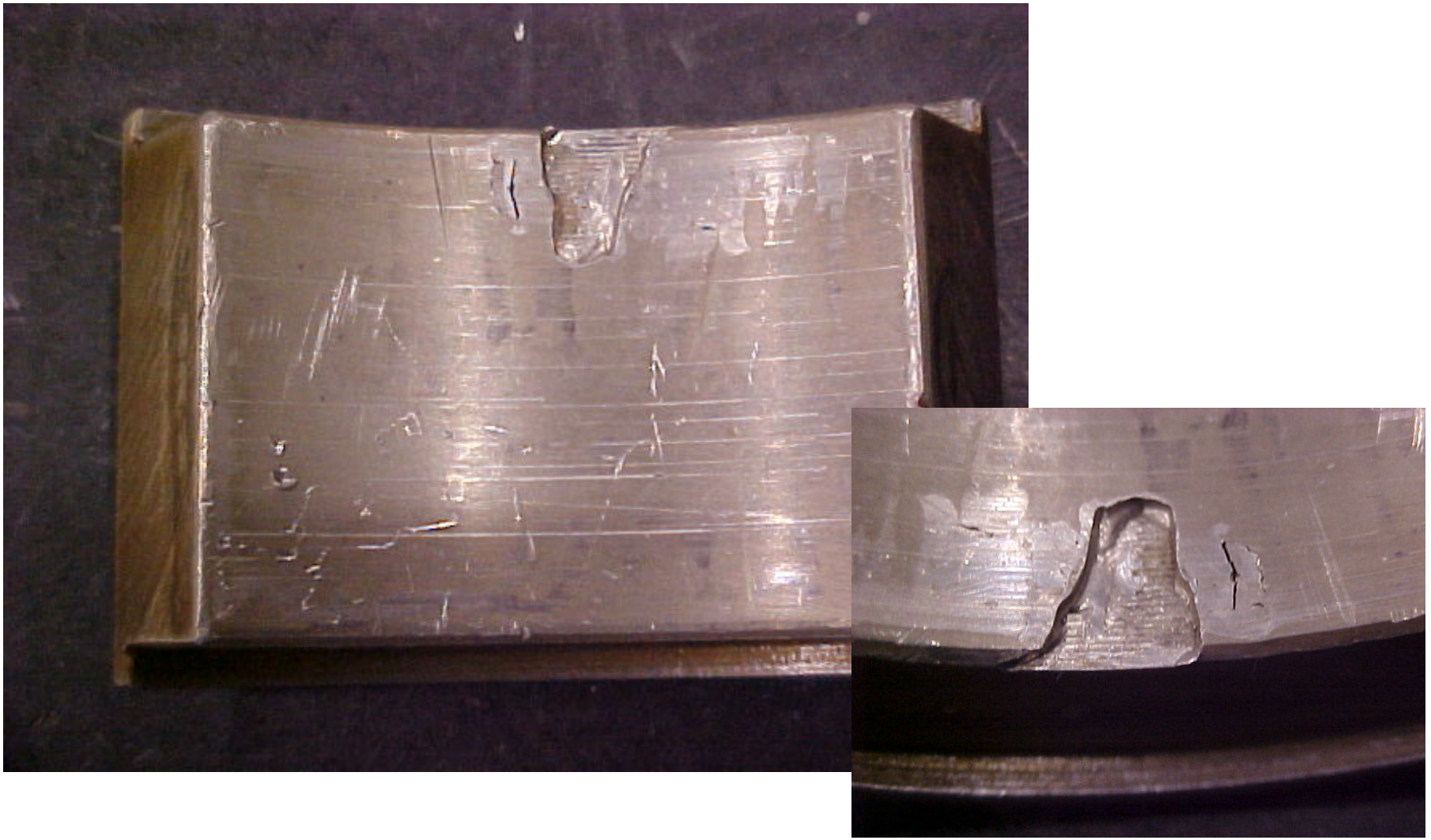
Loose Babbitt: Fatigue vs. Bad Bond

What is the Difference?

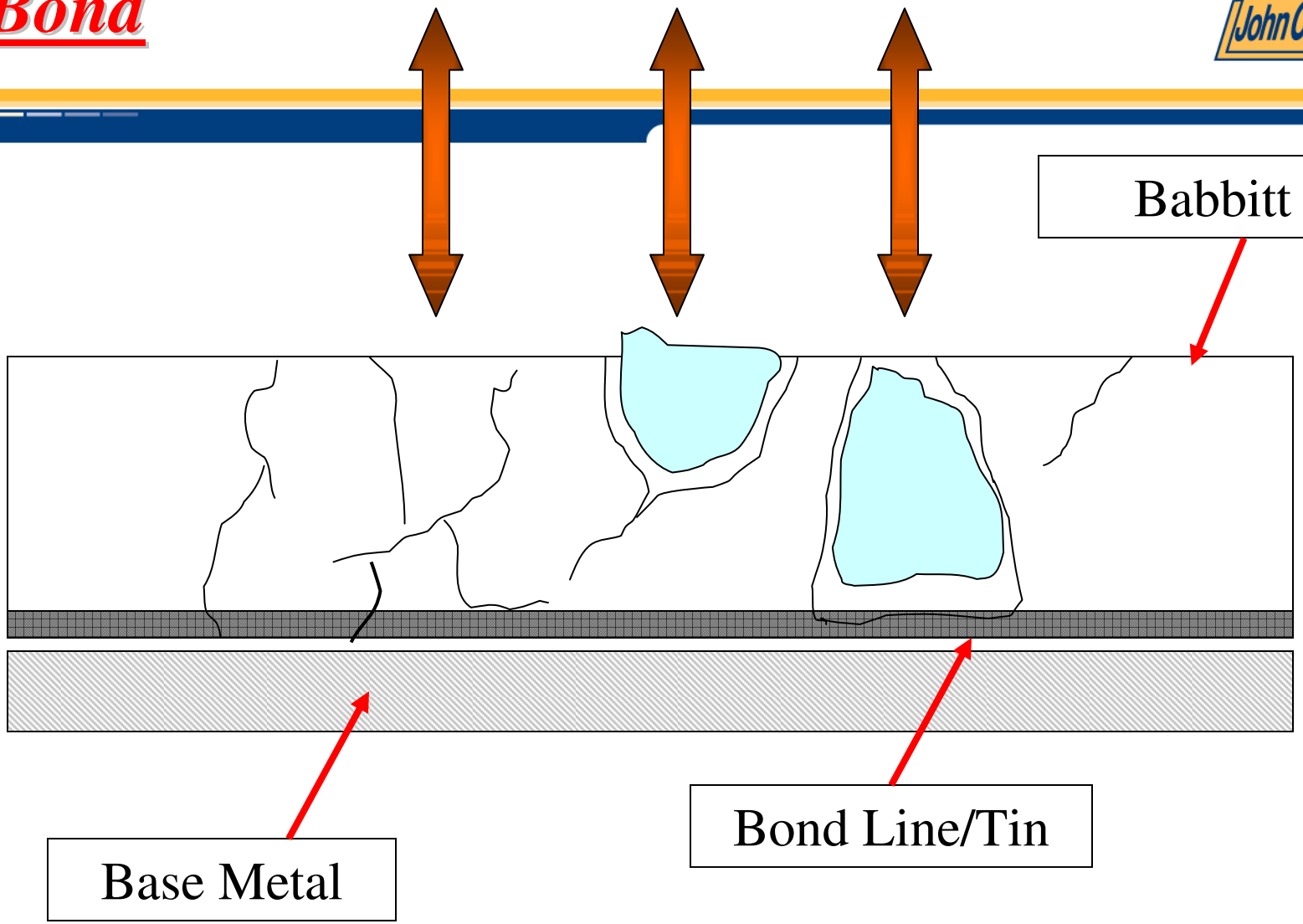
Babbitt Fatigue



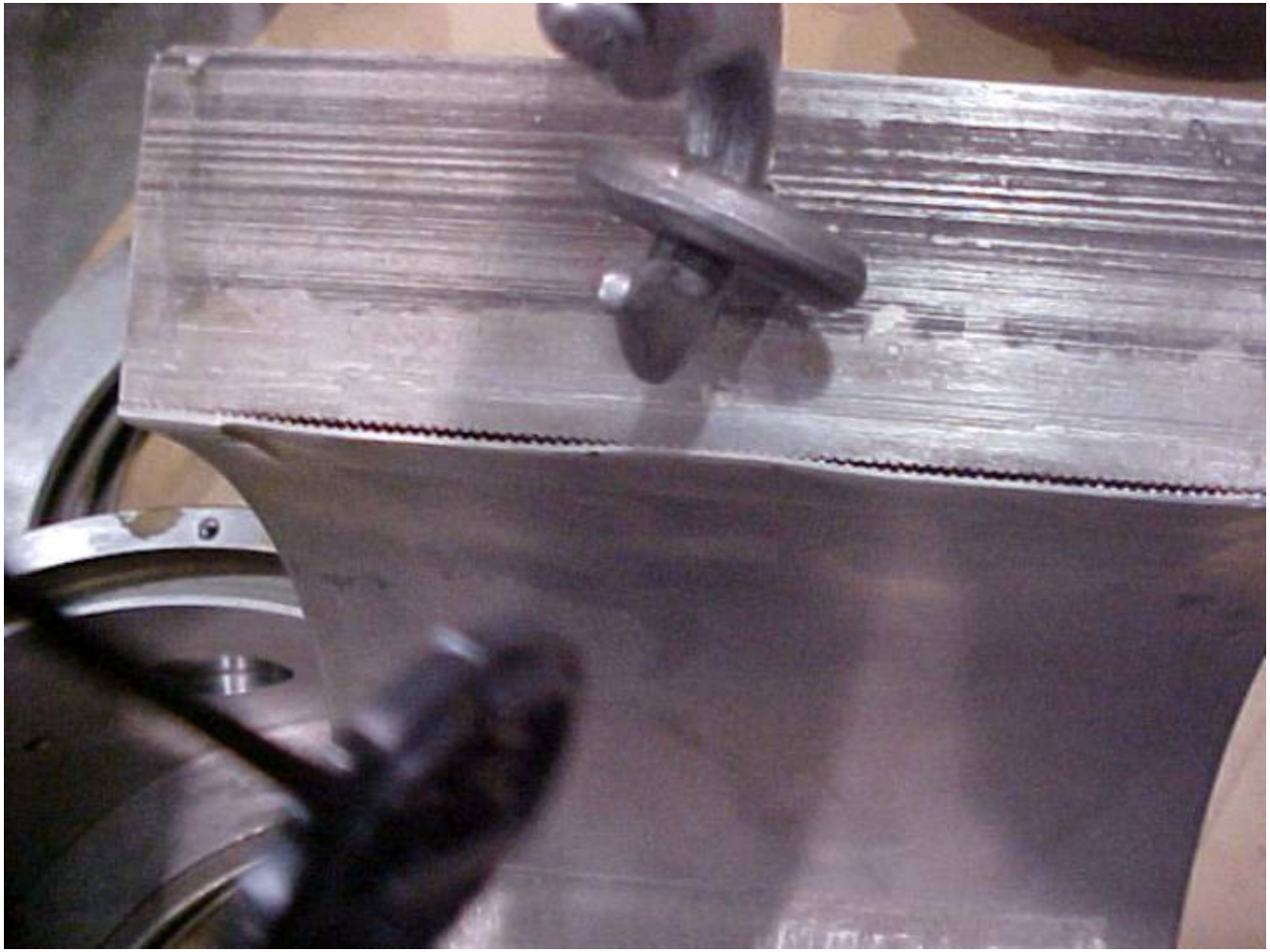
Babbitt Fatigue



Bad Bond



Bad Bond



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