Turbine Generator and Sleeve Bearing
General Discussion

Presented by:

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Highlights of:

- Mr. Kevin Guy’s Turbine Case History Presentation
  - Balancing
  - Looseness
  - Oil Whirl/Whip
  - General Characteristics

Highlights of:

- Dr. Lyle Branagan’s Journal Bearing Presentation
  - Load capacities
  - Looseness
  - Slinger Rings
  - General Characteristics
Highlights of:

- Mr. Kevin Guy’s Turbine Case History Presentation
  - Balancing
    - Do not rely on balancing to correct other problems.
  - If the reactions to your balancing attempts are not consistent, it is not a balance problem!

If you do not believe the primary issue is balance,
- Determine what the problem is
- Be wary of missing the simple items
  - Use a checklist to ‘look over’ the machine before you get started

Single Plane, Two Plane, Static, Couple, Multi-plane
- Process starts out the same, but the ‘view’ has to change

Looseness can/will magnify any imbalance that you are trying to correct and extend the time required to complete the process considerably
Highlights of:

• Mr. Kevin Guy’s Turbine Case History Presentation
  • General Observations
    • If ‘2x’ or ‘3x’ amplitudes are 15% or more of the ‘1x’ amplitude, there is a strong chance that looseness will affect any balancing attempts
    • If the bearing clearances approach 1.8 mils/inch of shaft diameter he has typically seen looseness affect his balancing attempts
    • ½ order frequencies are more of a concern at lower amplitudes than 1X frequencies due to the mode shape of the shaft. ½X creates higher stress levels in the shaft
    • Prefers coast down transient data over start-up transient data.
    • He is seeing more ‘significant’ misalignment issues than in the past
Highlights of:

- Mr. Kevin Guy’s Turbine Case History Presentation

Oil Whirl and Oil Whip Discussion

What is happening with Oil Whirl and Oil Whip?
Turbine Generator and Sleeve Bearing
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Highlights of:

• Dr. Lyle Branagan’s Journal Bearing Presentation
  • Load capacities
  • Looseness
  • Slinger Rings
  • General Characteristics

Different journal bearings:
• Plain sleeve
• Elliptical
• Various bore designs
• Tilt pad
• Lobed
• etc.
Highlights of:

- Dr. Lyle Branagan’s Journal Bearing Presentation

Looseness

- Bearing to shaft clearance
- Bearing to housing clearance
- Mechanical component fits in tilt pad assemblies
- Stability of the foundation
- Connection to the foundation
Highlights of:

• Dr. Lyle Branagan’s Journal Bearing Presentation

Slinger Rings

• Oil level is critical to proper operation and function of the slinger ring
  • The distance the oil level should be above the ID of the ring should be 10 – 15% of the ID of the ring (above 900 rpm). More than that, the ring slows down and the bearing is starved for oil. Less than that and the bearing is starved for oil.
  • Modern designers look towards the trapezoidal shape as the best design, the others are pretty much compromises that will get the job done for lessMoney

Oil Flingers are becoming a more common favorite among designers than the traditional slinger ring.
Highlights of:

• Dr. Lyle Branagan’s Journal Bearing Presentation

General Characteristics

What are the primary reason(s) for a journal (or any) bearing

• To separate the rotating from the stationary parts
• To transmit various static and dynamic loads to the foundation
• To stabilize and dampen the rotor dynamics of the machine

The loading on the bearing has to be correct:
• Both within the load limits and
• Enough to ensure stable operation

The lubrication for the bearing has to be correct:
• Proper viscosity for the loads and temperatures
• Enough flow for proper film and wedge development and cooling
General Comments and Highlights

Electrical Discharge
- Remember, it does not have to be a motor that makes the ‘stray’ electrical currents
- It could be a turbine or pump rotor or wheel that was repaired and residual magnetism was not removed.

With thin shell ‘liner’ bearings, the bore of the casing has to be in good condition, if the bore is not in good condition, support of the thin shell, shape of the thin shell and cooling of the thin shell will not be adequate.

Sight glass oil levels, I have seen sight glasses that were
- Full to the proper level, and plugged
- ¾ full so that from a distance there appeared to be ‘enough’ oil in the machine, but had to be 7/8 full to actually be at the proper level
- Showing oil to be in the machine, but due to the shape and position of the connection tube, there was actually considerable water in the lubrication

Mixing automotive oils or specialty additives in an industrial application
- I am sorry, but STP is not made for turbine applications. As stated yesterday automotive products have different additive packages to treat different conditions. Mixing 1 quart of STP into a 100 gallon sump could demolish a needed additive package.
General Comments and Highlights

Last thoughts on alignment:
• Be aware of the long turbine train and the fact that the bearing elevations are not level
• Yesterday’s slide showing 1.2” of elevation change in 75’ is not joking.
• These big heavy rotors with a long distance between the bearings sag when stationary and sag when operating. They do not straighten out, they flex on every revolution.

If you have a big sleeve bearing machine that is showing you that there is a strong preload during routine operation, it needs to be checked out.
• Even if a thermal growth study was done in the past that you had confidence in, it does not mean that the pedestal has not moved or the foundation has not shifted.

Please be aware that overloading the bearing with too high of a preload at the end of the long machine trains not only stresses the bearings, but puts very high stresses on the rotors. Do not overload the end bearings trying to make them stable, solve the complete alignment problem as to why one bearing is being unloaded and another seems to be carrying too much.
The End
Questions?
Comments?