3-27-2017 (Rev 3) **Topic: Grease Sampling**

Sampling from turbine pitch bearings with limited port access

Background

Grease analysis has become an important aspect of condition assessment in wind turbine maintenance, especially in blade pitch bearings where vibration technologies have a more limited effectiveness. Established sampling methods[3] typically require a minimum port diameter of ½" to fit a standard Grease Thief®, or for narrower "Slim" tool, an opening closer to 0.30", as shown on the left side of Figure 1, can suffice. In other cases, collecting the most recently purged grease from an existing catch container, such as those shown in the right side of Figure 1, is preferred. For the right place to sample, studies have shown that pitching bearings typically do a very good job at mixing and distributing the grease around the bearing periphery, and a properly obtained sample will provide a picture of the overall bearing health. Grease tends to accumulate more at the lagging edge of the bearing due to inertial force, so focusing sampling efforts at that end is suggested. Figure 1 shows how some catch containers in this lagging edge will fill nicely, while those at the leading edge can sometimes be found empty.

Figure 1

A challenge exists when the features and dimensions of a given bearing housing meets neither of those requirements. The user is faced with the choices of gathering contaminated grease that has bypassed the seal, removing the seal typically against the guidance of the OEM, or forgoing sampling entirely and running the risk of preventable failure. For this reason, we suggest an alternate approach to obtain the best possible sample under these limitations.

Recommended Method

CAUTION: *Before performing any tasks suggested in this bulletin, an independent evaluation of all personnel safety considerations and safe operation of the unit must be determined by safety and engineering personnel.*

1. First, remove and securely cap one of the supply lines sufficiently to prevent grease passage when pressurized by the addition of new grease. (Red Arrow in Figure 2). Alternatively, if there are access holes that are plugged instead of piped for grease supply, remove one of the plugs near the area of expected grease accumulation (based on inertial force as a result of hub rotation).

2. Slowly add grease through the remaining supply lines while rotating the bearing.
3. Observe the hole where the supply line or plug was removed for the appearance of purged grease.

Typically, there is a short channel between the external surface of the bearing and the "active zone" that may contain essentially new, unworked grease. This grease must be cleared by purging this volume into a waste container before collecting a sample. Experience with GE 1.6 model blade bearings, a common example, seems to show a purge volume of about 2ml will achieve this. It is recommended that you determine an optimal purge volume for each style that you sample, and consistently purge that volume each time. An unnecessarily large purge runs the risk of the sample being mixed and diluted with some of the newly added grease.

Figure 2

4. Continue adding grease and pitching the bearing while collecting purged grease initially in a waste container or empty syringe.
5. It may take about 2 ml or more to clear the channel and you may see a change in grease color and consistency.
6. Use a spatula or clean lint-free rag to wipe away excess grease.
7. After the channel has been cleared, collect sample in the syringe or Grease Thief.
8. The cleanest sample is obtained by holding the Grease Thief tightly against the hole or thread into the hole slightly as the grease is purging, allowing the pressure to fill the sampler with grease.
9. When the Grease Thief is full stop adding grease to the bearing. Remove the Grease Thief and place the cap on the end, just far enough to snugly engage the tapered threads. Place the Grease Thief in the protective shipping container and properly label it to identify the equipment and sampling location.
10. After the excess grease stops purging from the hole, reconnect the supply line to the bearing.
11. Wipe clean the surrounding area, return unit to service, and advance to next component to be sampled.

With this method, the user can collect a sample consistent with the approach outlined in ASTM D7718-11 and AWEA RP-814, ensuring the sample will be representative of current equipment and grease condition and allow for condition-based maintenance decisions.

Keywords

Grease Sampling, Pitch Bearings, Condition Monitoring

Other Resources

[1]H. S. Møller, K. H. Esbensen and R. Wurzbach, "Grease Sampling and analysis for in-service Condition Monitoring (CM) of wind turbine blade bearings," in *LUBMAT2016*, Bilbao, 2016.
[2]ASTM D7718-11, Standard Practice for Obtaining In-Service Samples of Lubricating Grease, ASTM International, West Conshohocken, PA, 2011, www.astm.org
[3]AWEA RP-814, Wind Turbine Pitch Bearing Grease Sampling "Operations & Maintenance Best Practices" American Wind Energy Association, Washington, DC 20005, www.awea.org