TIPS FOR LUBRICATION SYSTEM

Grease - How Much is Too Much ?

In November 2000 our plant added lubrication to its reliability enhancement program. I was assigned the responsibility to develop the comprehensive lubrication program and determine a time frame for implementation that would meet the January 2001 goal.

Several meetings were held with superintendents, supervisors and top operators from each operational area (rotating equipment specialists, vibration technicians, machinists, electricians and others) to get input on what needed to be accomplished. One phase of the program that we developed was relubrication PMs on electric motor bearings performed by operations personnel. Some of the questions which came from these meetings are answered below.

How Much Grease is Needful ?

We implemented the use of the SKF grease meter, which measures the amount of grease pumped from the grease gun into the equipment bearing. We purchased these through our local bearing supplier which handles SKF bearings. We learned that it was important to make sure the guns have a small air release valve on the end.

How Often Should this PM Activity be Performed?

SKF supplied us with a chart and formula for relubrication amounts. Time intervals based upon bearing size, equipment speed and load severities (from the National Electrical Manufacturers Association (NEMA) electric motor standards) were referenced to develop our relubrication schedules.

When Do We Know if the Grease Has Properly Reached the Rolling Elements of the Bearing?

A shock pulse meter supplied by SPM Corp. was acquired to let us know if the grease was reaching the bearings. This small instrument has an accelerometer attached to the meter by a cable. High-frequency vibrations picked up from the bearing are shown in bar scale on the face of the meter. When first connected to the equipment bearing housing, the meter may read from one to nine bars. During relubrication, if the meter is at one bar and starts increasing, the grease gun operator should stop the relubrication process. If the meter is at eight bars, the reading will decrease as the fresh grease reaches the bearing's moving elements.

Operations personnel were trained to use both instruments to relubricate the equipment according to guidelines from NEMA electric motor standards and SKF. Both meters and a laminated chart showing relubrication amounts were attached to each grease gun.

What are the Benefits?

The program was initiated on January 2001 in one operations area at a time and was implemented throughout the plant by March 2001.

In the three years before this lubrication program was implemented, our computerized maintenance management system (Maximo Tracking System) showed a total of 32 motor bearing-related repairs per year for 1999 and 2000. Since implementing the lubrication program, our plant has had only 23 motor bearing-related repairs in 2001 and 17 repairs from January to October 2002. Operations relubricates motors only 40 horsepower and above. Our plant has approximately 1,000 motors in this category.

Our plant achieved a 30-percent decrease in motor bearing repairs in 2001 from the average in 1999 and 2000, and another 25-percent decrease in 2002 from the repairs in 2001.

With these advantages, we continue to look for ways to help improve lubrication and our equipment's reliability.

Virgil Rexwinkle, Coffeyville Refinery/Farmland Industries

Bearing Lubrication

TIP #1

As a rule, larger bearings and those that run at high speeds shorten grease life. Grease time-to-failure typically halves when bearing rotational speeds reach DN limits. Operation at even higher speeds can trigger early bearing failure, partly because centrifugal force throws grease from cage and raceway surfaces.

Elevated operating temperature is also an enemy of greases. In fact, bearings that run at temperatures above 70 degrees C cut grease life by a factor of 1.5 for each 10 degrees C rise. *Ref: M.M. Khonsari and E.R. Booser*

TIP #2

In most cases, roller bearings handle dirt contamination better than ball bearings because there is more area supporting the load, so the pressure is less concentrated.

TIP #3

Avoid overfilling bearing housings with grease. When a bearing rotates, it is lubricated by a thin film of grease. Excess grease is moved into the cavities of the bearing and housing. If these cavities are already filled with grease, the excess has nowhere to go and remains in the bearing where it is "churned". This causes overheating which can lead to separation of the oil from the thickener, evaporation, oxidation and leakage.

TIP #4

When specifying a grease for a bearing in a high water environment, consider running the water washout, water spray off and rust tests on the candidate grease(s).

TIP #5

To ensure that the proper lubricant is used in a bearing, use a thin colored washer (anodized aluminum washers work well) at the fitting and paint the grease gun the same color as the washer. To install the washer, unscrew the grease fitting. Find a washer with an inner diameter a little larger than the outer diameter of the threaded shaft of the fitting. Insert the fitting into the washer and screw in the washer/fitting assembly.

TIP #6

Rounded, rose-petal shaped platelet particles in an oil are probably from ball bearings

Vibration Analysis Tip

Confirming 2x running speed and 2x electrical line frequency using vibration analysis.

Many vibration practitioners will have experienced that 100hz frequency component on the screen of their data collector during data collection on 50hz electric motors. On a circa 3000rpm motor, this frequency component could be either 2x line frequency or 2x running speed frequency. If the resolution is not set high enough in the collection specification too separate the two frequency components, how do you know which one is dominant?

Two ways to confirm the exact cause are as follows: -

1. Set the spectrum collection specification to Zoom, use minimum frequency 20Hz and maximum frequency 200hz. And set the resolution to 3200 lines. This will give sufficient resolution to split the two frequency components (if two components exist). This will confirm the symptom and increase analytical confidence.

2. If, after splitting the two frequencies, you find the 2x line frequency to be dominant (indicating some possible electrical anomaly within the motor) this can be doubly confirmed by setting the data collector to analyser mode, select the low and high frequency and the resolution as above. Whilst collecting spectral data in real time, and if possible, switch of the electrical power to the machine, this will result in immediate loss of the 100Hz component whilst the machine continues to run down to rest.

Click here for more Vibration Analysis resources & links

ROOT Cause Analysis Tip

The key to any investigative occupation is the identification of patterns that lead to an undesirable outcome. With Root Cause Analysis (RCA) we seek to identify this pattern (cause and effect relationships) down to its root causes imbedded in decision errors and their rationale.

Click here for more ROOT Cause Analysis resources & links

CMMS Tip

Use a number of different beta-testers for a new CMMS, and pay attention to their feedback. "If a user says the layout of a page too hard to figure out, find out why.

Click here for more CMMS resources & links

Click here for more Lubrication resources & links

Lubrication Tip

1. Almost every lubricant foams to some extent due to the agitation and aeration that occurs during operation. Air entrainment due to the agitation encourages foam formation. The presence of some detergent and dispersant additives tend to promote foam formation. Foaming increases oxidation and reduces the flow of oil to the bearings. In addition, foaming may cause abnormal loss of oil through orifices. Anti-foam agents are used to reduce the foaming tendencies of the lubricant. Foam inhibitors may be added to a lubricant in service if a foaming problem is detected. The lubricant and equipment manufacturer should be consulted before adding foam inhibitors. ASTM D892 is a laboratory test used to determine the foaming characteristics of the lubricant. It can monitor the foaming tendency and stability.

Motor Testing Tip

I do Meg-Ohm/Insulation Resistance testing on several different types of AC and DC rotating machines. What is an acceptable Meg-Ohm/Insulation Resistance value for my testing? In other words, what is a good Pass/Fail criteria for Meg-Ohms ?

Meg-Ohm (and PI testing) is governed by IEEE 43. This standard gives a MINIMUM acceptable values for random wound and form wound machines rated below 1 kV as: 5 Meg-Ohms

It also gives MINIMUM acceptable values for most formed coil stators and DC armatures built after 1970 as: 100 Meg-Ohms

And finally, for most windings made before 1970, as 1 Meg-Ohm plus 1 Meg-Ohm per kV.

Motors in good condition will exhibit higher or MUCH higher test values than the minimums shown here. If a motor with lower values than these is encountered, investigation and corrective actions should take place.

Click here for more Motor Testing resources & links

Electrical Safety Tip

Remember, even routine voltage checks and clamp-on ammeter readings require the use of rubber gloves and other personal protective equipment on circuits above 50 volts. Don't let this OSHA and NFPA 70E requirement get you in trouble when performing preventive maintenance checks.

What Causes Seal Leakage?

From "The Practical Handbook of Machinery Lubrication"

Cost cutting by machine design engineers, incomplete commissioning and plant start-up procedures, and inadequate equipment condition monitoring and maintenance practices are the major reasons for initial seal failure and fluid leakage.

Once a seal has failed, causing fluid leakage, the problem is perpetuated by bad purchasing department policies of purchasing and restocking low-quality (read less expensive), or incorrect seals, or by careless installation practices used during replacement procedures.

The subsequent leaks, though considered excessive, continue. Soon, plant operating and maintenance personnel accept the leakage as normal.

The lack of attention to a few basic details costs millions of dollars annually in external fluid wastage, unnecessary maintenance downtime and environmental damage.

More information about the "The Practical Handbook of Machinery Lubrication"