When to Regrease

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INTRODUCTION

Used oil analysis is recognized as a primary tool for predictive maintenance activities. In fact, oil analysis has been used for over 50 years in this capacity. But what about the 90 percent of all bearings lubricated with grease? How much do you know about the grease or greased bearings in your plant or wheel bearings? Grease analysis is certainly not for every bearing … maybe it's not even for most bearings. But when you have a need to know, a thorough analysis of the grease in question can prevent headaches and save money.

Grease is designed to lubricate systems where it is not practical to lubricate with oil. In general this includes open gearboxes and rolling element bearings. Greases are made up of oil, filler and additives. The filler is designed to hold the oil and additives in place and allow them to lubricate the system, while the oil and the additives degrade just like oil wetted lubrication systems.

SAMPLING OF GREASE ANALYSIS

Eight samples of grease were submitted to Herguth Laboratories for analysis. Six samples were used grease and two samples were unused grease identified as caliper grease and bearing grease. Several questions were posed. This case study attempts to answer these questions as completely as possible.

Herguth Project Number Sample Description

Lab # 720009 - ID: 1272 INLET END GREASE
Lab # 720010 - ID: 1272 DRIVE END GREASE
Lab # 720011 - ID: 0400 INLET END GREASE
Lab # 720012 - ID: 0982 INLET END GREASE
Lab # 720013 - ID: 1657 INLET END GREASE
Lab # 720014 - ID: 1657 DRIVE END GREASE
Lab # 720015 - ID: NEW BEARING GREASE
Lab # 720016 - ID: NEW CALIPER GREASE

Question: Is there another type of grease in Sample 0400 Inlet End, specifically, caliper grease?

Answer: There is no indication of caliper grease in this sample. However, there is a silicone substance present.

Question: Do the bearing grease properties match the product specifications?

Answer: The testing shows the bearing grease is a lithium-based NLGI Grade 1 grease. All parameters were not tested; however, the limited testing shows the grease is acceptable. The Cone Penetration test is not very precise. The range for Grade 1 is 310-340, while Grade 2 is 265-295. The reproducibility of the test is 27 units. Therefore, based on the precision of the test, the bearing grease submitted could

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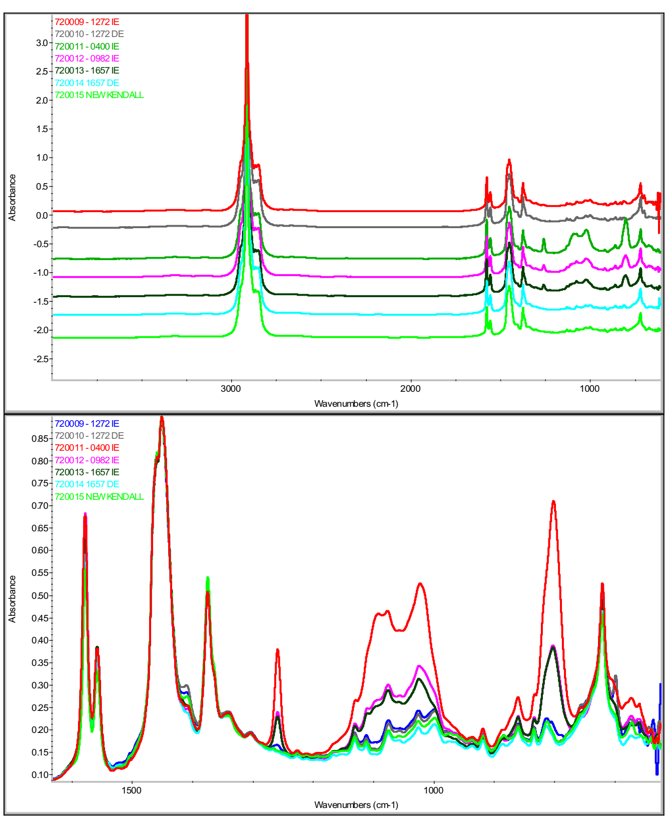
Figure 1.



Infrared Scans of Samples

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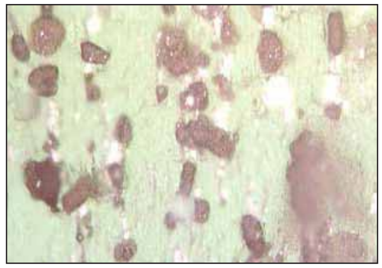
have a 292 value. The 292 would be a Grade 2 grease.

Question: Can you offer an opinion about life expectancy of the grease compared to the new bearing grease?

Answer: Life expectancy of grease is based on the physical characteristic of the grease and the resistance to oxidation. Considering only the grease properties (not contamination), all of the grease appears to be satisfactory. Unit 1272 Drive End Grease has 45.8% remaining useful antioxidant life. This is the lowest percentage of the group. In order to answer this question completely, there needs to be better information about grease times and additions. The Unit 1657 greases have about 55% of their oxidation life remaining after 2838 hours. This conflicts with data from Units 0400 and 0982. Once a grease gets to less than ~ 25% it is our opinion that a change out should be planned. However, additions and purges can increase the characteristic back to acceptable.

Figure 2.



500X Photo of wear debris in 0400 Sample

Question: Is there contamination from water, soaps, metals, silicones or caliper grease?

Answer: The greases were water and particulate free except Unit 0400. 0400 had what appears to be metal spheres. These spheres could be associated with the electrical arcing suggested in the test request. These iron particles are also believed to be why the grease is brown. Samples 0400, 0982 and 1657 Inlet all have silicone contamination.

Question: Compare the drop point to new bearing grease.

Answer: All drop points were in the same acceptable range.

Question: What is the condition of the grease in the motors?

Answer:

Lab # 720009 - ID: 1272 INLET END GREASE
The grease is clean, dry and generally acceptable. However, the cone penetration and viscous modulus show it has a higher apparent viscosity than the other greases. This is unusual since the oxidation stability is as high as the fresh grease.

Lab # 720010 - ID: 1272 DRIVE END GREASE
Copper and water are higher than any of the other greases. This may be bearing cage wear. The oxidation stability is the lowest. There is no immediate need to perform maintenance. However, the grease is reaching the end of its useful life. The water and copper may have acted as a catalyst for the rapid reduction in the oxidation stability.

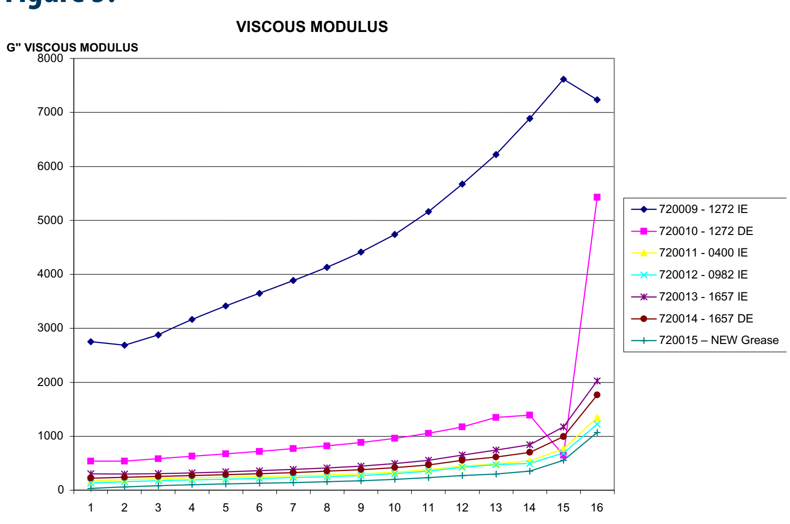
Lab # 720011 - ID: 0400 INLET END GREASE
The iron and silicone are the highest in this sample. The grease has held up well. However, the silicone and iron suggest a problem is developing. The silicone is a contaminant, while the iron is most likely wear debris.

Lab # 720012 - ID: 0982 INLET END GREASE
This sample is characteristic of the new grease. It is in very good shape with the exception that it has some silicone contamination.

Lab # 720013 - ID: 1657 INLET END GREASE
This grease appears to be in good shape. The oxidation stability is ~ 1/2 of the fresh product.

Lab # 720014 - ID: 1657 DRIVE END GREASE
This grease appears to be in good shape. The oxidation stability is ~ 1/2 of the fresh product.

Figure 3.



Viscous Modulus vs. Radians

Question: Can you offer an opinion on the appropriate interval to add ~ 1 ounce of fresh grease?

Answer: The samples with 2838 hours (Unit 1657) show the grease to be in good shape; however, there was a grease addition on January 16, 2003. If this grease addition brought the oxidation stability back up to the 50% range, than the interval was too long. Without further, more-controlled testing, it is difficult to answer this question. If the 2838-hour samples are the old portion of the grease (having 2838 hours in service) then it is reasonable to expect the relubrication interval to be upward of 3000 hours.

Question: Can you identify the source of the brown color?

Answer: The brown color in the 0400 sample appears to be from the metal spheres. This suggests there is some electrical discharge occurring.

CONCLUSIONS

Accurate determination of regreasing intervals is possible if:

1. Adequate information is kept about the status of the grease components.
2. Correct testing methods are used to evaluate a series of used grease components in various stages of service life.

Regreasing intervals must consider contamination and grease degradation. Once established, regreasing intervals help to optimize maintenance activity so the user does not over- or under-maintain the greased bearing. **<<**

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Figure 5.

Lab Number	720009	720010	720011	720012	720013	720014	720015	720016
Description	1272 INLET END	1272 DRIVE END	0400 INLET END	0982 INLET END	1657 INLET END	1657 DRIVE END	NEW BEARING GREASE	NEW CALIPER
							L-427	GREASE
Grease Hours	Unknown	Unknown	69	853	2,838	2,838	NEW BEARING GREASE	N/A
Test Method								
Infrared Analysis	Enclosed	Enclosed	Enclosed	Enclosed	Enclosed	Enclosed	Enclosed	Enclosed
Metals by ICP (ppm)								
Silver								34
Aluminum	14	20	4	2	15	10	7	1203
Boron	654	821	714	676	490	432	601	23
Barium	6	2	2		32	2		10210
Calcium	924	1196	102	96	327	244	784	50
Chromium	4	10	11	1	1			
Copper	5	248	5	3	4	31	1	
Iron	356	552	4665	110	119	10	5	13
Magnesium	2	4		1	2	1	4	
Molybdenum	1	1	2	1	26	22	13	695
Sodium	37	46	80	89	36	16	21	115
Nickel	4	5	5	1	2	1	1	4
Phosphorus	997	1052	1032	1045	786	809	917	51
Lead	2	19	2	2	2	1		5
Silicon	5053	70	27550	16570	1332	55	9	884
Tin		1	1				1	8
Vanadium								
Zinc	1103	1266	1213	1181	913	912	988	9
Cadmium		1				1	1	
Manganese	2	2	13	1	2			1
Titanium	2	4		1	1		1	22560
Antimony	3	4	22	20	1	1	4	5
Potassium	12	10	18	15	12	1	10	76
Rheology	Enclosed	Enclosed	Enclosed	Enclosed	Enclosed	Enclosed	Enclosed	Enclosed
Cone Penetration (worked)	274	289	328	334	292	284	319	263
Dropping Point (deg. C)	286	>304	>304	>304	>304	>304	287	>304
Water (ppm)	500	1060	360	510	260	170	290	430
Deleterious Particles								
No. of Scratches	0	6	2	14	9	6	20	5
OIT by PDSC (mins.)	18.94	8.7	10.37	17.09	11.03	10.56	19	58.94
% Remaining Useful Life	99.7	45.8	54.6	89.9	58.1	55.6	N/A	N/A