

SUCCESS STORIES

Oil & Gas



Time-Based greasing? Sure?

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It makes sense to be reminded, from time to time, that calendar is not always the best decision-making tool. Actually, it rarely is.

Because, if it was, you would have been dragged out of your 65th birthday party and taken to a hospital for a hip replacement, since statistics say that hip failures happen from that age on, and if your hip is just fine... bad luck, they will “repair” it anyway.

Personally, I somehow prefer it to be done based on REAL CONDITION of MY hip, not statistics and calculations. And, luckily for all of us, that’s exactly how medicine does it.

Unfortunately, bearings do not always have the luxury we have, the luxury to be examined before someone injects something into our bloodstream or replaces some of our “parts”.

Fortunately, more and more “doctors and nurses”, in Maintenance and Reliability, care enough and know enough to question the calendar and actually ask the patient (bearing) three simple and effective questions:

- Do you need grease?
- How much?
- Do you feel better now?

You just need to speak the bearing language, and you’ll get your answers loud and clear.

Recently, Mr. Alican Gozuacik and I spent 4 days in training with high performing Jotun team in Turkey, led by Mr. Bahadir Buyukeren, with Hakta Zeren and Kamil Okcu.

It is also important to mention Mr. Serdar who was not involved in training until the very end but played a highly important role in greasing bearings right.

So, let’s see what we had on the menu:

Two fans with the same specs (not using word identical as I do not believe in it, but “same” fans), operating in the same conditions (according to how the process is supposed to work) and treated with copy/paste time-based lubrication plan.

- Direct drive, 55 kW motors, with 6 313 and 6 315 bearings.
- Lubrication plan based on recommendations:
 - 13 grams every 4 000 hours, both DE and NDE on both motors.
- No Ultrasound history data available – no alarms applied at this point.

As assuming seems to be the keyword in many lubrication programs, let me join the club and assume something myself.

I assume that the recommendation is wrong.

As it was time to replenish the grease in both motors (according to those 4 000 hours), we used the opportunity to do it. But this time with LUBExpert.

After a couple of minutes of basic instructions to Mr. Serdar, he was on his way to replenish grease based on real condition and real bearings’ needs. We did nothing, we simply enjoyed the scene.

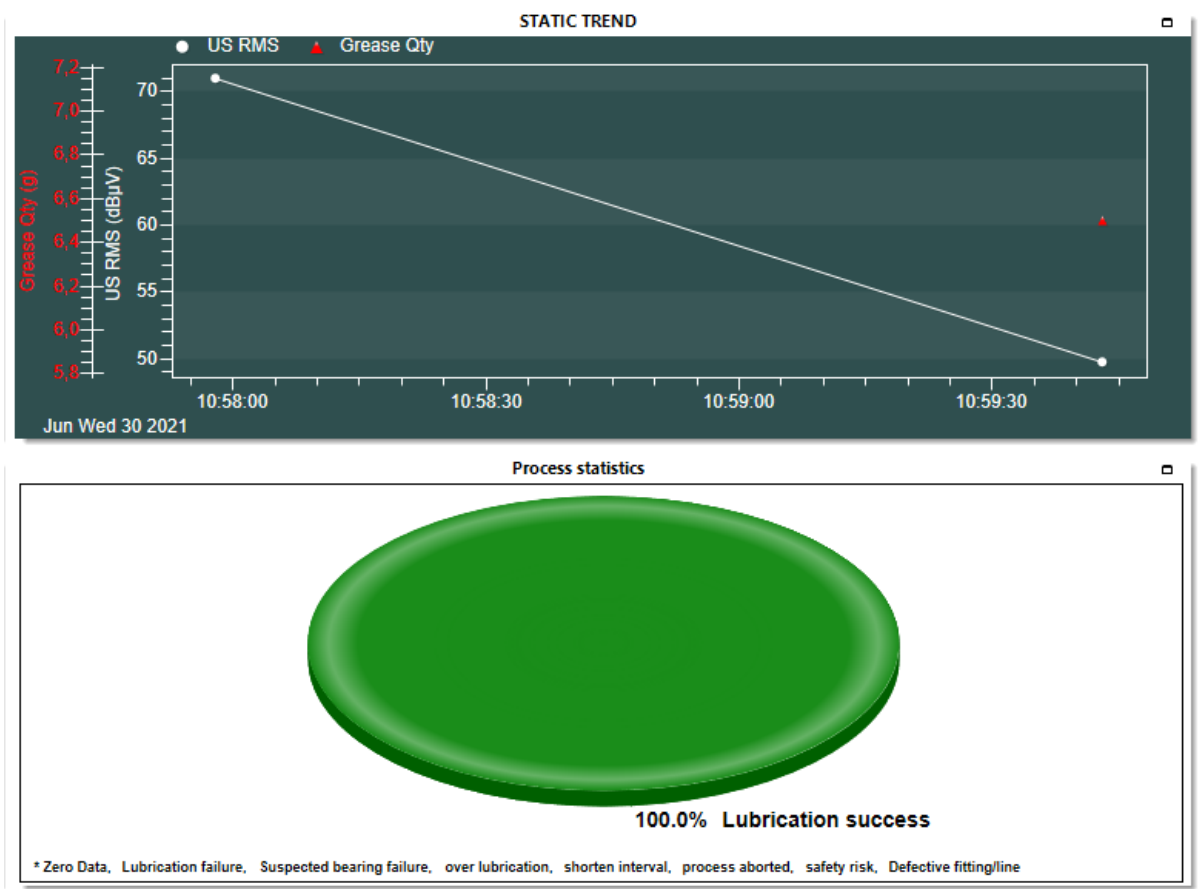
And, surprise, surprise... what happened during grease replenishment was not even close to what time-based recommendations were directing Mr. Serdar to do.

Fan 2 Motor NDE:

Planned quantity: 13 grams / proven wrong

Applied: 6.5 grams

Outcome: Lubrication success



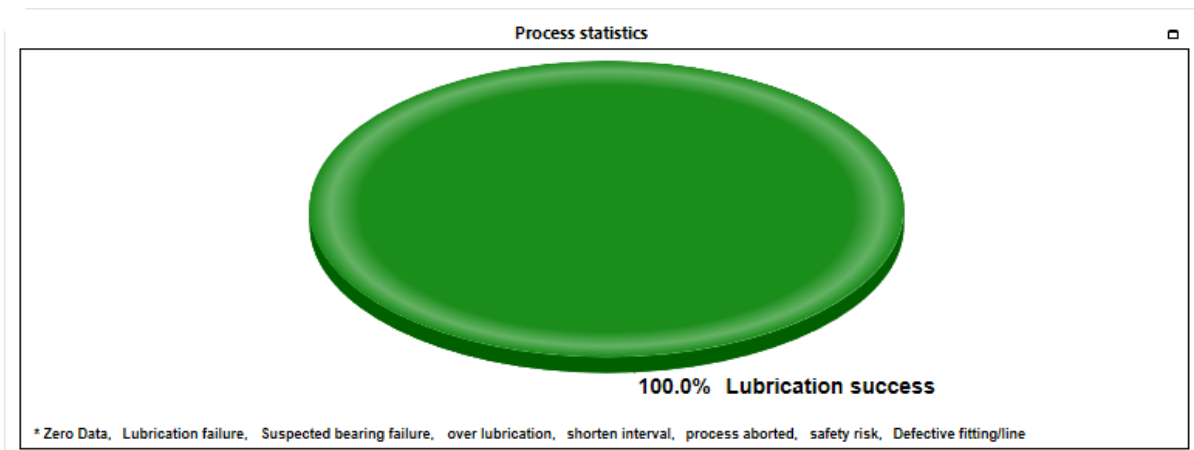
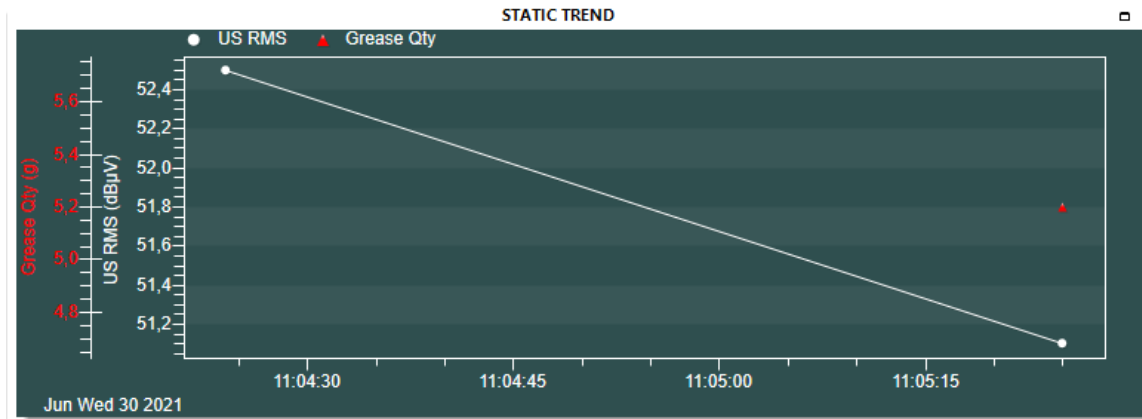
Readings Alarms Events									
Jotun Lube/Line 2 FAN Direct Drive/Motor Nde/LUBEsense1(ST-Ht)									
RMS	Lube Alarm	Lube Alarm Level	Grease Name	Nb. Grease Shot	Grease Qty	Sensor Name	Length (Sec)	Operator	
49,7	▲	Lubricationsuccess	LGHP	5	6,5	LUBEsense1	4	default	
71		initial reading	LGHP	0	0	LUBEsense1	4	default	

Fan 2 Motor DE:

Planned quantity: 13 grams / proven wrong

Applied: 5.2 grams

Outcome: Lubrication success



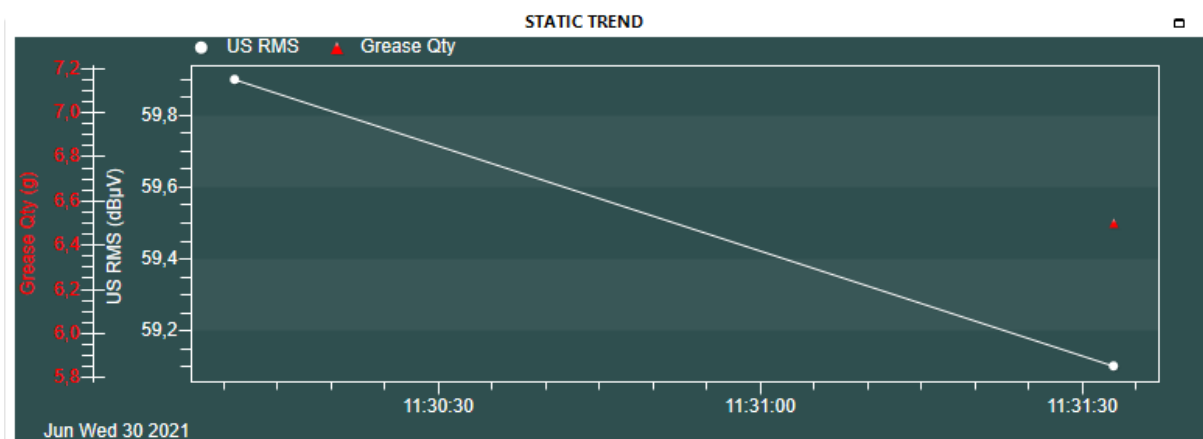
Readings Alarms Events									
Jotun Lube/Line 2 FAN Direct Drive/Motor DE/LUBEsense1(ST-Ht)									
RMS	Lube Alarm	Lube Alarm Level	Grease Name	Nb. Grease Shot	Grease Qty	Sensor Name	Length (Sec)	Operator	
51,1	▲	Lubricationsuccess	LGHP	4	5.2	LUBEsense1	4	default	
52,5		initial reading	LGHP	0	0	LUBEsense1	4	default	

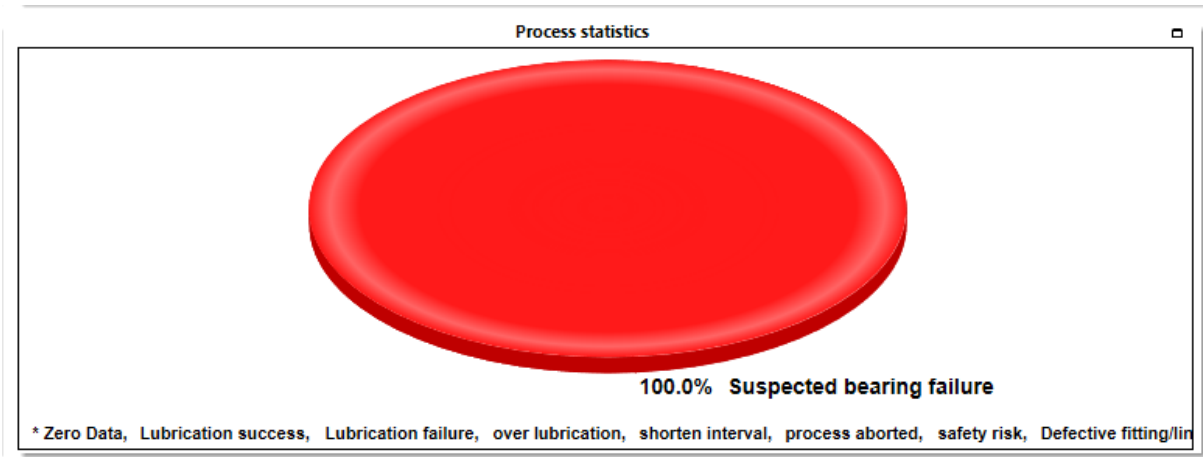
Fan 1 Motor NDE:

Planned quantity: 13 grams / proven wrong

Applied: 6.5 grams

Outcome: Suspected bearing failure – Data reported to CM team





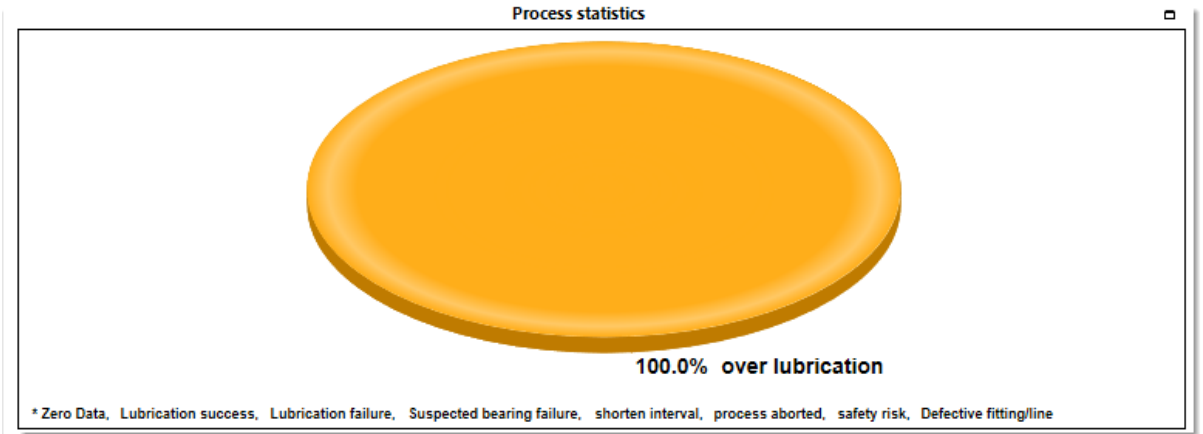
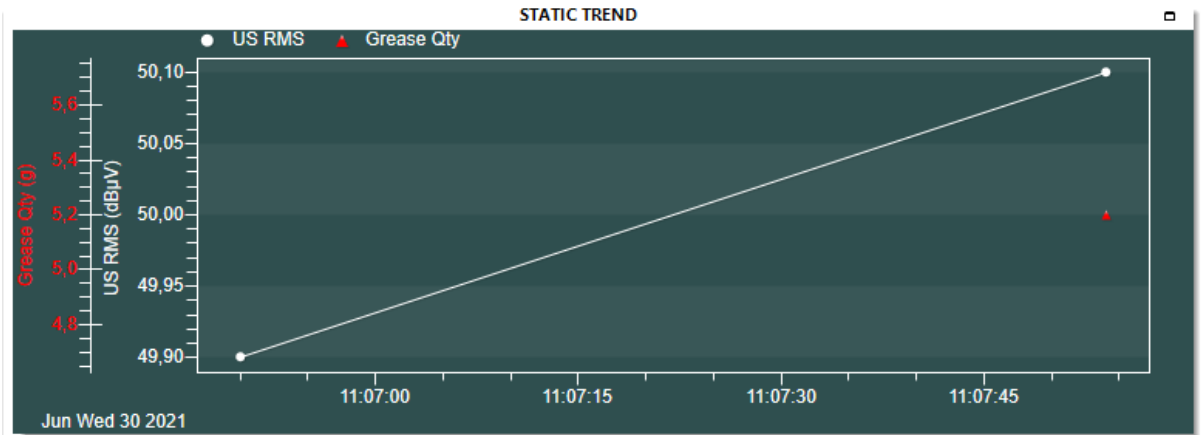
Readings Alarms Events									
Jotun Lube/Line 1 FAN Direct Drive/Motor NdE/LUBEsense1(ST-Ht)									
RMS	Lube Alarm	Lube Alarm Level	Grease Name	Nb. Grease Shot	Grease Qty	Sensor Name	Length (Sec)	Operator	
59,1		Suspected bearing failure	LGHP	5	6.5	LUBEsense1	4	default	
59,9		initial reading	LGHP	0	0	LUBEsense1	4	default	

Fan 1 Motor DE:

Planned quantity: 13 grams / proven wrong

Applied: 5.2 grams

Outcome: Over Lubrication – Bearing didn't need any grease



Readings Alarms Events									
Jotun Lube/Line 1 FAN Direct Drive/Motor DE/LUBEense1(ST-Ht)									
RMS	Lube Alarm	Lube Alarm Level	Grease Name	Nb. Grease Shot	Grease Qty	Sensor Name	Length (Sec)	Operator	
50,1		over lubrication	LGHP	4	5.2	LUBEense1	4	default	
49,9		initial reading	LGHP	0	0	LUBEense1	4	default	

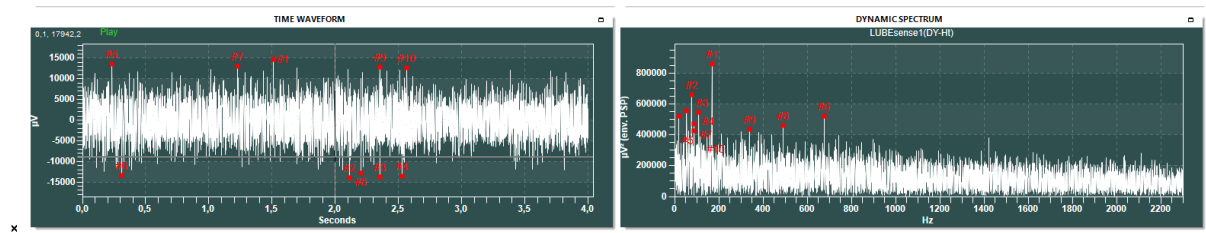
Worth mentioning:

Mr. Serdar performed the task perfectly and with no assistance from our side.

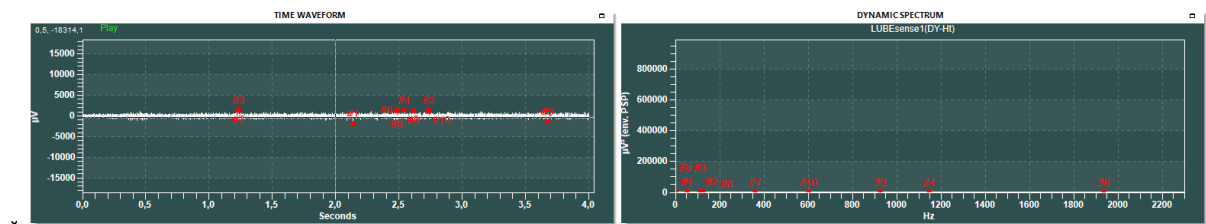
In addition, LUBExpert collected the Dynamic data (TWF and Spectrum) for each bearing before and after the grease replenishment process.

That makes Mr. Serdar a member of the Condition Monitoring team, providing highly valuable data.

Before:



After:



Let us conclude this interesting and clear case:

- The needs of each bearing were different, opposite to what was assumed;
- None of those needs matched the Time-Based plan;
- Following the Time-Based plan would have actually hurt the bearings;
- The job was done easily, correctly, fast, and effectively.

Obviously, there is a good way and a bad day to replenish grease.

Your bearings – your choice.

On-Condition or Time-Based?

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Maintaining plant assets in an optimal state of lubrication is a topic receiving lots of attention. Maintenance and Reliability practitioners dedicate teams to the task but not every organization achieves world-class results. As much as 80% of all bearing failures are attributed to poor lubrication practices including:

- Using the wrong lubricant
- Lubricant deterioration
- Lack of lubricant
- Too much lubricant
- Contamination
- Mixing grease types
- Using sealed bearings but still providing a grease nipple access point on the motor (whoops!)



Figure 1 - Collecting ultrasound data with SDT270 while replenishing lubricant.

“During the training, we performed measurement practice on several machines (Figure 1). One of the machines was a fan, scheduled for re-lubrication in a few days” recalls Haris. “The customer’s standard greasing practice is to follow manufacturer’s recommendations for both interval and amount. In other words, they grease on a time-based schedule and trust the motor manufacturer to guide on quantity.”

Haris Trobradovic used the opportunity and performed re-greasing exactly as

One glaring mistake that contributes to early bearing failure is over/under lubrication. Over and under lubrication is the product of scheduling grease replenishment on a time-based instead of a condition-based schedule, and not knowing how much grease to inject.

Too often bearings are being fed new grease before it’s required. Other times the grease gun comes out too late. Some lubrication technicians guess the quantity of grease to inject and don’t even know how much grease is dispensed with a stroke of their grease gun. Bearing manufacturers provide formulae for calculating a theoretical grease capacity for each bearing but not everyone knows how to use them. Still others simply follow guidelines given by the motor manufacturer. Often this “bad advice” is stamped directly on the motor.

To drive home this point, Haris Trobradovic, one of SDT’s many globe-trotting corporate trainers recently delivered training to a petrochemical facility in the Middle East.



Figure 2 - Two fan bearings with different load. Why do they share the same grease replenishment protocol?

recommended by the OEM, even though the Condition Monitoring team had a different opinion. Their ultrasound data did not indicate any need for grease replenishment, after having added a small amount of lubricant followed by a measurement. The CM team members are strong advocates for on-condition lubrication and doing away with time-based.

Following the facility's lubrication procedure raised several red flags. Figure 2 shows two bearings driving the fan. Why would two identical bearings, but with different loads, have the exact same grease replenishment protocols? Maybe it's purely out of convenience; since the lubricator is there to grease the drive end bearing, might just as well pump a few strokes into the non-drive end.

Another issue that disturbed the SDT trainer was the instructions stamped on the motor plate. See Figure 3 – Maintenance of the bearings with grease quantity regulator". This stamp instructs the owner of the motor to add 32.7 grams of grease (grease type not identified) every 3 068 operating hours. Haris wondered if the OEM took into consideration the installation of the motor in a climate that is

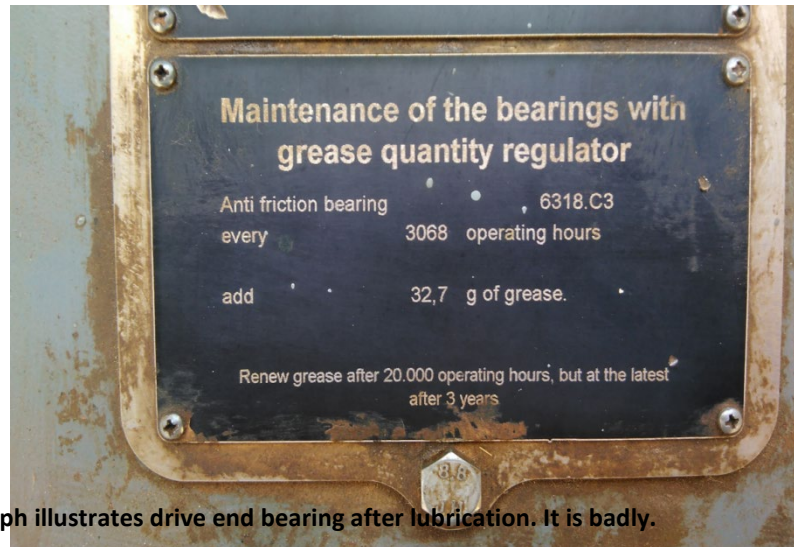
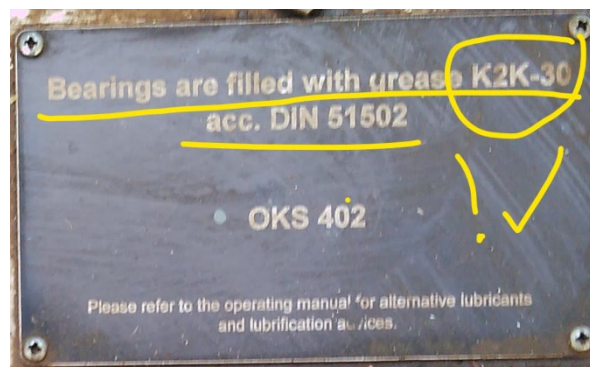


Figure 3 - This motor had a secondary plate reminding lube-techs which grease type to use.

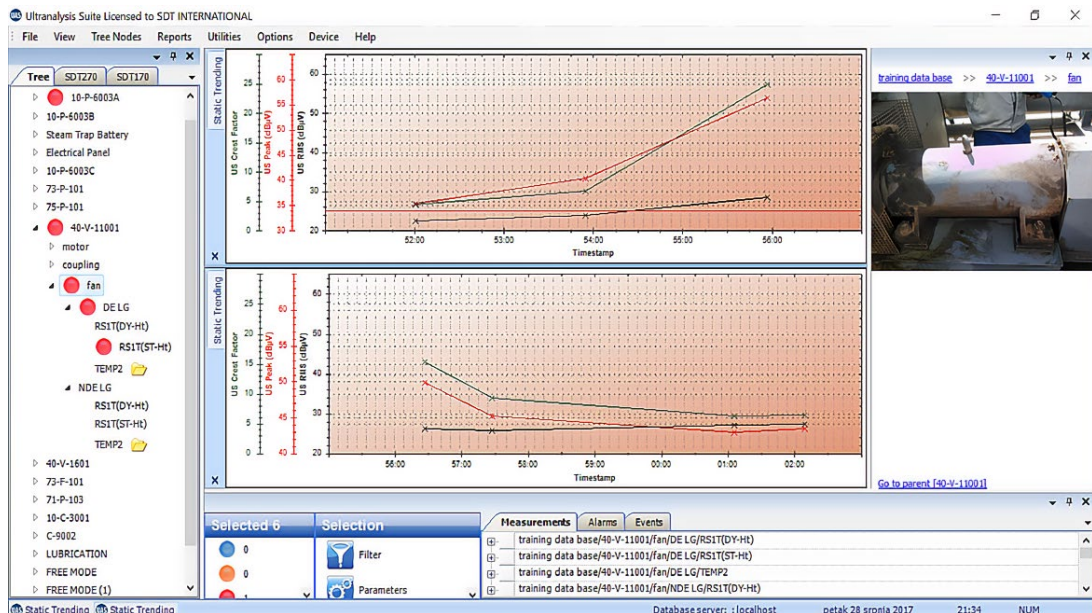
One refreshing fact was an additional plate (Figure 4) with details about the grease type used in the bearing. Mixing incompatible grease types is an often-cited cause of premature bearing failure. This same reminder is provided by the SDT LUBExpert Ultrasound Tool. Prior to beginning a lubrication task LUBExpert reminds the operator of the correct grease type to use.



Continuing with the experiment, Haris and the CM team attached the grease gun to the SDT equipment and greased the drive end bearing following OEM recommendations. Figure 5 is a screen

Figure 4 - OEM instructs the owner to grease on a time-based schedule without considering the operating environment.

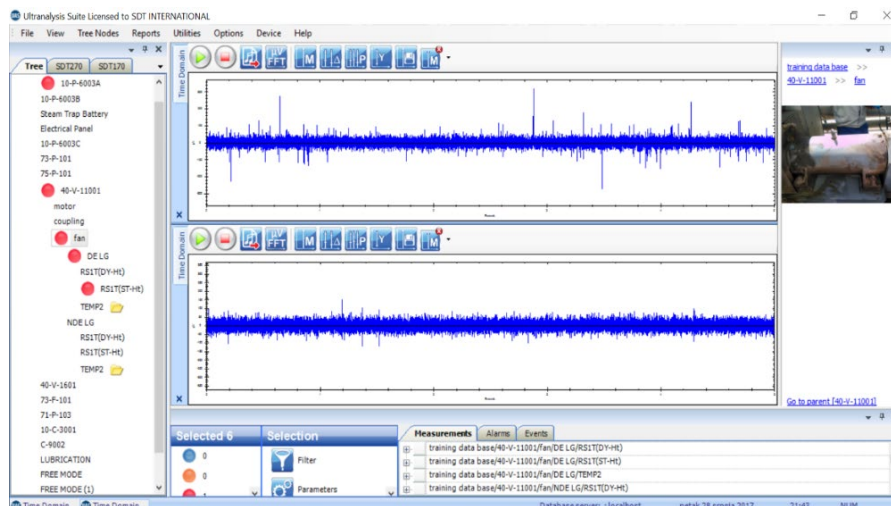
shot captured from UAS, the companion software to LUBExpert. The top trend is the drive end bearing. Within four minutes, the overall RMS increased by 7 dBμV while the Crest Factor and Peak spiked sharply.



The bottom trend is from the non-drive end bearing. Adding the requisite amount of grease had no positive outcome for the Overall RMS which stayed stable at 26 dB μ V. The drop in Crest Factor and Peak readings, however, indicates the bearing may be entering a failed state. More frequent condition monitoring with complimentary technologies such as vibration analysis will ensure any machine downtime is scheduled on the client's terms, not the machine's.

For those unfamiliar with these data formats, Overall RMS, Max RMS, Peak, and Crest Factor are used to bring synthetic meaning to ultrasound STATIC data. Sadly, following OEM procedure resulted in over lubrication of the DE bearing.

To drive home the point, Haris also captured DYNAMIC signals from the drive end bearing. As seen in Figure 6 the time signal before (bottom) and after (top) reveals new peaks and impacts forming. Over lubrication causes pressure to build inside the bearing. Ideally, the lubricant wants to feed from the



thickener to form a thin film between the rolling elements and the race. It can't do this if there's too much grease and pressure. The result is increased friction and impacting, two phenomena easily detected with ultrasound specialty tools like SDT's LUBExpert.

Finally, Haris collected DYNAMIC time signals on the non-drive end bearing. In Figure 7 the bottom time signal shows dominant peaks that are clearly random impacts. After lubrication those peaks are

Figure 6 - Dynamic data from drive end shows the emergence of defects (top) after bearing was over-greased following OEM recommendations.

gone, as you can see in the top time signal, Figure 7. It appears that replenishing the grease in the non-drive end had some positive benefits, and those benefits are clearly illustrated in UAS.

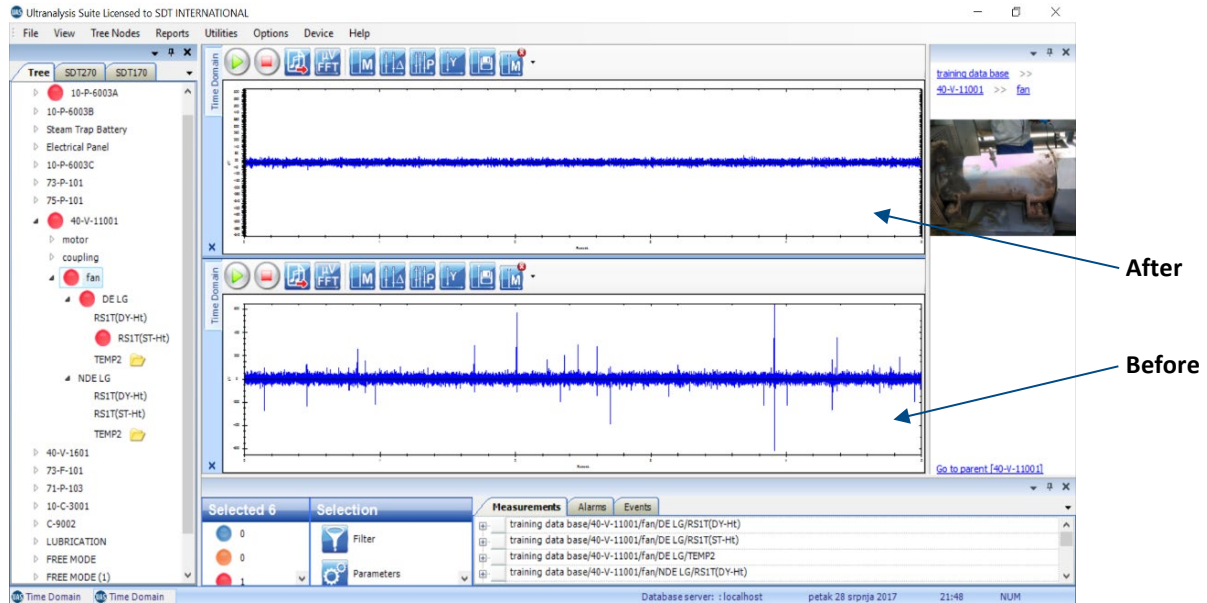


Figure 7 - The non-drive end bearing has defects as shown by this dynamic time signal. Ultrasound assisted lubrication with SDT allowed the CM team to identify this potential fault.

The bottom line is that following OEM recommendations to replenish lubrication on a time-based or time-in-service protocol are proven wrong time and again. Following the greasing instructions stamped on the motor plate led to the drive end bearing being over greased and reducing life expectancy.

Another interesting takeaway here is that while an ultrasound lubrication solution – LUBExpert – was used to monitor the effects of adding grease, the added benefit for the CM team is the indication that a failure state may exist. There was a day not too long ago when the lubricator was counted on for keeping his finger on the pulse of the plant. Solutions like SDT’s LUBExpert are restoring important responsibilities to a task that recently has been given to “lower-skilled” tradespeople.

It’s past time that lube-techs be recognized for the important role they can play contributing to plant reliability.