

GREASING WITH ACCOUNTABILITY!

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Digital greasing is here.

Most grease lubricated bearings fail to reach the lifespan they are designed for.

This statistically based fact is due to a number of statistic reasons, one of which is the statistic greaser, who has properties regrettably very similar to a human being. Man is not faultless – either as an individual or in a group – and makes all kinds of errors daily.

Automatic Greasing

To date, the prime objective of maintenance departments has been to replace all manual greasing with automatic lubrication systems.

Automatic systems offer several advantages:

- Greasing with the correct amount of lubricant significantly reduces the consumption of grease when compared to traditional manual greasing. There are several substantiated cases reporting grease consumption reductions of 30 to 50%. Not only have several automatic systems' manufacturers documented this, but also an article in issue .2/2000 of the Swedish magazine Underhåll & Driftsäkerhet (Maintenance & Reliability) and a case report from VTT (Technical Research Centre of Finland) carry convincing evidence.
- Automatic grease lubrication providing reliable cycles and correct discharge of lubricant will reduce the number of bearing failures by circa 50%. This is qualified by the VTT report.
- The systems are closed, ensuring that the grease is isolated from the environment from lubricant reservoir to bearings (no contaminated grease nipples).

- Correctly designed, installed and maintained automatic lubrication is very reliable, the impact of the human factor being virtually eliminated.

Price is, however, the obstacle to implementation. Installed in process industries, automatic lubrication is costly, roughly estimated, between 3,000 and 6,000 SEK per lubrication point.

Current Manual Greasing

Manual greasing is carried out as a daily task in pulp and paper mills worldwide. It is performed with simple tools as a routine task without status and low priority - this is industry's practice to date!

However, the problem with this method is the average frequency of faults. Manual lubrication is performed by human beings and human beings make mistakes.

Mistakes and Aviation

In some human activities mistakes cannot be tolerated. One of these activities is aviation.

Aviation demands numerous routines and systems. These are created to increase safety and to eliminate (or minimise), where possible, the human element.

Aviation has adapted itself to the following conditions:

- | |
|---|
| <ol style="list-style-type: none">1. Human beings make mistakes.2. Mistakes cost money and may cost lives. |
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What are the similarities between Aviation and Greasing?

- Both are large scale routine activities performed by numerous people every day.
- In both activities, mistakes result in ongoing expensive consequences ruled by natural laws.

Aviation and greasing are thus very similar in these important aspects.

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What, then, is the Difference?

In aviation the potential consequences of human mistakes are obvious and immediate.

In greasing the consequences of mistakes are similarly ruled by the laws of nature and are very costly, but the difference is that the consequences are not immediately obvious and lives are very seldom lost when we fail to lubricate.

The Problem with Problems

The grease in a rotating bearing works only for a limited period and has to be replenished whilst the lubrication film in the bearing still is perfect. Unfortunately, nature pays no attention to excuses and good intentions - only the laws of physics apply.

If the grease in a bearing is not replenished in time, heat, oxygen in the air and mechanical stresses will degrade the base oil in the lubricating film. This will result in a bearing failure process commencing, which will dramatically reduce the life of the bearing.

One obvious problem is that we are never aware that we have missed lubricating a bearing. If we had been made aware of this error, it would not have been missed! A further problem is that the bearing that was missed 1 month ago and still functions without problems does not show any symptoms of deterioration. When finally the bearing is replaced it is found to be filled with good grease from several replenishments made after the missed application. Without doubt the life of the bearing is reduced and acceptance of the shortened life of the bearing becomes the norm.

Not being aware of mistakes prevents the making of adjustments to manual greasing, which leads to the basic consequences:

1. Human beings make mistakes
2. Mistakes cost money..

Accordingly, the costly mistakes made by the greaser do not become apparent until a long time after the event. But the mistakes remain, otherwise there would not be such a large difference when manual greasing is replaced by automatic, as outlined in the aforementioned VTT report.

Remember that the lubricating film must remain perfect around the clock, day after day, year after year, in order that there are no breakdowns in any of the many thousands of bearings in a large mill

Until today, manual greasing has definitely been inferior to automatic lubrication when trying to maintain uninterrupted production of a mill.

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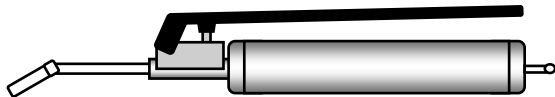
Statistical Greasing

Manual greasing is an activity of such magnitude that it must be looked upon as a statistical phenomenon. At our mill we perform in the region of 100,000 replenishments of bearings through grease nipples per year.

If our team of greasers perform to the highest level and do not miss more than 1 nipple per 1,000, we will have a statistical outfall of 100 misses per year. These misses can be expected to involve an outlay of 1,000,000 SEK for increased maintenance costs and lost production.

So, we definitely have a problem!

With today's performance level, the mistakes cost 1,000,000 SEK. If we decrease the error level by a factor of 10, the mistakes will cost 100,000 SEK per year and furthermore if the level is decreased 100 times we will come down to a cost of 10,000 SEK per year, which is acceptable.



How can we then decrease the error level 100 times?

Overgreasing, a Solution or a Problem?

If we unnecessarily grease twice as often we will miss some nipples here and there without any perceived problem, as the missed bearings will, in all probability, be greased the next time.

If we randomly miss 1 bearing per 1,000, the risk that the same bearing will be missed consecutively is no larger than $1 \text{ in } 1,000 \times 1 \text{ in } 1,000 = 1 \text{ in } 1,000,000$, that is 1 in a million only. Greasing at half the optimum intervals offers a solution to the problem of randomly missed grease nipples.

But, we will then overgrease our equipment. Overgreasing is considered to be 1 of the main causes of grease-lubricated bearings failing. Greasing at half the required interval demands a great deal of work and is bad practice.

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A Better Solution: System Supported Control Function

The greaser is provided with a hand-held aid, which during the greasing round tells him with how much grease each lubrication point is to be greased. As the greasing takes place the aid **automatically** reads the lubrication point number and registers the grease amount pumped into the bearing. It finally stores all data. If the greaser, in spite of this, should miss 1 or more lubrication points he will be advised of that when he downloads the greasing round data into the computer. He can then return and finalise the greasing round by replenishing the missing points.

Not a single lubrication point will be missed. The professional man/woman with the new aid will guarantee this!

The correct procedure is no longer dependent upon individuals and can be carried out equally well with substitute greasers, who may be standing in due to sickness or holidays.

In Brief

An automatic system will register which lubrication points have been greased, as well as when and with what quantity. The display will show the greaser what he has done and which lubrication points remain to be greased to finalise the lubrication round.

Factually, we will obtain guaranteed lubrication cycles that statistically will be more certain than the sun in the Sahara. We will certainly profit from this over and over again!

Description of the System

The system that met our requirements was a RFID-based manual greasing system in which each lubrication point is equipped with a special grease nipple, combined with a transponder. By means of a built-in antenna the grease meter communicates with the transponder. Fig.1.

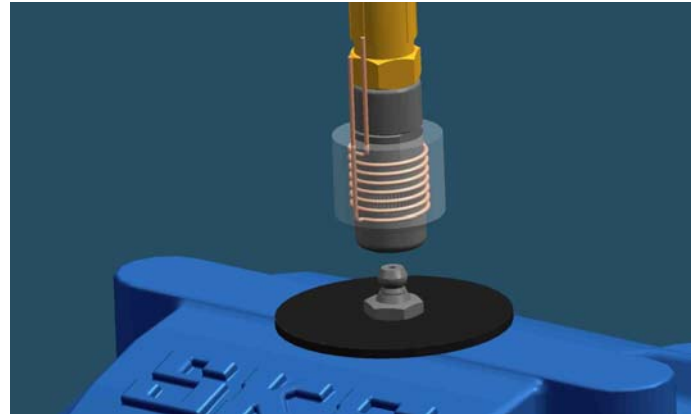


Figure 1. Grease nipple with transponder and hydraulic coupling with antenna.

In addition to the RFID-unit and its antenna (figure 1), the grease meter also has a metering module which meters the grease quantity being pumped through the meter.

The grease meter is also equipped with intelligence and storing capacity (figure 2).



Figure 2. The grease meter.

The whole system is controlled by a computer which we allow our greasers to manage. The grease meter is connected to the computer via a communication and loading unit.

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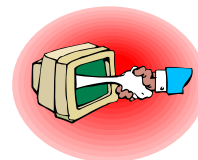


How is it Done?

When it is time to lubricate, the greaser starts by loading down the current greasing round into the grease meter, whereupon he walks his round and performs his task. For each lubrication point, the grease meter displays exactly how much is being pumped into the lubrication point.

When the greaser returns to his base, he connects the grease meter to the computer and pushes a button on the meter, which allows the meter to download the stored information into the computer. The time of the download operation is simultaneously registered.

The computer display immediately shows the status of the lubrication points of the greasing round in form of a list with different colours for greased and non-greased lubrication points.



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The Economy

The impact on the economy of greasing efficiently is dependent on 3 factors, namely:

1. The current fault frequency (the human factor).
2. The physical consequences of double greasing intervals (the misses). The more frequent our greasing intervals are set, the greater the impact will be.
3. How much overgreasing disappears when we dare to grease with exact doses at optimal intervals.

The first factor is difficult to estimate and is dependent on personnel and organisation, of which we only know for sure that it is larger than nil. In my calculation I have assumed it to be 1 in 1,000, but I believe it to be larger for most mills.

With the new system it will decrease by at least 2 powers of 10; that means that the fault frequency will be less than 1 in 100,000.

The second factor is more easily estimated as it is dependent only on those relentless powers of nature which have a degradable effect on lubricants and bearings. I have estimated it to 1:3, ie I have assumed that a defective lubrication film will appear in 1/3 of the missed bearings. These will have to operate another period with the old grease. This figure is presumably on the small side.

This will, in practice, mean that we can avoid at least some 30 premature bearing breakdowns yearly by radically decreasing the human factor.

$(100,000 \times 1:1,000 \times 1:3 = 33)$

The improved reliability and the decreased maintenance costs can be estimated to several million SEK per year in total. This will also result in an improved environment (decreased grease consumption and accordingly also decreased waste handling)

To that should be added the profits from the reduced overgreasing which SKF, for example, estimate as one of the main causes of bearing breakdowns in our type of industry

If SKF are right we can also save another million SEK per year from reducing our overgreasing.

The investment for the whole mill amounts to approximately 1.5 million SEK.

The described system (LubeRight) has been invented and developed by the Swedish company Assalub.

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