

Speciality **Lubricants**

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Introduction

To maintain the functionality of machinery in a cement plant, several tonnes of lubricants are used for the numerous gearboxes, open drives, bearings, chains, compressors and other components each year. The rough operating conditions in the cement industry pose special challenges to the lubricants used. Among these challenges are: high pressure, shock loads and vibrating stress, as well as extreme temperatures and temperature changes, frequent, unforeseen stops and also low-speed operation,

which the lubricants have to withstand. Additionally, all structural components are subject to high dust and dirt particle concentrations in ambient air. It is under such difficult operating conditions that the right type of lubricant plays a vital role in terms of operational reliability. Efficient speciality lubricants tailored to the requirements of the cement industry can make a significant contribution to increased production quantities and operational reliability while considerably decreasing maintenance and repair costs.



Figure 1. The rough operating conditions in cement plants pose special challenges to the lubricants.

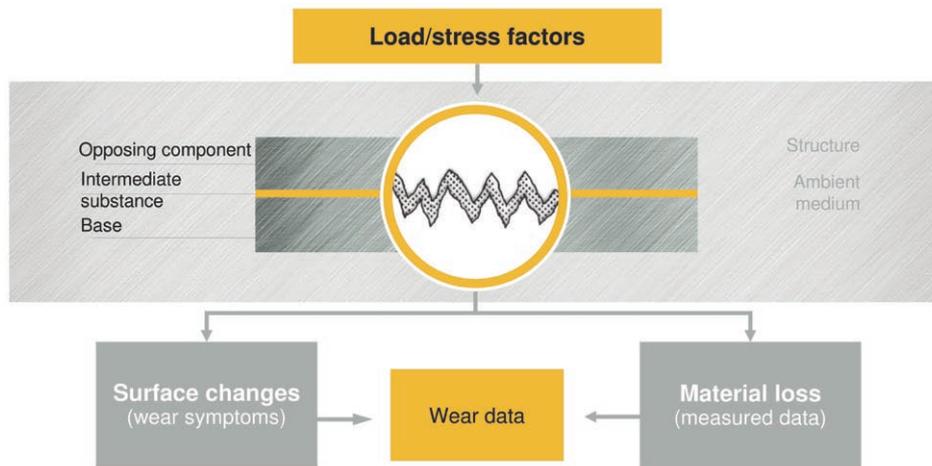


Figure 2. Schematic of the tribological system.

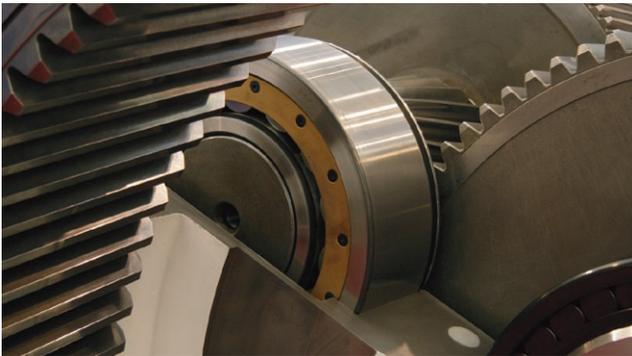


Figure 3. Rising performance requirements of gears call for speciality lubricants.



Figure 4. Transparent adhesive lubricants allow for constant monitoring of the tooth flanks.

Choosing the right lubricant

Open and closed gears are important structural components to consider in a cement plant when it comes to operational reliability and potential cost reductions. Klüber Lubrication München KG developed transparent adhesive lubricants for large open gear drives, which offer clear advantages over conventional black, graphite-containing adhesive lubricants and are already in operation worldwide on high as well as low-speed open gears. For closed gears, polyglycol-based lubricants are one option to considerably increase the degree of energy efficiency and hence to decrease operating costs.

When deciding on a lubricant, it is important to consider various aspects to find the most efficient and cost-effective solution for a particular friction point. The following must be taken into account:

- The entire tribological system, including the base body (e.g. the girth gear), opposing body (e.g. the pinion), intermediate substance (lubricant) and surrounding media (e.g. dust, environmental conditions, etc.).
- Further influencing parameters, such as condition of the gear, operating temperature, speed, vibrations, etc.

This complex subject matter not only affects the manufacturers (OEM) of components and equipment for the production of cement, but also the operators of cement plants. The consistent, application-oriented implementation of the evaluation procedure described above leads to significant cost decreases for maintenance and repair when conducted by operators of cement plants with the support of a tribologist or application expert.

Transparent adhesive lubricants

Currently, most girth gears are lubricated with graphite-containing, black adhesive lubricants, which operators have been familiar with for decades and are generally considered to be the latest and best standard lubricants for this kind of application. Due to this long tradition, many operators are reluctant to change to transparent lubricants, fearing that they are not as efficient due to the lack of solid particles, although the advantages of transparent lubricants are very convincing:

- They are suitable for all kinds of open gear lubrication systems and do not block the system, not even parts of it (nozzles, tubes, etc.) as they do not contain any solid particles.
- They have proven to be successful in both mill and kiln drives and are suitable for high-speed and low-speed applications as well as for low and high temperature conditions.
- Significant reduction of lubrication quantities is possible, approximately 30 – 50%; sometimes even more, depending on the condition of the drive.

As the lubricant film's thickness exceeds that of conventional lubricants, friction surfaces are optimally separated and softer engagement is achieved (significant reduction of vibrations and tooth flank temperature in operation).

As the lubricant film is transparent, it is easier and safer to maintain and inspect the condition of the engaged tooth flanks.

- The drive is cleaner and more convenient to clean and maintain.
- Less and easier maintenance due to lower lubricant consumption.



Figure 5. Mechanical treatment of tooth flanks and repair lubrication are services provided by experienced tribology specialists.

- Reduction of storage costs and the required storage area.
- In summary, operation is much more efficient and economical.

As manufacturers of large gear drives and cement plant operators require longer gear lifetime, less downtime and fewer maintenance needs, the future of operational lubricants will be “transparent”. These state-of-the-art fluids, combined with the right professional support, e.g. technical and commercial pre- and after-sales service (cost monitoring, correct settings of spraying quantities, time intervals, etc.) are convincing more and more operators to replace the black adhesive lubricants step-by-step.

Synthetic oils

Closed gears play an ever-increasing role in cement plants. The general industry demand for more performance at decreased operating costs also applies here: gears must transfer ever more power while attaining a longer lifetime and requiring less downtime. As the potential for constructional solutions offered by bearings, gear teeth, shafts and seals has been exploited in many cases, speciality lubricants have an important role to play.

Closed gears are normally lubricated with high-quality, doped mineral oils, which meet all requirements in terms of resistance to pressure, speeds and temperatures, if the gear has been designed properly. With rising performance requirements, however, mineral oils reach their limit, especially in terms of thermal resistance. Oils with higher viscosity or fluid greases with extreme pressure or anti-wear additives are therefore needed. If the fretting risk is particularly high, there is a tendency to use synthetic oils, e.g. on the basis of polyalphaolefins (PAO) or polyglycols (PG). Polyalphaolefins are miscible with mineral oils and extend oil-change intervals compared to mineral oils approximately three-fold. Polyglycols, which are not miscible with mineral oils, extend oil-change intervals even up to five-fold and increase the efficiency of closed gears by up to 10%. The potential energy savings generated with these oils leads to significantly lower operating costs.

Obtaining operators’ objectives: a case study

The potential of speciality lubricants in combination with tribological know-how and service support is demonstrated by the following example.

A cement plant in an Eastern European country was confronted with the major problem of a worn-out double pinion kiln drive, which was also subject to strong vibration; due to serious damage (tooth crack, pitting etc.), one production line

was in danger of a longer unplanned maintenance stop.

Klüber Lubrication was called in for support, and immediately after receiving the request, a service team visited the plant to get a clear impression of the existing operating conditions. A thorough examination led to the recommendation of a mechanical treatment for the complete gear, combined with a number of adjustment settings and a changeover from the low-budget standard open gear lubricant to a high-performance synthetic transparent lubricant that provides a softer engagement, is free from heavy metals, bitumen, solid particles, etc. Although this kind of

transparent fluid for the lubrication of open girth gear drives had not been used before, the responsible plant managers agreed to the recommendations of the tribology specialists.

Within six days, the necessary mechanical work was undertaken, the lubrication system was checked and adjusted and repair lubrication was completed. During this time, the plant staff were theoretically and practically trained by the service team on mechanical treatment, on optimum adjustment and maintenance of lubrication systems and on how to choose and use the optimum lubricants in their areas of responsibility.

The plant operator appreciated the good results of these combined measures. He confirmed an overall increase in operational safety and efficiency:

- Operating conditions have been improved considerably; the dangerous vibrations were reduced significantly.
- Optimum separation of the friction partners due to a 10x stronger lubricant film compared to the previously used lubricant leads to an extended lifetime of the components. The result: reduced maintenance and material costs.

The transparency of the lubricant film allows for constant monitoring of the repaired tooth flanks, even when the kiln is running. Thus any possible problems can be anticipated easily and the right type of action can be planned and initiated in time. This possibility of preventive maintenance leads to increased operational safety.

Due to the high performance of the new open gear lubricant, relubrication intervals can be extended significantly, which results in a reduction of the lubricant consumption by at least 50%.

Conclusion

Operators aim to prevent failures, lower operating costs and increase production quantities. Although it is often underestimated, the right lubricant can contribute significantly to obtaining these goals by providing an optimum separation of the friction partners, even under extreme conditions, extending maintenance and oil-change intervals, as machines do not have to be relubricated as often. Costs for spare parts can be saved, as the right lubricant reduces wear and considerably increases the components’ lifetime. Less failures and greater machine efficiency are the result, so that targeted production quantities can be achieved and even increased. To make use of the full potential, it is important to involve tribologists and application experts in the development process of machinery components for cement plants. The operators of existing plants should also consult tribologists to optimise their plant’s operation. 🌐