

Looking after open gears

Open gears are commonly used drive units in the raw materials industry, eg, for tube mills and kilns. This equipment is indispensable and special significance is attributed to its operational safety, also involving its lubrication. A variety of lubricants are available for open-gear lubrication, with the design of the open gear and the method of application determining the requirements on the lubricant. This article shows the pros and cons of common open-gear lubricants and reveals the positive aspects of the latest generation.

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The selection of the appropriate open-gear lubricant is based on its suitability for the existing gear design, production equipment and process, and the existing application unit.

Design criteria

A distinction is made between DIN/ISO-standard designed gears and open gears, according to the American Gear Manufacturers Association (AGMA) design. The latter mainly have helical teeth with the pinion and shaft representing one unit. Compared to DIN/ISO-designed gears, their pinion diameter and module are usually much smaller.

Lubricants for AGMA-designed gears are defined under ANSI/AGMA 9005, which specifies standard open-gear lubricants with high and extremely high viscosities. Therefore, either highly viscous, synthetic oils or asphaltic lubricants with volatile solvents are used for AGMA-designed gears, whereas grease-based, graphite-containing lubricants are primarily used on DIN/ISO-designed gears.

Method of application

The majority of open gears are still lubricated by intermittent spray units.

Some machine manufacturers increasingly install circulation systems that provide continuous lubrication through an enclosed circulation unit.

Few open gears are lubricated with splash lubrication, whereby the girth gear is submerged into the lubricant and transfers the collected lubricant onto the pinion teeth.

For all these application methods, graphite greases and high-viscosity oils are suitable. Solvents containing asphaltic lubricants are restricted to intermittent spray systems to the girth gear.

General aspects of common open-gear lubricants

Most bitumen and solvent-containing lubricants, so-called asphaltics, have been replaced by graphite-containing greases. Due to their volatile solvent and bitumen content, their use has been restricted by many sites to prevent any environmental or health hazards. As previously mentioned, they are not suitable for circulation, splash or pinion-spray application and are thus restricted to girth gear spray application. Some of these lubricant types can build up hard residues on the tooth root, which can lead to serious mechanical problems.

Graphite-containing greases are still the most common open-gear lubricants. They are approved by all major gear and machine manufacturers within the cement industry and provide optimum wear and damage protection for any kind of kiln and mill gear. Suitable grades for spray, splash and circulation applications are available. However, an unfavourable feature is their limited drainability from the gear housing. The black colour of the graphite-containing lubricants is also deemed to be a disadvantage by some users.

Highly viscous fluids are a clean and technically sound solution for high-speed mill gears. Most of these fluids meet the AGMA criteria. They provide excellent drainability but require a good sealing of the gear housing. High-viscosity fluids can

Figure 1: test gear after DIN wear test, no wear, manufacturing marks still visible



show disadvantages if used on low-speed kiln gears, where a sufficient lubricant layer can hardly build up with pure oils. To separate the meshing gear flanks, additional solid lubricants definitely prove to be beneficial. As most sealing designs of kilns are not designed for oils, the lubricant may reach the hot kiln shell, resulting in the risk of ignition. This clearly shows that the common open-gear lubricants have certain restrictions.

FUCHS is a leading manufacturer of modern open-gear lubricants with decades of experience. As such, the company has pioneered the development of the latest open-gear lubricants, combining all the benefits of the aforementioned products.

Taking open gear lubrication to a new level

FUCHS' CEPLATTYN GT range combines the benefits of commonly used graphitised products and high-viscosity fluids – taking open gear lubrication to a new level. The lubricants in this range consist of a synthetic oil including white solid lubricants, and are free of asphaltics and volatile solvents.

The development of the CEPLATTYN GT range is focussed on meeting the requirements of low-speed kiln gears running at elevated temperatures in the cement industry and high-powered gears for semi-autogenous grinding (SAG) mills in the mining industry. In this context the non-flammability of the lubricant is extremely important. In recent years, the milky-coloured CEPLATTYN types for open-gear lubrication have been very successfully used and have been approved by all major equipment manufacturers.

The high base oil viscosity of the CEPLATTYN GT leads to a generally lower vibration level and in particular a lower vibration level during start-up. Compared with the commonly used black greases and fluids without solids, lower application volumes can be achieved by using CEPLATTYN GT. However, a reduction should always be carried out step-by-step and in a controlled manner, considering the condition of the machine.

The solid lubricants included in CEPLATTYN GT products provide safe running conditions under boundary lubrication conditions. Under high specific loads the special white solids activate a protective layer, reducing friction and minimising wear (see Figure 1). The CEPLATTYN GT range allows a reliable low-consumption lubrication. Its formulation includes flame-retarding additives guaranteeing safe use on kiln gears.

The thixotropic behaviour (ie, viscous under static conditions and flowable when shear-stressed/in motion) of the CEPLATTYN GT range results in excellent adhesion, even to hot tooth flanks. In FUCHS' experience the tooth flanks remain

Figure 2: left – lubrication film after a 6h shutdown of a cement mill with spray application and right – retention of lubrication film after a 21-day lab test



very well covered with lubricant, even after a long machine downtime (see Figure 2), thus supporting a smooth start-up of the machine. Furthermore, the lubricant shows excellent drainability to the gear sump. This also means that there is no accumulation of sticky residues in the gear housing, thus preventing the risk of abrasive particle build-up and protecting the drive. The CEPLATTYN GT range is also perfect for drives that show leakage of conventional fluids, as it has a certain self-sealing effect.

CEPLATTYN GT is designed for spray, splash and circulation application. With the CEPLATTYN GT range FUCHS offers the right lubricant for each lubrication step: priming, running-in and operational lubrication.

Industry experience

The cement mill of one of FUCHS' internationally operating customers was changed over from using a commonly used graphite-containing grease to CEPLATTYN

GT 10. The lubricant change-over was very easy and usually just involves connecting a new drum. A reduction in lubricant consumption of 30 per cent was achieved (see Figure 3, right), although the lubrication quantities of this cement mill had already been optimised. The results were lower lubricant and thus disposal costs, as well as a reduction in the pinion bearing vibrations by approximately 20 per cent. These favourable effects have induced the customer to use the CEPLATTYN GT range on all open gear drives in the plant.

Another customer was also able to reduce the lubricant quantity. In this case it was a ball mill, the consumption of which decreased by more than 50 per cent after switching from a common open gear fluid without solid lubricants to CEPLATTYN GT 10 (see Figure 3, left). Another positive effect was a significant improvement in the sprayability of the product.

Benefits

In a nutshell, the benefits of the CEPLATTYN GT range are as follows:

- excellent wear protection of the gear – proven and verified by practical tests
- reduced costs because of lower consumption compared to other lubricants
- reduced complexity – one lubricant for all open gears
- minimised risk of damage after downtime – adheres to cold and hot tooth flanks thus ensuring safe start-up
- outstanding emergency running properties – extra protection while operating in the boundary friction range eg, for low-speed gears
- high safety – flame-retarding additives prevent self-ignition, eg, on the hot kiln shell. ■

Figure 3: reduction of lubricant quantity by changing from a common fluid or graphite-containing grease to CEPLATTYN GT

