



Automatic lubrication system for open gears

Extend the lifetime of
large gear drives

Gear drives

Large gear drives are used to transmit movement under very heavy loads. They are open gear systems driven by one or two pinions.

They are generally used in the material conversion industries, as well as in the mining industry, steelmaking, cement works, fertilizer plants, waste incineration and composting plants, etc. They are used on various types of machines converting large quantities of materials: tubular mills (ball, bar or free fall mills), cooling, washing and drying drums, rotary ovens and incinerators.



Lafarge Group photo

Lubrication of gear drives

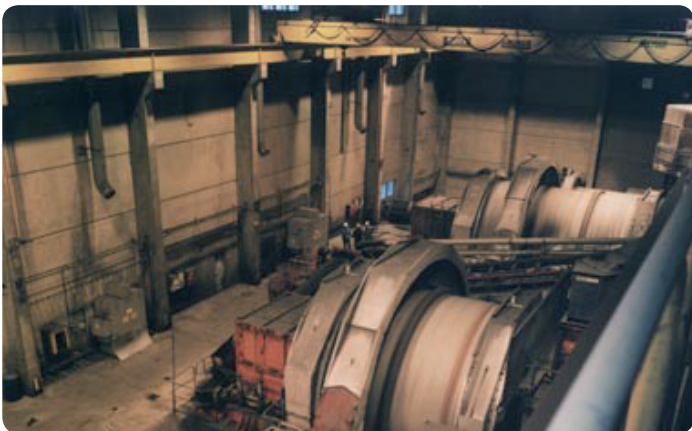
The forces transmitted from one gear to another are such that the metal on metal friction immediately causes pronounced wear on the surfaces in contact.

Experience has shown that even with precise positioning of the gears, only 50 % to 60 % of the initial area bears the load. This low percentage is caused by roughness, together with the surface deformations (waviness and irregularity).

Lubrication is therefore essential to ensure trouble-free operation of these gear drives and extend their mechanical lifetime.

Above all, the lubrication process creates a homogeneous film on the surface of the tooth flanks to avoid any direct metal/metal contact when the gear wheels and pinions mesh. This lubricating film reduces the friction points and protects the mechanical components against fast premature wear.

The lubricant also equalizes the load bearing areas of the teeth to obtain perfect meshing of the gears. Since the load bearing area becomes larger, the total load is distributed much better. Consequently, the drive forces are lower, resulting in energy savings.



Lubrication system for open gears and support rollers by automatic spraying

SKF offers an automatic lubrication system for the lubrication of open gears. This system, which has demonstrated its efficiency on numerous occasions, sprays the lubricant directly onto the gear teeth.

This lubrication system includes a pneumatic pump fitted on the user's drum of lubricant. The pump supplies distribution units positioned above the gears to be lubricated. The progressive distributors fitted on these units direct the lubricant towards the sprayers. An air control unit controls both the supplied air of the pneumatic feed pump and the air directed towards the nozzles to spray the lubricant. The whole system is controlled and monitored from a control unit dedicated to the lubrication of open gears.



Lafarge Group photo

Efficiency

Spraying offers the advantage of covering the surface of the teeth perfectly, to obtain a homogeneous film of thickness adapted to the requirements of the gear.

Complete solution

The spray lubrication system is fully automated. The control unit, dedicated to this application, allows the possibility of continuous or cyclic lubrication. As a result it is perfectly suited to the requirements of open gears, whether for running-in lubrication (continuous) or regular service lubrication (cyclic).

Flexibility

The duration of the lubrication phases and the pause phases in cyclic lubrication mode is configured using the system control unit. Users can therefore adjust the lubrication cycles according to their requirements (to cope with an increase in production rate for example) or environmental conditions (e.g. temperature variation).

Modularity

Users can work on each sprayer, for maintenance work or other reason, without having to dismantle the various connections. The flow control function can be added or deleted similarly.

Simplicity

SKF provides users with help software to adjust the various parameters in the control cabinet. On the basis of data supplied by the user, the software will calculate the various control unit parameters.

Safety

The entire lubrication installation is equipped with numerous monitoring and safety devices to guarantee optimum operation.

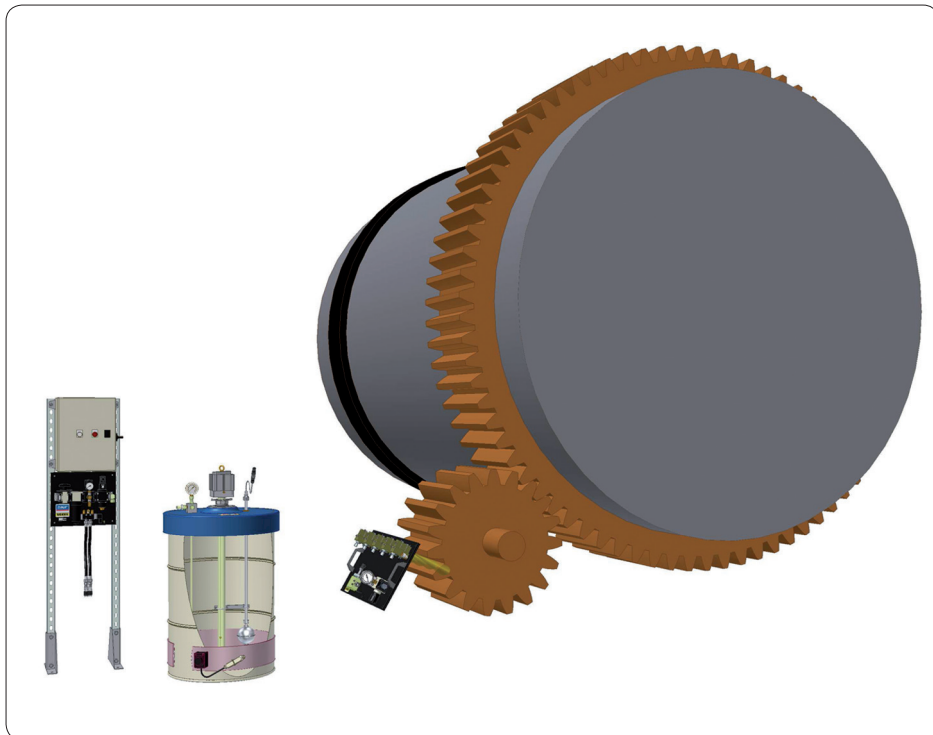
- Lubricant level monitoring
- Spray monitoring

Diagrammatic representation of a complete installation

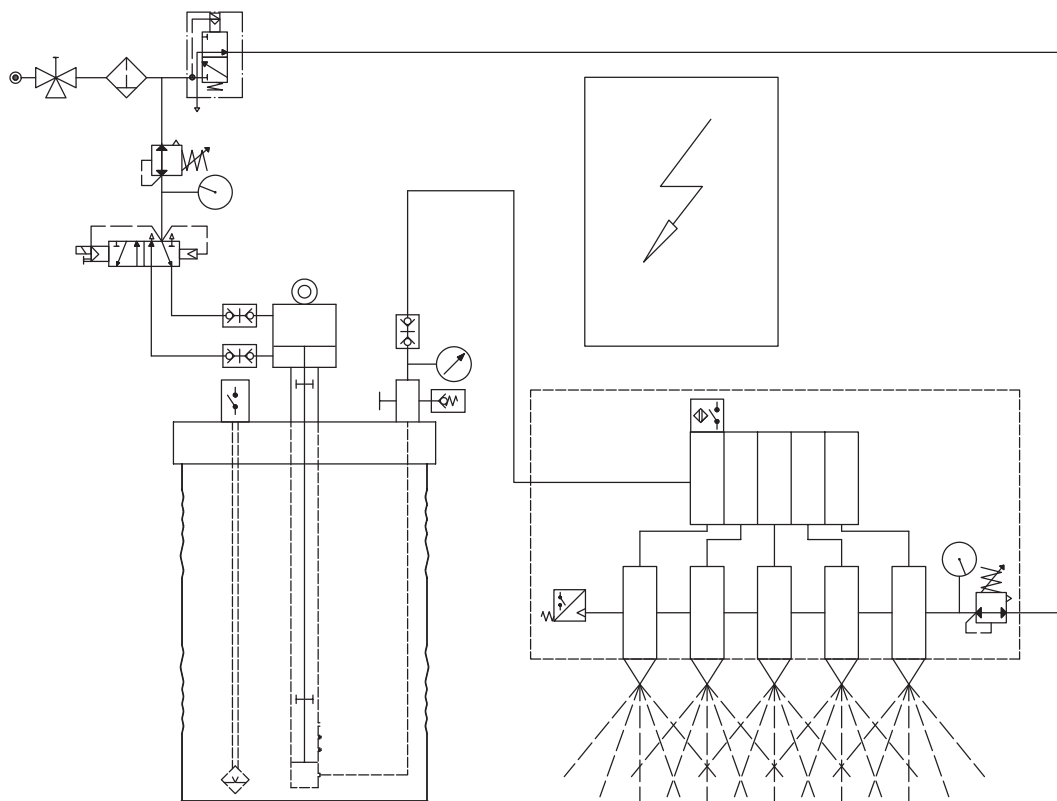
An example of a unit for the lubrication of open gears. It includes a control cabinet with an air regulation unit, a pneumatic pump on drum and a spraying unit with five nozzles for the gear.

The drum of lubricant is also fitted with a heating belt to keep the lubricant at optimum temperature. The pipes can also be fitted with a heating tape.

The following hydropneumatic diagram shows the operating principle of this installation.



Function principle



Lubrication principle

Running-in lubrication

Before using the gear drives for the first time under full load, it is important to carry out running-in lubrication.

The surfaces of the tooth flanks generally have faults, even when new, such as roughness and deformations. However, a surface can only remain intact under very heavy loads if it is perfectly smooth, obviously provided that the gears are perfectly aligned (longitudinal and transverse load distributions perfectly balanced).

Running-in lubrication increases the load bearing area of the flanks by causing deliberate but controlled wear of the surfaces. During this phase, the surface roughness will quickly be worn away, the surface waviness and irregularities are eliminated as much as possible. The percentage of load bearing area will increase and the loads will be better distributed.

Running-in lubrication is carried out for a short period of time, but with high volumes of special running-in lubricant.

Service lubrication

The transition to service lubrication must be carried out progressively after the running-in lubrication. The aim is to use as little lubricant as possible to guarantee correct operation of the gear drive. If cyclic spray lubrication is used, the operator can modify the volume of lubricant consumed by changing the spray duration and pause time parameters.

Efficient lubrication allows the gear drive to operate correctly with minimum wear, significantly reduces damage and substantially increases the lifetime of mechanical components. The lubrication must be chosen according to numerous criteria, such as the load, speed of rotation, temperature of the flanks and the general condition of the gear drive. Environmental conditions such as dust, humidity and ambient temperature variations may also affect the choice of lubrication.

Lubricants

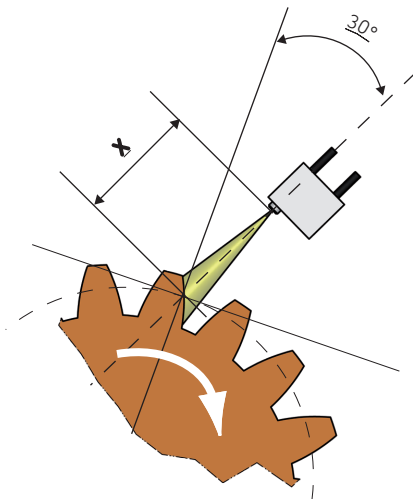
- consistency up to NLGI grade 1
- solid particles max. size: 3 μm
- solid particles max. concentration in the lubricant: 8%

SKF approves lubricants only after they have been tested in its laboratories. A lubricant sample of 5 kg is necessary for the test. SKF carries out the following tests: material compatibility, soap separation and spraying.

The positioning of the nozzles with respect to the tooth flanks is extremely important. The surface of the teeth must be perfectly covered with lubricant.

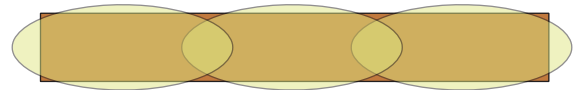
Experience has shown that the optimum spraying angle is 30°, as shown by the following diagram.

The nozzles are generally pointed downwards, sometimes horizontally. They must never be directed upward, however. In this case, the spraying quality would not be guaranteed and the nozzles would clog up much more quickly.

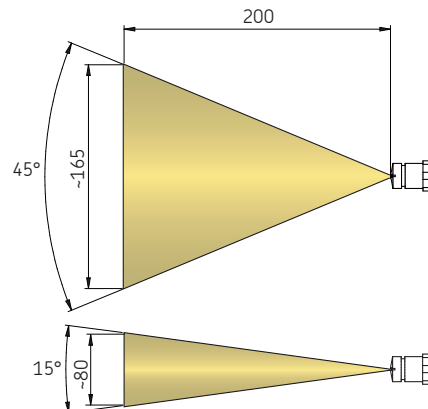


The number of nozzles varies depending on the length of the tooth flank. They are positioned at a distance X, generally 200 ±50 mm.

Optimum lubrication is obtained when the spraying image covers the entire surface of the teeth.



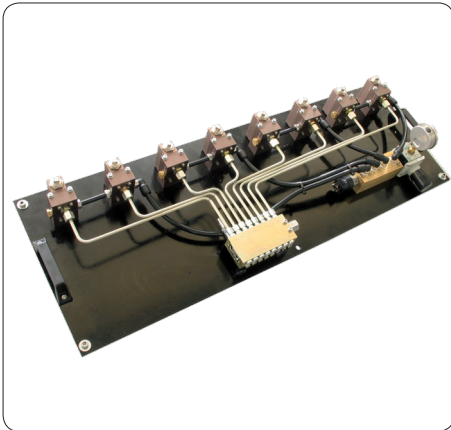
If flat jet nozzles proposed by SKF are fitted, users must take into account the jet angles in order to determine the number of nozzles required according to the length and width of the tooth flanks.





Lubrication pump

- Pneumatic pump for oil or grease
- Greases up to NLGI grade 1
- Oils with a max. viscosity of 90 000 mm²/s at 20 °C
- Pump for 200 kg drum
- Air inlet pressure 4 to 7 bars
- Lubricant outlet pressure max. 300 bars
- Flow adjustable from 1, 2 or 3 cm³ per stroke
- Lubricant minimum level monitoring
- Heating belt for drum (optional)



Spraying unit

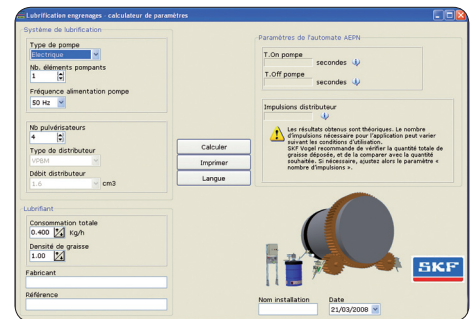
- Flat jet sprayers
- From 1 to 8 sprayers per unit
- Separate air and lubricant control
- Air consumption for each sprayer 200 l/min
- Outlet air regulation for each sprayer
- Sprayer with or without function monitoring
- Lubricant distribution by progressive distributor



Control cabinet

- System operating control
- Pump operating frequency control
- Blowing air control
- Lubricant minimum level monitoring
- Function monitoring of distributor(s) (max. 3)
- Air pressure monitoring of the spraying units
- Lubricant temperature monitoring

SKF has developed a help software to guarantee optimum adjustment of the user's lubrication parameters in the control cabinet.



Open gear lubrication

++ 33 (0) 2 41 40 42 42
to be returned by fax

Company name, address, contact

Application

Machine type:

Industrial environment:

New equipment yes no

Gear drive Single-pinion drive Double-pinion drive

Pinion dimensions Width:

Support roller yes , width: number: no

Current lubrication mode

Ambient temperatures Min.: Max.:

Saline air yes no

Caution!

In the case of surrounding temperatures below +18 °C, the lubrication system has to be fitted with a heating device.

Resources

Process control system yes no

Pneumatic energy

Dry air yes no

Network pressure [bar]:

Air flow rate available:

Filtered air yes , filtration class: no

Electrical energy

Europe Δ/Y 230/400 V, 50 Hz ⊥ 230 V, 50 Hz Δ 400 V, 50 Hz

USA Δ/Y 265/460 V, 60 Hz YY/Y 230/460 V, 60 Hz

Japan Δ 200 V, 50 Hz Δ 200-220 V, 60 Hz

Other:

Lubricant*

Lubricant type: Oil Grease

Brand

Running-in lubricant reference**:

Service lubricant reference:

Packaging

Caution!

Lubricants containing 8% or more of graphite are not compatible with SKF lubrication systems.

Lubrication installation

Distance between control cabinet and spraying unit:

Distance between control cabinet and pump:

Distance between pump and spraying unit:

Control cabinet environment:

Pump environment:

*) Please send us the data and safety sheets of the lubricant(s) used

**) In case of running-in lubrication, some components of the lubrication equipment (wearing parts) must be changed before switching to service lubrication

This brochure was presented by:

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