



Innovative Power Transmission



COPE® Drive systems for LOESCHE VRM
More availability @ lower TCO

COPE®

Compact Planetary Electric Drive

**+ 2–3 %*
better grinding
availability**



* compared to conventional 3 stage single-slipring-motor VRM drives

The right solution for large VRM drives

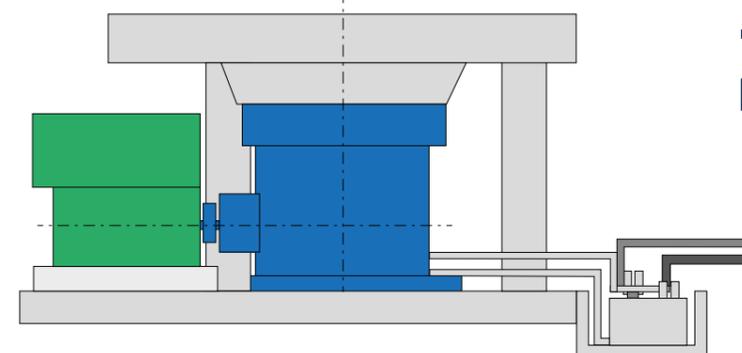
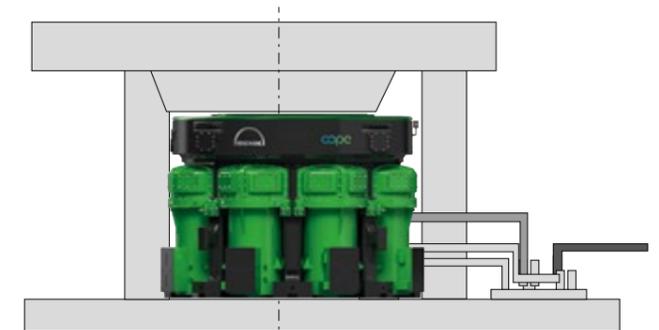
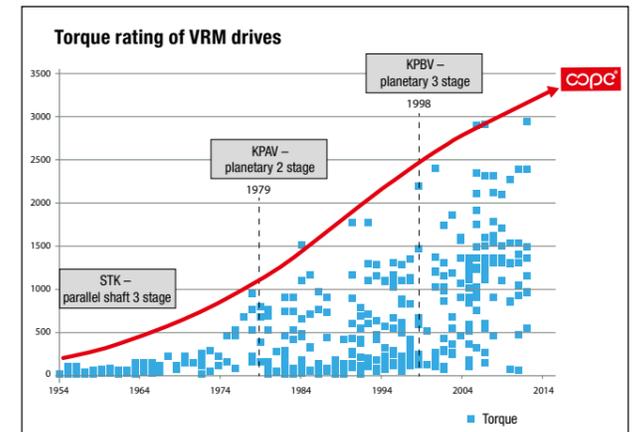
Vertical Roller Mills (VRM) represent the most widely spread milling technology for raw materials in the cement industry and for many years also for clinker and slag grinding.

The availability of a VRM largely depends on the driving gear unit which features the transmission between the motor and the VRM as well as the VRM axial thrust and radial bearings. LOESCHE and RENK focus on offering the most reliable VRM drive system at the lowest possible total cost of ownership (TCO).

The COPE® drive system for LOESCHE Mills (LM) is the next stage in a development which started with bevel/parallel shaft gear units nearly a century ago. In the 1980s, those were gradually replaced by bevel/planetary gear units – first introduced by RENK – as the output torques increased and required a power split gear train.

Before the turn of the century, mill sizes had increased further and mill speeds had been reduced as a consequence. RENK was the first in the market to launch a three stage gear unit featuring a bevel stage and two planetary stages with an output stage of six planetary wheels.

With mill powers exceeding 6 MW and torques exceeding 3 million Nm, the demands on the drive system have increased considerably. COPE® is the solution that meets these demands.

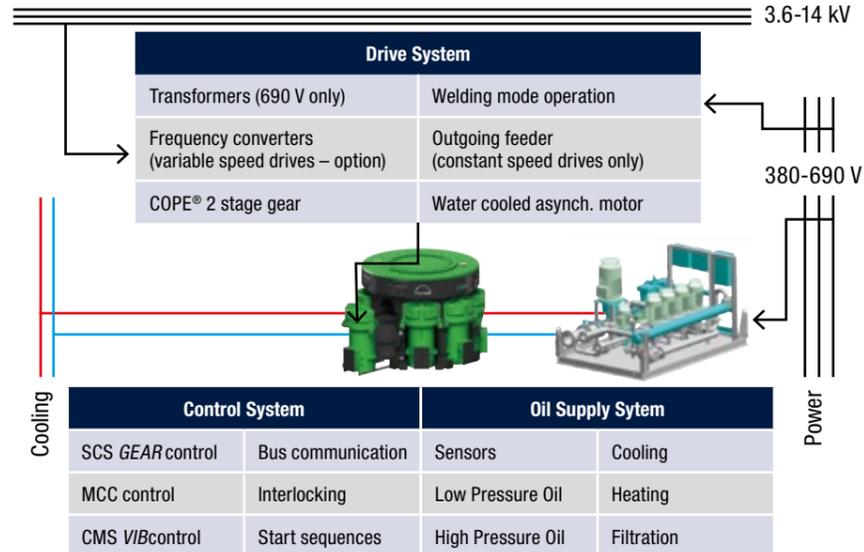


... better with the requirements.

From a component to a system

A major change over conventional VRM drives is the reduction of interfaces: From the power supply line to the mill table, everything is from a single source.

As a result, COPE® is the first VRM drive to be tested on the RENK factory test stand as a complete system, including the Sub Control System (SCS), the motors and the power supply. This reduces the set-up time and the commissioning risk.



The reasons we “COPE®” with

Lower system cost than with any other alternative mill drive design

COPE® is built from standardized components. COPE® is compact. Frequency converters are possible, not mandatory.

Higher availability than with other mill drive designs

COPE® does not have a bevel gear stage. Power is provided by up to 8 individual drive units. Motors, gears and roller bearings of motor pinions can be taken in and out of operation individually. Gear unit bearings are hydrodynamic and hence fatigue-proof.

“Built-in spares”

Gear and coupling elements except the driving pinion are designed symmetrically, i.e. their geared flanks have a second life if worn out.

Separation of gear and grinding forces

In the COPE® design, the gear and grinding forces are separated from one another, avoiding unfavorable load distribution on gears and bearings.

Tested performance

COPE® is the first VRM drive which is tested as an entire system. As an option, the first stage can be tested at full load.

Shorter commissioning time

COPE® comes with a RENK Sub Control System featuring all interlocking and online support of the drive system.

Maintenance and repair without removing the gear unit

The removal of a COPE® motor and its drive pinion is quick and easy thanks to the transfer system – no alignment work is required.

Integral welding speed function

No assembly work is required.

Efficiency higher than with any other drive system

No mandatory frequency converter (saving 4%), just two gear stages, high planetary gear efficiency (saving 1%).

No limitation of service life by bearing fatigue

All bearings except those of the motor and driving pinion unit are hydrodynamic or hydrostatic sleeve bearings.

The vertical axis torque path

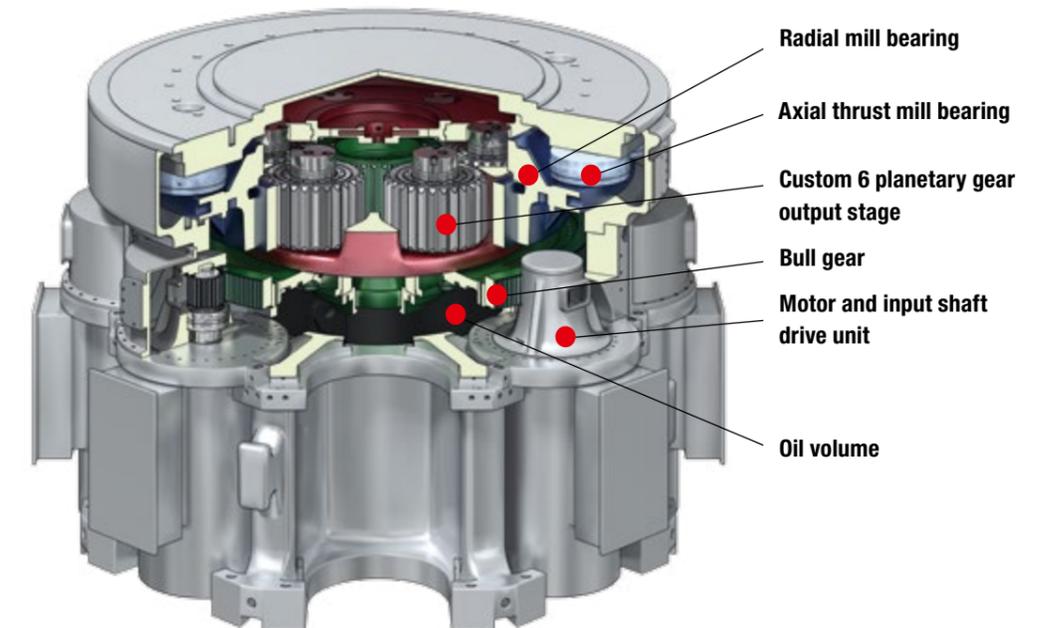
Six to eight water jacket cooled cage induction motors drive a central bull gear. This parallel shaft stage has a high ratio. The bull gear is linked to the planetary output stage. This planetary stage has been used for more than 15 years in VRM drives with output torques of more than 5 million Nm.

These two stages are sufficient to cover all ratios required for LOESCHE mills.

The radial mill bearing is arranged next to the mill table to transmit the radial load directly into the casing. The rating of this bearing allows the operation of mills with 4, 5 and 6 rollers even if one or more rollers are out of service.

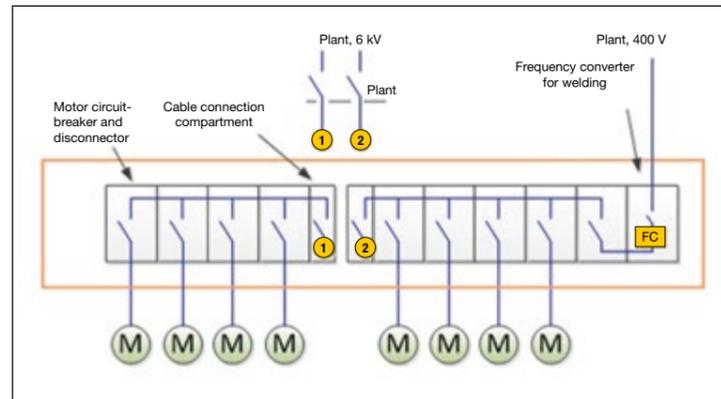


| COPE® size | LM size | Approx. power kW |
|------------|---------|------------------|
| 2 | 53 – 60 | 4,000 – 6,500 |
| 3 | 63 – 70 | 6,000 – 10,000 |
| 4 | 75 | 10,000 – 13,000 |



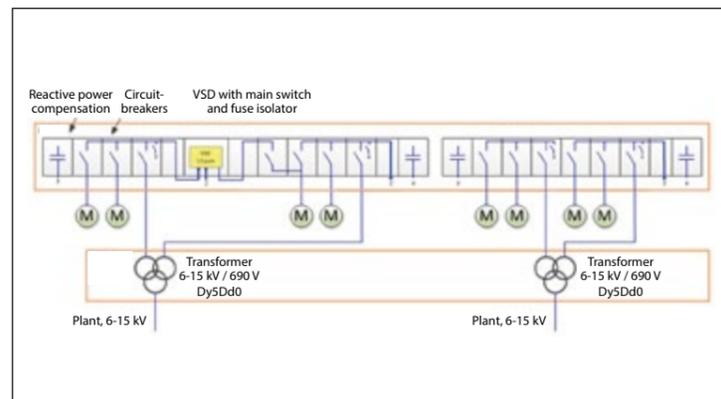
Fixed speed or variable speed

Depending on the application of the LM, COPE® can be ordered with a power supply system for constant speed (for optimum efficiency) or variable speed (for adaption to varying materials). As the power of an individual motor is only a fraction of the total mill power, the power supply system allows the direct on line (DOL) starting of medium voltage motors.*



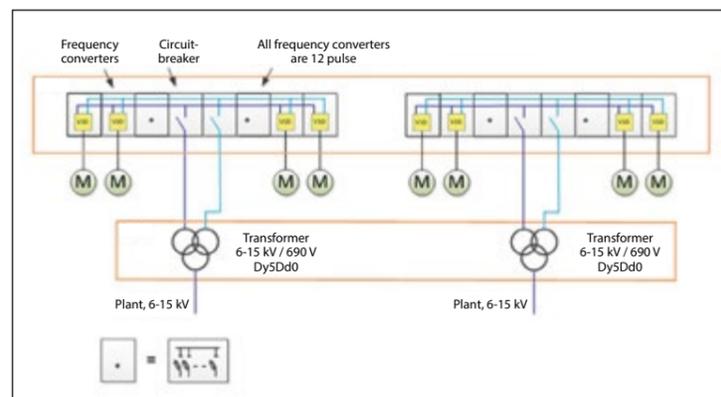
3.6 to 6.6 kV motors, 8x DOL with reactive power compensation, constant speed

Smaller mills are normally driven by low voltage motors.*



690 V motors, one frequency converter for start up, 8x DOL, constant speed

If required by the grinding process, COPE® can be operated at variable speed. The motor power allows the use of low voltage frequency converters.*



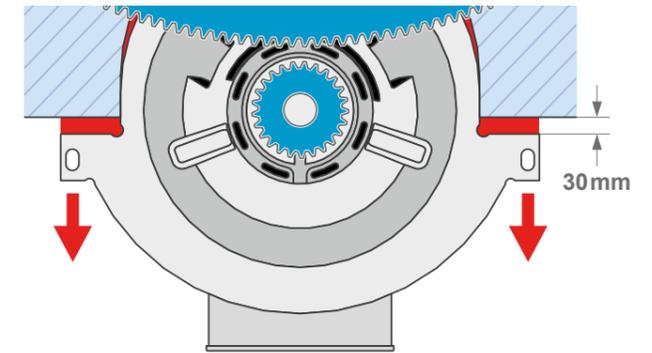
690 V motors, 8x frequency converter, variable speed

*) In specific mill designs and applications, the grinding track is repaired by welding in abraded materials which requires a very slow rotation of the mill. Up until now, a specific drive system has been mounted to drive the gear input shaft and has been removed after the welding work. COPE® now integrates this function which can be selected via the controller in any of the above configurations.

Maintenance under the mill

Major maintenance of conventional VRM drives involves the removal of drive motor, coupling guard, coupling and gear unit from under the mill. After maintenance, the motor has to be realigned. COPE® opens a new horizon in the maintenance of compact gear drives under VRMs: If one drive is inoperable, the operator has four options:

- disconnection of the motor and letting it idle until the operational requirements allow its removal
- quick drive disengagement where the drive unit remains passively in the gear unit and is just radially moved to disengage
- removal of the drive unit and operation with less motors
- replacement of the drive unit.



In any case, the gear unit is left under the mill which can continue operating at close to nominal load as one motor just represents 12.5% (8 motors) to 17% (6 motors) of the total installed power. Through the grinding table of the LM, the central sun gear and the coupling between the two stages are accessible.

This way, more than 50% of the geared components and more than 70% of the bearings are accessible without requiring a major stop, on-site work by gear specialists and shaft alignment. For conventional drives, this figure is around 10% for both the geared components and the bearings. This is a big step forward in maintainability.

All bearings which are not easily accessible are fatigue-proof sleeve bearings. Gears (except the driving pinion) and couplings are designed in a way that their back flank can become the load flank – i.e. COPE® is the first large size drive with the “spares built in”.



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