## Fixed speed or variable speed

Depending on the application of the LM, COPE can be supplied 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.7

<table>
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<th>Motor circuit-breaker and disconnector</th>
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</table>

## Maintenance under the mill

Major maintenance of conventional VRM drives involves the removal of driver motors, coupling guards, coupling and gear unit from under the mill. After maintenance, the motor has to be realigned.

COPE offers a new horizon in the maintenance of compact gear drives under VRM. If one drive is inoperative, 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 gradually moved away.
- 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 12.2% (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 in-line on-site repair 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 around 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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7) In specific mill designs and applications, the grinding mill is required to be fed in at a different speed which requires a two speed motor system. This has been overcome by using the gear speed shaft and has been removed from the welding works. The motor speed circuit can be used in any of the above configurations.

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COPE Drive Systems for LOESCHE VRM more availability @ lower TCO

53 to 88 kV motors, 6x DOL with reactive power compensation, constant speed

690 V motors, 1x frequency converter for start-up, 6x DOL, constant speed

690 V motors, 6x frequency converter, variable speed
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 transition 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 in 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 torque increased and required a power split gear train.

Before the turn of the century, multistage load increased further and roll speed 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.

The COPE drive system is the solution that meets these demands.

A major change over conventional VRM drives is in the reduction of interfaces. From the power supply line to the mill table, everything is in 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.

COPE is better with the requirements.

The vertical axis torque path

Six to eight water 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 volumes required for LOESCHE mills.

The radial oil 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 used rollers even if two more rollers are out of service.

No limitation of service life by bearing fatigue

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 standard components. COPE is compact. Frequent changes are possible, not mandatory.

Higher availability than with other multistage designs

COPE does not have a central gear stage. Power is provided by up to 8 individual drive units. Sliders, 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"

User and supplying companies enjoy the driving power is designed operationally, i.e. their gear lends have a second life if one motor unit.

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.

Integrated oiling speed function

The assembled unit is oil-tight.

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 are hydrodynamic or hydrostatic sleeve bearings.

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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 coarser and dry 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 roll 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. 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.

COPE is the solution that meets these demands. 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 COPE drive system offers a reduction of interfaces: 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.

Features of the COPE design

- The removal of a COPE motor and its drive pinion is quick and easy thanks to the transfer system – no alignment work is required.
- The gear and coupling elements except the driving pinion are designed symmetrically, i.e. their geared flanks have a second life if worn out.
- Gear and grinding forces are separated from one another, avoiding unfavorable load distribution on gears and bearings.
- The radial mill bearing is arranged next to the mill table to transmit the radial load directly into the casing. The casing of this bearing allows the operation of mills with 4, 5 and 6 rollers even if a more rollers are out of service.
- The planetary wheel carrier stage of the motor pinions can be taken in and out of operation individually. Gear unit bearings are hydrodynamic and hence fatigue-proof.
- COPE comes with a RENK Sub Control System featuring all interlocking and online support of the drive system.
- 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.
- COPE is built from standardized components. COPE is compact. Frequency converters are possible, not mandatory.

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.

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The reasons we “COPE” with

Lower system cost than with any other alternative mill drive design

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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. Sliders, 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.

Integrated welding speed function

The welding mode operation is integrated. Efficiency higher than with any other drive system

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

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The vertical axis torque path
The right solution for large VRM drives

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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 torque increased and required a power split gear train.

Even 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 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 3 million Nm.

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COPE is the solution that meets these demands.

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 in 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 COPE drive system is constructed of standardized gear units. 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. Sliders, 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"

The radial and axial mill forces are designed operationally. i.e. their gears feature to have a second life if a mill unit stops.

Separation of gear and grinding forces:

In the COPE design, the mill 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 handling all interlocks 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.

Integrated sliding speed function:

The assembly of motors and gear unit is simple and easy thanks to the transfer system — no alignment 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 are hydrodynamic or hydrostatic sleeve bearings.

The vertical axis torque path

Six to eight water cooled cage induction motors drive a central bevel gear. This parallel shaft stage has a high ratio. The ball 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 three stages are sufficient to cover all values required for LOESCHE mills.

The radial oil 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 a new roller shell is added.
Depending on the application of the LM, COPE can be extended with a power supply system for constant speed or variable speed (for maximum efficiency) or variable speed (for adaptation 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.*

COPE Drive Systems for LOESCHE VRM

COPE now integrates this function which can be selected via the controller in any of the above configurations.

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 safety-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 around 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".
Fixed speed or variable speed

Depending on the application of the LM, COPE can be supplied with a power supply system for constant speed (for optimum efficiency) or variable speed (for adaptation 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.7

COPE Drive Systems for LOESCHE VRM
more availability @ lower TCO
Edition: 10.2015/200/ke

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depending on the grinding process, COPE can be operated at variable speed. The motor power allows the use of low voltage frequency converters.8

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 remotely 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.

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