

QUADROPOL® QMC

Roller mill for the grinding of
cement and blast furnace slag

ThyssenKrupp Polysius



ThyssenKrupp

QUADROPOL® QMC for binding agents

One mill – two application-specific drive concepts

Process flexibility, energy efficiency, and high throughput characterize this mill type. Compared to a traditional ball mill, the roller mill consumes 40 to 50 % less energy. By combining 3 process steps – grinding, drying, and separating – in only one machine, the QUADROPOL® also features a remarkably simple system concept.

Global expertise along with a large variety of test equipment in our own R&D lab and the ability to design complex grinding circuits with help from powerful simulation tools are the basis for developing high quality and innovative solutions for the individual application.

The QUADROPOL® designed for the grinding of binding agents is equipped with 3 rollers. The general construction of the mill – from the hot gas supply with CFD optimized gas flow design, through the milling tools to the separator – is standardized regardless of the drive concept.

In addition to the process-specific performance, the availability of the plant as well as a simplified maintenance concept have the highest priority.

The QUADROPOL® roller mill features systematically minimised bearings, seals and hydraulic elements as well as perfect accessibility to all parts that require maintenance.

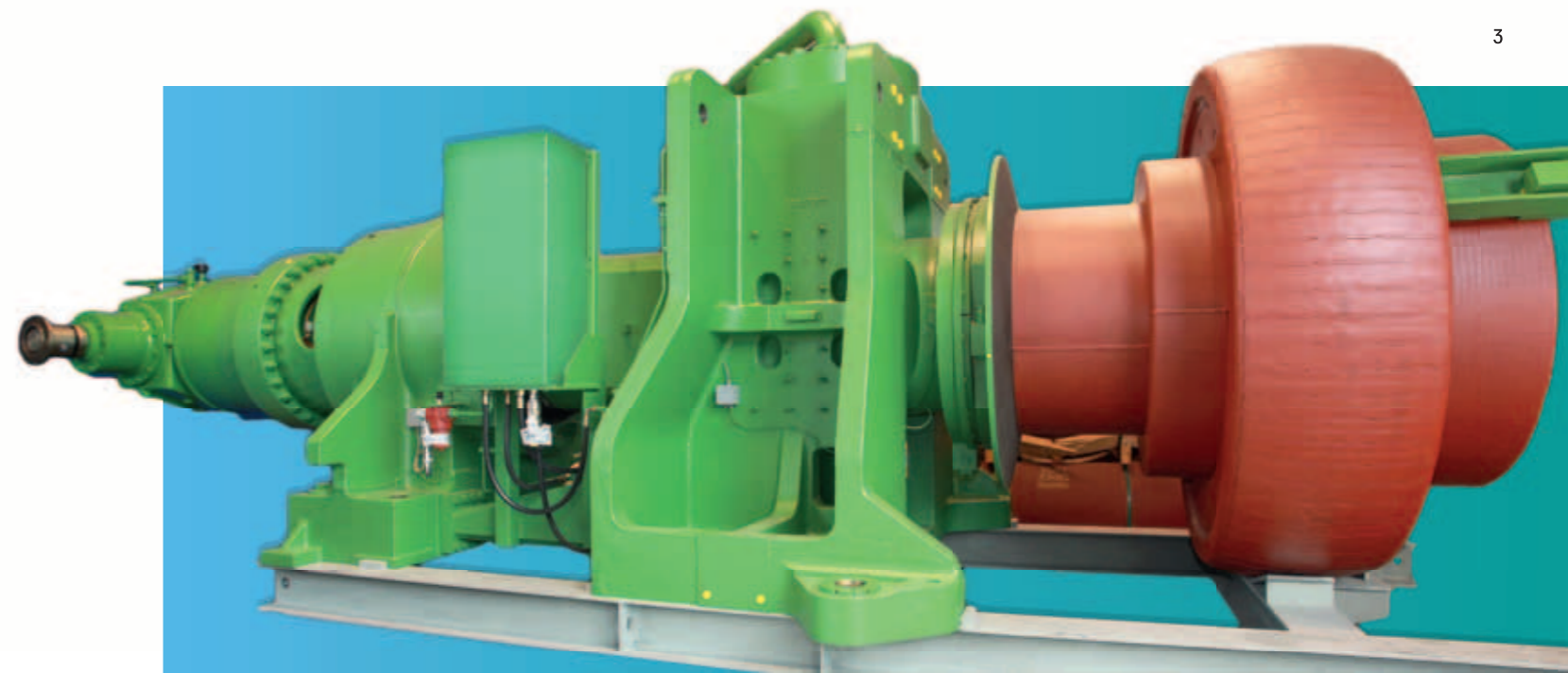
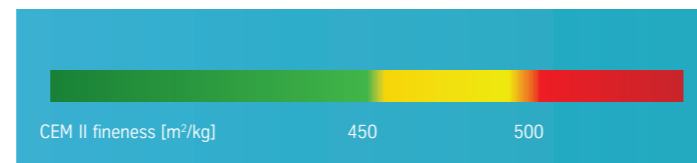
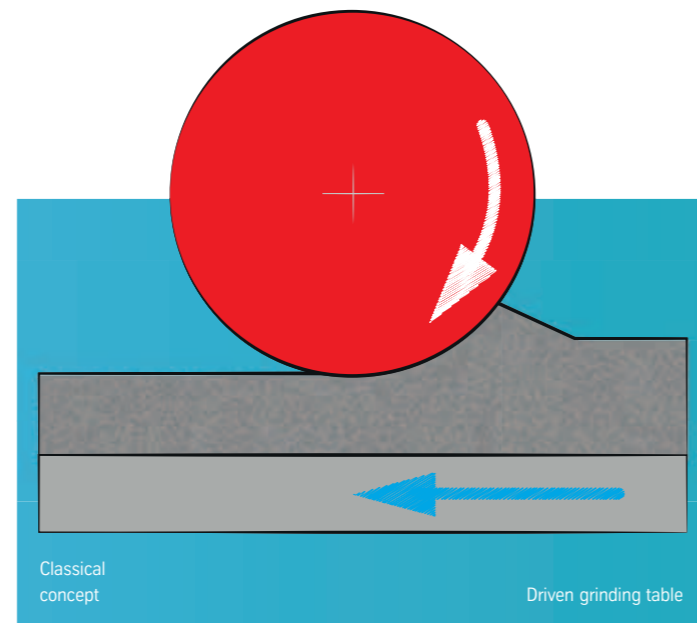
Thanks to the implementation of modern foundation design concepts – roller units supported by structurally optimized concrete foundations – no grinding forces are transmitted to the housing. The result is a smooth, quiet running mill with low vibrations and a high resistance to inleakage of false air.

Owing to a housing design characterised by efficient dust sealing, low vibrations, low noise emission and zero grinding forces, the mill can even be erected outdoors.

QMC-TD – the classical drive concept with “Table Drive”

The classic drive concept is based on a driven grinding table.

- ✓ The grinding table rotates faster than the grinding rollers.
- ✓ The material is pushed under the rollers by the grinding table.



Completely preassembled QMC-RD roller unit, including bearing, hydraulic system and gear unit.

QMC-RD – the new patented drive concept with “Roller Drive”

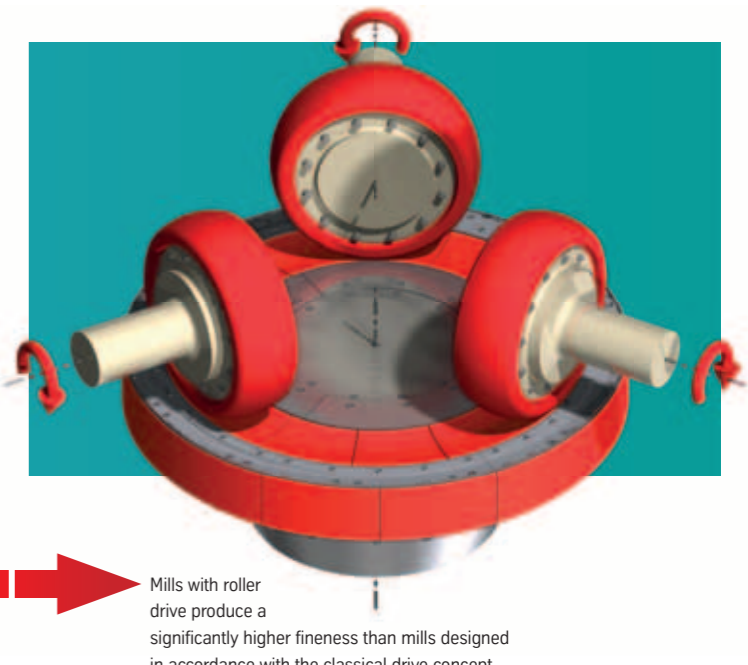
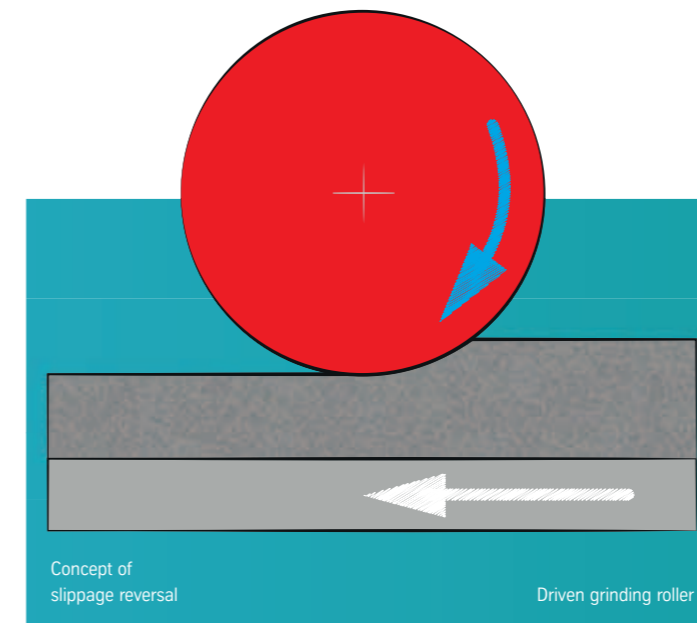
The new grinding roller drive concept meets the increasing demands on the grinding of binding agents.

The roller drive concept is based on driven grinding rollers.

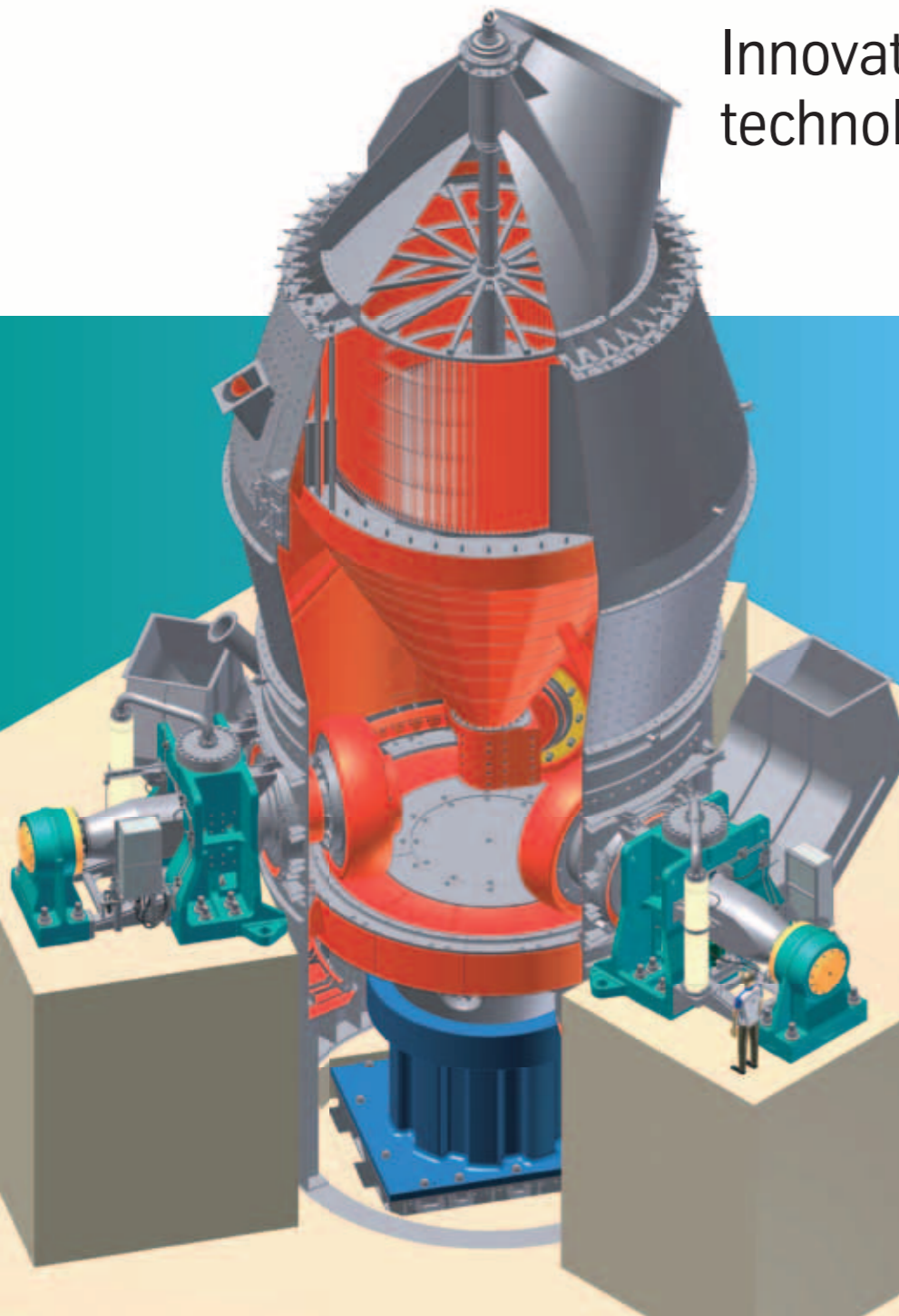
- ✓ The grinding rollers rotate faster than the grinding table.
- ✓ The material is pulled under the grinding rollers.

Benefits:

- ✓ Higher product fineness of composite cement
- ✓ Lower power requirement due to improved material pull-in
- ✓ Smaller gear units and motors coupled with a reduction of the driving torque
- ✓ Optimal speed adjustment of the grinding rollers and grinding table to a variety of different products, and thus
- ✓ Highest product flexibility for optimised throughput
- ✓ Higher availability due to the redundancy of the roller drives, i.e. even if one drive fails, the mill can still be operated with up to 70 % of its nominal capacity.



Innovative process technology assures ...



The QUADROPOL® integrates three operations into a single unit: grinding, drying, and separation. The ground material spills over the edge of the grinding table and is entrained in the gas stream flowing from the nozzle ring. The material is dried if necessary and transported pneumatically to the separator. The material that is not caught by the gas stream and/or is rejected by the separator falls through the nozzle ring and is returned to the mill via an external circuit with bucket elevator.

The gases required for the internal material conveyance and for the drying process pass through the circumferential nozzle ring into the grinding compartment. The gas distribution can be optimally adjusted to suit the operating conditions, thus minimising the specific gas volume and reducing the pressure drop in the grinding system.

The pneumatically conveyed ground material is separated into finished material and oversized material by means of a SEPOL® QM high-efficiency separator that can accommodate varying process parameters and reduces the specific power requirement for the grinding as a result of its excellent separating efficiency. Both the separating air flow rate and the rotor speed of the separator are continuously variable and, therefore, optimally adjustable to suit different product finenesses.

The design of the dam ring is of great importance for an optimum combination of the grinding and separating processes. The dam ring can be adjusted to suit a specific product and then be fixed in the optimum position, so that it is not necessary to adjust it as long as the portfolio does not change. After a significant change in portfolio, it may be useful to readjust the dam ring to optimum position. Owing to the segmented design with bolted connections, it only takes a few hours to carry out the readjustment without any trouble.

In order to ensure an undisturbed gas flow from the nozzle ring in the mill to the separator, the material feed chute has been integrated into the grit cone of the separator.

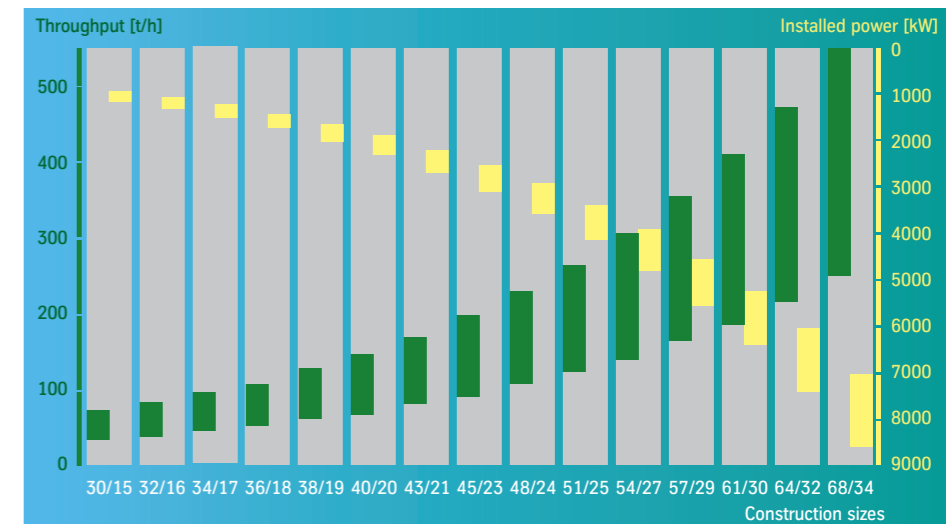
A short material retention time, a highly efficient drying process, and the continuously variable control of grinding pressure, separating air flow rate and rotor speed – each of which is automatically and centrally controlled – allow for a wide range of products.

The whole gas piping design is based upon state-of-the-art CFD calculations, from the gas inlet of the mill to the gas outlet of the separator.

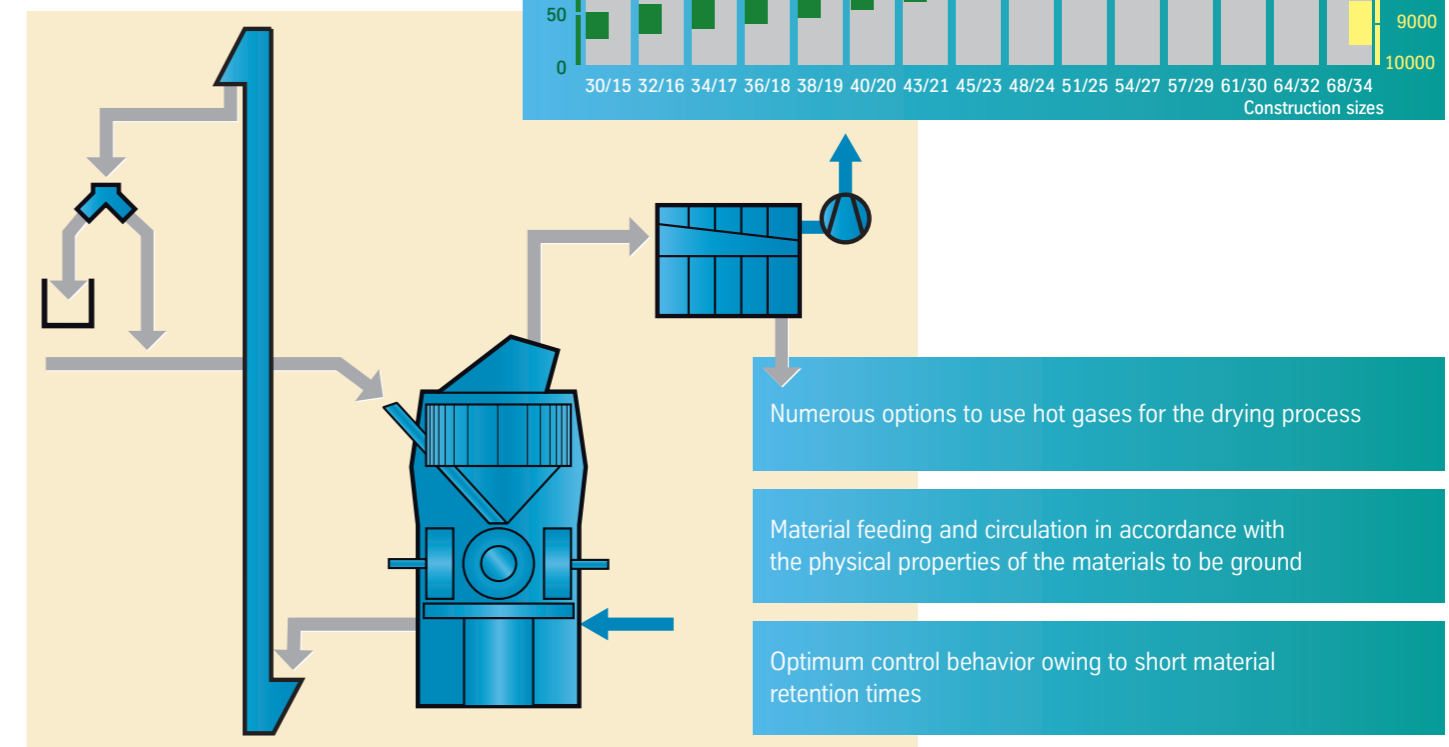
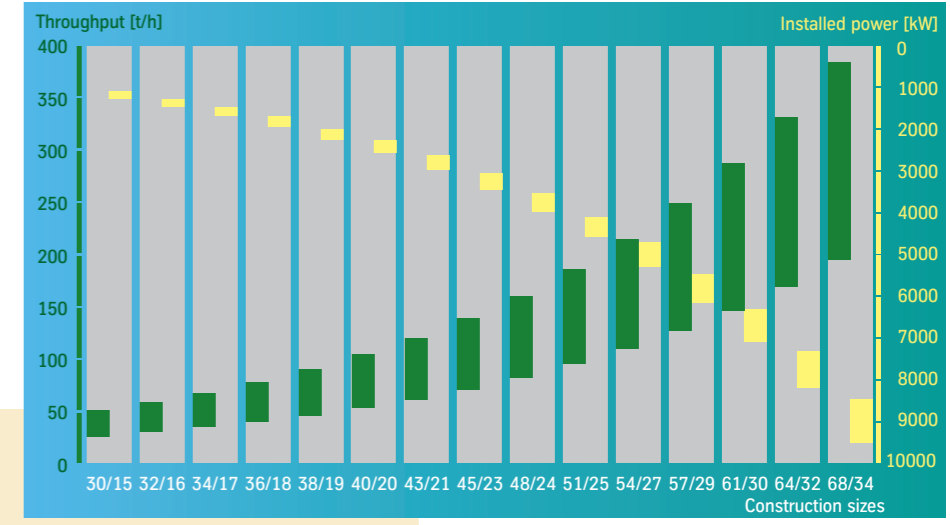


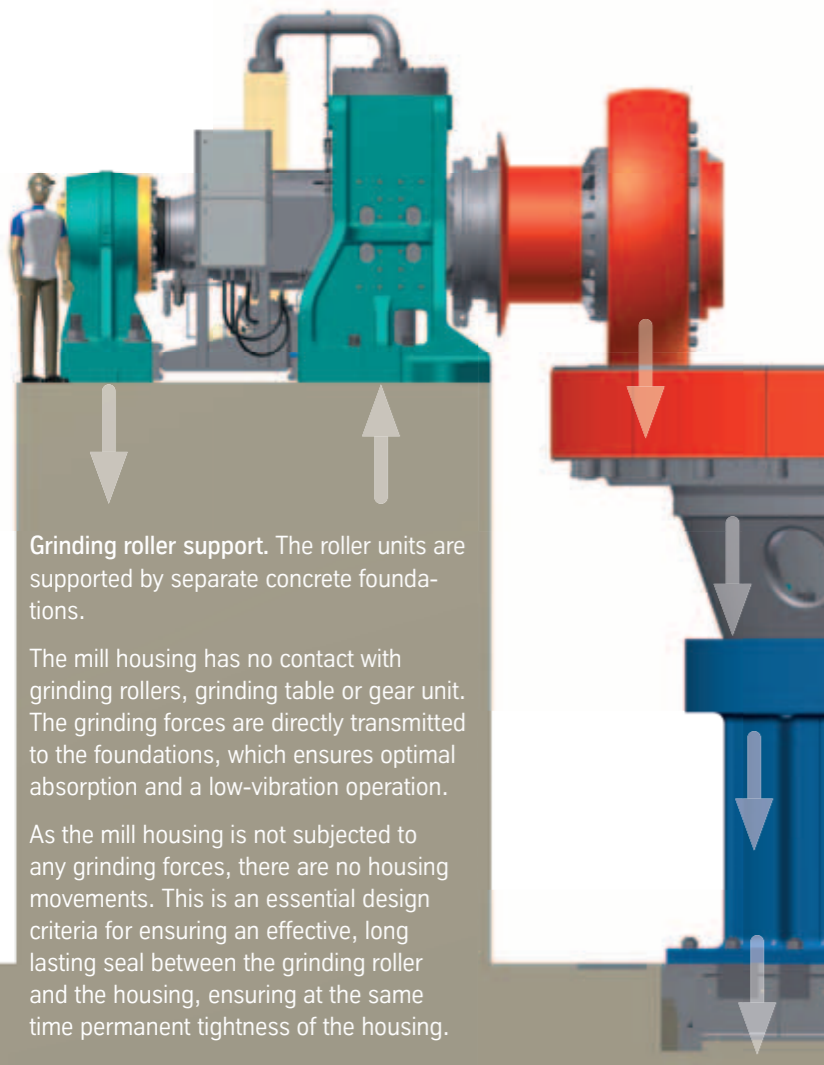
... optimum performance in cement and granulated blast furnace slag grinding

Cement grinding
 Throughput rates up to 550 t/h
 Drive power up to 8.600 kW
 Product fineness up to 550 m²/kg



Granulated blast furnace slag grinding
 Throughput rates up to 400 t/h
 Drive power up to 9.500 kW
 Product fineness up to 600 m²/kg





Grinding roller support. The roller units are supported by separate concrete foundations.

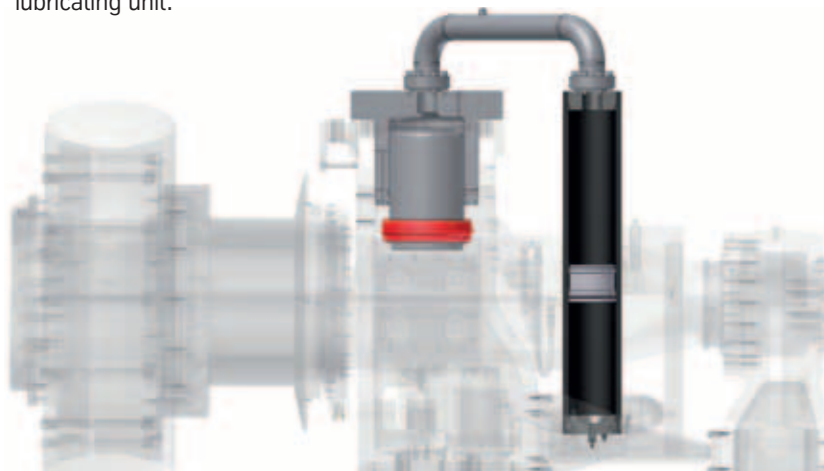
The mill housing has no contact with grinding rollers, grinding table or gear unit. The grinding forces are directly transmitted to the foundations, which ensures optimal absorption and a low-vibration operation.

As the mill housing is not subjected to any grinding forces, there are no housing movements. This is an essential design criteria for ensuring an effective, long lasting seal between the grinding roller and the housing, ensuring at the same time permanent tightness of the housing.

The **grinding roller seal** – only one per grinding roller is required – is installed outside the grinding compartment and can be replaced without having to dismantle the roller. The main components are easily accessible, so that maintenance work can be quickly performed. Visual inspections are possible at any time – even during mill operation. No sealing air fans are required.

Grinding roller bearing assembly. Each grinding roller unit needs only 2 bearings. The pivot bearing at the axle end, outside the mill, does not require any maintenance. The number of moving parts inside the mill has been minimized. The antifriction bearing inside of the grinding roller is encapsulated to protect it against dust.

Lubrication of the antifriction bearing incorporated in the grinding roller is performed from outside via oil circulation. No sensors or piping are installed inside the grinding compartment. Each roller unit is equipped with a separate lubricating unit.



Innovative mill equipment

SEPOL® separator. The SEPOL® separator is characterised by smooth running thanks to a design that perfectly meets the requirements concerning manufacturing, assembly and, in particular, process technology. The rotors, for instance, have been so dimensioned that they run below their natural frequency. Moreover, concentricity measurements are performed during manufacturing to ensure smooth running.

Separation efficiency. The rotor cage is sealed with a labyrinth seal and has no contact with the housing. The flow resistance produced by the labyrinth seal reduces the gas bypass to a minimum. Further optimisation for highest product requirements can be achieved without additional fans by means of passive sealing air supply.

Owing to the good accessibility of the foundations, the few components of the roller units that require maintenance can be easily accessed without additional scaffolding at any time.

FEM calculations support the engineering and design.

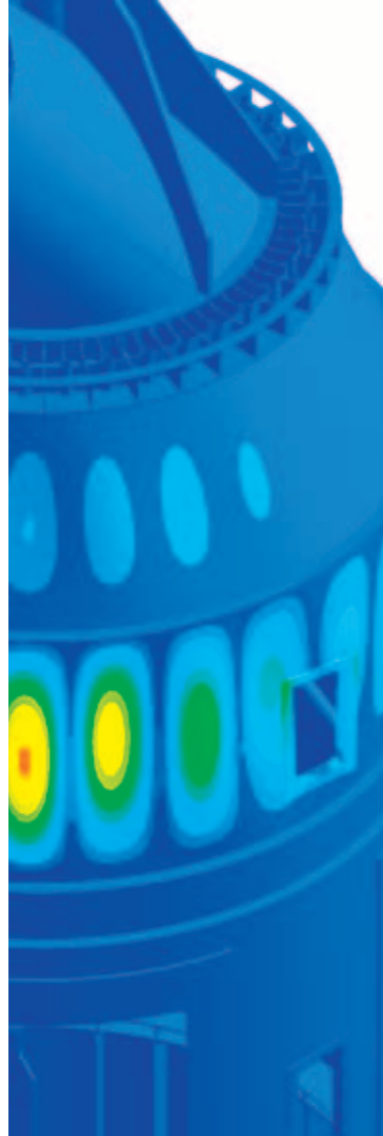
Wear protection. Special materials, adapted to the abrasiveness of the material to be ground, are used for the roller tyres and grinding track; special linings installed in the mill housing and in the separator ensure durability of the machine.

Maintenance crane. Usually the roller units and the mill motors are mounted or dismantled with the help of a mobile crane. However, if there is not enough space, for example if the assembly/disassembly is to take place in an existing plant, a ring crane can be installed.

Hydraulic system. The grinding force is generated hydraulically. Each roller unit only has one hydraulic cylinder for the working pressure and one accumulator.

The preassembled, compact hydraulic system comes equipped with oil filters and consists of only a few components, thus making it very easy to maintain. The steel connection between the accumulator and the cylinder is short and has an optimised design for high flow efficiency.

An additional mechanical stop per roller unit prevents any contact between the grinding elements, even when very little material is left on the grinding table.



... to achieve maximum availability and minimum maintenance requirements

The basis: research and development

ThyssenKrupp Polysius has both the expertise and the equipment to develop plant concepts specific to the needs of individual material properties. The ThyssenKrupp Polysius R&D Center, with its modern equipment, is one of the world's leading centers of raw materials technology development.

Powerful simulation tools aid in the selection of the correct equipment and systems: they allow for not only the precise calculations of component strengths and air/gas flow distributions, today they can be used to even evaluate the interactions between the parts themselves.

Laboratory tests and analyses, as well as wear and grindability tests with different grinding procedures, ensure design safety:

- ✓ Fineness determination according to Blaine
- ✓ Screen analyses
- ✓ Determination of grain/particle size and true density
- ✓ Chemical tests and moisture content determination
- ✓ Grindability tests according to Zeisel, as well as various laboratory tests and semi-industrial grinding tests



The ThyssenKrupp Polysius Research Centre is equipped with various grinding systems of different sizes and for different grinding tests.

Services. Worldwide. ThyssenKrupp Polysius provides a broad range of services that customers around the world rely upon for comprehensive support, which is essential for strengthening the trust and loyalty of our customers and building long-lasting working relationships.

The preassembly of core components in our workshops and Service Centers ensures the highest quality, availability, and durability of our products. With a global network of well-equipped Service Centers in key locations close to our customers, ThyssenKrupp Polysius has laid the groundwork for quick and effective servicing and maintenance of all wear parts

ThyssenKrupp Polysius Service also focuses on preventive maintenance of machines and on comprehensive training of the plant operators.

