

OK™ mill

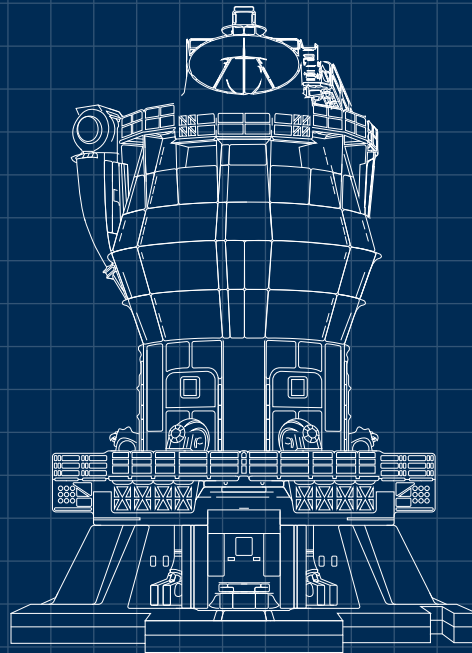
The most reliable
and efficient mill for raw
and cement grinding



Based on proven technology

FLSmidth has supplied the global cement industry with leading Vertical Roller Mill (VRM) designs for raw, fuel and cement grinding for several decades.

The OK™ mill has been FLSmidth's standard cement VRM since 1993. Since its introduction, the OK mill has proven to be the most efficient cement VRM available, with the highest reliability and ease of operation. In 2017, FLSmidth introduced the OK raw mill, which is designed with the same proven technology and modular design as the OK cement mill.



Key benefits

- Energy-efficiency
- Easy to operate
- High run factor
- High capacity
- Operating flexibility
- Easy maintenance
- Low Total Cost of Operation

Design advantages

The design of the OK mill allows the combination of standard VRM features such as drying, grinding, material conveying and separation process in one unit, thus simplifying the plant layout.

It also incorporates unique patented design elements in the roller and table profile that improve operating stability and reliability, giving a typical availability of 90 to 95 percent of scheduled operating time. Due to its inherent flexibility, the OK mill can be operated with a number of rollers out of service and still achieve 60 to 70 percent of the nominal output, minimising risk of lost production due to unplanned stoppages and guaranteeing long-term availability. Furthermore, the mill inlet and outlet points can be installed to match the specific layout for any plant. Its low noise level makes installation without a building feasible, substantially reducing civil construction costs and improving the working environment.

Lower power consumption

The OK mill is more energy-efficient than other cement grinding VRMs, it consistently operates with lower airflow and the lowest power consumption. Featuring a patented cement grinding profile and an integral separator with industry-leading efficiency, the mill consistently uses five to ten percent less power than other cement VRMs. This productivity benefit amounts to millions of kilowatts saved annually for OK mill owners. The OK raw mill is designed according to the same design principles.



The OK™ mill can be operated with a number of rollers out of service, minimising the risk of lost production.

Parts commonality

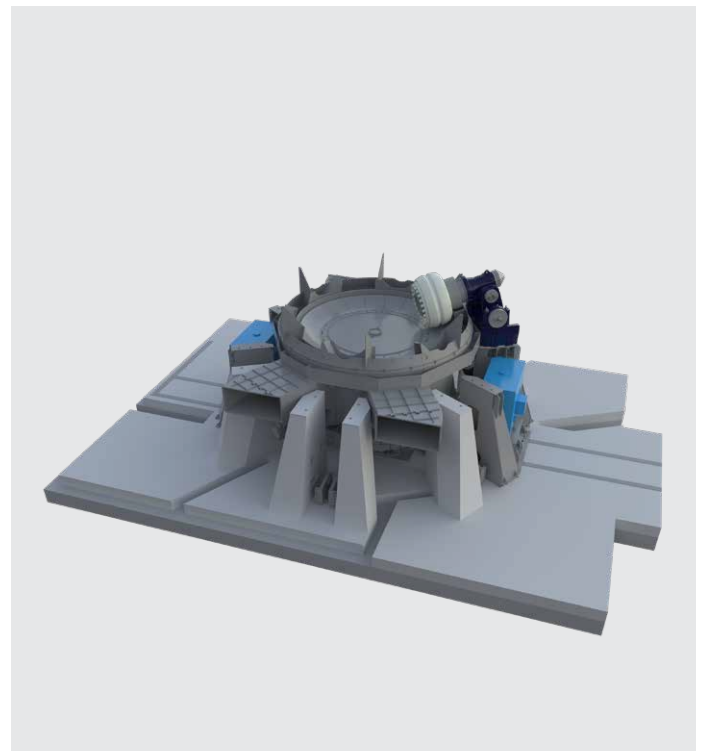
The OK mill uses the same common mill parts for both raw and cement applications. This includes the roller assembly, swing lever system, grinding tables and liners, hydraulic system and drive system. As an OK mill owner, you can benefit from a high degree of spare part flexibility, lower volumes of inventories and consistent maintenance procedures.

Cost of installation

Reliable large-sized mills not only take advantage of economies of scale in reducing the project CAPEX investment, but also reduce the Total Cost of Ownership per tonnes of cement produced, while increasing total plant productivity. The size range of the OK mill includes 3, 4 and 6 roller mills and includes the largest VRM sizes available with installed power over 11,500 kW.

Concrete mill stands

The latest version of the OK mill includes a simple concrete stand replacing the full conventional steel stand. The use of concrete stands not only saves installation time by eliminating unnecessary transportation of heavy parts, it also reduces the total installed cost. Furthermore, the concrete mill stands allow standardization of the mechanical parts of the mill, along with the use of the same erection procedure. As the amount of steel in the mill has been minimised, vibration is also reduced and plant-specific installation requirements can be made to the concrete stand itself.

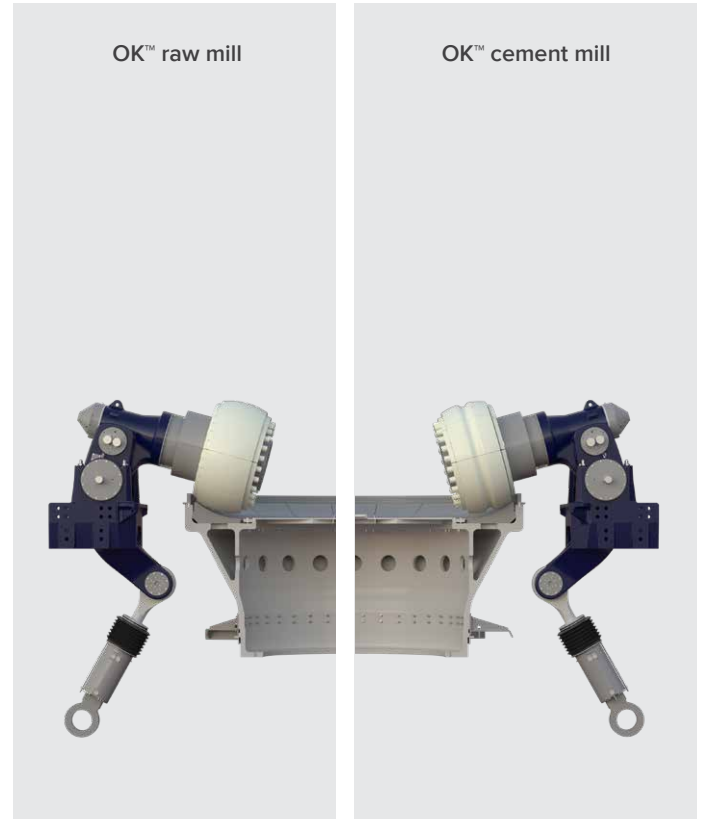


The use of concrete stands saves installation time and reduces the total installed cost.

Ease of operation and maintenance

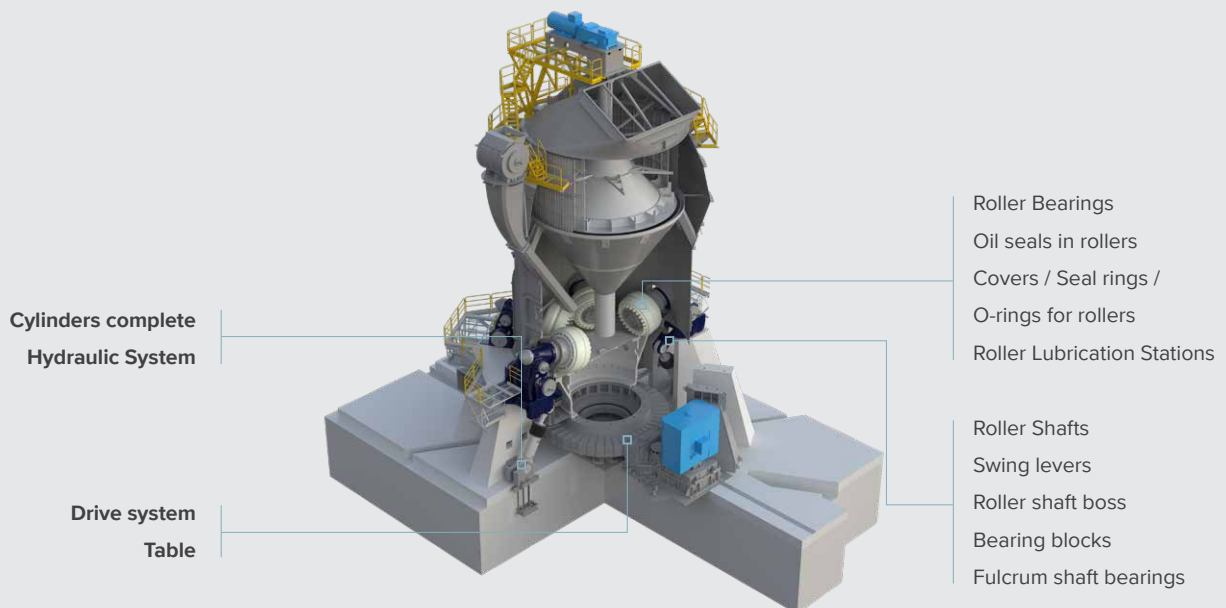
Operation and maintenance of the OK mill has been continuously improved through the more than 20 years of operating experience and over 150 installations worldwide. The mechanical design and layout have been simplified and internal components have been adapted to improve airflow and reduce wear from jet abrasion, and updated design features have been included to provide greater long-term clamping of internal components such as table liner segments.

The mechanical design of the main grinding components gives flexibility to adapt maintenance procedures to fit any plant's specific conditions and needs. Segmented roller tires offer the flexibility of more than one approach for fast and simple wear surface maintenance inside the mill. When the roller grinding surfaces are worn, the tire segments can either be replaced or they can be re-welded, without removing the rollers from the mill. The swing-out feature allows rollers to easily be removed from the mill, allowing the possibility to perform maintenance work externally from the mill.



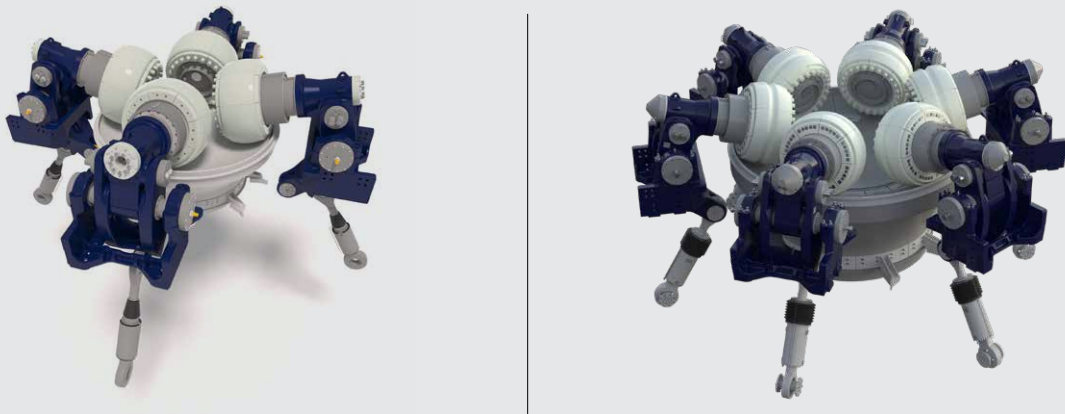
Common OK™ mill roller assembly for raw and cement mill.

Common OK™ mill parts



Sharing of common parts

The sharing of common parts is not limited to raw and cement mills of the same size but also extends across different mill sizes providing much greater flexibility in terms of the use of standard component combinations.



Example of 4 and 6-roller OK™ mills with common parts.

The size combination options in the table above shows how 4 and 6 roller mills exploit the advantages of common features across different mill sizes for cement and raw applications.

OK™ raw

	37-3	40-4	43-4	48-4	52-4	56-4	61-6	66-6	71-6	77-6	81-6
37-3	■	■									
40-4	■	■									
43-4			■								
48-4				■			■				
52-4					■			■			
56-4						■			■		
61-6							■				
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OK™ cement

Quality and profit-improving features

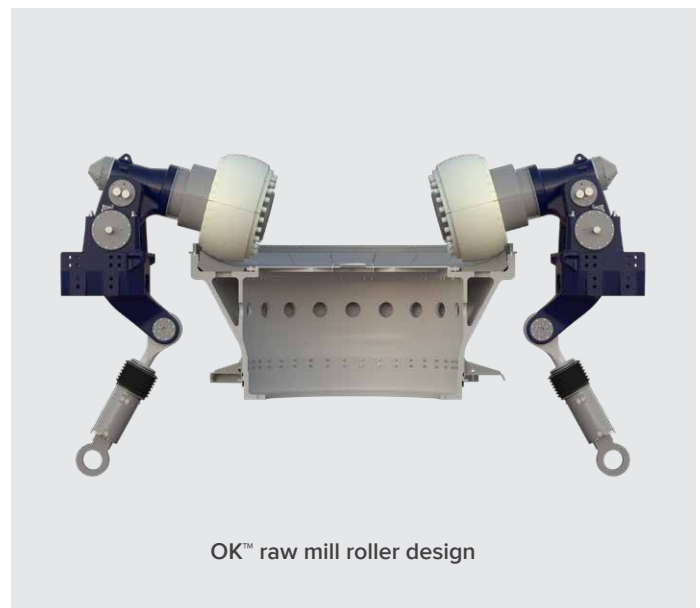
Detailed technical advantages

The OK mill uses a hydro-pneumatic system to press its grinding rollers against the material bed on the rotating grinding table. Segmented roller wear parts are made of the hardest possible material that do not crack and are very well-suited for repeated hard-facing. Re-positioning of rollers is possible to distribute wear more evenly. These features ensure maximum longevity.

The rollers

The OK mill design uses the same swing lever and roller assemblies for either cement or raw applications. It also allows the ability to continue using the unique grinding roller profile of the OK cement mill and an optimised spherical grinding profile for raw grinding applications.

The rollers are in a lifted position when the mill is started, ensuring trouble-free start-up. A standard control system monitors the machinery and facilitates operation.



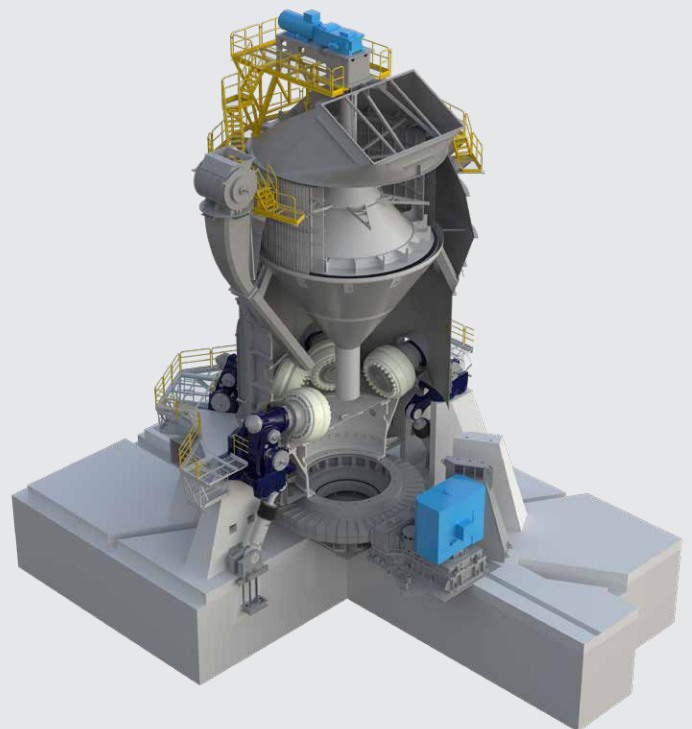
Gear types

To accommodate the various requirements for different mill sizes and applications, the OK mill is designed with the flexibility to install all available drive types. This includes standard planetary gear systems, which are proven reliable for up to 9,000 kW, and the many alternative drive systems that have recently been introduced to the market – such as the MAAG® MAX Drive for large mill sizes up to 15,000 kW.

Illustration of 6-roller OK™ mills with conventional gear and MAAG® MAX Gear.



OK™ raw mill with MAAG® WPV drive



OK™ cement mill with MAAG® MAX drive

Dimensions and characteristics

The capacity range depends on fineness, grindability and additive types and proportion of mill feed

OK™ mill size	28-3	37-3	40-4	43-4	48-4	52-4	56-4	61-6	66-6	71-6	77-6	81-6
Power, Cement & Raw, kW	800	1,300	1,800	2,350	3,000	3,750	4,600	5,500	6,500	7,800	9,500	11,000
Power, Slag, kW	950	1,545	2,160	2,830	3,590	4,450	5,420	6,490	7,800	9,500	11,000	13,200

Nozzle ring

The OK mill nozzle ring is designed to accommodate specific requirements for each application. Examples include increasing the open area for higher gas flow in drying raw materials or the specially designed iron removal feature for slag grinding that minimises wear of the mill internals.

One mill, many products

The OK mill efficiently grinds even the hardest raw materials and blended cements with a wide range of additives such as slag, pozzolana, limestone and fly ash. Its versatility is demonstrated by the ability to switch between a wide variety of feed mixes and to vary the particle size to meet individual needs.

Wear liners

The wear liners of the grinding table and the rollers are of the segmented type and are therefore easy to replace when worn out. For mills grinding very abrasive materials, such as slag, hard-facing is a viable means of achieving a high availability of the grinding system, optimising the grinding process and saving refurbishment costs.

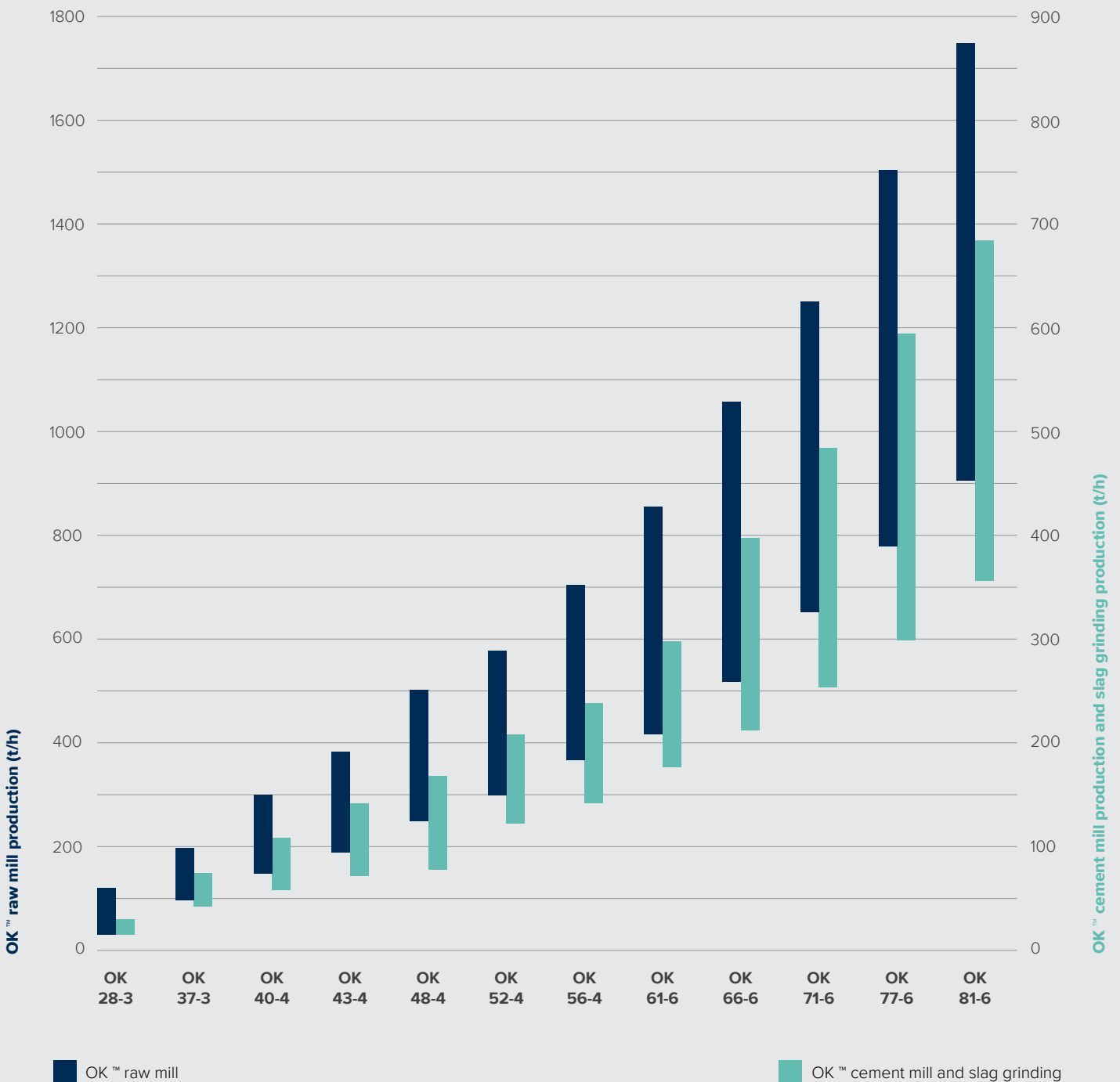
Hard-facing is an economical alternative to changing wear parts and is very suitable for the high chrome cast iron grinding parts used in the OK mill. The segmented type of wear liners can be hard-faced numerous times throughout their life with low risk of cracking due to the welding process.

Optimisation of operation

Adjustment of mill airflow and grinding pressure for optimisation of the operation, including adjustment of particle size distribution and switching between different types of products for example from Portland cement to slag cement, can be made immediately. When necessary, adjustment of mechanical components such as the dam ring can be made during short mill stops.

Size range

A complete size range ensures the ability to meet all possible capacity requirements in a single mill even for the hardest materials. The OK™ raw and cement mills are available in all sizes.



Technical details about the **OK™ cement mill**

Application advantages

Proven commercially, the OK mill is the premier roller mill for finish grinding of Portland cement, slag and blended cements. The OK mill's grinding efficiency can contribute significantly to plant profitability and competitiveness.

Roller profile

The patented grooved roller profile has two grinding zones: an inner and an outer. The inner zone prepares the grinding bed by compressing the feed material as it moves under the rollers into the high-pressure grinding zone. The center groove allows air to escape from the material. Grinding pressure is concentrated under the outer zone of the roller, allowing for most efficient operation.

Handle multiple materials with ease

As the operating parameters can be adjusted instantly and the retention time of the system is very short, the switching between different types of products can be performed with almost immediate effect. Most OK mills regularly switch between products such as Ordinary Portland cement and slag blended cement or from a lower to a higher Blaine. Furthermore, the temperature profile of the system can be controlled to adjust the level of dehydration of gypsum. The OK mill has proven to be effective for grinding blended cement with one or more wet components, because of its highly effective drying performance and its ability to maintain a stable grinding material bed. As an example, the OK mill has been used to grind a wide range of materials from 100 percent slag with feed containing more than 20 percent moisture to limestone, pozzolan and fly ash.

Improved control over particle size distribution

Product quality is a function of cement particle size distribution (PSD) and the dehydration of the gypsum within the cement. In the OK mill, parameters such as mill air flow, separator speed and grinding pressure can be easily adjusted during operation to control or adjust the PSD curve to a steeper or flatter profile that achieves the desired quality standards. When needed, the PSD curve can match one from an existing VRM or ball mill grinding system.

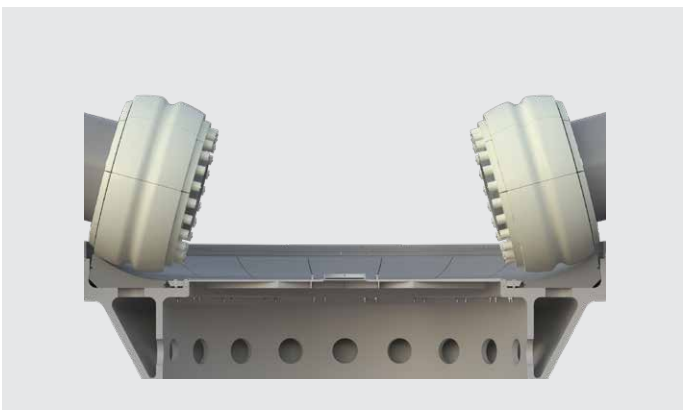


Illustration of OK™ cement mill roller profile.



Example of ROKSH separator for optimum cement product quality.

Technical details about the **OK™** raw mill

Application advantages

The OK raw mill is designed with the same proven technology and modular design as the standard OK cement mill.

Roller profile

Raw materials in general have easier grindability and do not require the same pressure profile in the grinding zone that comes with the patented OK™ cement mill dual-lobed roller geometry. Therefore, a more optimal grinding geometry is used in the OK raw mill.

RARM separator

A compact separator design features a unique concept that entails a number of advantages and enhances the reliability and performance of the raw material VRM and RARM separator.

Along with FLSmidth's proven high-efficiency RAR separator, the OK raw mill also incorporates the best VRM features in one proven design.

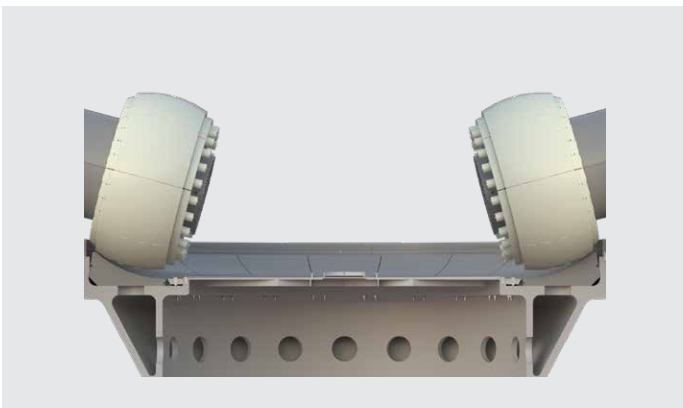


Illustration of OK raw mill roller profile.



Example of RAR separator for optimum raw meal quality.

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