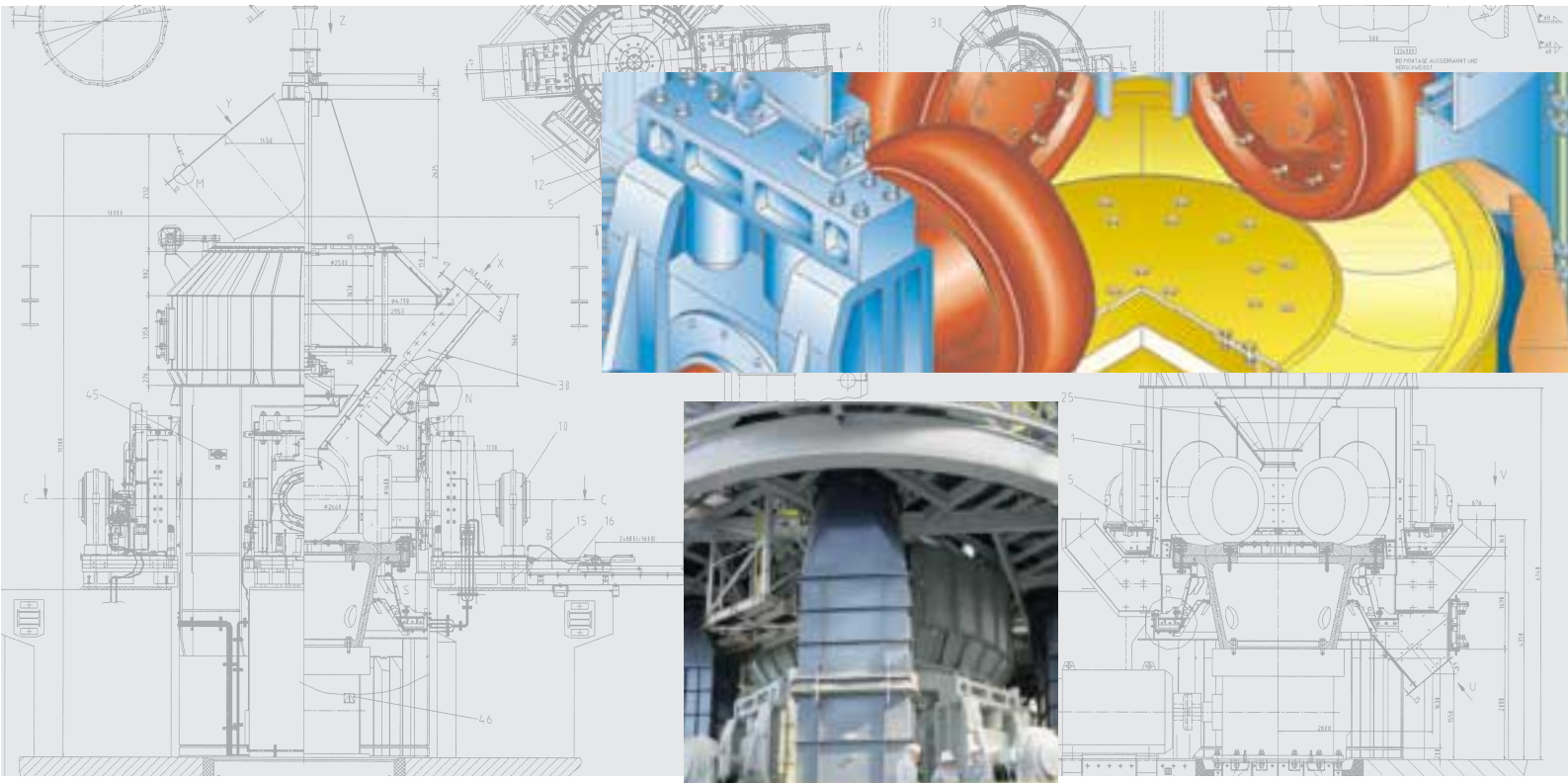
The QUADROPOL® roller mill.



A company
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Technologies

Krupp Polysius

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The QUADROPOL® roller mill.
The new mill generation, tailored to market requirements.

The fundamental market demands on a cement raw material grinding plant are high throughput rates and drive power combined with small construction size and high availability. And – thanks to the consistent implementation of well-founded research and development work – these are precisely the performance characteristics of the new roller mill generation from Krupp Polysius.

The QUADROPOL® has decisive advantages that make it particularly suitable for online operation. One is the 4 individual grinding rollers, whose bearing assemblies are located outside the grinding chamber, protected from dust and high temperatures. The cambered geometry of the grinding roller, proven in the classical mill with double roller pair and with outstanding wear resistance, was retained for the QUADROPOL®. This geometry results in long service lives and a constant performance profile with regard to throughput and energy requirement over the entire lifetime of the grinding elements.

The compact QUADROPOL® is designed for drive powers of up to and above 6 MW while assuring high plant availability. With its automatic changeover from 4 to 2-roller operation, the mill provides high adjustment flexibility within a range of approx. 30 – 100% for adaptation to changes in raw meal requirement. In addition, the mill has extremely maintenance-friendly design features. For instance, the two opposite grinding rollers can be swung hydraulically out of the mill housing; the two roller units remaining in the mill then continue the grinding process.

The new mill system from Krupp Polysius thus fulfils the prerequisites for »online operation« in the cement factory with a practically uninterrupted flow of material from the mill to the kiln. High raw material grinding plant availability has two beneficial results: it permits the use of a smaller mill and, provided that the factory is equipped with suitable raw material and raw meal analysis systems, allows the blending and storage silos to be downsized or even dispensed with.

QUADROPOL®
in a Westphalian
cement factory.

Large QUADROPOL®
with 3,356 kW drive power
in the USA.

QUADROPOL®
in a South-German
cement factory.

A convincing concept.
Technology in detail.

Roller diameter of 2.3 m.

QUADROPOL® roller during manufacture.

Installation of roller unit.

Principle of functioning

The QUADROPOL® roller mill integrates three work operations in a single unit: drying, grinding and separating.

The ground material spills over the grinding table rim and is entrained and dried by the stream of hot gas emerging from the nozzle ring. Depending on the gas velocity, either all or some of the material is then carried to the high-efficiency separator.

The portion of material not transported by the hot gas stream is returned to the mill via an external circuit with bucket elevator. The finished material is discharged in the stream of gas and collected in cyclones and/or in the dust collection filter. Even low-temperature exhaust gas can be used for the combined grinding and drying process, allowing straightforward drying of raw materials with moisture contents of up to 20%.

The main components of the QUADROPOL® include:

- the roller units with their integrated hydraulic systems and the bearing assemblies located outside the grinding chamber,
- the grinding table with exchangeable grinding track liners,
- the force-free mill housing with its hot gas inlets and maintenance doors,
- the variable speed SEPOL® high-efficiency separator and
- the drive system, consisting of gear unit, motor and auxiliary drive unit.

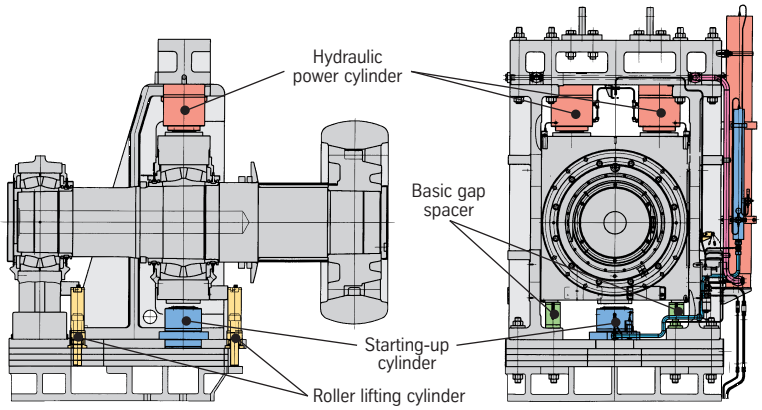
Grinding rollers

Unlike conventional roller mills, the QUADROPOL® has grinding rollers whose bearing assemblies are located outside the grinding chamber. The bearing units are mounted on concrete foundations. The hydraulic system is located directly at the floating bearing of each grinding roller. The bearing block of the floating bearing was adopted from the well-tried design of the POLYCOM® high-pressure grinding roll and the profile of the grinding elements was adopted from the proven Polysius roller mill.

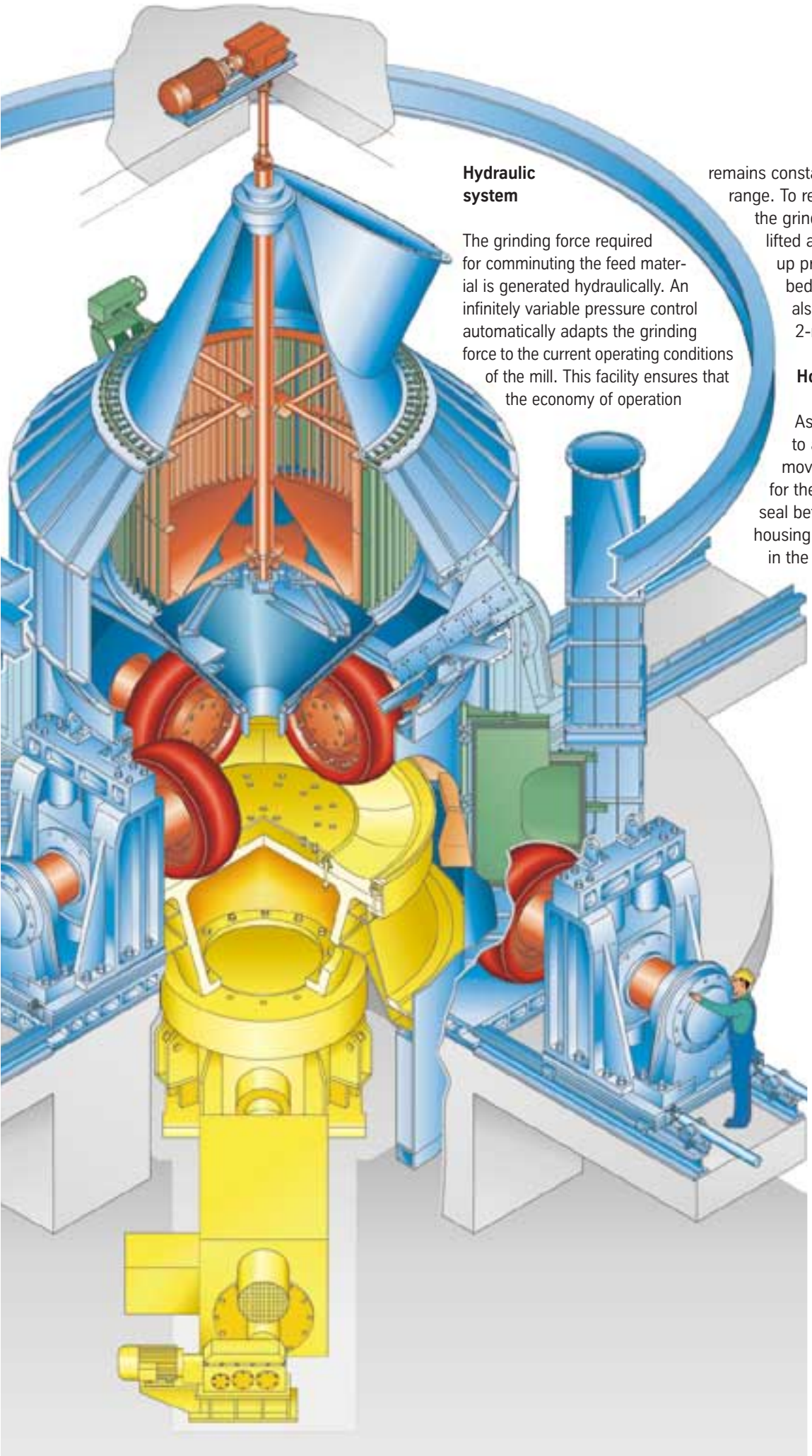
Mounting the bearing units on separate foundation blocks ensures optimum damping of the grinding shocks and thus produces a very smooth mill operation.

Additionally, the external bearing concept provides considerable maintenance advantages: the mechanical components inside the mill are reduced to a minimum; the main components located outside the grinding chamber are easily accessible, allowing quick performance of maintenance and repair work; visual checks are possible at any time – even during mill operation.

As the hydraulic system of each roller unit can be independently controlled, it is possible to change automatically from 4 to 2-roller operation and vice versa. If one roller unit requires maintenance, this and the opposite grinding roller, including sealing frame, are swung hydraulically out of the mill housing. The two roller units remaining in the mill then continue the grinding process in partial-load operation, meaning up to 60% of nominal throughput capacity. This results in very short stoppage times.



Roller unit with hydraulic system.

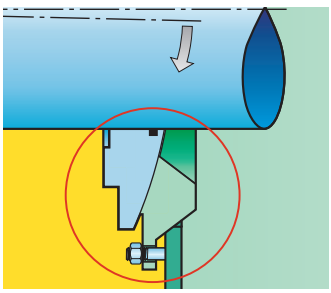


Hydraulic system

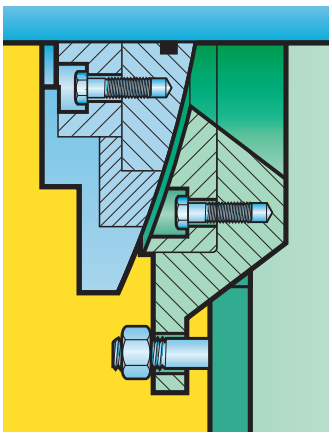
The grinding force required for comminuting the feed material is generated hydraulically. An infinitely variable pressure control automatically adapts the grinding force to the current operating conditions of the mill. This facility ensures that the economy of operation remains constant over the entire throughput range. To reduce the mill starting torque, the grinding rollers can be hydraulically lifted and, at a later point in the starting-up process, again lowered into the bed of material. The hydraulic system also enables the changeover between 2-roller and 4-roller operation.

Housing

As the mill housing is not subjected to any forces there are no housing movements. This is a positive factor for the design of the grinding roller seal between the roller unit and the mill housing. This contact-free gap seal is in the form of a ball socket and moves around the fixed bearing pivot point.



Housing/roller seal.



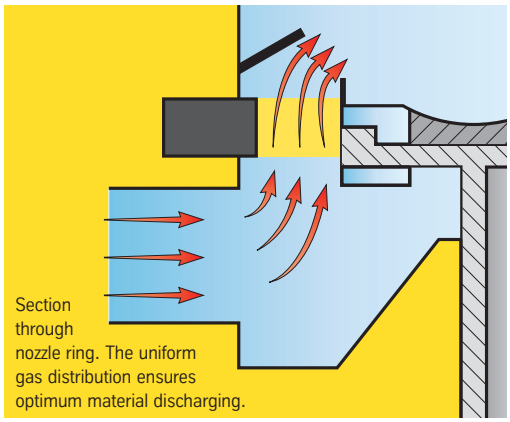
Practical experience has shown that it is possible to adjust the seal gap to less than 1 mm, which minimises the inleakage of false air, even in long-term operation.

Hot gas supply ducts.

Ring craneway.

Hot gas supply system / adjustable nozzle ring

The hot gas required for the internal transportation and drying of the material reaches the 4 nozzle ring segments via 4 vertical ducts alongside the mill housing and subsequently passes through the nozzle ring openings and into the mill. Both the velocity and the distribution of the gas can be optimally adjusted to suit the operating conditions, thus minimising the specific gas volume and reducing the pressure drop in the grinding system to a very low figure. In partial-load operation the gas volume can be reduced to 60 % of the nominal by suitably adjusting the nozzle ring diameter, which is of great advantage for online operation. The uniform gas distribution to the nozzle ring segments ensures optimum discharge of ground material. In the nozzle ring the hot gas is horizontally deflected, thus minimising the external material circuit and reducing the wear of internal mill fittings.



Section through nozzle ring. The uniform gas distribution ensures optimum material discharging.

SEPOL® high-efficiency separator

For separating the ground material into finished material and oversize, the SEPOL® high-efficiency separator is outstandingly effective. It can be adjusted in accordance with various parameters and reduces the specific power requirement for the grinding as a result of its excellent selectivity.

Drive system

The drive system consists of the motor and a planetary gear unit that was specially designed for roller mills. The gear unit takes up the vertical grinding forces and transmits them via a hydrodynamic axial thrust bearing with partial or full hydrostatic lubrication directly into the grinding plant foundation. An additional auxiliary drive unit ensures troublefree starting up, even after a mill stoppage during full production and also ensures quick emptying of the mill for maintenance work.

Wear protection

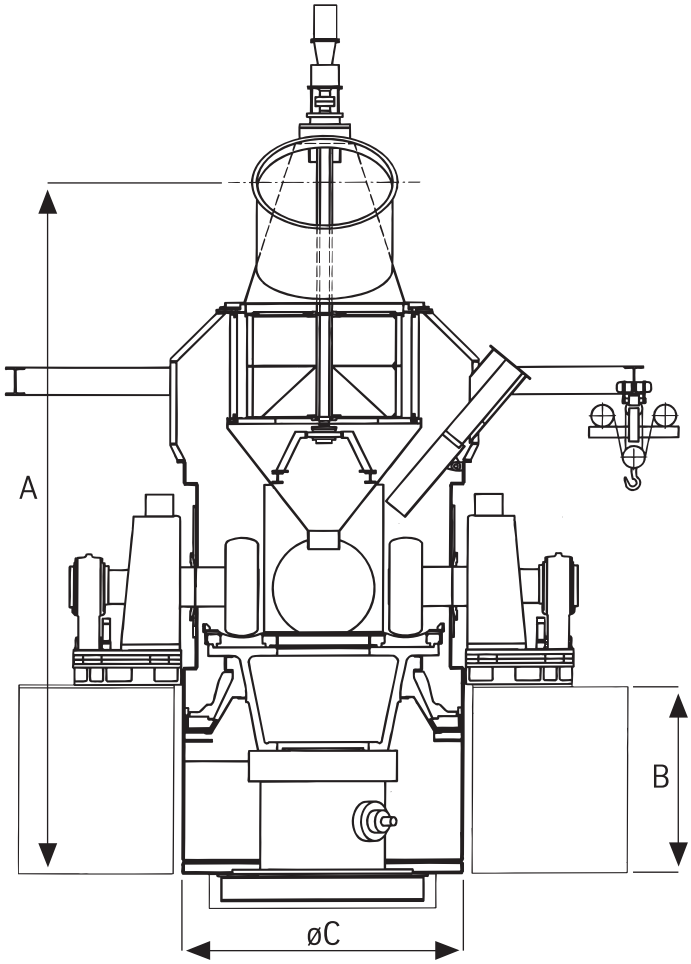
Special materials suited to the abrasiveness of the feed material are used for the roller tyres and grinding track and special linings are installed in the mill housing, separator and cyclone. These ensure reliable wear protection.

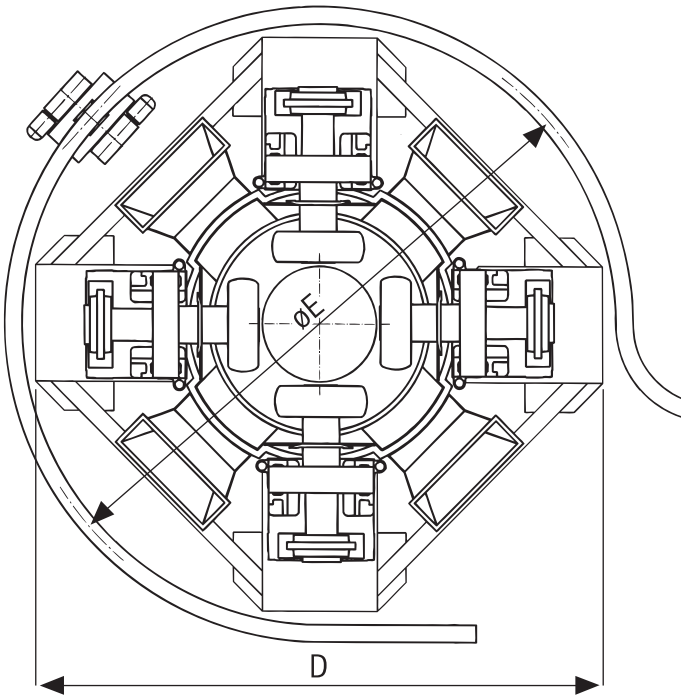
Craneway

A ring craneway is installed in the mill building to facilitate mounting and dismounting of the roller units and the mill motor. After the roller units have been pulled out of the mill it is easy to hoist them away and set them down in a convenient place. A special craneway facilitates the replacement of table liner segments.

Mounting of the separator unit.

Technical data.





Mill type	Installed power [kW]	Throughput [tph]*	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]
20/10	460	70	7,100	1,900	3,000	6,200	6,300
21/10,5	520	70	7,500	2,000	3,100	6,500	6,600
23/11	650	90	8,200	2,200	3,400	7,100	7,200
24/12	720	100	8,500	2,300	3,600	7,400	7,500
25/12,5	800	110	8,900	2,400	3,700	7,700	7,900
27/13	970	130	9,600	2,600	4,000	8,300	8,500
28/14	1,060	150	9,900	2,700	4,200	8,600	8,800
30/15	1,260	170	10,600	2,900	4,500	9,200	9,400
32/16	1,480	200	11,300	3,000	4,700	9,800	10,000
34/17	1,720	230	12,100	3,200	5,000	10,500	10,700
36/18	1,980	270	12,800	3,400	5,300	11,100	11,300
38/19	2,270	310	13,500	3,600	5,600	11,700	11,900
40/20	2,580	350	14,200	3,800	5,900	12,300	12,500
43/21	3,090	420	15,200	4,100	6,400	13,200	13,500
45/23	3,460	470	15,900	4,300	6,700	13,800	14,100
48/24	4,070	550	17,000	4,500	7,100	14,700	15,000
51/25	4,730	640	18,100	4,800	7,500	15,700	16,000
54/27	5,460	730	19,100	5,100	8,000	16,600	16,900
57/29	6,250	840	20,200	5,400	8,400	17,500	17,900
61/30	7,400	990	21,600	5,800	9,000	18,700	19,100

* related to raw material with an average grindability and a product fineness of 12 % R 90 µm.