

# ATOX Coal Mill

- Compact design
- Suitable for grinding any type of coal
- Long service life of grinding parts



**FLSmidth**

# Continuous improvement

## MAIN FEATURES

- **High-efficiency mill grinding coal, lignite petcoke, anthracite, etc.**
- **Dynamic rotary separator ensures high-grade end product.**
- **Compact design minimizes space requirement.**
- **Segmented roller and table wear parts prolong service life and facilitate installation.**
- **Large rollers permit coarser feed and ensure a thick grinding bed.**
- **No auxiliary drive needed.**
- **High flexibility ensures stable operation, even during low production load.**
- **Optimized air distribution reduces pressure loss.**

## Proven technology

Over the last few decades, the air-swept vertical roller mill has become the standard solution for coal grinding installations. Continuous improvement of the ATOX coal mill has resulted in today's compact construction featuring high reliability and a wide range of mill sizes. The ATOX grinds and dries all types of coal and is highly economical in terms of specific energy consumption.

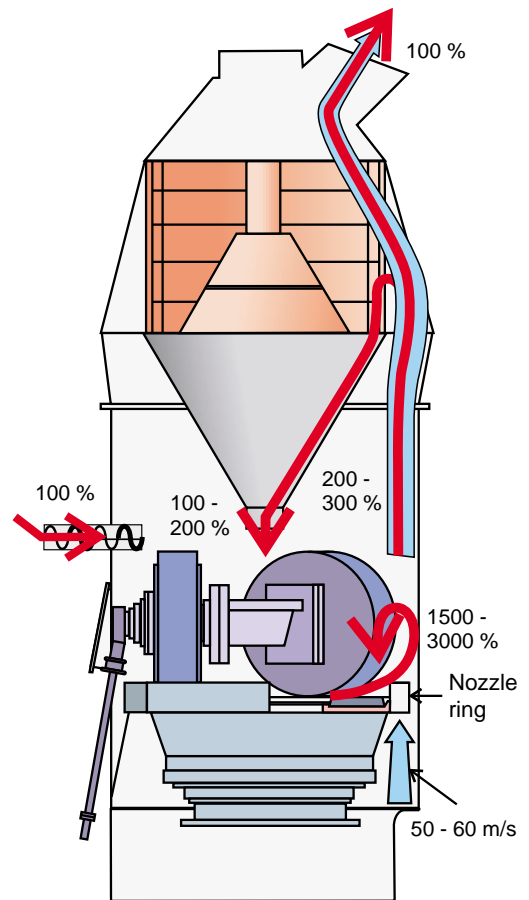
## Versatile system

The ATOX coal mill is suited for various installation types, whether inert or non-inert and direct or indirect firing systems. An inert system designed for indirect firing is the most common solution at cement plants. Equipped with the high-efficiency RAKM dynamic separator, the ATOX coal mill will grind any type of coal to the necessary fineness. The ATOX mill, if provided with a variable speed motor, will grind petcoke and anthracite down to a fineness below 5% +90  $\mu\text{m}$ .

Separator and nozzle ring are sized independently of the mill itself, and this makes it possible to select them according to the amount of gas needed for drying and conveying the material. The ATOX mill will grind and dry coal containing more than 20 per cent moisture in one operation.

## Working principles

The raw coal enters the mill via an airtight feed screw and is discharged onto the centre of the rotating grinding table. The



*Material circulation inside the mill.*

rotation of the table accelerates the flow of material towards the grinding track where the coal is ground between the table and the three rollers. The coal then continues over the dam ring and is entrained in the hot drying air that enters the mill house through the nozzle ring.

The air lifts the coarser particles back onto the grinding table and sweeps the finer particles up to the separator that lets the final product proceed to the mill outlet while returning the coarse fraction to the table for further grinding.

Having left the mill at the top, the final product continues with the air to a cyclone or a bag filter where it is collected.

## Layout

The layout of a coal grinding system must take into account the available heat sources for drying the raw coal as well as the fire and explosion hazards of coal and coal dust. The entire grinding plant must therefore be shock-resistant and equipped with a number of explosion relief valves.

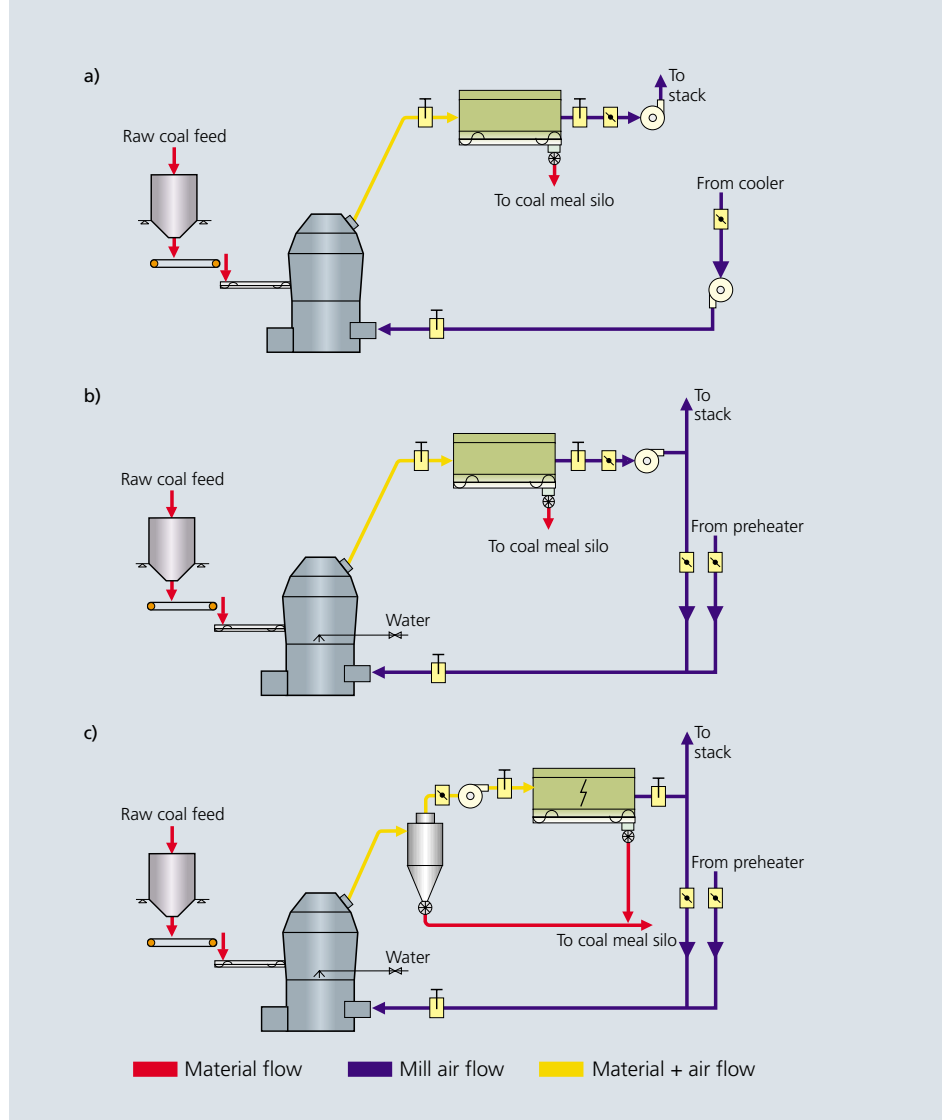
### Non-inert operation

When grinding low-explosive to moderately explosive coal types, the system may operate under non-inert conditions. Non-inert operation allows using excess air from the clinker cooler for drying and conveying purposes. No recirculation of air nor water injection in the mill is required, because atmospheric air can be used to maintain the necessary flow, independent of the amount of hot air needed for drying.

### Inert operation

A commonly adopted safety precaution is to operate the coal grinding system under inert conditions. At a cement plant this can be achieved by using exit gases from the kiln preheater to dry and convey the material through the mill. A variable amount of cleaned air can be recycled from the grinding system filter to maintain the required flow for separation and conveying through the mill, independent of the amount of hot air needed for drying.

The ATOX coal mill has a water injection system to compensate for a low water content in the raw coal, which allows increasing the amount of hot air instead of recircu-



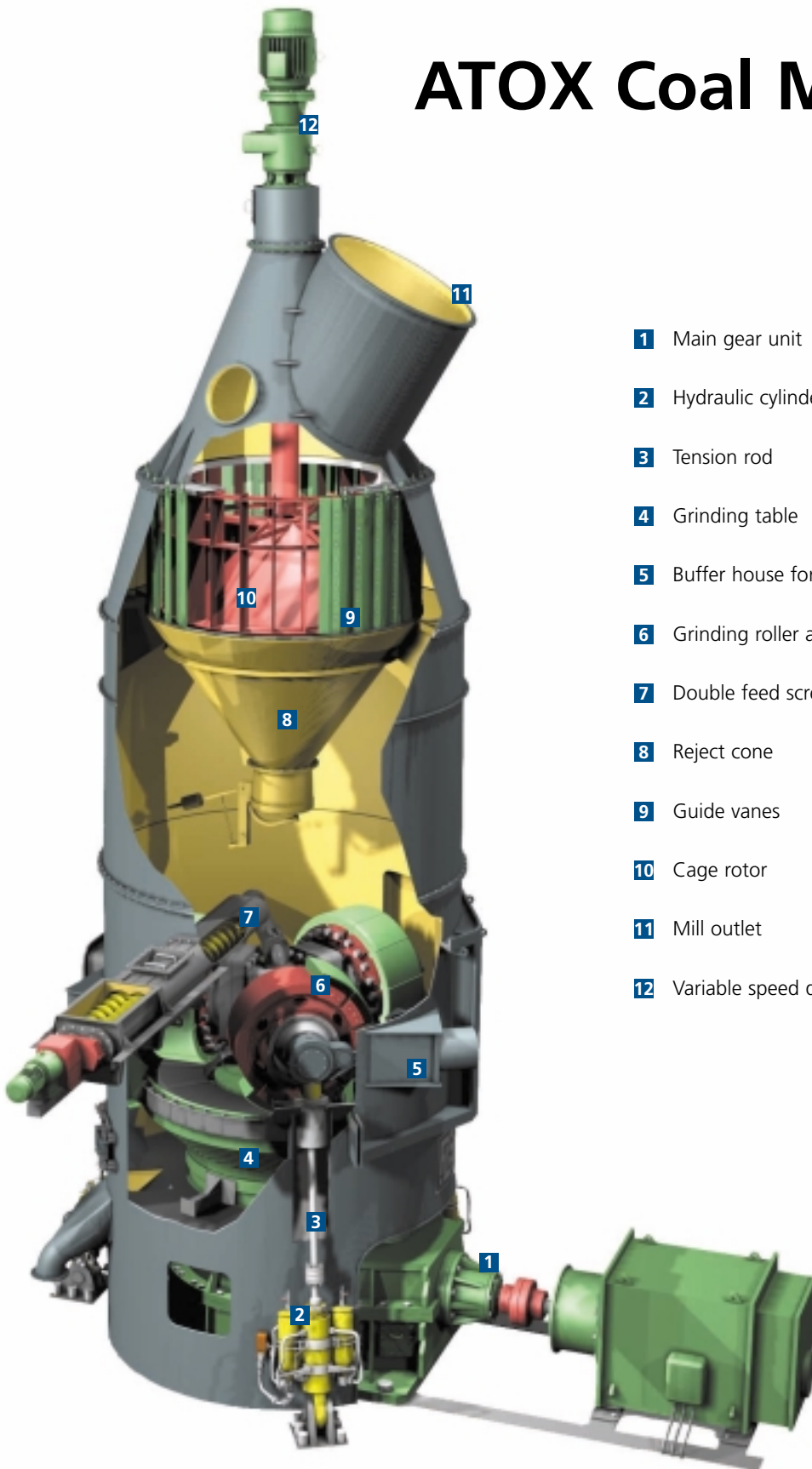
*Layout of a) non-inert, b) inert and c) inert system for handling highly explosive coals.*

lating air at a level that would invalidate the inert condition of the grinding system.

For most types of coal, the grinding system is arranged so that finish ground coal meal is collected in a bag filter or a cyclone followed by an electrostatic precipitator, before the cleaned air enters the mill fan. For more explosive types of coal such as lignite, the filter may be installed on the pressure side of the fan. This eliminates ingress of false air into the filter and keeps the level of oxygen in the filter and the recirculated air at a minimum.



# ATOX Coal Mill



- 1** Main gear unit
- 2** Hydraulic cylinder, incl. accumulators
- 3** Tension rod
- 4** Grinding table
- 5** Buffer house for torque rod
- 6** Grinding roller assembly
- 7** Double feed screw
- 8** Reject cone
- 9** Guide vanes
- 10** Cage rotor
- 11** Mill outlet
- 12** Variable speed drive for separator

# Mill design for long life and simple operation

Both the grinding table and rollers are fitted with segmented wear parts. Segmentation allows the use of very hard and wear-resistant material without running the risk of thermal cracks occurring in the wear segments. The cylindrical shape of the rollers makes it possible to reverse the segments, enabling a high degree of material utilization even in the case of uneven wear. Using wear-resistant, high-chromium white cast iron ensures long life of the grinding segments.

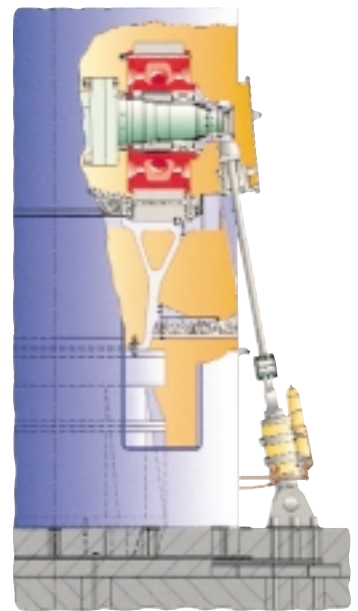
Hydraulic cylinders anchored in the foundation block generate the grinding force for the individual rollers. The hydraulic force is transferred to the ends of the roller shafts via tension rods. The joints of these rods are designed as prestressed bolted flanges which offer high resistance against fatigue failure.

The roller assembly is kept concentric with the table by means of horizontal torque rods connecting each roller shaft end to buffer houses in the mill casing via shock absorbers.

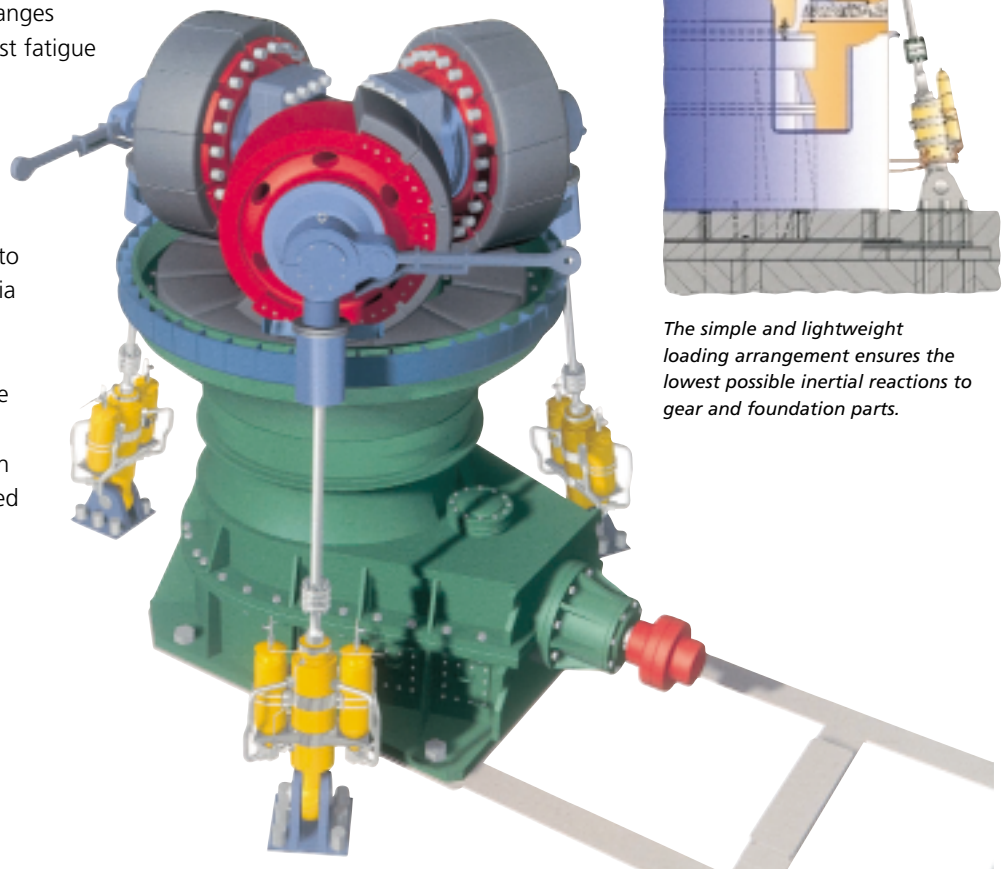
Before starting the mill motor, the rollers are lifted off the grinding track. When the mill fan has been running for a short while, mill feed is started and the rollers are lowered onto the grinding bed.

An oil circulation system effectively lubricates the bearings of the grinding rollers. Each roller is fed individually with conditioned oil from a common supply station in which a separate circulation system provides filtration and temperature conditioning. For most mill sizes a three-section flow divider ensures an equal flow of oil to each roller. Instead of the flow divider system, the largest coal mills have separate feed and suction pumps for each roller. High-temperature grease is used to lubricate the bearings of the smallest mill types.

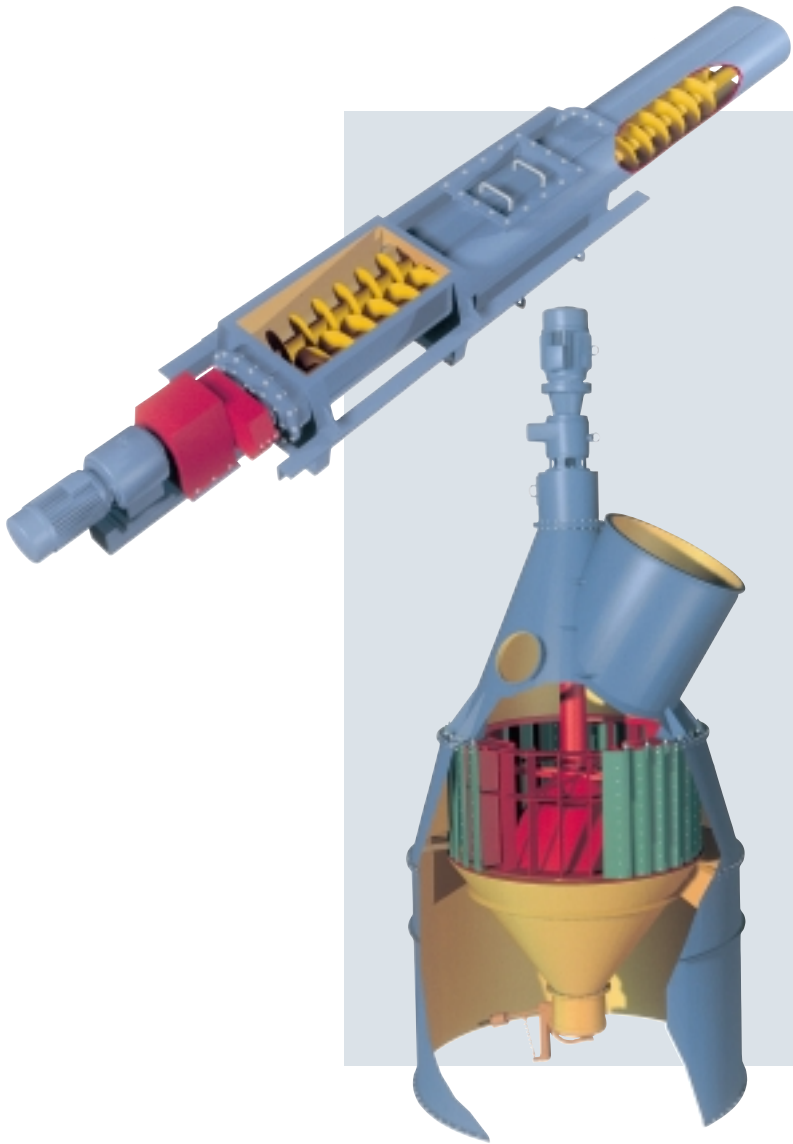
*Rollers with wear segments*



*The simple and lightweight loading arrangement ensures the lowest possible inertial reactions to gear and foundation parts.*



# High-performance units



## Feed arrangement

The raw coal enters the mill via a double feed screw that also serves as an air sluice. The double screw is specially designed to handle sticky material.

## RAKM rotary air separator

The rotary air separator is flanged to the top of the mill housing. The rotor shaft is driven by a variable-speed AC motor via a gear unit. The rotor runs inside a ring of guide vanes. The material entrained in the air from the mill enters the rotor through the guide vanes. The rotor rejects the coarse particles to be collected by the guide vanes and returned via the reject cone to the grinding table for further grinding, while the air and the finished material leave the separator via the outlet duct. The fineness of the ground product can be adjusted by varying the speed of the rotor.

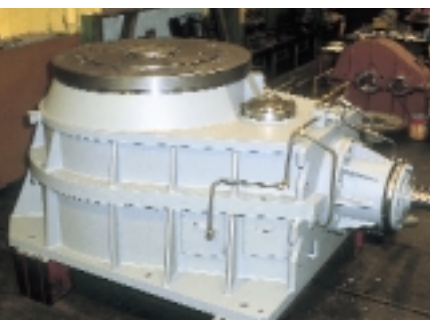
## High-performance gear unit

The standard main gear unit for an ATOX mill is of the sturdy bevel-helical or more compact bevel-planetary type supplied by MAAG Gear.

The gears are designed for high dynamic loads with a generous service factor. The axial thrust bearing supporting the grinding table and the grinding force is of the segmented design in which all thrust pads are immersed in an oil bath.

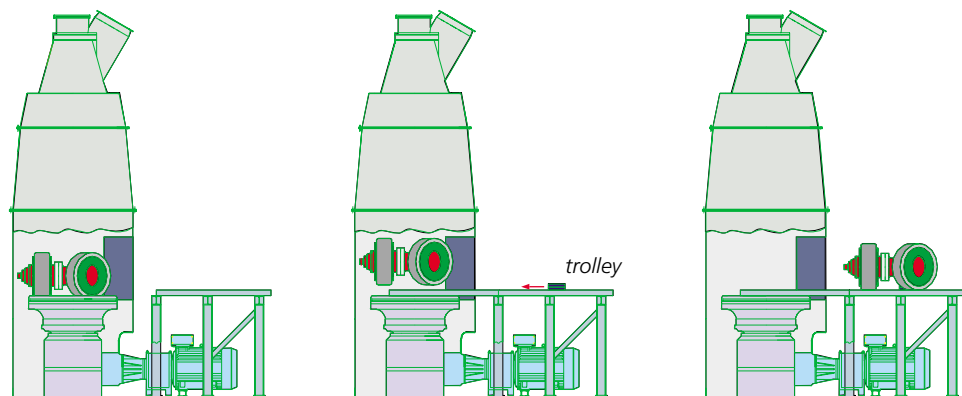
The lubricant for the thrust pads and for the internal gearings/bearings is conditioned and filtered in a separate pump station.

*Bevel-helical gear type*



*Bevel-planetary gear type*





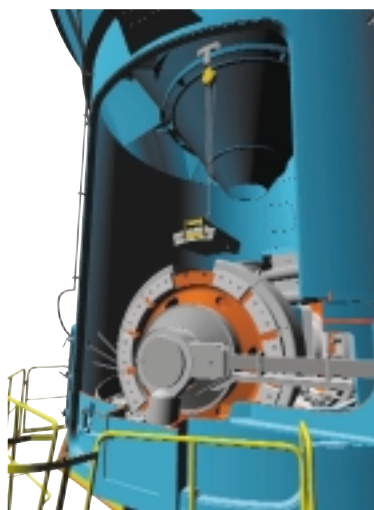
*Removal of roller assembly in small-size mills before changing segments.*

## Changing of wear segments

Changing of roller wear segments for smaller-size mills normally takes place outside the mill. The whole roller assembly is pulled out on a special trolley and serviced on the platform in front of the mill. In the case of bigger-size mills changing of roller and table segments is easily carried out inside the mill which is provided with a small hoist for that purpose.

## Sizing the Atox mill

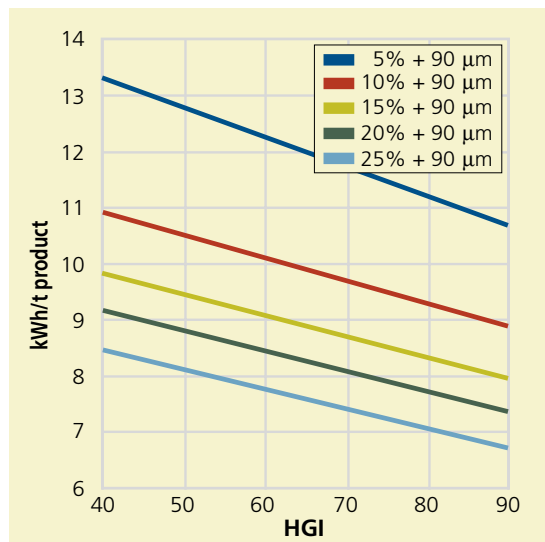
The specific energy consumption depends on the grindability of the raw coal and the coal meal fineness required.



*Changing of the wear segments in large-size mills.*

The grindability is usually specified according to the Hardgrove Grindability Index (HGI). The specific energy consumption of an ATOX coal mill based on the Hardgrove index is shown by the grindability diagram.

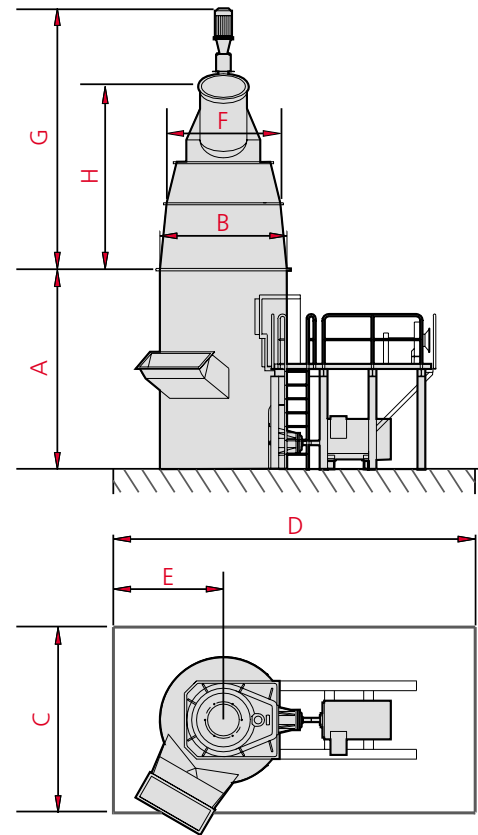
The specific energy consumption stated in the grindability diagram is based on the capacity including residual moisture in the coal meal. This is an important consideration for coal types such as lignite that are often produced with 8-12 per cent residual moisture.



*Atox coal mill sizing – Specific energy consumption.*

## Separator dimensions and characteristics

RAKM Separator	F mm	G mm	H mm	Max. speed r/min	Installed power kW
12.5	1850	4820	3050	436	10
13.5	1970	5140	3310	406	12
15.5	2200	6030	3880	356	16
17.5	2450	6410	4160	316	22
20.0	2920	7240	4550	250	31
22.5	3260	8010	5170	223	41
25.0	3600	8940	5750	201	54
27.5	3950	9610	6320	183	69
30.0	4510	10210	6960	160	95
32.5	4900	11090	7570	147	116
35.0	5200	12000	8390	141	140
37.5	5580	13230	9120	132	166



## Mill dimensions and characteristics

Atox Mill	A mm	B mm	C mm	D mm	E mm	Installed power kW	Table speed r/min
12.5	2800	1900	2800	5500	1600	93-106	50.1
13.5	3265	2100	3100	6100	1800	113-129	48.2
15.5	3610	2400	3450	6800	2000	159-182	45.0
17.5	4095	2600	3800	7400	2250	215-246	42.3
20.0	4450	2900	5000	7500	2500	300-343	39.6
22.5	4950	3250	5600	8600	3000	403-461	37.3
25.0	5335	3550	6000	9200	3000	524-599	35.4
27.5	5600	3900	6000	10000	3500	666-761	33.8
30.0	7500	4360	6600	10500	3500	828-946	32.3
32.5	8420	4694	7600	11300	3800	1011-1156	31.1

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