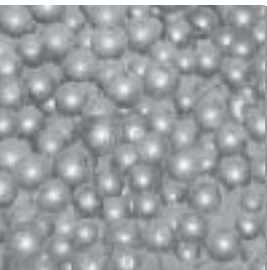




## BALL MILLS

- Low operation and maintenance cost
- High capacity
- Easy maintenance



# Ball mills



Ball mills are used for dry and wet grinding of different materials such as cement materials, cement, lime, and ceramic materials.

PSP Engineering has continuously refined the design of its ball mills. Horizontal ball mills have become a reliable part of grinding plants

## Main characteristics of ball mills seated on shoe-type bearings

- Low operation and maintenance cost
- High operating reliability
- High capacity
- Smaller built-up space in comparison with mills seated on trunnion bearings

## Mill internals:

- Face and peripheral armoring
- Partition diaphragm
- Outlet wall
- Grinding charge

Cement grinding plant with a  $\varnothing$  4.0 x 13.75 m mill seated on shoe-type bearings

## Ball mill structure

### Mill shell

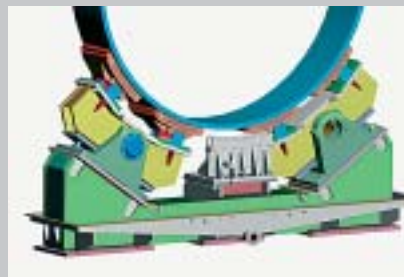
Segmented plates are bent and welded together. After welding the segments are annealed in order to relieve internal stress. The entire mill body is inspected by non-destructive testing. It is machined and bearing rings are ground with high accuracy.



### Mill seating

Shoe-type bearings with tilting segments seated on swinging balance beams are designed with hydraulic-dynamic lubrication. They perfectly fit the shape of the bearing rings.

Except for mills seated on shoe-type bearings PSP Engineering supplies also mills of a classic design seated on trunnion bearings.



### Mill drive

Mills are driven by a circumferential drive with a gearbox DMG 2 with two integrated pinions via a girth gear or with a gearbox, countershaft and one pinion for mills with a smaller diameter. An auxiliary drive is used for turning of the mill drum during maintenance.



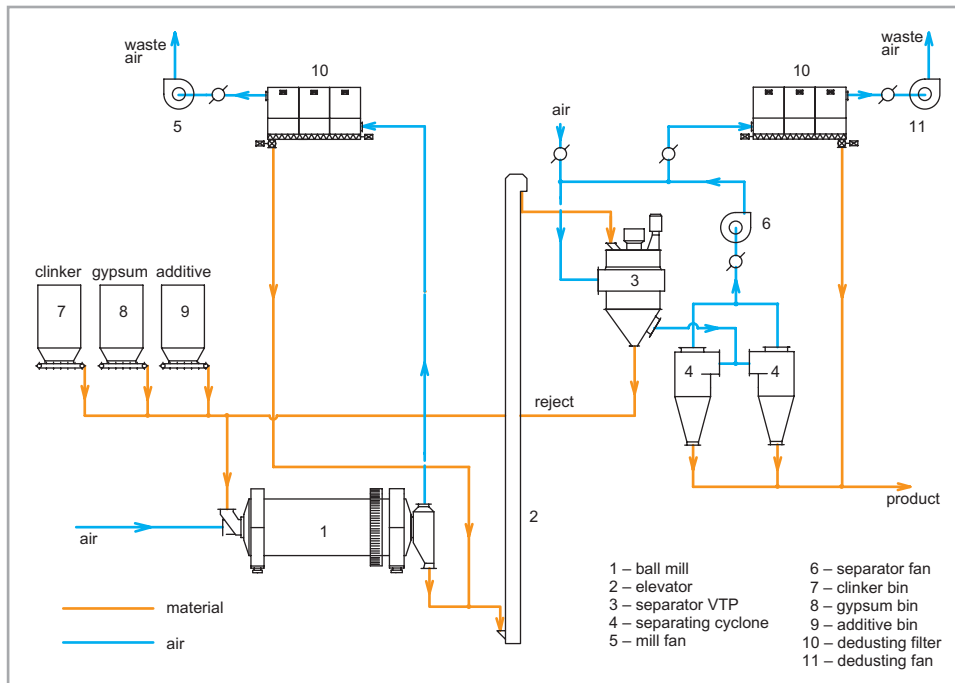
# Ball mills

## Two chamber cement mills

Two chamber mills are used for grinding cement, slag and similar materials. They are typically arranged in a circuit with high efficiency VTP separators. They grind materials up to 6500 cm<sup>2</sup>/g according to Blaine. The mill itself is equipped with a lifting armoring in the first chamber with larger balls with a high comminuting effect. The second chamber is equipped with classifying armoring using smaller balls for finish grinding.

The partition diaphragm is equipped with a controllable material flow so that both chambers maintain an optimum filling ratio.

Material from the second chamber is supplied to a separation circuit via an outlet wall. In case warmer materials are ground, water is sprayed into the second chamber or both chambers. In case the grinding circuit includes a roller press, single chamber mills with classifying armoring without a partition diaphragm are used.



Example of a flow sheet

## Range of two-chamber mills

Mill dia.	Length total	Speed	Installed power	Capacity
m	m	min <sup>-1</sup>	kW	th <sup>-1</sup>
3.4	11.0	17.2	1 600	45
3.6	11.5	16.7	1 900	55
3.8	12.0	16.3	2 300	65
4.0	12.5	15.9	2 700	75
4.2	13.0	15.5	3 200	90
4.4	14.0	15.1	3 800	105
4.6	14.5	14.8	4 400	125
4.8	15.0	14.5	5 000	145
5.0	15.5	14.2	5 700	165
5.2	16.0	13.9	6 500	185
5.4	17.0	13.6	7 500	215

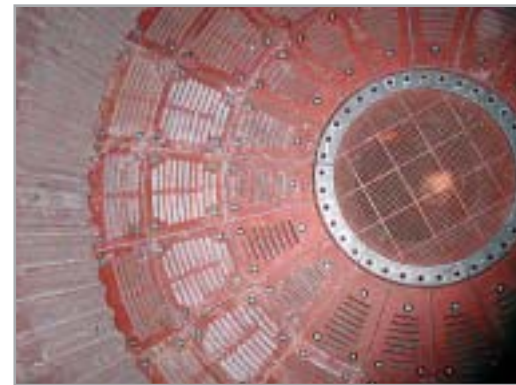
Mill design: Seating on shoe-type bearings, integral circumferential drive with a gearbox DMG2.

Product expected: Portland cement 42,5, with 3 200-3 300 Blaine.

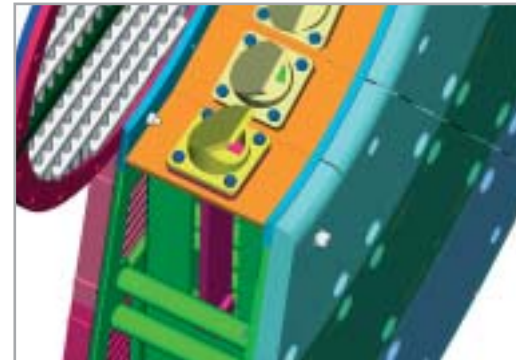
The capacity is based on a specific energy consumption 33 kWh<sup>t</sup><sup>-1</sup>.



Cement grinding with a Ø 4.0 x 13.75 m mill seated on shoe-type bearings



Armored outlet wall



3D model of a detail of the mill partition wall



Partition diaphragm with controllable material flow for both chambers

# Ball mills



## One- and two-chamber raw mills with a pre-drying chamber

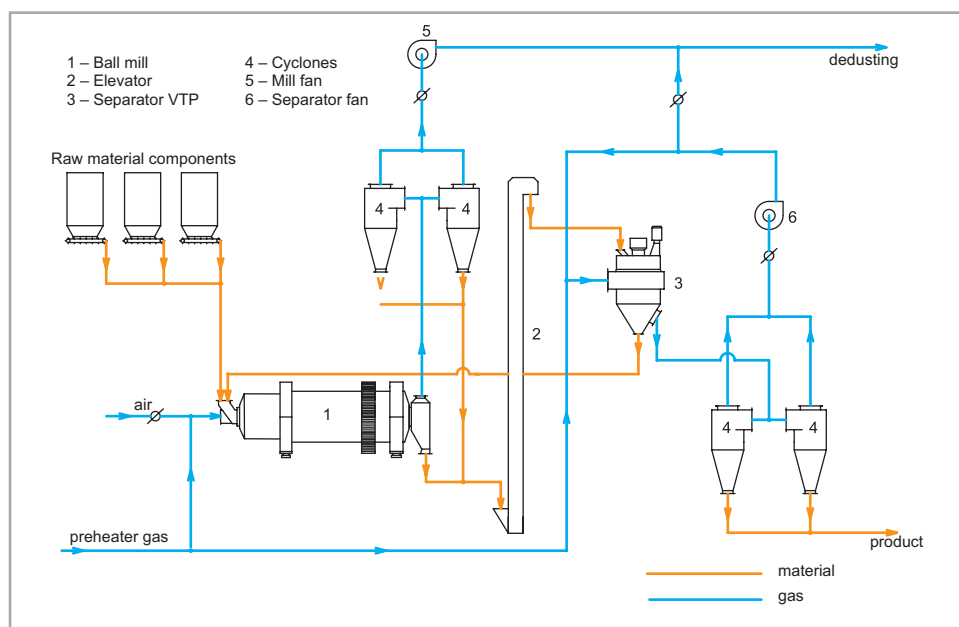
One- and two-chamber mills with a pre-drying chamber are used for grinding material for kiln lines. They are arranged in a circuit with a high efficiency VTP separator for simultaneous drying of raw materials with kiln gas or heat from the grate cooler. These circulating grinding plants are suitable for grinding and drying of materials with a moisture content of up to 8%. The outlet product, raw meal is ground to fineness 12÷14% R90 with a moisture content of 0.5%.

All components of the raw material are supplied to the pre-drying chamber where they are dried before they pass through a parting plane to the mill. The reject coarse material from the separator is taken to the mill inlet.

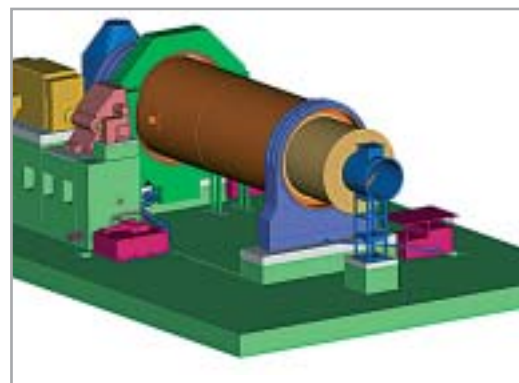
The seating and drives of the mill are similar to cement mills.



Assembly of a raw mill  $\varnothing$  5.4 x 11 m with pre-drying chamber



Example of a flow sheet of raw mill grinding circuit



3D model of a raw mill

## Range of raw mills with pre-drying chambers

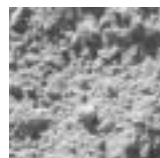
Mill dia.	Length	Drying chamber length	Grinding length	Speed	Installed power	Capacity
m	m	m	m	min <sup>-1</sup>	kW	th <sup>-1</sup>
3.6	11.0	2.0	9.0	16.7	1 600	70
3.8	11.5	2.0	9.5	16.3	1 900	85
4.0	12.5	2.5	10.0	15.9	2 200	100
4.2	13.0	2.5	10.5	15.5	2 600	120
4.4	13.5	2.5	11.0	15.1	3 100	140
4.6	14.5	3.0	11.5	14.8	3 600	165
4.8	15.0	3.0	12.0	14.5	4 200	190
5.0	15.5	3.0	12.5	14.2	4 800	220
5.2	16.0	3.0	13.0	13.9	5 400	250
5.4	16.5	3.0	13.5	13.6	6 200	285
5.6	17.0	3.0	14.0	13.4	7 000	320

Mill design: Seating on shoe-type bearings, integral circumferential drive with a gearbox DMG2. The capacity is based on a specific energy consumption of 20 kWh<sup>t</sup><sup>-1</sup>.



Raw mill  $\varnothing$  5.4 x 11 m with a pre-drying chamber

# Ball mills



## Pneumatic mills

Pneumatic mills are equipped with one grinding chamber with a pre-arranged drying chamber. The material supplied to the mill is ground and then taken by air to a high efficiency separator LTR. The final product is collected in cyclones or a filter.

Pneumatic mills are used for grinding and drying of very moist materials.

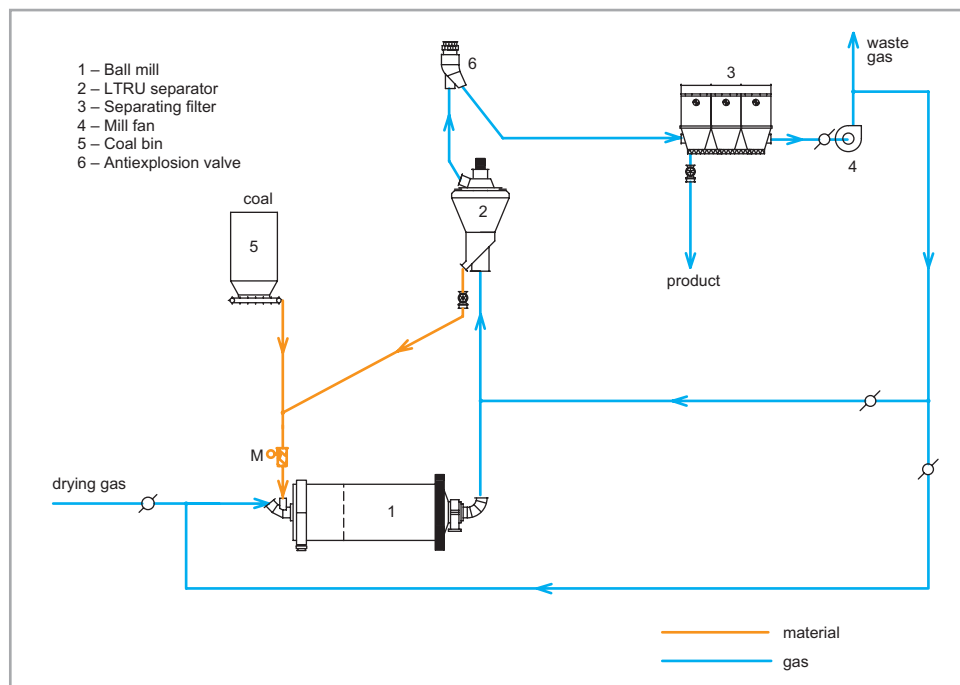
Drying is possible with a large volume and high temperature of the drying gas flowing through the drying chamber, mill and separator.

Pneumatic grinding plants are known for their simple design and reliability.

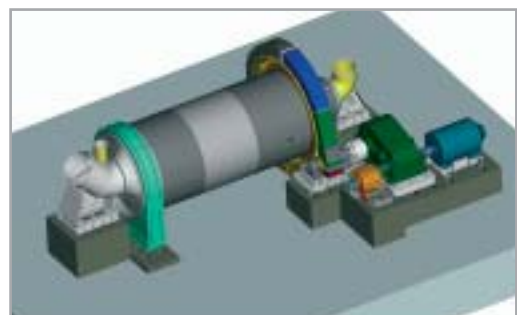
Pneumatic grinding plants are designed also for grinding of coal and petroleum coke in a circuit with a high efficiency separator LTR-U with a pressure drop of up to 3.5 bar.



*Pneumatic mill Ø 3.4 x 7 m for petcoke grinding*



*Example of flow sheet of pneumatic mill grinding circuit*



*3D model of a mill Ø 3.1 x 6.5 m for coal grinding in the pneumatic grinding plant*

## Mills seated on trunnion bearings

PSP Engineering has supplied a large number ball mills with a classic design seated on trunnion bearings



*Examples of cement mills seated on trunnion bearings.*



[www.pspengineering.cz](http://www.pspengineering.cz)

PSP Engineering a.s. is a leading supplier of specialized equipment and complete production plants for the building material and mineral processing industries. PSP Engineering has been involved in the design and construction of cement plants, lime works, quarry and crushing plants, as well as gravel and sand pits for more than 50 years.

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Grinding systems/Ball mills EN01/2005

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