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 conveyed to an air to an high efficiency separator, where the 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 designed for high efficiency of grinding and drying with a pressure drop of up to 3.5 bar.

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Grinding system/Ball mills EN 07/12

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Pneumatic mill Ø 3.4 x 7 m for petcoke grinding

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.

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, clinker, and similar materials.

Main characteristics of ball mills seated on shoe-type bearings
- Low operation and maintenance cost
- High grinding reliability
- High capacity
- Centrally fed and spaced in compliance with rings seated on suspension bearings.

PSP Engineering has continuously refined the design of its ball mills. A number of new improvements have become a reliable part of grinding plants.

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

Two chamber cement mills
Two chamber mills are used for grinding cement, clinker and similar materials. They are especially arranged in a circuit with high capacity Vertical Roller Preheaters. The grinding charge is added to the mill itself is equipped with a lifting arrangement for the first chamber with large balls with a high comminution effect. The second chamber is a fine grinding chamber with using smaller balls for fine grinding.

The partition diaphragm is equipped with a controllable material flow so that both, chamber number two and chamber number one can be used for turning of the mill drum during dry grinding.

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

Ball mill structure

Ball mill structure consists of various parts and sub-units, which together form a functional grinding unit.

Ball mill walls are bent and welded together. After welding the segments are ground with high accuracy.

The capacity is based on a specific energy consumption of 20 kWth.

Range of two-chamber mills

<table>
<thead>
<tr>
<th>Mill dia</th>
<th>Length</th>
<th>Speed</th>
<th>Installed power</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.8</td>
<td>11.0</td>
<td>17.2</td>
<td>1 800</td>
<td>42</td>
</tr>
<tr>
<td>4.6</td>
<td>16.0</td>
<td>14.3</td>
<td>2 500</td>
<td>56</td>
</tr>
<tr>
<td>5.6</td>
<td>20.0</td>
<td>13.8</td>
<td>3 200</td>
<td>66</td>
</tr>
<tr>
<td>6.6</td>
<td>25.0</td>
<td>13.8</td>
<td>4 800</td>
<td>125</td>
</tr>
<tr>
<td>7.6</td>
<td>30.0</td>
<td>14.2</td>
<td>6 500</td>
<td>175</td>
</tr>
<tr>
<td>8.6</td>
<td>39.0</td>
<td>13.8</td>
<td>8 500</td>
<td>255</td>
</tr>
</tbody>
</table>

Ball mill design is based on a DF4 or DF5 grinding charge with a grinding ball diameter of 150 mm. The capacity is based on a specific energy consumption of 20 kWth.

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

Shoe and two-chamber raw mills with a pre-drying chamber

Shoe and two-chamber raw mills with a pre-drying chamber are used for grinding material for raw mills. They are arranged in a circuit with a pre-drying chamber with a pre-drying line. The pre-drying line consists of a pre-drying mill, a mixer and a classifier for the pre-drying of the raw material mixture with air before the gyratory separator.

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

Range of raw mills with pre-drying chambers

<table>
<thead>
<tr>
<th>Mill dia</th>
<th>Length</th>
<th>Drying chamber length</th>
<th>Grinding charge</th>
<th>Speed</th>
<th>Installed power</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.8</td>
<td>2.5</td>
<td>14.0</td>
<td>2300</td>
<td>230</td>
<td>5 800</td>
<td>125</td>
</tr>
<tr>
<td>4.6</td>
<td>3.5</td>
<td>14.0</td>
<td>3 200</td>
<td>250</td>
<td>7 800</td>
<td>175</td>
</tr>
<tr>
<td>5.6</td>
<td>4.5</td>
<td>14.0</td>
<td>3 800</td>
<td>300</td>
<td>10 500</td>
<td>255</td>
</tr>
<tr>
<td>6.6</td>
<td>5.0</td>
<td>14.0</td>
<td>4 800</td>
<td>350</td>
<td>15 000</td>
<td>355</td>
</tr>
<tr>
<td>7.6</td>
<td>6.0</td>
<td>14.0</td>
<td>5 500</td>
<td>400</td>
<td>20 000</td>
<td>455</td>
</tr>
<tr>
<td>8.6</td>
<td>7.0</td>
<td>14.0</td>
<td>6 500</td>
<td>450</td>
<td>25 000</td>
<td>505</td>
</tr>
</tbody>
</table>

Mill design is based on a DF4 or DF5 grinding charge with a grinding ball diameter of 150 mm. The capacity is based on a specific energy consumption of 20 kWth.
Ball mills

Mill seats on shoe-type bearings

Cement grinding plant with a Ø 4.0 x 13.75 m mill seated on shoe-type bearings. The entire mill body is inspected and bearing rings are ground with high non-destructive testing. It is machined to relieve internal stress. The segments of the mill are annealed in order to relieve internal stress. Segmented plates are bent and welded together. After welding the segments are machined with hydraulic-dynamic lubrication. They perfectly

Main characteristics of ball mills seated on shoe-type bearings

- Low capital and maintenance cost
- High energy efficiency
- High capacity
- Low noise level
- Long service life
- Simple design

Ball mill shell

Mill seating

Mill drive

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

Main characteristics of ball mills seated on trunnion bearings

- High capacity
- High operating reliability
- Smaller built-up space in comparison with mills of a classic design seated on swinging balance beams

Two chamber cement mills

Two chamber mills are used for grinding cement, lime, and ceramic materials. They are typically arranged in a circuit with high capacity and high operating reliability. The first chamber is equipped with a lifting armor in the form of a slotted plate with a high contact Rolling effect. The second chamber is equipped with a lifting armor in the form of flat plates. Mill design: Seating on shoe-type bearings, integral circumferential drive with a gearbox DMG2.

Main characteristics of ball mills seated on trunnion bearings

- High operating reliability
- Smaller built-up space in comparison with mills of a classic design seated on swinging balance beams

Shoe-type bearings with tilting segments

Shoe-type bearings with tilting segments are designed with hydraulic-dynamic lubrication. They perfectly fit the shape of the segment. Except for mills seated on shoe-type bearings PSP Engineering supplies own designs of a classic design based on trunnion bearings.

Range of two-chamber mills

<table>
<thead>
<tr>
<th>Mill dia.</th>
<th>Length</th>
<th>Speed</th>
<th>Installed power</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.8</td>
<td>17.0</td>
<td>17.0</td>
<td>1000</td>
<td>45</td>
</tr>
<tr>
<td>5.0</td>
<td>18.0</td>
<td>18.0</td>
<td>1000</td>
<td>50</td>
</tr>
<tr>
<td>5.2</td>
<td>12.0</td>
<td>20.0</td>
<td>300</td>
<td>25</td>
</tr>
<tr>
<td>5.4</td>
<td>12.5</td>
<td>22.5</td>
<td>300</td>
<td>28</td>
</tr>
<tr>
<td>5.6</td>
<td>14.0</td>
<td>24.0</td>
<td>400</td>
<td>35</td>
</tr>
<tr>
<td>5.8</td>
<td>16.0</td>
<td>26.0</td>
<td>600</td>
<td>45</td>
</tr>
<tr>
<td>6.0</td>
<td>18.0</td>
<td>27.5</td>
<td>800</td>
<td>50</td>
</tr>
<tr>
<td>6.2</td>
<td>20.0</td>
<td>29.0</td>
<td>900</td>
<td>60</td>
</tr>
<tr>
<td>6.4</td>
<td>22.0</td>
<td>31.0</td>
<td>1100</td>
<td>70</td>
</tr>
</tbody>
</table>

All components of the raw material are supplied to the pre-grinding chamber via a grate cooler. The capacity is based on a specific energy consumption of 35 kWh.

Range of new rolls with pre-drying chambers

<table>
<thead>
<tr>
<th>Mill dia.</th>
<th>Length</th>
<th>Driving</th>
<th>Grinding</th>
<th>Installed</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0</td>
<td>13.0</td>
<td>4.0</td>
<td>12.0</td>
<td>1900</td>
<td>50</td>
</tr>
<tr>
<td>5.2</td>
<td>13.5</td>
<td>4.5</td>
<td>12.5</td>
<td>1950</td>
<td>55</td>
</tr>
<tr>
<td>5.4</td>
<td>14.0</td>
<td>5.0</td>
<td>13.0</td>
<td>2000</td>
<td>60</td>
</tr>
<tr>
<td>5.6</td>
<td>14.5</td>
<td>5.5</td>
<td>13.5</td>
<td>2200</td>
<td>70</td>
</tr>
<tr>
<td>5.8</td>
<td>15.0</td>
<td>6.0</td>
<td>14.0</td>
<td>2500</td>
<td>80</td>
</tr>
<tr>
<td>6.0</td>
<td>15.5</td>
<td>6.5</td>
<td>14.5</td>
<td>2700</td>
<td>90</td>
</tr>
</tbody>
</table>

All components of the raw material are supplied to the pre-grinding chamber via a grate cooler. The capacity is based on a specific energy consumption of 35 kWh.
Mill rolling is used for dry and wet grinding of different materials such as cement, lime, and similar material.

Main characteristics of ball mills seated on shoe-type bearings:
- Low commissioning and maintenance cost
- High grinding media mobility
- High capacity
- Smooth running of the mill body in compliance with the shoe bearings or bearing rings.

PSM Engineering has continuously refined the design of its ball mills. Integral sun rolls have become a reliable part of grinding plants.

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. The grinding chambers are equipped with grinding media and are lined with cast steel liners. The second chamber is equipped with a lifting armoring in the form of corrugated lining or with a lifting armoring board. The partition diaphragm is equipped with a control plate made of cast steel, chamber’s members or cast steel lining to allow the classifier to circulate the material back to the first chamber when necessary. The entire mill body is inspected before welding the segments.

Except for mills seated on shoe-type bearings PSP Engineering supplies mills of a classic design seated on trunnion bearings. Also mills of a classic design seated on swinging balance beams are designed with hydraulic-dynamic support. The sealing and drives of the mill are similar to cement mills.

Ball mills

- High capacity
- Low operation and maintenance cost
- Smaller built-up space in comparison with traditional plants
- Lower energy consumption

One-and two-chamber raw mills with a pre-drying chamber:
One-and two-chamber raw mills with a pre-drying chamber can be used for grinding material for raw mills. They are arranged in a circuit with a girth gear or with a gearbox, with two pinions or with one pinion. Pinions are driven by a circumferential drive with a gearbox DMG2. The seating and drives of the mill are similar to cement mills.

Mill design:
Mill dia. Length total Speed Installed power Capacity
---
3.4 11.0 2.0 9.0 16.7 1 600 70
3.6 11.5 2.0 9.5 16.3 1 900 85
3.8 12.5 2.5 8.0 15.1 2 200 105
4.0 13.0 2.5 8.0 15.1 2 200 105
4.4 13.5 2.5 10.0 15.9 3 600 165
5.0 15.0 3.0 12.0 14.5 6 200 200
6.0 17.0 3.0 12.0 14.5 6 200 200
7.0 21.0 3.0 12.0 14.5 6 200 200

---
Drying and grinding of raw materials takes place in two-chamber mills. Gypsum and similar materials are conveyed to the second chamber or both chambers. In case the grinding circuit includes a roller press, the outlet product, raw meal is ground to a fineness of 0.5%.

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VTP separator for simultaneous grinding and drying of raw materials.

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The capacity is based on specific energy consumption of 20 kWht-1.

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Mill design: Seating on shoe-type bearings, integral circumferential drive with a gearbox DMG2. The capacity is based on specific energy consumption of 20 kWht-1.
Ball mills

Pneumatic mills

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

Pneumatic mills are equipped with a pre-grinding chamber with a pneumo-sealed drying chamber. The material supplied to the mill is ground and then taken by air to a high-efficiency separator and 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 designed 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.

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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**Example of flow sheet of pneumatic mill grinding circuit**

**Pneumatic grinding plants** are known for their simple design and reliability. They can be used 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.

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