Solutions for Wear Protection in Power Plants
Reduce Costs and Avoid Downtime

Kalenborn offers a complete array of wear protection materials

Large quantities of bulk material are handled in the conveying and storing systems of coal fired power plants. Unless they are suitably protected these systems will experience frequent failure, requiring repair or replacement. Kalenborn offers a complete array of wear protection materials, including not only ceramic and metallic materials, but also plastics and rubber.

In addition, Kalenborn has extensive experience in the field of slide promotion. Interruptions of material flow inside of bunkers and silos must be avoided. We can supply you a tailor-made solution for your particular problem from the entire material range of plastics as well as metallic and ceramic materials. Our experts are prepared to assist.

Advantages of Lining Materials:

Ceramic Wear Protection
- Very good abrasion resistance
- Tile, cylindrical or jointless lining
- Temperatures up to 1,000 °C/1,832 °F

Metallic Wear Protection
- Good resistance against sliding and impact wear
- Thin walls, self-supporting structures
- Good thermal shock resistance

Technical Plastic Lining
- Excellent slide promotion for many application
- Good resistance against impact wear
- Low weight

Material Combinations
- Optimal wear protection for every application
- Optimized lining cost
- Optimized weight

A typical application in power plants is pulverized fuel piping.

Pipes, Components and Service

Optimal solutions for every plant component

Plant components are a risk in all power plant systems, especially in coal storage and coal transport. This includes coal pulverizing and injection into the boiler, dust collection and ash removal including fly ash and wet ash. The situation is similar for limestone and gypsum handling systems.

Service life of many years is often achieved with the following materials:
- ABRESIST fused cast basalt
- KALCOR zirconium corundum
- KALCOR S sintered zirconium corundum
- KALOCER high alumina ceramics
- KALCERAM hard ceramics
- KALCRET hard compound
- KALSLICA silicon carbide ceramics
- KALCAST hard casting
- KALMETALL hard overlay welding
- KALEN slide promotion plastics

In addition, material combinations have been very successful in practice. They enable both technically and economically optimal solutions.

<table>
<thead>
<tr>
<th>Components</th>
<th>Lining Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyclones</td>
<td>ABRESIST, KALCOR, KALOCER, KALSICA, KALMETALL</td>
</tr>
<tr>
<td>Fan housings</td>
<td>KALOCER, KALCRET, KALMETALL, KALCAST</td>
</tr>
<tr>
<td>Fan rotors</td>
<td>KALOCER, KALMETALL</td>
</tr>
<tr>
<td>Gates</td>
<td>KALOCER, KALCOR, KALSICA, KALMETALL, KALCRET</td>
</tr>
<tr>
<td>Hydraulic pipes</td>
<td>ABRESIST, KALCOR, KALOCER, KALCRET</td>
</tr>
<tr>
<td>Mechanical pipes</td>
<td>ABRESIST, KALCOR, KALCRET, KALMETALL, KALCAST</td>
</tr>
<tr>
<td>Nozzles</td>
<td>KALOCER, KALSICA</td>
</tr>
<tr>
<td>Pneumatic pipes</td>
<td>ABRESIST, KALCOR, KALOCER, KALCRET</td>
</tr>
<tr>
<td>Pumps</td>
<td>KALSICA</td>
</tr>
<tr>
<td>Separators</td>
<td>ABRESIST, KALCOR, KALOCER, KALSICA, KALMETALL</td>
</tr>
<tr>
<td>Transfer chutes</td>
<td>ABRESIST, KALCOR, KALMETALL</td>
</tr>
<tr>
<td>Valves and fittings</td>
<td>KALOCER</td>
</tr>
</tbody>
</table>
Typical applications for wear protection

Coal transfer equipment is protected with ABRESIST fused cast basalt or KALOCER high alumina ceramics (example: Philippines).

Impact coal pulverizers operate in lignite fired power plants; the impact plates are made of KALMETALL W100.

Kalenborn also supplies grinding rolls and grinding tables for coal pulverizing; the picture on the left shows regeneration of a worn grinding roll with KALMETALL W100; the cast grinding roll made of KALCAST C155 on the right is a new piece.

With references all over the world, ABRESIST fused cast basalt is time-tested wear protection material for separators set up in coal pulverizing systems.

Separators are frequently protected by KALMETALL hard overlay welding or by KALCRET hard compound (pictures) installed without joints.

Pulverized coal burner made with parts of KALMETALL W100 hard overlay welding ready for installation.

Weight saving design of a separator cage with KALSICA A silicon carbide ceramics; alternative linings are KALMETALL and KALOCER tiles.

Housing of a pulverized coal fan protected with KALMETALL W100.
Solutions for wear protection in power stations

### Storage of Raw Materials

- **Stacker/Reclaimer**
  - Bucket wheel, transfer chutes, bunkers
  - Lining materials: KALMETALL, KALOCER, ABRESIST, KALEN

- **Conveyor belt**
  - Housings, chutes, transfer chutes
  - Lining materials: KALMETALL, KALOCER, KALEN, KALCAST

### Coal Grinding and De-ashing

- **Coal bunks**
  - Transfer chutes, crushers, sifters
  - Lining materials: KALEN, ABRESIST, KALMETALL, KALOCER, KALCAST

- **Coal grinding mill**
  - Vertical mills, ball/pebble mills, separators, cyclones
  - Lining materials: KALMETALL, KALCAST, ABRESIST, KALCRET, KALOCER

- **Boilers**
  - Pulverised coal lines, burners
  - Lining materials: KALMETALL, KALCAST, ABRESIST, KALCRET, KALOCER, KALSICA

- **Wet deslagger**
  - Drop shafts, transfer chutes
  - Lining materials: ABRESIST, KALOCER, KALCRET, KALMETALL

- **Bottom ash silos**
  - Mixers, hydraulic bottom ash piping
  - Lining materials: ABRESIST, KALOCER, KALCRET, KALMETALL

- **Flue gas coolers**
  - Ducts, heat exchangers
  - Lining materials: KALCRET, KALCOR, KALSICA

- **Filters**
  - Pneumatic fly ash piping
  - Lining materials: ABRESIST, KALOCER, KALCOR

- **Fly ash silos**
  - Discharge equipment, injectors
  - Lining materials: KALEN, KALCERM, ABRESIST, KALOCER, KALCOR

### Flue Gas Desulphurisation Plant

- **Limestone mills**
  - Raw material bunks, transfer chutes
  - Lining materials: KALEN, KALCERM, ABRESIST, KALCAST, KALMETALL

- **Limestone silos**
  - Transfer chutes
  - Lining materials: KALEN, KALCERM, ABRESIST

- **Mixers**
  - Pumps, hydraulic conveyor piping
  - Lining materials: ABRESIST, KALOCER, KALCRET, KALCAST, KALMETALL

- **Gypsum silos**
  - Chain conveyors, Transfer chutes
  - Lining materials: KALEN, ABRESIST, KALOCER, KALCRET, KALMETALL
Kalenborn offers a complete range of solutions for PF-pipe. With diameters between 400 and 800 mm many possible combinations of linings have been used in practice. Depending on the specific operating conditions (such as particle size, ash content, capacity to be conveyed and transport velocity) successful designs have achieved service lifetimes of more than 10 years.

Jointless lining with KALCRET hard compound – also possible with asymmetric cross section.

Material combinations of KALCOR and ABRESIST provide economic wear solutions.

KALCAST zirconium corundum lining and unlined transition elements; 488 mm diameter.

Lining of an infed coal pulverizer with KALCAST.

KALCOR S allows the use of large lining segments, thin walls and homogeneous structure.

Long lifetimes at favorable costs are achieved with KALCAST hard casting; this example shows 518 mm diameter bends up to 700 kg weight.

KALMETALL hard overlay welding enables the production of self-supporting structures for PF-bends without an additional lining.

PF-bends typical solution: KALOCER high alumina ceramics pipe tiles.

PF-distribution boxes protected with KALCOR for large area lining and KALOCER to ensure maximum wear resistance.

PF-splitter made of KALSICA N silicon carbide ceramics.

PF-burner lined with KALMETALL.
**Ash Handling & Flue-Gas Desulphurization**

**Wear protection in power plants**

When particularly high dust loads occur, the waste gas ducts are protected by KALCRET hard compound or KALMETALL hard overlay welding.

Solution adopted for economizers handling large dust quantities: tube protecting shapes made of KALSICA silicon carbide ceramics.

Chain conveyors for wet ash removal are efficiently lined with ABRESIST fused cast basalt; KALCOR, KALOCER or KALMETALL can be used as well.

Time-tested materials for fly ash pipes: ABRESIST, KALCOR or KALOCER.

Limestone may have a very abrasive effect in FGD systems; a typical lining material is ABRESIST.

**Specialist in Wet Ash Pipes**

Kalenborn has supplied many thousands of meters of wet ash pipes to plants all over the world, normally lined with ABRESIST fused cast basalt. This material has proved to be an excellent choice for this particular application. ABRESIST combines the properties of high wear resistance and high corrosion resistance. The service lifetimes of these piping systems frequently cover more than 20 years. There is no other material that has reached similar service life in practice.

We offer wet ash pipes of many different configurations with inside diameters between 200 and 500 mm. The steel casing can also be efficiently protected against corrosion. The pipes are usually joined by flanges. However, any type of coupling is feasible. In addition, welded joints also have proven successful in practice.

Wet ash pipes in North America; the pipes are flanged together.

Installation of wet ash pipes in Malaysia (350 mm diameter).

Long pipes require the use of expansion joints for linear extension.

Pipes for several units running to the central disposal site in Brazil.

Installation of wet ash pipes in Malaysia (350 mm diameter).
# Wear Resistant Linings

<table>
<thead>
<tr>
<th>Lining</th>
<th>Material Hardness</th>
<th>Process Parameters</th>
<th>Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mohs</td>
<td>Vickers HV 1</td>
<td>Max. Max.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>conveying</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>speed m/sec.</td>
</tr>
<tr>
<td>ABRESIST fused cast basal</td>
<td>8</td>
<td>770</td>
<td>20</td>
</tr>
<tr>
<td>KALOCER high alumina ceramics</td>
<td>9</td>
<td>1,050</td>
<td>30</td>
</tr>
<tr>
<td>KALCOR zirconium corundum</td>
<td>9</td>
<td>900</td>
<td>30</td>
</tr>
<tr>
<td>KALCOR S sintered zirconium corundum</td>
<td>9</td>
<td>970</td>
<td>25</td>
</tr>
<tr>
<td>KALSICA N silicon carbide ceramics</td>
<td>9</td>
<td>1,100</td>
<td>25</td>
</tr>
<tr>
<td>KALSICA S silicon carbide ceramics</td>
<td>9</td>
<td>1,600</td>
<td>35</td>
</tr>
<tr>
<td>KALCRET hard compound</td>
<td>8</td>
<td>1,250 *</td>
<td>20</td>
</tr>
<tr>
<td>KALMETALL.W100 hard overlay welding</td>
<td>7</td>
<td>700</td>
<td>20</td>
</tr>
<tr>
<td>KALCAST C155 hard casting</td>
<td>7</td>
<td>700</td>
<td>20</td>
</tr>
</tbody>
</table>

* referred to the hard aggregate material

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# Slide Promotion Linings

<table>
<thead>
<tr>
<th>Lining</th>
<th>Slide Promotion</th>
<th>Max. Temperature</th>
<th>Wear Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>KALEN slide promotion plastics</td>
<td>++++</td>
<td>80 176</td>
<td>+</td>
</tr>
<tr>
<td>KALCERAM hard ceramic</td>
<td>+++</td>
<td>350 662</td>
<td>++</td>
</tr>
<tr>
<td>ABRESIST fused cast basalt</td>
<td>+++</td>
<td>350 662</td>
<td>+++</td>
</tr>
</tbody>
</table>

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