

## Time-tested grinding principle

The grinding cylinders which are made to perform almost circular movements by the effect of the unbalanced weights, are normally filled with grinding media to 65 vol % by weight. The grinding media are subject to impact pulses transferred by the cylinder walls which results in reducing the mill feed.

In general, reduction by impact forces is predominant in a PALLA® vibrating mill but not that by friction. The ratio of these forces can be influenced by a suitable selection of grinding media, speed and vibrating circle diameter.

The material passes the cylinder along a helical path with transportation being primarily a result of displacement. Due to the effect of vibration, the material is directed to the outlet even without new feed material being admitted into the mill. Therefore, the mill can be run empty, e. g. for changing the kind of feed. The continuous revolving of material yields a particularly intensive mixing and homogenizing.

*2 PALLA® 65 U mounted on a vibrating isolated concrete foundation*



## Examples from the practice

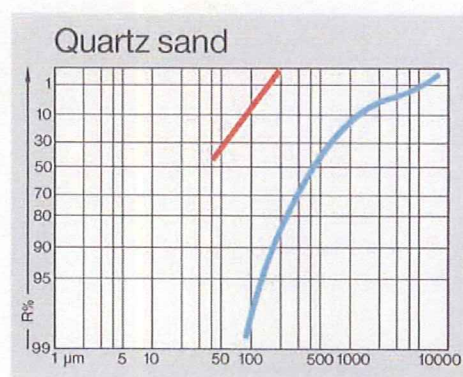
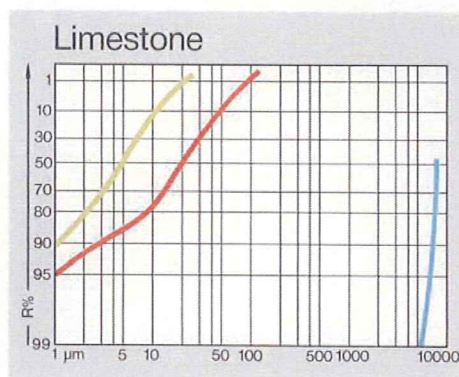
The PALLA® vibrating mill has a wide application for process-engineering duties. The fact that our vibrating mills are operated in more than 50 countries for treating more than 100 different materials furnishes proof of their versatility.

Hardness and grindability may be subject to strong fluctuations even if the material originates from the same deposit. Hence, the values quoted for the examples are applicable only to that specific duty. They may only be considered indicative for other applications.

— feed  
— ground material  
— finished product discharged from the separator

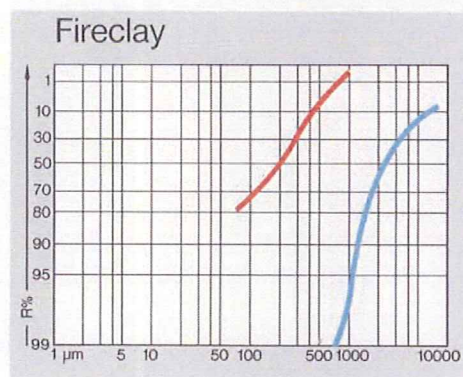
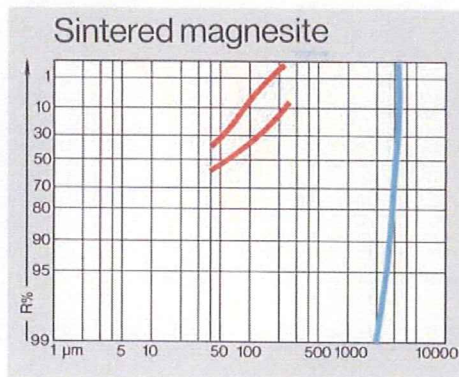
### Non-metallic minerals, cement

anhydrite, burnt lime, diabase, dolomite, gypsum, greenstone, limestone, quartz sand, cement, zirconium sand etc.



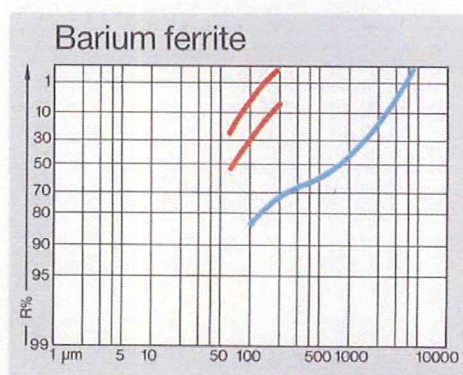
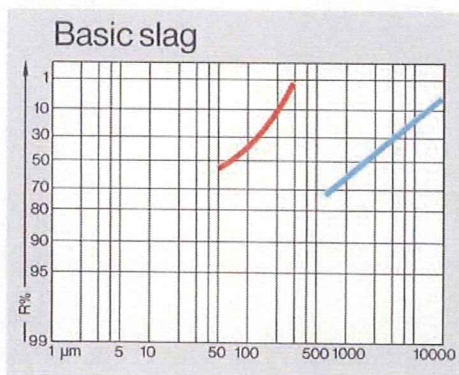
### Ceramics refractories

bauxite, feldspar, fritte, kaolin, ceramic compounds, sillimanite, fireclay, sintered dolomite, sintered magnesite, wall tiling compound, etc.



### Ore dressing, metallurgy, glass

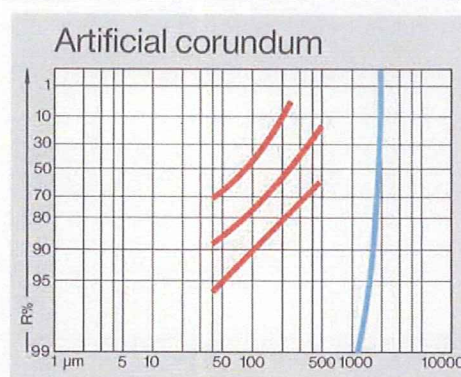
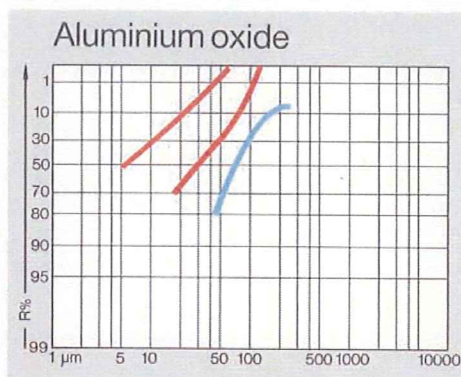
barium ferrite, black wad, chromium ore, iron oxide, fluor spar, Co-Ni speiss, slags, cobalt sulfate, cryolite, zinc oxide, etc.





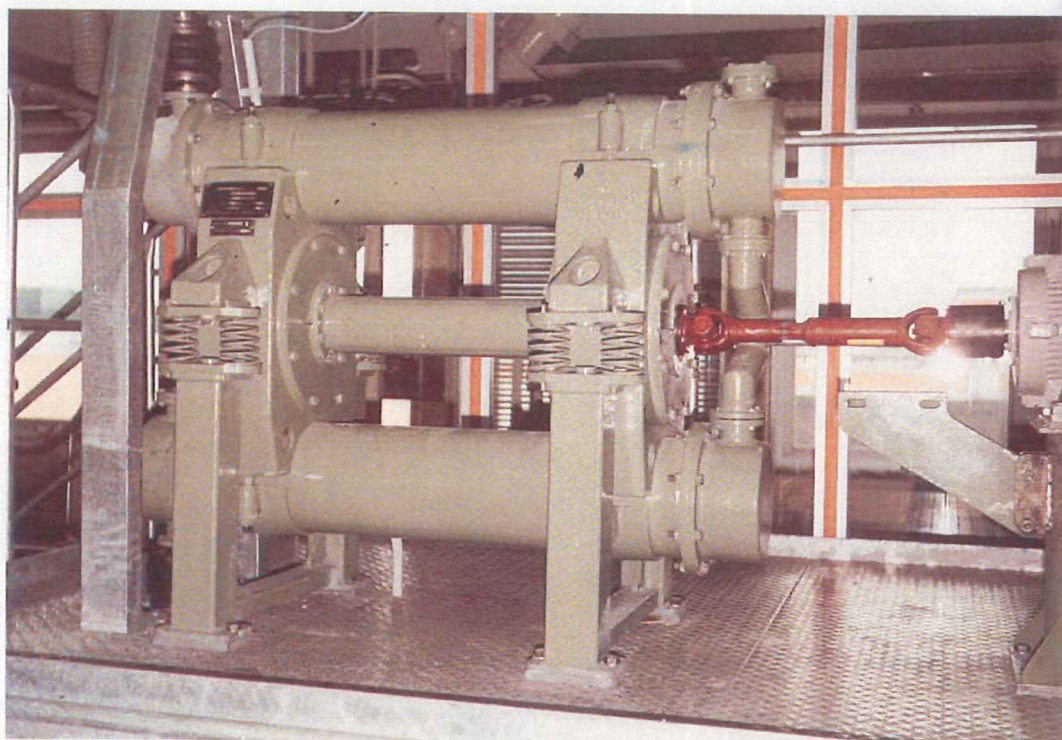
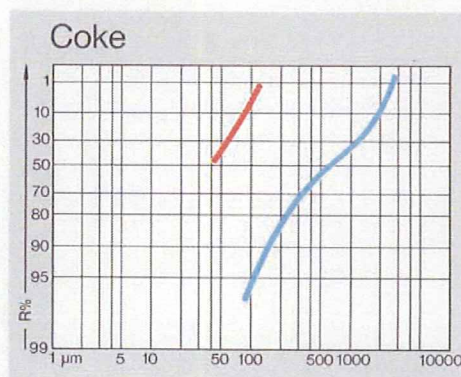
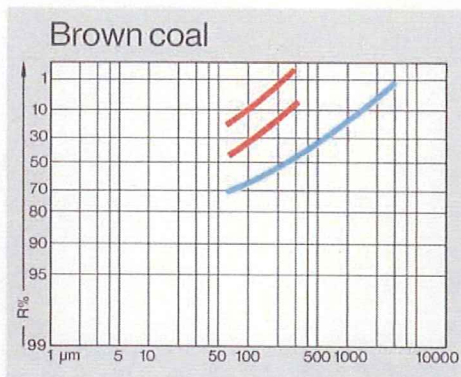
## Abrasives

aluminium oxide, artificial corundum, glass, corundum, alumina, emery, silicon carbide, etc.



## Chemical industry, coal, coke

electrode paste, pigments, ion exchange compound, calcium carbide, coke dross, plastics moulding compound, calcium cyanide, petroleum coke, herbicides, pit coal, etc.





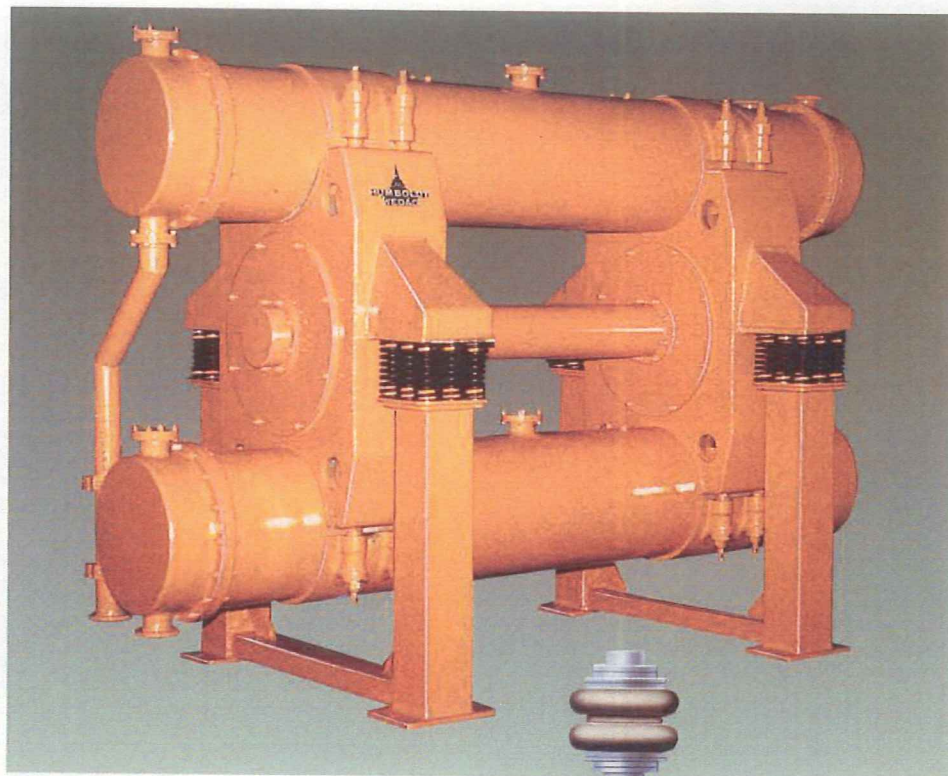
# The PALLA® vibrating mill

In view of its wide range of application, the HUMBOLDT WEDAG PALLA® vibrating mill offers itself for solving most versatile problems of grinding. It is used for dry and wet secondary grinding and pulverizing of materials of any hardness. It permits continuous and intermittent operation. Grinding can be carried out at excess or negative pressure, as well as in an atmosphere of inert, protective or reaction gas.

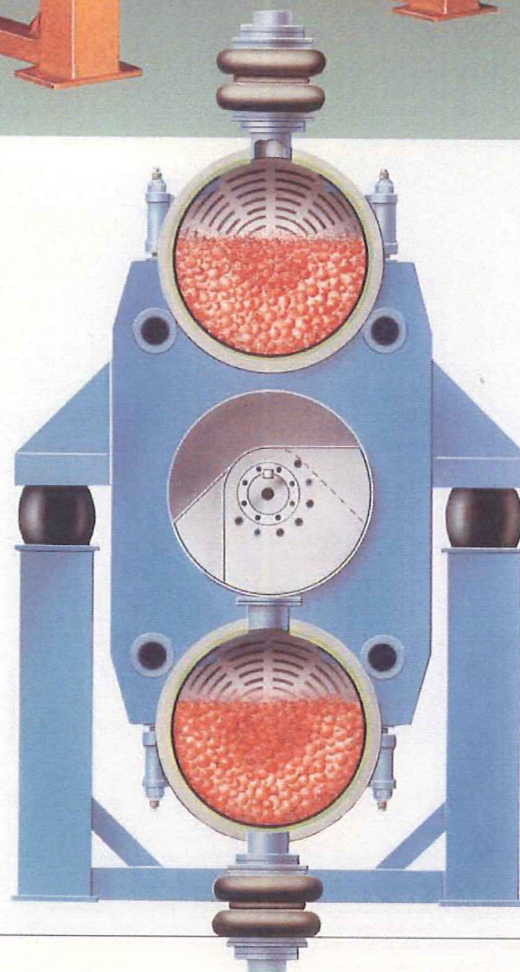
The maximum feed size is an edge length of approximately 30 mm. Depending on the feed characteristics, product sizes of less than 5 microns can be attained. Subject to the specific duty, throughputs from 20 kg/h up to 20 tons/h can be realized with the different machine sizes offered. At installed drive capacities of up to 200 kW, the PALLA® ranges among the most powerful vibrating mills.

## Details of design

The PALLA® vibrating mill is a single-mass vibrator which is operated within the supercritical zone. The vibrating structure excited by unbalanced weights, consists of two parallel grinding cylinders that have been joined by webs. It is supported on the frame by rubber buffers. Varying with the feed and the fineness requested for the product, either balls, rods or rod sections (so-called cylpebs) of different size and materials are used as grinding media.

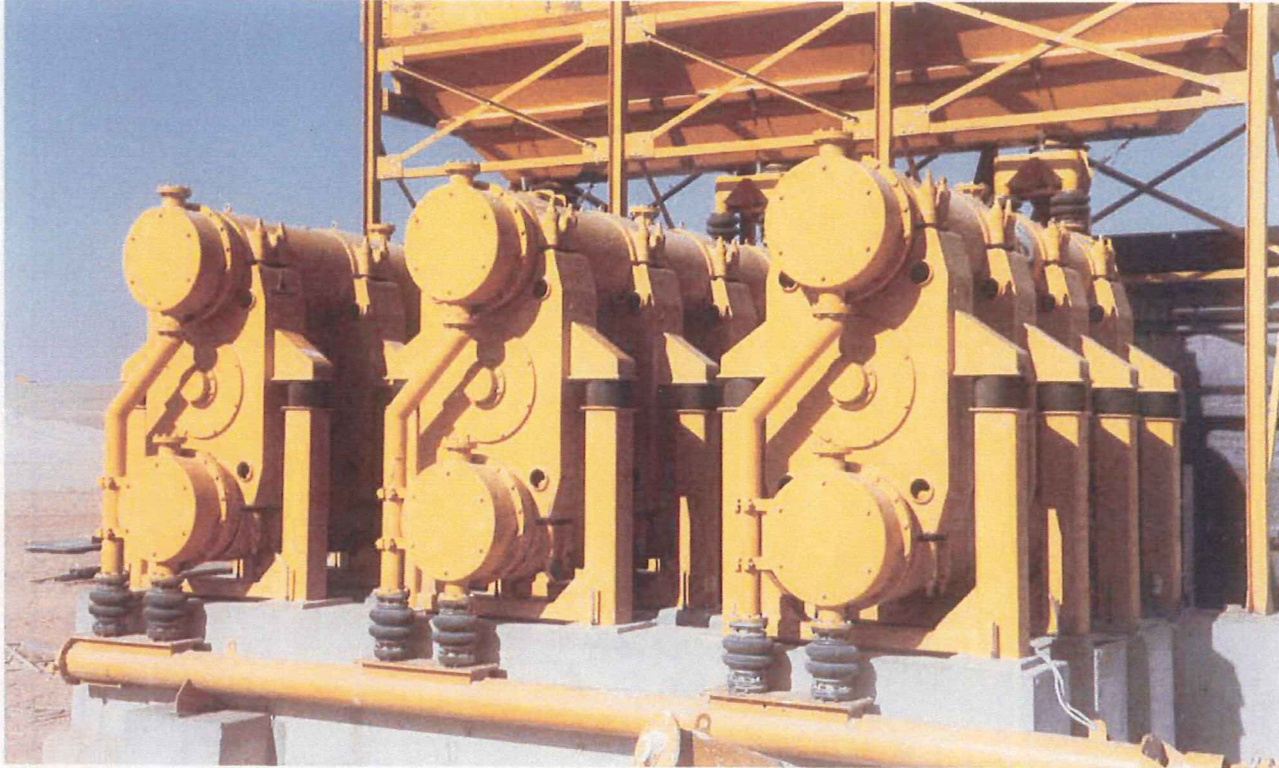


PALLA® vibrating mill



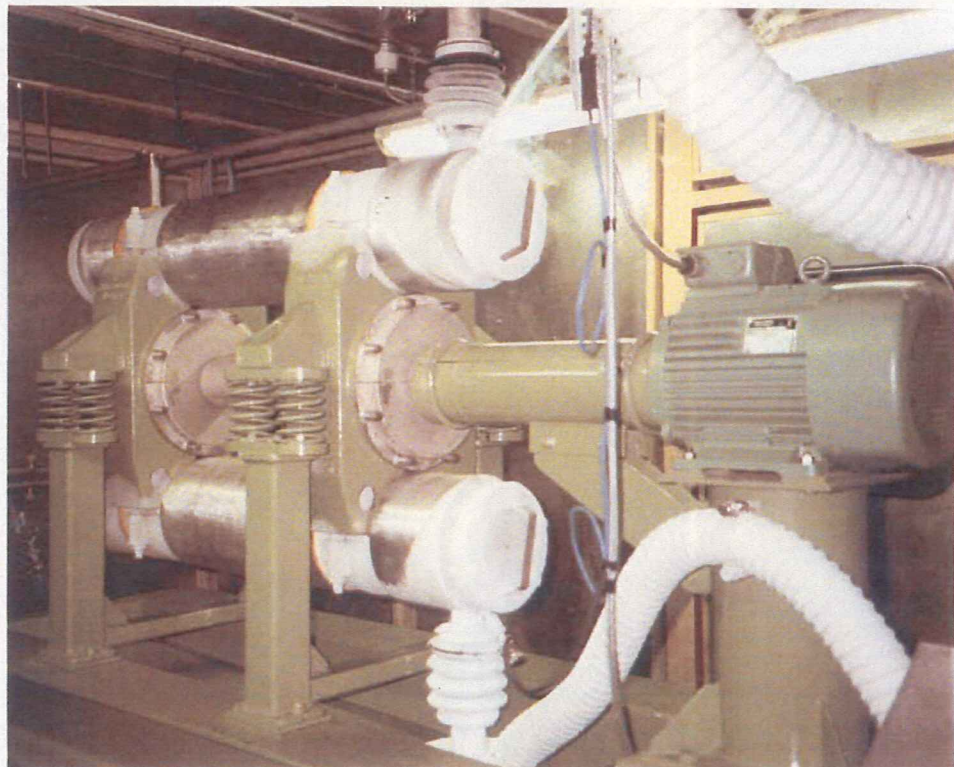


Filler grinding system with 3 PALLA® 65 U operated under harsh conditions in the desert



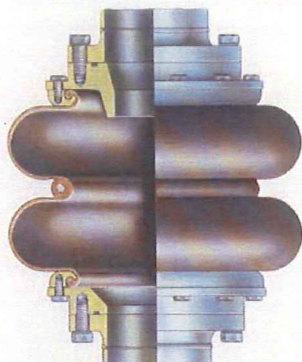
## CRYOPALLA®

The CRYOPALLA® is a time-proven machine for grinding of metals or other materials difficult to grind in normal temperatures. In a CRYOPALLA® the feed material is brittled by cryogenic agents down to  $-195^{\circ}\text{C}$  and then ground. Thanks to its special design this grinding mill enables cost-effective grinding at low temperatures.

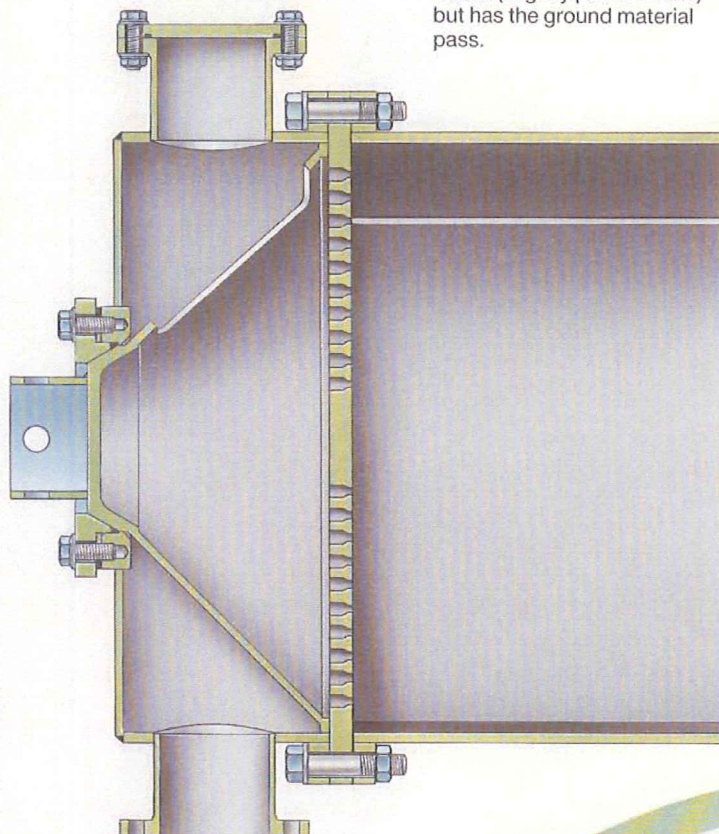


CRYOPALLA® 16 UT for grinding of ferroalloys





*Inlet and outlet of vibrating mill with bellows*



*Outlet cap with separating wall and discharge device*

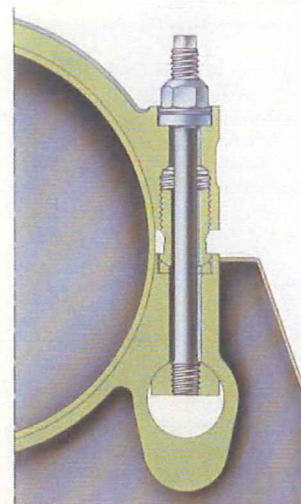
## Grinding system

The grinding cylinders are manufactured of high-grade steel. The tube length of any model ensures superfine grinding even without a separator. Inlet and outlet caps have been flanged to the tube ends for admitting and discharging the material. Adjustable retaining devices in the outlet caps permit an optimum utilization of the grinding compartment. A slotted plate has been fitted between cylinder and outlet cap which retains the grinding media (e. g. cylpebs or balls) but has the ground material pass.

Sockets mounted to the cylinder top permit a quick inspection of the grinding compartment and refilling of cylpebs and balls.

Flexible and airtight components couple the mill to upstream and downstream mounted proportioning and conveying equipment so as to minimize dust annoyance. Therefore, connection to a dust collector is normally not necessary. All flange connections are sealed by temperature-resistant O-rings.

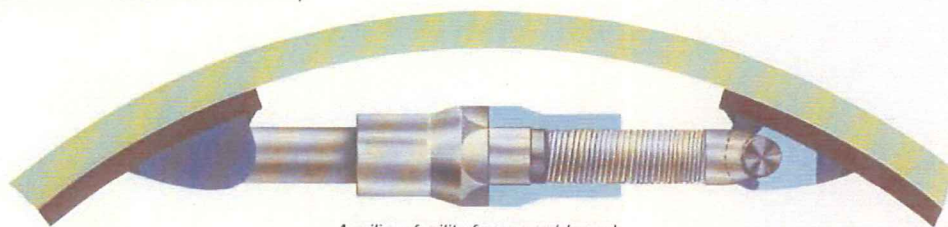
The cylinders are protected by highly wear-resistant and easily replaceable liners. For iron-free grinding, these liners are made of ceramic or plastic materials. Since the liners are subject to little wear, they reach long service spans.



*Cylinder fastening by anti-fatigue screw*

## Fastening of the grinding cylinders

The cylinders of the PALLA® vibrating mill are fastened to the webs by way of clamps and anti-fatigue screws. This arrangement not only ensures secure fastening of the cylinders but at the same time their easy replacement. Apart from that, the risk of cracks is eliminated which may be implied in welded joints of cylinders and webs. This makes costly repairs and downtimes unnecessary.



*Auxiliary facility for assembly and disassembly of cylindric liners*

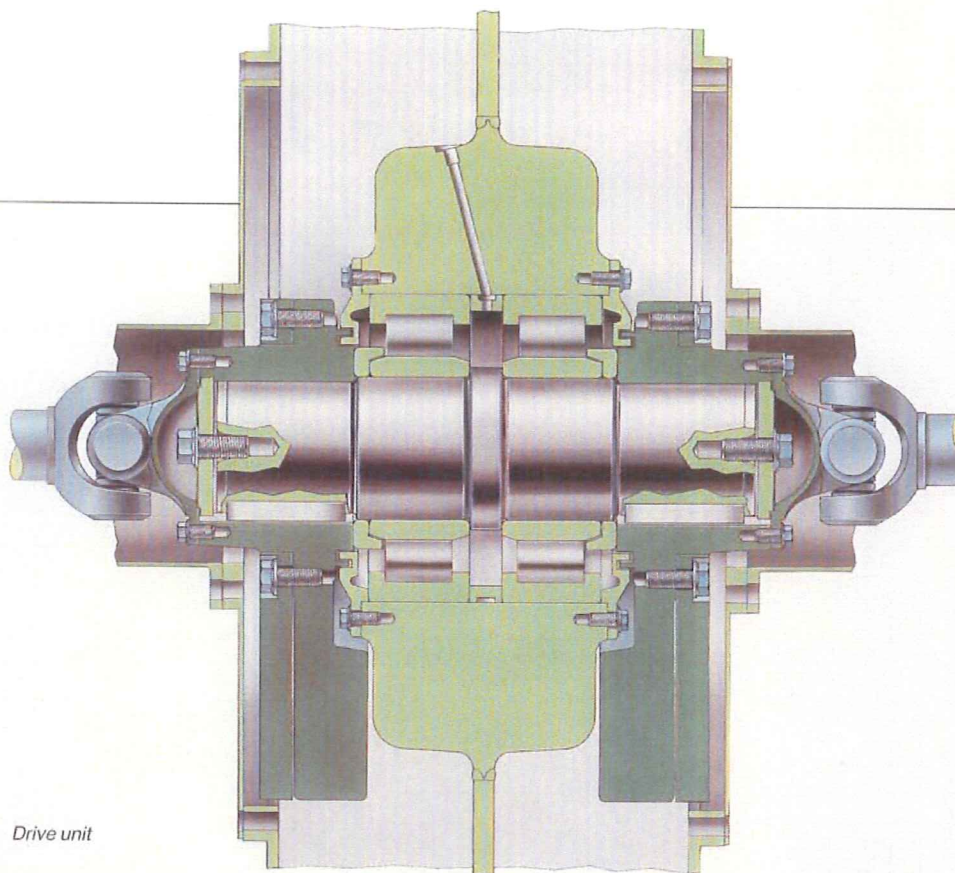


## Generating vibration

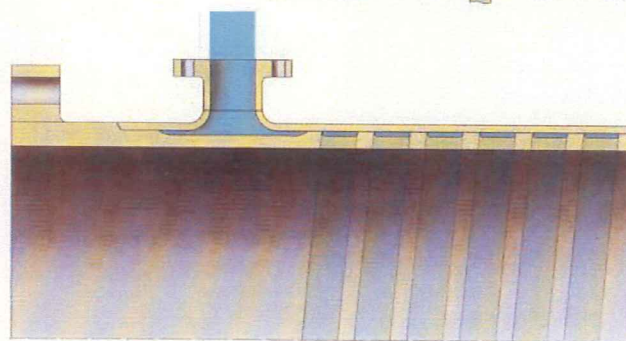
The drive is carried in the centre of the robust web. The major drive components are 2 cylindrical roller bearings, the drive shaft and the two pairs of unbalanced weights. The latter are easily accessible and can be quickly adjusted relative to each other at very small steps. Consequently, there is no difficulty in accurately matching the diameter of the vibrating circle to the feed material, thereby achieving optimum size reduction. The roller bearings of high load-carrying capacity have been fastened in the webs in such a manner that the complete unbalanced-type drive can be easily removed for inspections or repairs. The squirrel-cage motor which normally drives the mill has been mounted on a bracket at the machine front end. It is connected over a cardan shaft to the shaft of the front unbalanced drive direct. The drive is of such design that no axial forces act on the mill bearings. The motor can be set up at either end of the machine.

## Electric connection

Electric connection and circuit connection of the motor depend on the local regulations and load capability of the supply network. The motor should be laid out such that the starting torque equals at least 2.2-times the rated torque. The sense of rotation of the motor is optional. Alternating operation will considerably extend the service life of the cylindric liners. Mill operation can be monitored with the aid of an ammeter which indicates the power consumption of the motor.



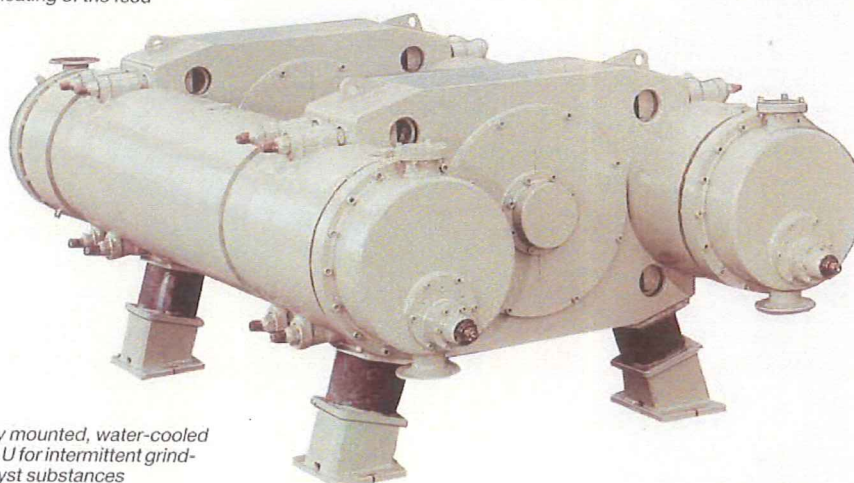
Drive unit



Double-walled cylinder for indirect cooling or heating of the feed

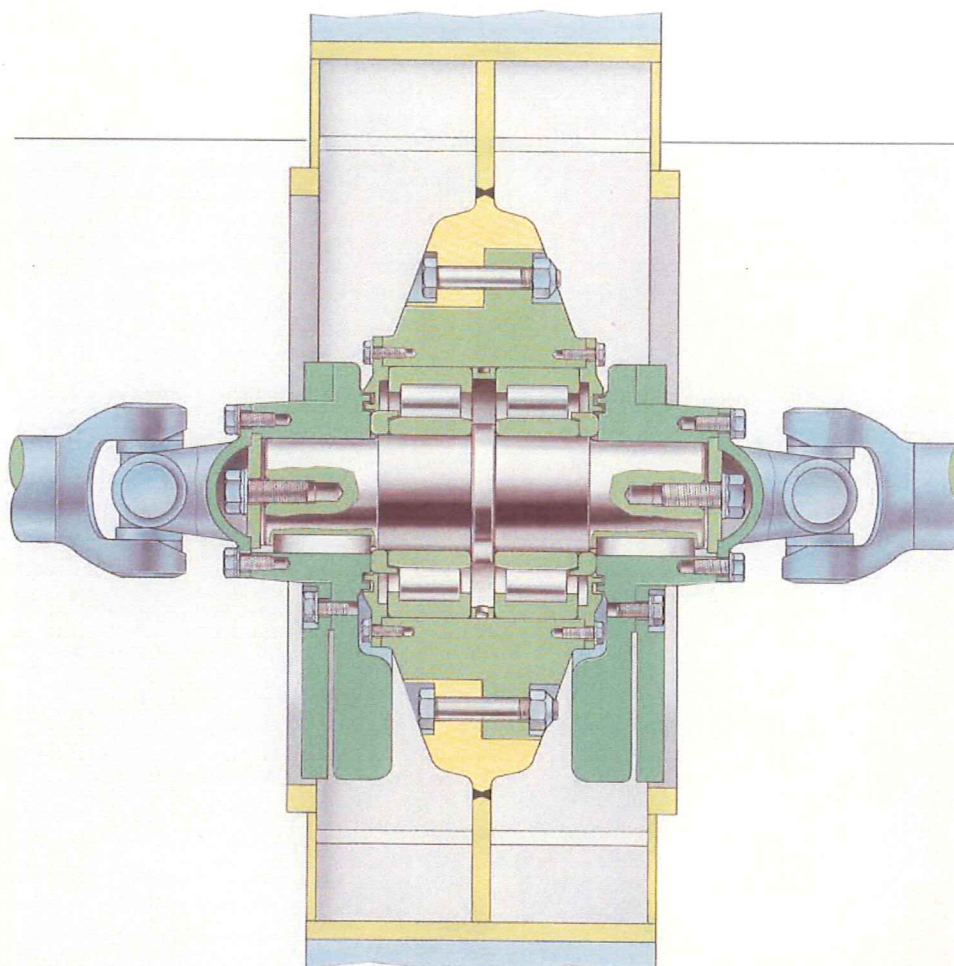
## Special designs

To maintain a given material temperature, double-walled cylinders are used which enable cooling or heating with water or brine.



Horizontally mounted, water-cooled PALLA® 50 U for intermittent grinding of catalyst substances





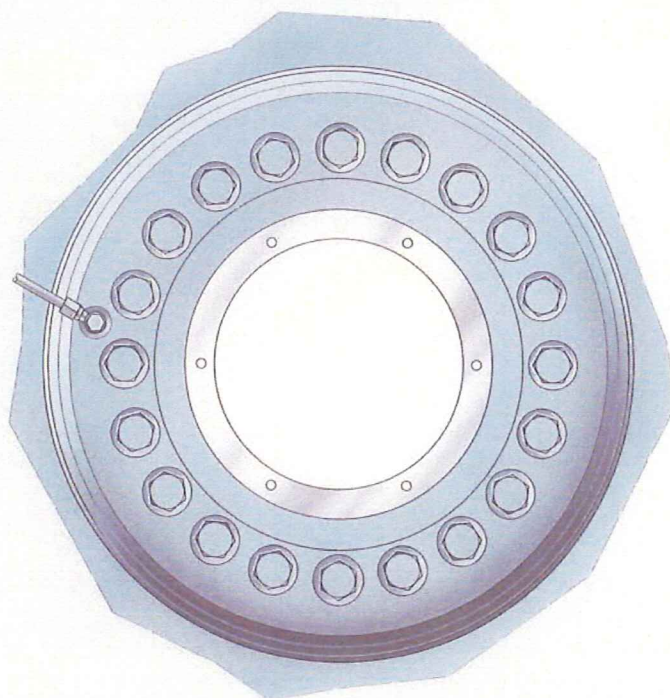
## New replaceable bearing seats for PALLA® 65 U

Along with advances in the design of our vibrating mills PALLA® U, the cylindrical roller bearing assembly of the PALLA® 65 U has been significantly improved.

The roller bearing assemblies are carried in replaceable bearing bushes screwed to the webs of the grinding mill and transmitting forces exclusively by way of static friction.

This new feature allows a simple, fast and cost-effective elimination of damage at the bearing seat, caused e. g. by faulty operation simply by replacing the bearing bushes. Consequently, the web does not require replacement and the mill therefore does not have to be dismantled.

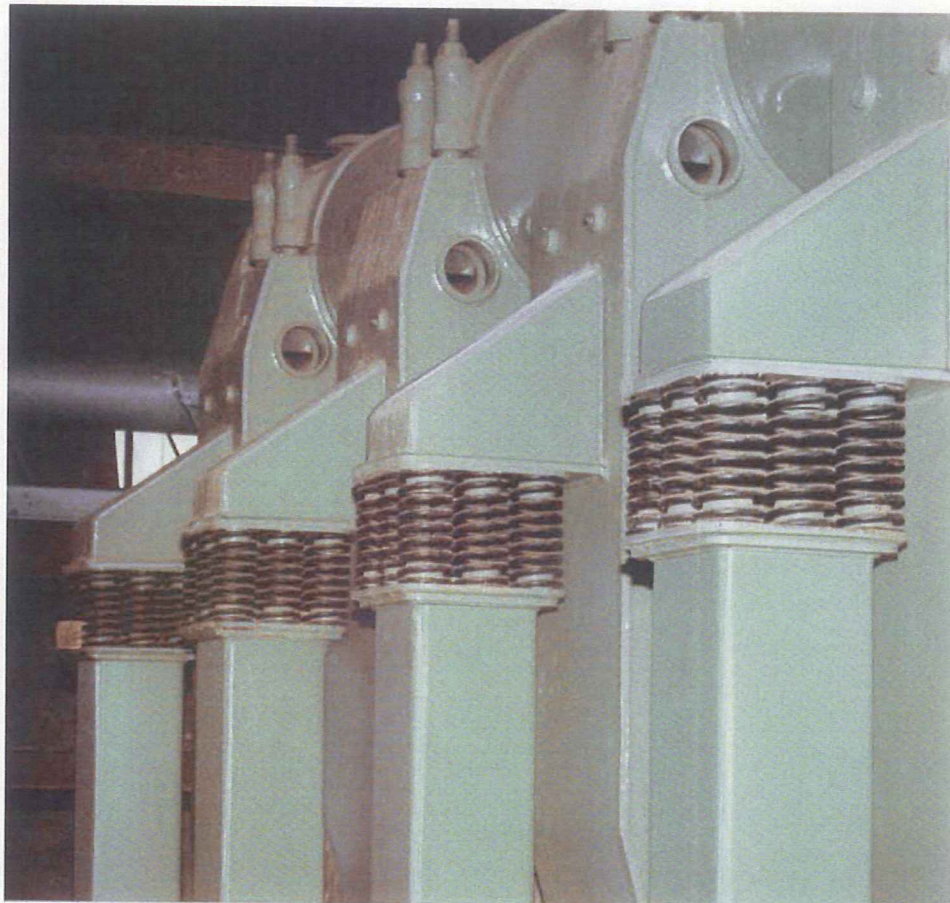
This service facilitating type of bearing assembly is optionally available for type PALLA® 50 U.





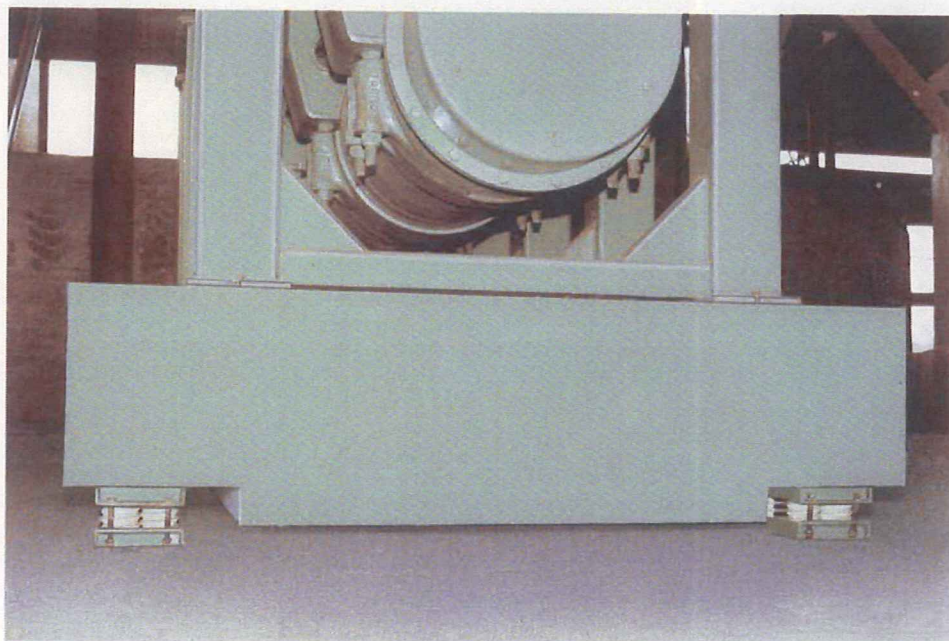
## Mounting

Vibration isolation by means of elastic elements means that relatively small dynamic forces are transmitted from the vibrating machine to the supports. Therefore, special foundations are hardly ever required.



*PALLA® 65 U  
supported by steel springs and  
installed in a refractories manufac-  
turing plant*

Even strictest isolating requirements can be met also in case of adverse site conditions by using a foundation with exactly calculated damping mass.

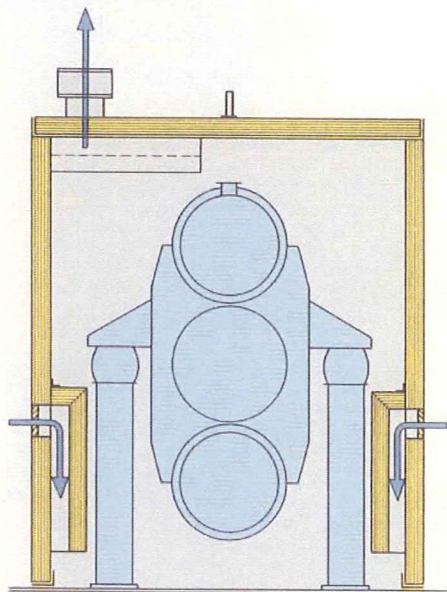


*PALLA® 65 U  
mounted on a vibration isolated  
steel foundation in a refractories  
manufacturing plant*



## Sound-proofing enclosure

When installing vibrating mills in open buildings or in the close vicinity to working areas, it will be advisable to have them enclosed for sound abating.



## Options for grinding cylinder connection of a PALLA®

### 1. Series connection

With this arrangement, the feed passes the two cylinders successively which results in maximum grinding path lengths and longest retention times.

#### Application:

It is recommended for fairly hard or coarse feed, for very fine end products, for materials that are characterized by poor blending properties or for long grinding, dissolving and reaction processes.

### 2. Parallel connection

With this arrangement, either cylinder yields a finished product. It enables shorter retention times and higher throughput rates. Identical or varying materials can be ground, blended or chemically treated in the two cylinders at the same time.

#### Application:

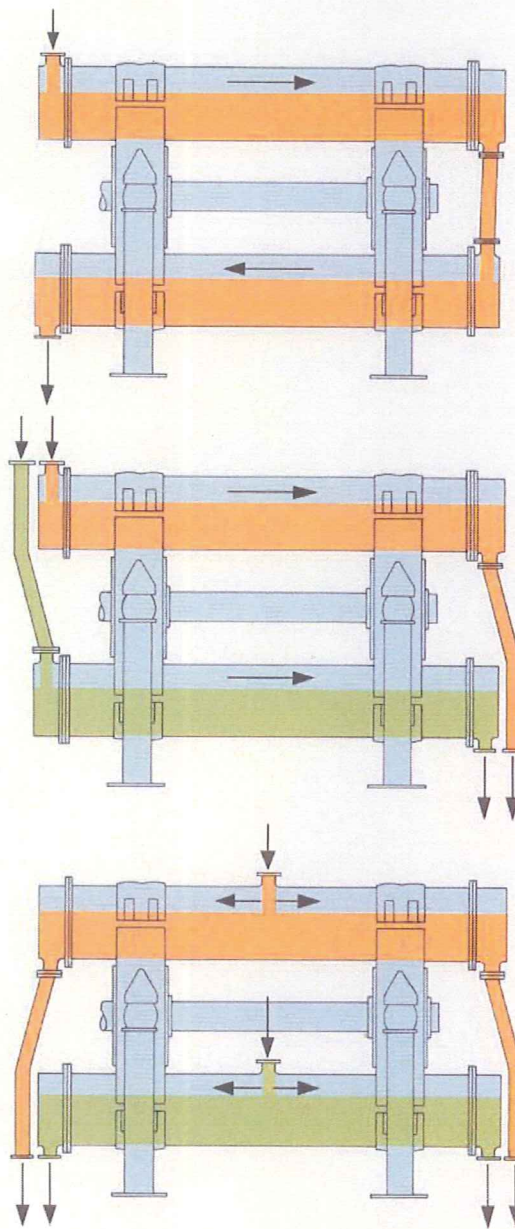
for materials that are more easy to grind, for closed-circuit grinding, for simple blending operations and dissolving processes and chemical reactions of short duration.

### 3. Centre feeding

In this configuration the material flows in either direction towards the outlet caps. Grinding path and retention time are very short and the throughput is correspondingly high. Size reduction is less than under 1) and 2) above.

#### Application:

for soft materials that require no more than little grinding or any other substance to reach an as coarse product as possible, for quick chemical reactions or dissolving processes.





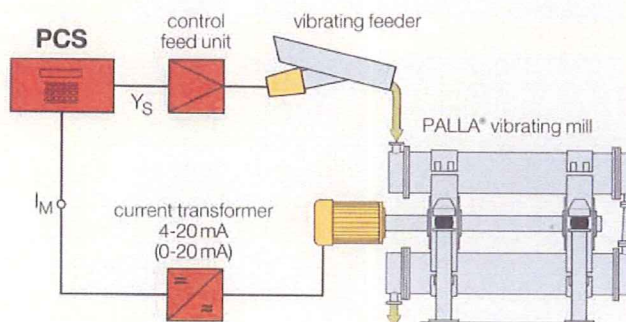
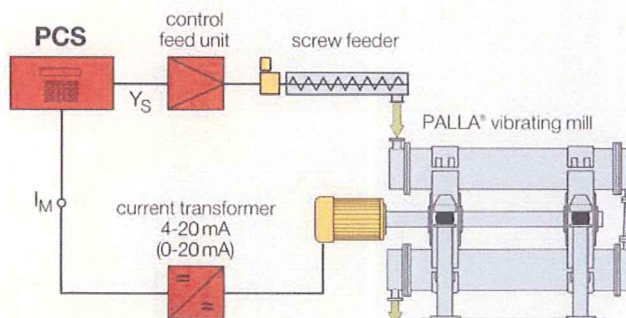
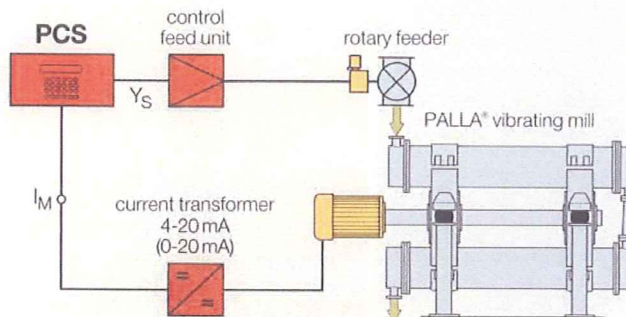


The PALLA® control system PCS measures the mill current and controls the feed unit. A system controller with a control algorithm adopted to the requirements of the vibrating mill keeps the mill current within such narrow limits that a uniform optimal quality of the ground product will be ensured.

## Highlights

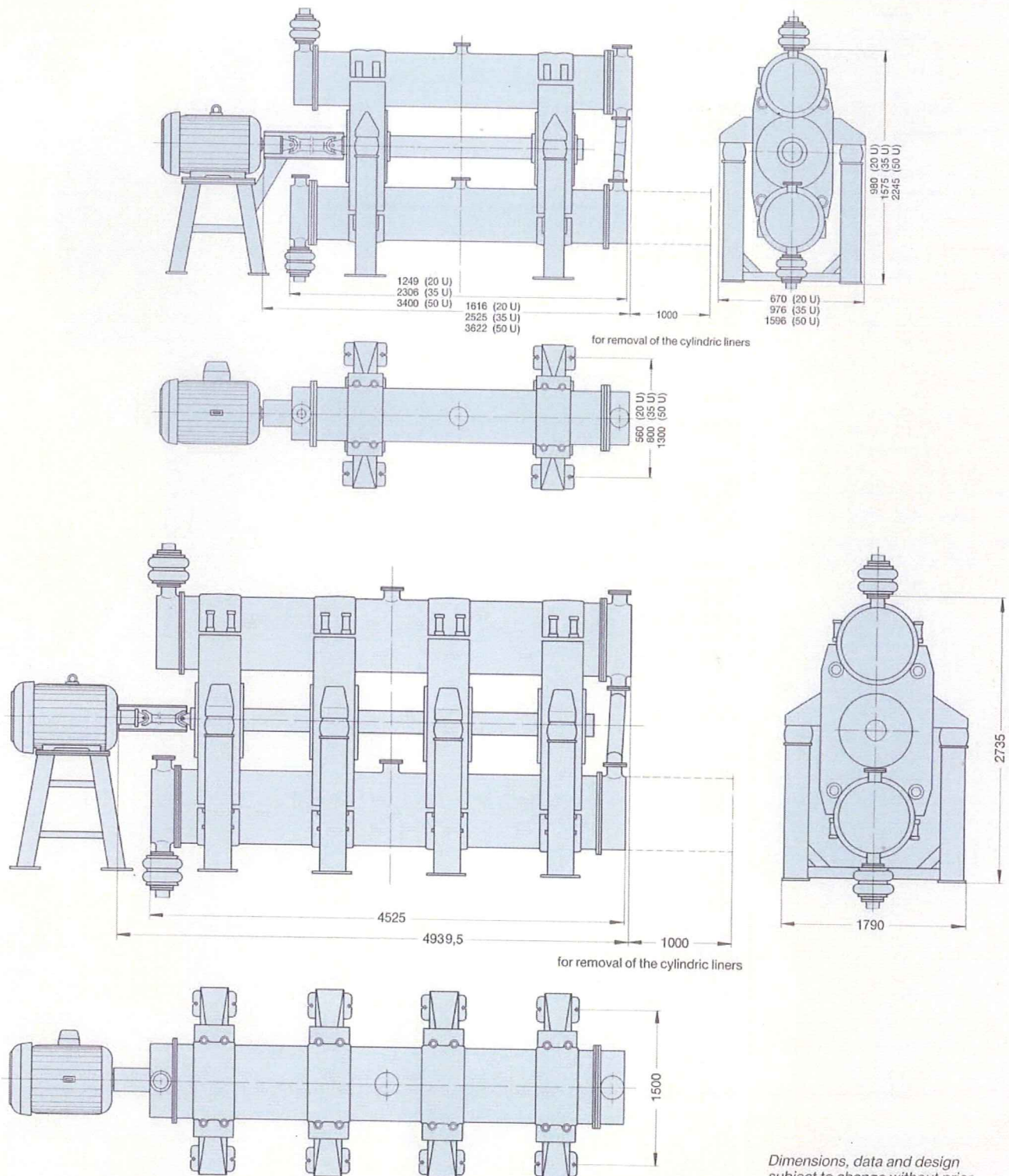
- PCS is menu-assisted
- PCS is of 4-language type
- PCS is user-programmable
- PCS is password secured
- PCS is in part self-adjusting

## System control





# Dimensions



Dimensions, data and design  
subject to change without prior  
notice.



## High-efficiency separator PSR

KHD Humboldt Wedag AG have extended their already broad range of separators by a new type PSR suitable for the production of extremely fine-ground minerals to a maximum fineness of  $D_{97} = 2 - 30$  microns.

Its design is based on the principle of a cage-wheel separator and is highlighted by the following features:

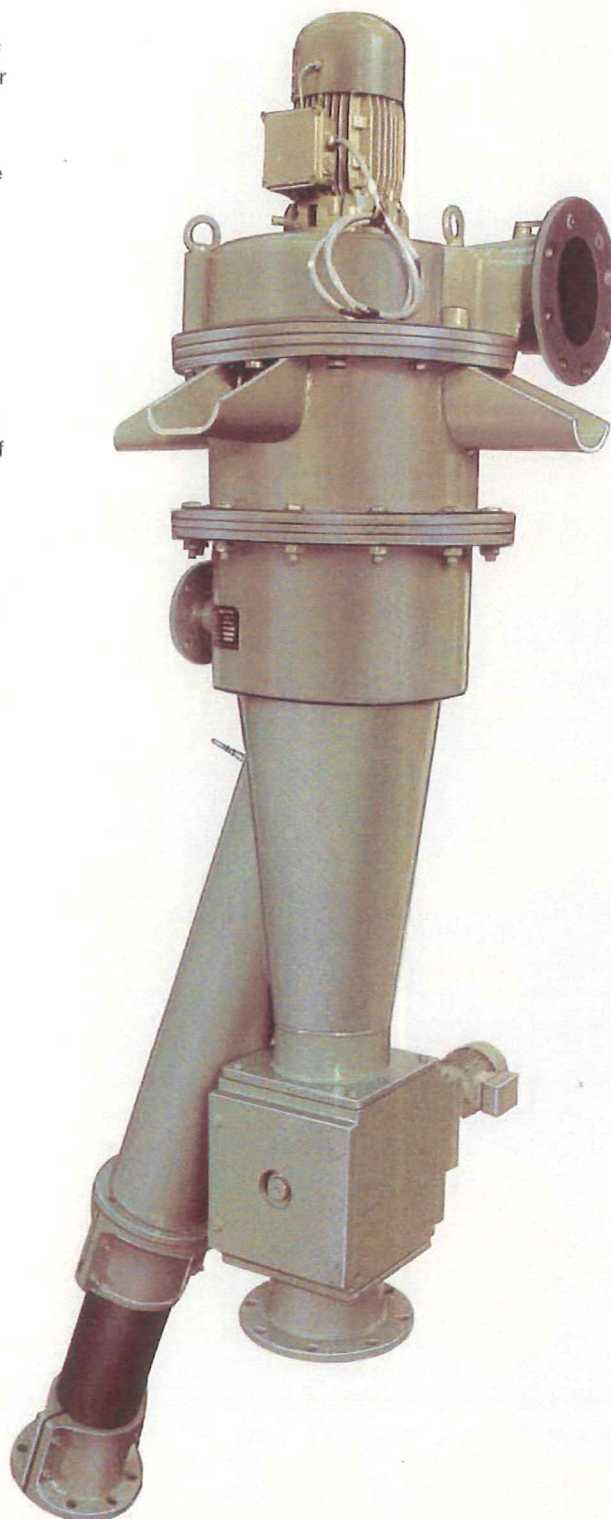
- efficient and economic modular construction
- compact design offering optimal versatility as to the use of wear materials
- cage wheel characterized by high sharpness of cut
- product feeding by means of air intake which means that no additional conveying element is needed.
- aerodynamic product feeding enables high dispersion
- broad range of application thanks to process controlling.

Based on KHD Humboldt Wedag AG's long tradition in the construction of all types of separators, this PSR separator has been optimally tuned to the performance characteristics of the PALLA® vibrating mill. The latter is also one of the company's top products and more than 1500 units have been sold so far.

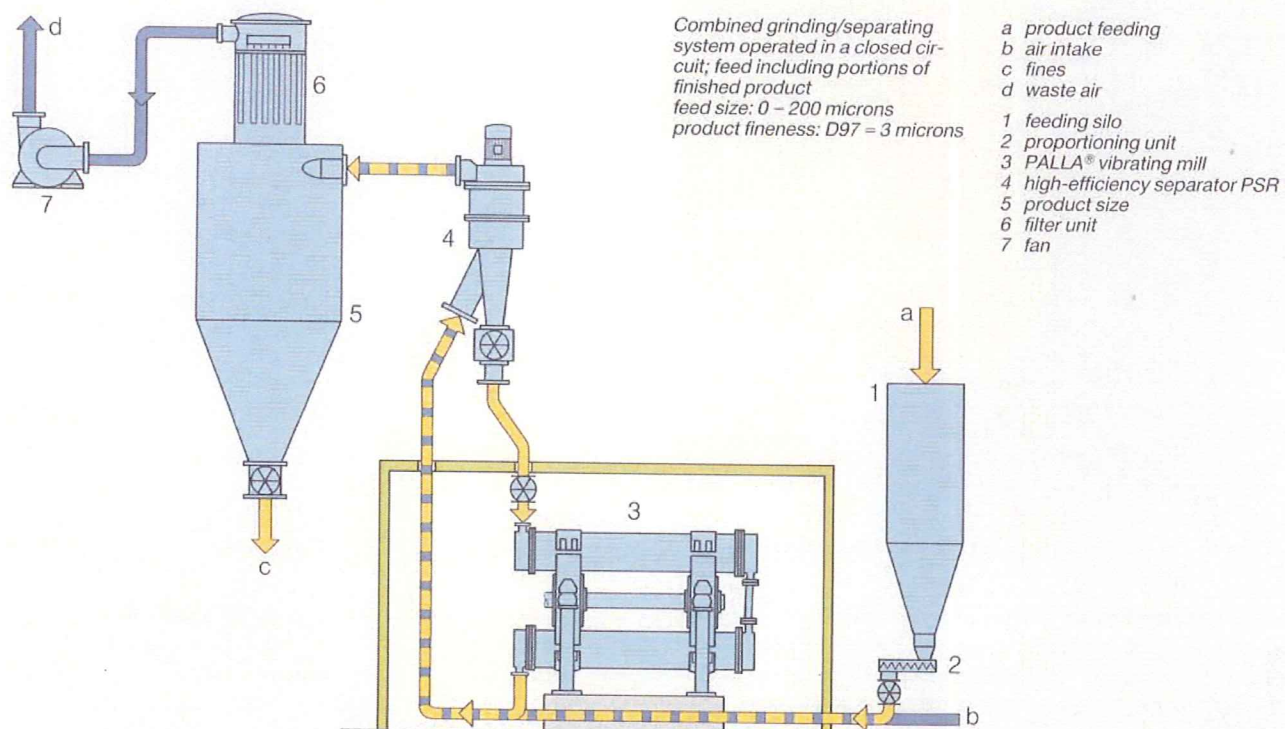
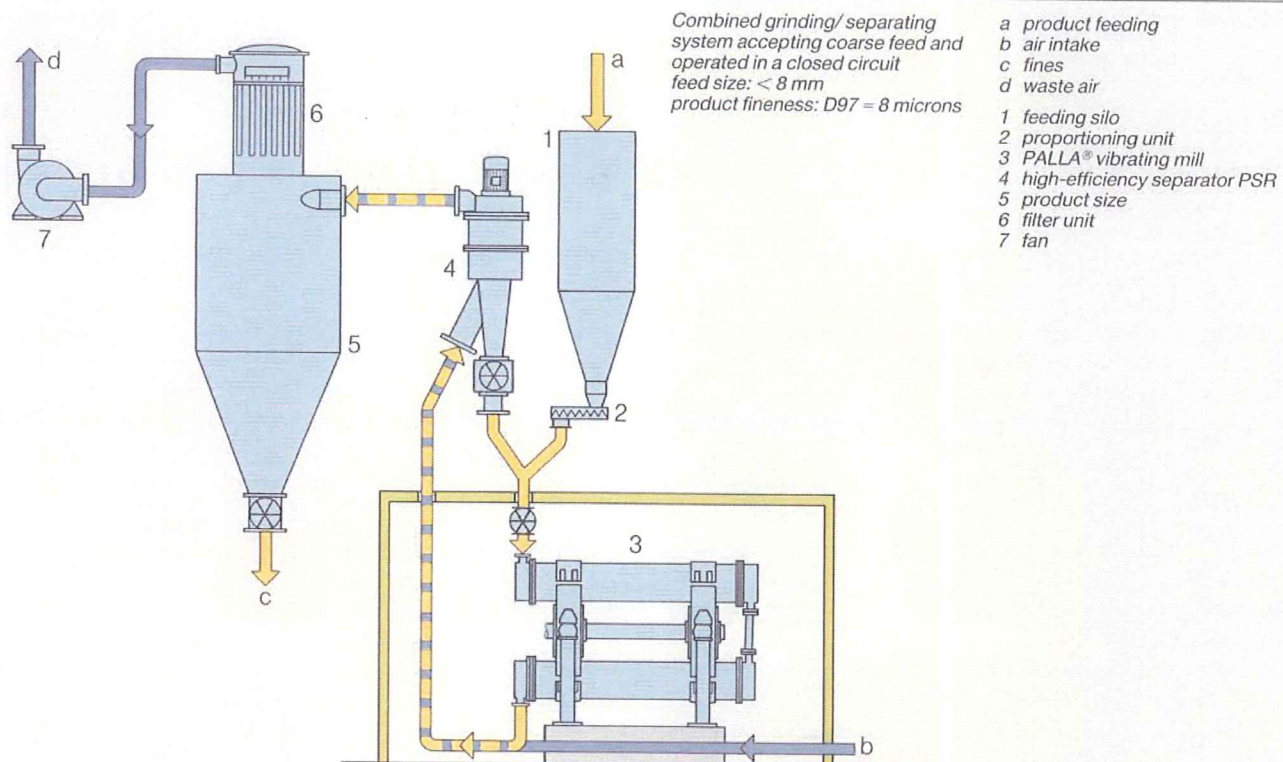
In combination with the newly developed high-efficiency separator PSR the PALLA® vibrating mill which is predominantly applied for direct superfine grinding of hard materials becomes a grinding/separating machine capable of attaining maximum product fineness.

This high-efficiency separator PSR may, of course, also be operated with other fine and superfine grinding machines in a closed grinding/separating circuit or be operated as a separator by itself.

At present, the high-efficiency separator PSR is offered at 2 different sizes, i. e. PSR 160 and PSR 315. They cover the power range of vibrating mills PALLA® 20U to 65U.

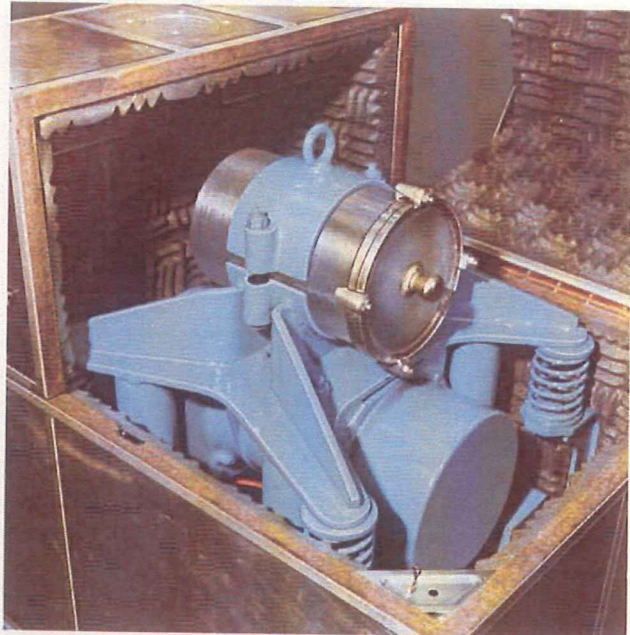




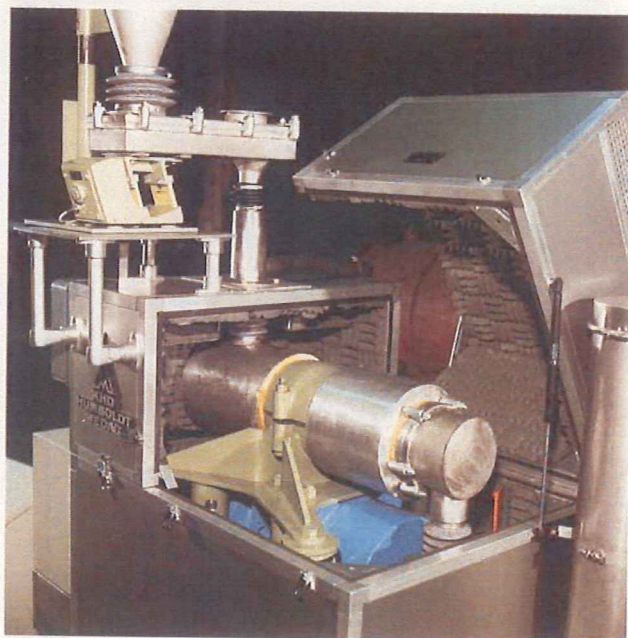
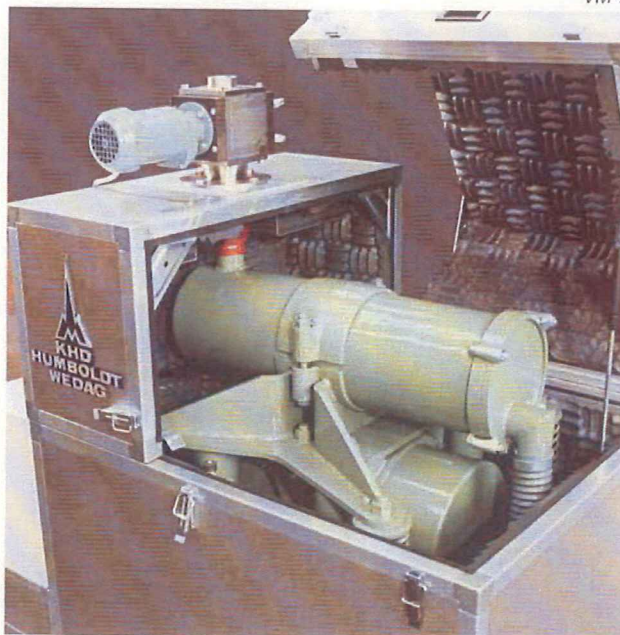




VM-S



VM-K



VM-KT

### PALLA® VM vibrating mill

for a rapid and economic pulverization of most different feed materials with small sample quantities. Compact grinding system for laboratory and semi-industrial application, used for most varying process phases. Fully equipped with sound-proofing enclosure, vibration isolation and electric connections. The results obtained can without restriction be transferred to large-scale systems including our time-proven PALLA® vibrating mills. 3 different types are offered, i. e.

#### Type VM-S

enabling individual tests for a rapid process optimization at low expenditure and with small material quantities (approx. 1 to 2 kgs).

#### Type VM-K

designed for short and long-term tests (up to 100 kgs/h – depending on feed properties) for process optimization.

#### Type VM-KT

permitting tests as detailed for type VM-K above but for temperatures down to  $-190^{\circ}\text{C}$  (83 K).

\* special brochure no. 2-174 on request.