

- Main drive**
- 1 Main motor
 - 2 Flexible coupling with brake drum
 - 3 Double shoe brake
 - 4 Main gear box
 - 5 Lubricating oil system
 - 6 Flexible coupling
 - 7 Pinion gear
 - 8 Gearwheel guard

- Auxiliary drive**
- 9 Internal combustion engine
 - 10 Centrifugal clutch
 - 11 Electrical auxiliary motor
 - 12 Centrifugal clutch / brake
 - 13 Auxiliary gear box
 - 14 Flange pump
 - 15 Free-wheel
 - 16 Flexible coupling

The drive components

Either single, double or triple reduction gearboxes are used, depending on the torque to be transmitted. These are the most common types of drive for rotary kilns because they have a high degree of efficiency and long-term economical design.

Nothing can shake them

The even, smooth operation of the kiln and optimal contact pattern with the pinion is achieved by mounting the girth gear on the kiln shell using tangential springs. The centered action of the girth gear is adjustable.

One special feature of the gear drive, as a single drive with two pinions, is that it can operate with only one main motor. This type of drive is often used to increase productivity using the existing girth gear.

This variant, which was developed by KHD Humboldt Wedag, has two positive advantages:

- no additional foundation is necessary for a second drive unit
- each pinion transmits precisely half of the torque

Feel free to create friction

Alternatively, it's possible to transmit the drive torque from the rollers to the tire. This type of drive is only suitable for two station kilns. The characteristics of both types of drive are listed in the adjacent table.

Hydraulic drives – acting directly or via gears on the driven shaft – also permit smooth kiln operation but are less efficient. This is why they are also considerably less economical.

	Gear drive (form-fit)	Roller drive (friction-fit)
Function	Transmission of loads via tyres and rollers, transmission of torque via pinions and girth gear Optimal separation of functions without reciprocal influence	Transmission of loads and torque via tyres and rollers Bearing and drive function in one unit means: functional compromise
Design	Components are optimised for the relevant function	Additional drive forces requires stronger roller bearings
Efficiency	Maximum degree of efficiency, minimum wear and tear	Slipping and friction result in wear and tear to tyres and rollers and impair efficiency
Maintenance	Ensure lubrication	Ascertain friction values

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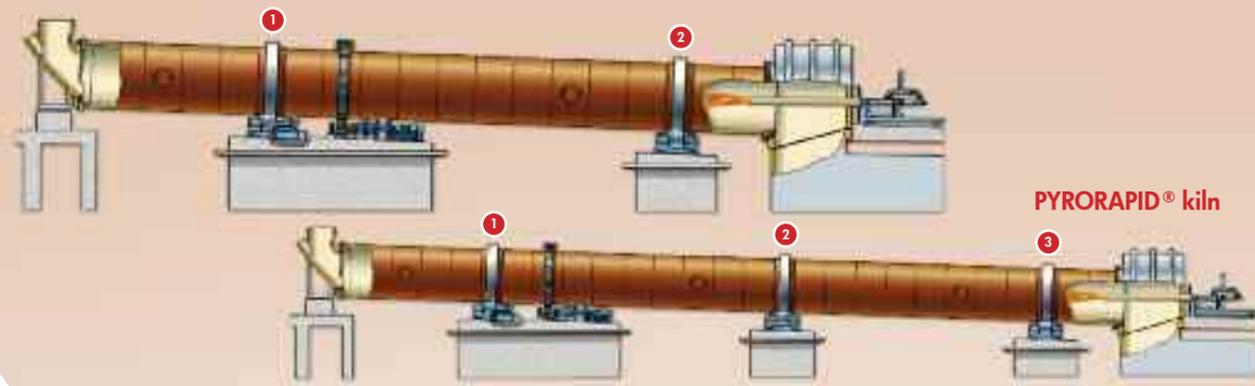
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Compact and Efficient Rotary Kilns



KHD HUMBOLDT WEDAG

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3-station-kiln

It all started with a revolution

Kiln plants from KHD Humboldt Wedag are top of the line. One reason: highly efficient precalcining systems, which were developed by KHD Humboldt Wedag, revolutionizing the clinkering process. Rotary kilns no longer have to function as calciners which mean that they can be substantially smaller in size.

The advantage for customers is lower investment and operating costs. No wonder these systems quickly gained excellent reputations among our customers.

In addition the PYRORAPID® kiln offers:

- Investment costs approx. 15% lower than three station kilns.
- The lower space requirements and lower weights lead to more favorable construction costs.
- Mechanical overloading is impossible. This results in higher levels of operational reliability and lower maintenance costs.
- Lower consumption of refractory lining.
- The reduced required power and lower radiation losses reduces energy costs.
- The tire at the kiln discharge is outside the sintering zone.

Convincing arguments for the benefit of our customers.



This is what you can save

The main criteria for rotary kilns are high availability, considerable flexibility and cost-effectiveness. They must also meet all process technology requirements for the clinkering process. The KHD **PYRORAPID®** rotary kiln fulfills all of these requirements. With two tire stations, length to diameter ratio of approx. 11:1 to 12:1 and a statically defined bearing arrangement, the **PYRORAPID®** kiln offers superior advantages over a two/three station kiln with a greater length to diameter ratios.

All good things

From time to time, special circumstances necessitate a kiln with a greater length to diameter ratio which means that a three-station kiln is needed. The three-station kiln from KHD Humboldt Wedag is a classic kiln which has been thoroughly tried and tested over the decades. Its proven standardized parts are also used in the **PYRORAPID®** kiln. Regular optimization of standardized parts leads to even greater operational reliability and efficiency. The interaction of all components ensures the overall problem-free continuous operation of the kiln.

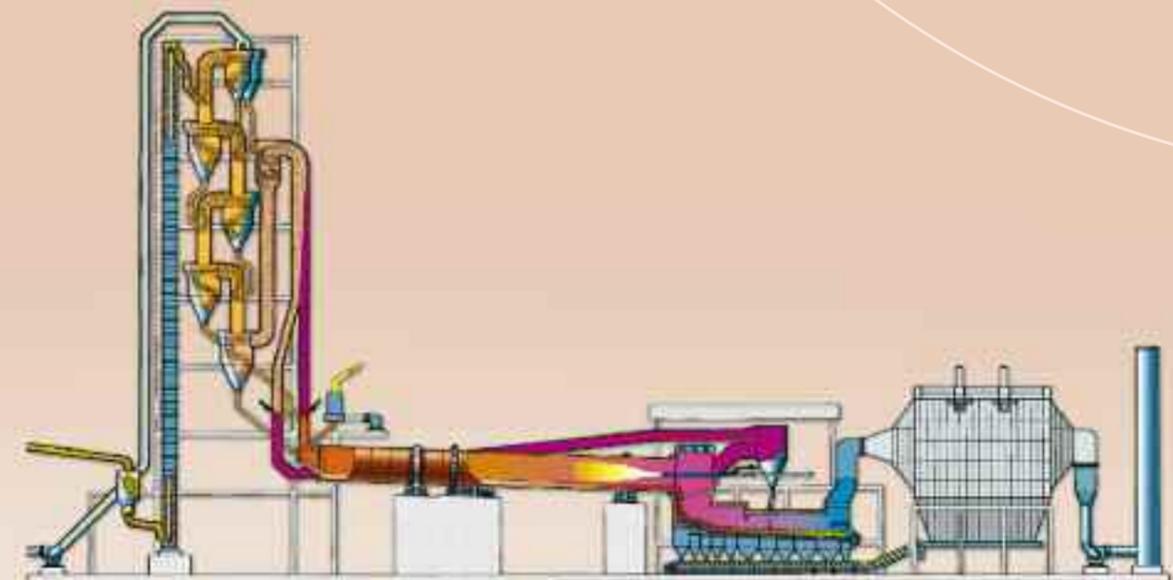
For example

- optimized kiln configuration ensures even load and force distribution
- the low shell stresses ensures low shell deformation and low consumption of refractory material
- the floating tire fastening system ensures optimal load transmission to the rollers supported in double slide bearings
- the large service factor of the kiln drive ensures extremely flexible plant operation
- the repeatedly proven kiln inlet and outlet seals ensure minimum false air infiltration.



These kiln components, essential for ensuring maximum availability, are furnished with high levels of safety and service factors. Further information about these kiln components are on the following pages.

Thermal plant with **PYRORAPID®** kiln



It's what's inside that counts

In order to ensure a long service life of the refractory lining, the kiln shell is optimized for minimum stress and deformation. The shell plate thickness changes with corresponding shell stresses, which are determined from bending and tangential shell stress loads. This ensures optimal safety to material elasticity limits at operating temperature. Elastic shell deformations remain within narrow limits.

Put it all in

Precalcined raw meal is fed from the inlet chamber via the refractory lined and air-cooled brick retaining ring into the kiln. The simultaneously rotating scoop ring safely returns any hot meal backspill into the inlet chamber.

What comes out

The outlet end of the rotary kiln is protected by heat-resistant outlet segments. The air cooling of this large surface ensures long life of the segments. Their bracket mounting prevents flaring of the kiln shell. The kiln hood is supplied with monitoring and sampling openings, connections for the burner and for the control and measuring equipment.

Depending on the layout, there is a tertiary air take-off on either the front or back side of the kiln hood. A large door opening permits easy access to the kiln and enables the use of portable conveyors for servicing.

We know what we're talking about when it comes to seals

The high efficiency and low wear rates of KHD kiln seals make important contributions to economical kiln operation. The proven spring-loaded segmented seals, which were developed by KHD Humboldt Wedag, are fitted to the kiln inlet and outlet. The pressure elements, springs and levers, rotate with the kiln, so they can be easily accessed at any time. KHD rotary kilns can also be supplied with pneumatically operated seals. Pressure is applied to the movable suspended sealing ring by a number of stationary mounted pneumatic cylinders.

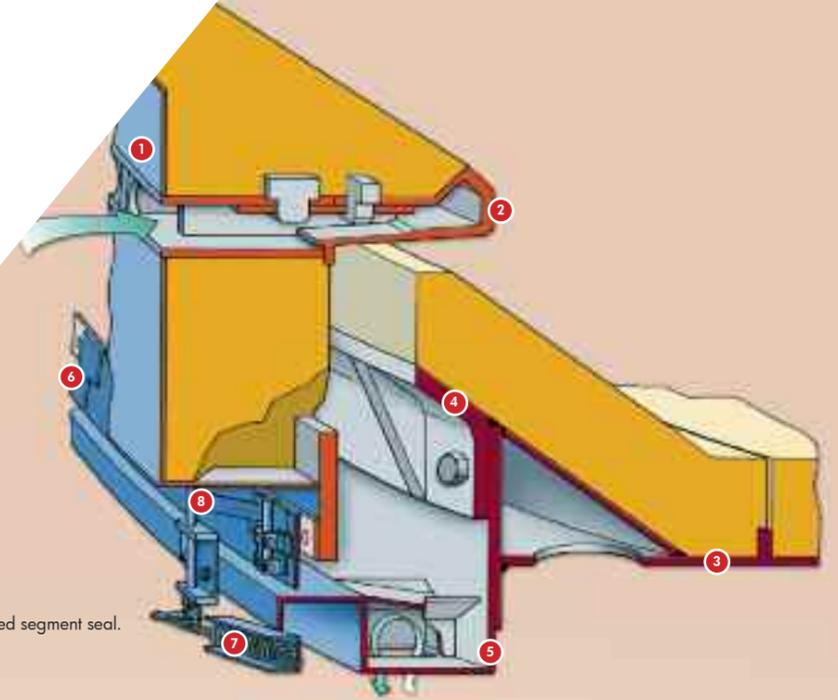


The kiln inlet area with pneumatically-operated seal...

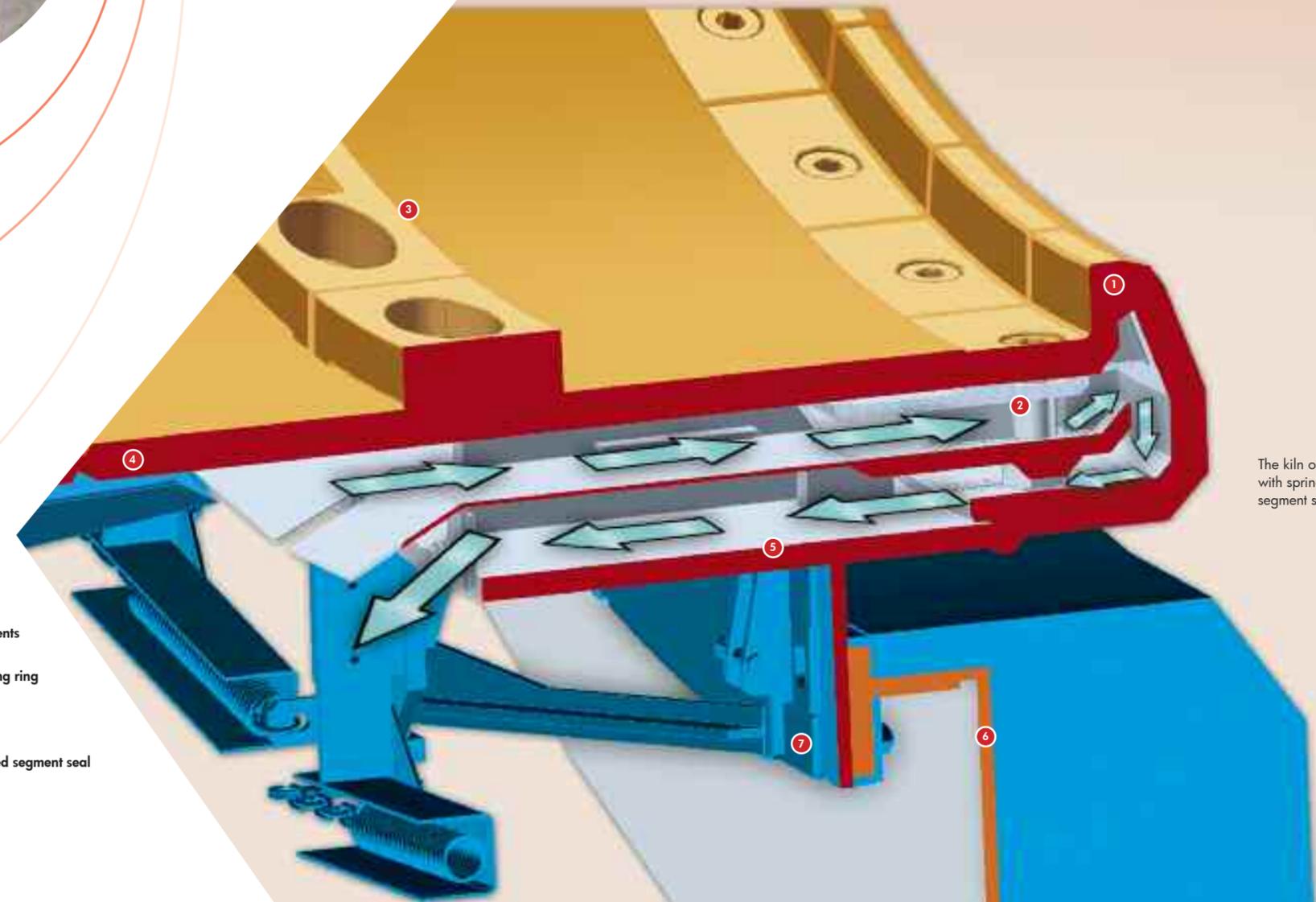
Both types of seals are designed to ensure a continuous seal despite shifts in the position of the kiln due to the influence of temperature and longitudinal movement, as well as any possible "deformations" to the kiln shell. This also prevents false air infiltration in the kiln. The pressure forces are adjustable on either type of seal.

- 1 Outlet segments
- 2 Bracket
- 3 Brick retaining ring
- 4 Kiln tube
- 5 Cooling ring
- 6 Kiln hood
- 7 Spring-loaded segment seal

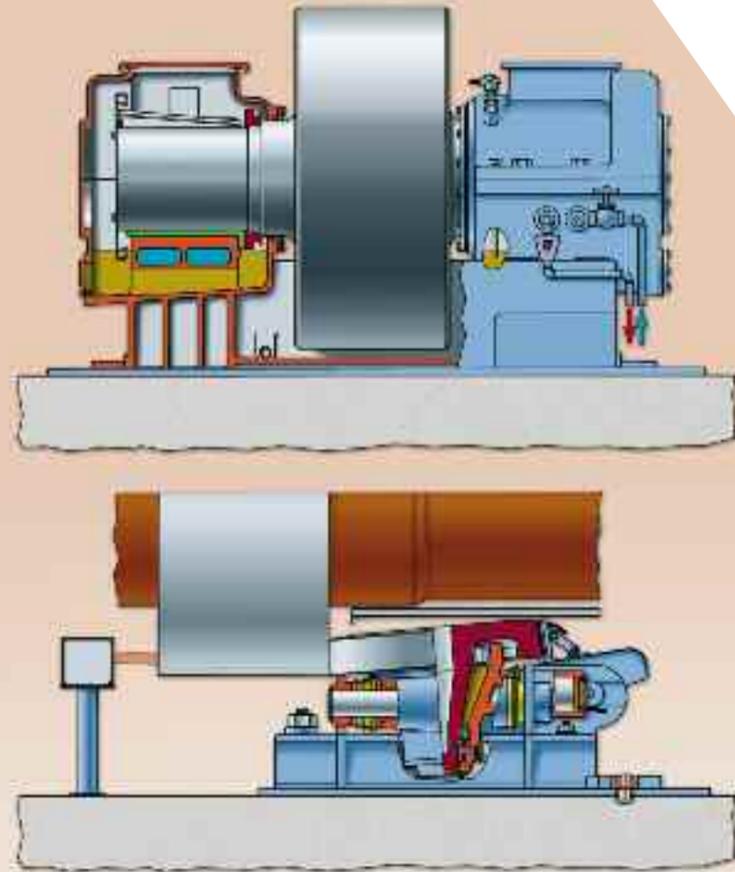
- 1 Inlet chamber
- 2 Brick retaining dish, air-cooled
- 3 Kiln tube
- 4 Conical inlet ring
- 5 Scoop ring, air-cooled
- 6 Spring-loaded segment seal
- 7 Spring
- 8 Lever



...or with spring-loaded segment seal.



The kiln outlet area with spring-loaded segment seal.



The roller bearing

The pressure's on the hydraulic thrust roller mechanism

Always up to date

The forged rollers and cast tires have solid rectangular profiles. They are manufactured without relief or drilled holes to ensure that no notch stresses or stress concentrations occur. The tires of the kiln are designed according to Nies for maximum ovality of 0.15 to 0.2 percent of the nominal kiln diameter. This guarantees the rigidity of the tires.

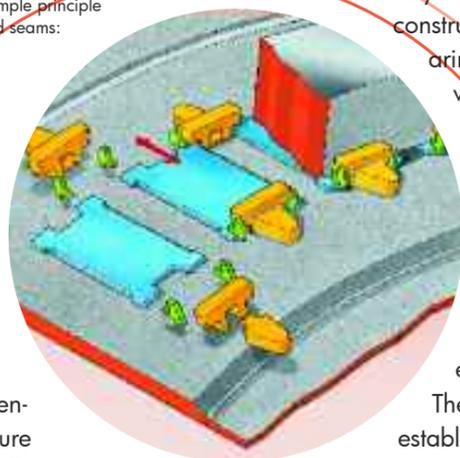
One special feature is the constraint free and low-maintenance tire fastening system, which reliably transmits all loads via large contact surfaces at low surface pressure from the kiln shell to the tire. This also applies to the driving torque if the kiln is powered by a friction drive. This connection also maintains a perfect

contact pattern between the tire and rollers.

Based on a very simple principle with nearly no weld seams: the tyre fastening.

The sophisticated and thousand-fold proven KHD roller bearings offer optimal reliability.

They are dimensioned to ensure they are not affected by any types of load resulting from various operating conditions. However, in the event that it is necessary to straighten a bent shell of a three-



station kiln during operation, the system is equipped to do so. The extremely robust and solid

construction of the bearing arrangement, with double slide bearing blocks which remain aligned, is designed to ensure that the roller stations have a centering effect on the kiln.

They absorb the re-establishing forces of the distorted kiln and do not deflect as flexible or moving bearings would. The axial forces are also effectively controlled and do not result in

indefinable changes to the ratio of forces. This controlled absorption of the axial forces is easy to recognize at all times. It helps to precisely adjust the bearing position and to make any necessary corrections during operation. One special advantage is that it offers the opportunity, in the event of changed linear expansion of the kiln shell, to return

the roller to an optimal position in relation to the tire by way of the linear adjustment of the bearing block.

No fear of contact

In order to ensure uniform use of the contact surfaces between tires and supporting rollers, as well as the girth gear and pinion, the axial mo-

tion of the rotary kiln is hydraulically controlled. The hydraulic thrust roller mechanism counteracts the forces which are generated by the slope of the kiln. It operates automatically and is controlled by non-contact measurement.

This is our drive

The drives for all kilns are designed for the reliable operation of the kiln under any operating conditions. This means that even greater safety factors and torque reserve, are installed for nominal operation. All drive components are designed for the installed motor torque plus all safety factors and not only for effective torque generated at nominal capacity.

The installed reserves and safety factors ensure the extremely flexible operation of the kiln, including higher clinker throughput, without overloading the drive.

KHD Humboldt Wedag offers various types of drives for kilns operation, depending on the application. We differentiate between form-fit drives (pinion / girth gear) for all kilns with two and three stations and friction drives (roller / tire) for kilns with two stations.



Single drive with two pinions

This is where the power is

The drive units consist of the main and auxiliary drive. Variable speed AC or DC motors are used as drive motors. The auxiliary drive is furnished with an electric motor and/or a combustion engine. In conjunction with multi-stage or planetary gearboxes and elastic, practically maintenance-free couplings, the drives offer maximum operational safety and outstanding efficiency.

The gear drive

