

Rotary kilns for cement plants



Setting the standard yesterday, today and tomorrow

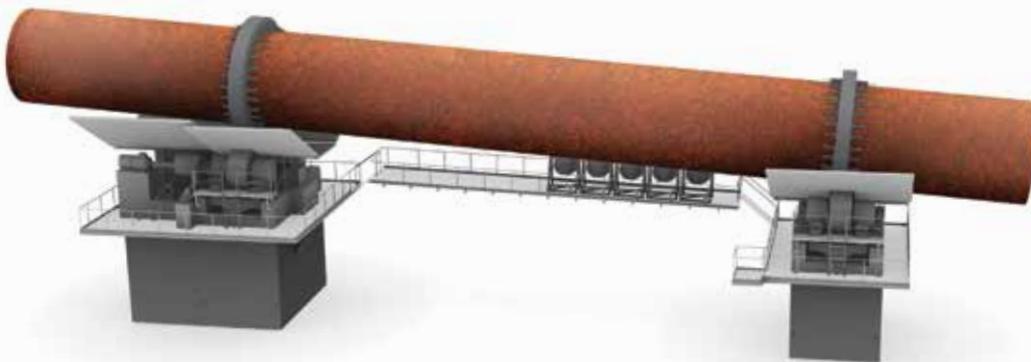
ROTAX-2®: for the modern plant

Benefits:

- High availability, low maintenance on fewer parts
- Low civil investment costs with only 2 bases
- Low kiln-shell ovality and long brick-lining lifetime
- Lowest specific heat loss and energy consumption

Design characteristics:

- Direct electro-mechanical drive through rollers
- Fully self-aligning roller support system
- Tangential tyre suspension
- Inlet and outlet graphite seal



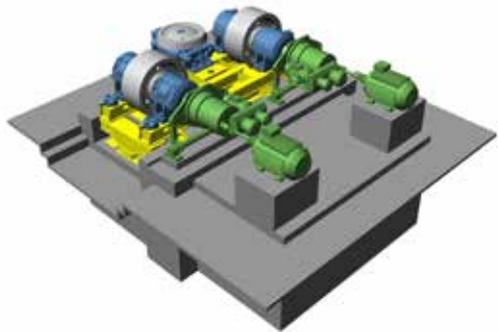
The kiln is the heart of the plant – what an entire cement plant is dimensioned around, and where most of the final chemical reactions take place. So it's not surprising that a producer requires an ideal kiln solution.

FLSmidth's ROTAX-2® and 3-base kilns deliver the best in rotary kiln designs. With the ideal temperature profile and material retention time, these rotary kilns play a key role in ensuring optimal quality clinker. Their maximum operating

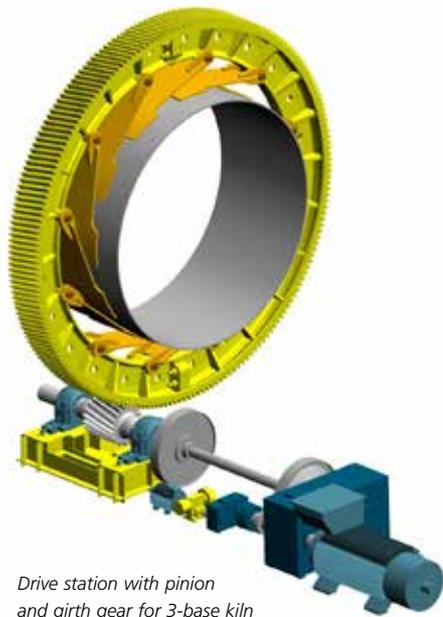
reliability and minimum operating costs help our customers stay competitive as well.

Since 1897, FLSmidth has been supplying cement plants around the world with the best in rotary kilns. Today our ROTAX-2 and 3-base kilns reflect our commitment to constantly pushing the limits of pyro-technology. Proven performers, they bring reliability and cost-effectiveness to the ambitious cement plant.

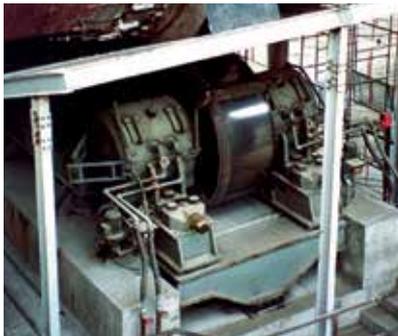
The components of success



Electro-mechanical direct drive station for ROTAX-2 kiln



Drive station with pinion and girth gear for 3-base kiln



Self-aligning roller support for ROTAX-2 kiln

Robust kiln drive station **= long lifetime**

While the ROTAX-2 and 3-base kilns share a number of proven components, the drive station is very different for the two kilns.

In the ROTAX-2 kiln, an electro-mechanical direct drive on the support rollers replaces the electro-mechanical gear rim pinion drive used on the traditional 3-base kiln. The friction between the roller and the kiln tyre is sufficient to ensure the rotation of the kiln. No lubrication is needed for the drive station.

When driving directly on the supporting rollers, tangentially suspended tyres are used to transmit the torque to the kiln shell. The straight-forward direct drive system requires only minimum maintenance, compared to the traditional girth gear and pinion mechanism.

Most ROTAX-2 kilns are driven through two of the rollers, except for the largest sizes which require four drives. For all kiln sizes hydraulic drives are available on request.

The 3-base kiln takes the classic approach to the drive station. The large gear rim has bolted spring plates which are welded onto the kiln shell. The shell can then expand without distorting the shell and gear rim. An automatic spray lubrication system ensures adequate lubrication of the gear rim. A simple, proven solution, it features high-quality materials and precision engineering.

Flexible roller support system **= high availability, low maintenance/ operating costs**

The roller support system in both types of kilns has the appropriate amount of flexibility needed to provide maximum support when spreading the load from kiln to foundation.

The ROTAX-2 kiln features an advanced support system – a fully flexible, self-aligning solution that follows the movement of the kiln. Supported in tangentially suspended tyres, on self-adjusting rollers, the kiln shell benefits from a support configuration that ensures full contact between roller and tyre. This leads to an even distribution of the load, eliminating the possibility of localized high stress areas. The increased allowable hertz pressure permits the use of smaller support rollers and tyres. This leads to high availability, low maintenance and low operating costs.

Due to the more stiff structure of the 3-base kiln, the support can be made in a more simple rigid and semi-rigid design to ensure adequate support.

FLSmidth uniquely offers its semi-rigid support system on 3-base kilns >4.35 m diameter, providing alignment, flexibility and reduced stress on components.



Dependable tyre suspension
= low ovality

Tangential suspension – when the kiln shell is fixed to the kiln tyre all the way around – can be used in both kiln types. Its main function is to distribute the supporting forces along the entire circumference of the kiln. This results in low ovality of the kiln and longer refractory lifetime. Furthermore, kiln alignment is not affected by minor settling of the foundation, making periodical realignment unnecessary.

Because the kiln is suspended concentrically inside tangentially suspended tyres, the kiln shell can expand freely, and there is always a gap between the kiln tyre and the kiln, eliminating the need for lubrication as well as wear between tyre and kiln. This completely eliminates the risk of shell constriction and the need for tyre migration monitoring systems. It ensures reliable transmission of drive power under any operating conditions. All parts are also visible with tangential suspension, simplifying both inspection and maintenance.

The ROTAX-2 kiln uses only tangential suspension to accommodate its higher flexibility. While the 3-base kiln is provided with floating suspension as standard, it can also be fit with tangential suspension.

In the 3-base kiln, when using floating suspension of the kiln tyre, loose-fitting blocks are held in place by bushings secured to the kiln shell. This allows easy restorative shimming to take place, lessening maintenance costs.

Reliable seals
= high thermal efficiency

The inlet and outlet zones with seals are very critical parts of a kiln. If false air enters the kiln system, fuel consumption increases, production output decreases and operating expenses go up.

The graphite seal uses a staggered arrangement with two rows of graphite blocks held in place by a wire rope system. This ensures an efficient seal against the outer air casing.

With their simple, mechanical construction, graphite seals require no greasing and are practically maintenance-free under normal operating conditions.

Our graphite seals at the inlet and outlet of the kiln reduce false air intake yet allow enough flexibility to follow the kiln's movements. Graphite seals are the preferred choice for both the ROTAX-2 and 3-base kiln; however inlet pneumatic seals and lamella seals are also available.

Automatic thrust device
= stability

Both types of kilns are kept in position by an automatic hydraulic thrust device (HTD) that controls the axial motion of the kiln. It counteracts the slope of the kiln and ensures uniform use of the contact surfaces between tyres and supporting rollers, as well as the girth gear and pinion. The hydraulic thrust device is designed to take up the full axial load of the kiln, so skewing of the support rollers is not needed.



Kiln tyre with tangential suspension



Outlet graphite seal



Hydraulic thrust device



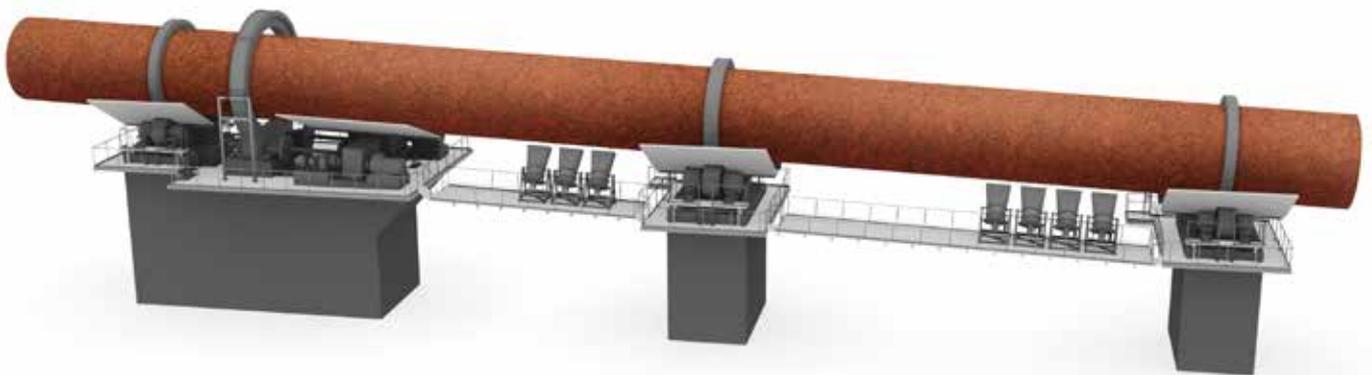
3-base kiln: the traditional choice

Benefits:

- Classic technology with well-known performance
- High length-to-diameter ratio
- Sturdy construction and longest lifespan of any 3-base kiln
- Straightforward design for low maintenance

Design characteristics:

- Girth gear and pinion drive station
- Rigid or semi-rigid roller support system
- Floating tyre suspension (tangential suspension optional)
- Inlet and outlet graphite seal



Different designs

= same quality

The ROTAX-2 kiln is the choice of the modern cement plant. The 2-base rotary kiln is a statically determined beam system, where the support load is always known. It is a shorter and wider kiln, with a reduced slope to maintain the material retention time, similar to a 3-base kiln. The larger diameter reduces the gas velocity and the dust recirculation, and secures a lower burning zone thermal load ($Gcal/h/m^2$) at the same production as a corresponding 3-base

kiln. Due to the ROTAX-2 kiln's particular length to diameter ratio, it has small space requirements and lower surface heat loss.

The ROTAX-2 kiln is directly driven via the inlet-end roller station, a design that takes the place of the traditional girth gear and pinion drive used in 3-base kilns.

The 3-base kiln is a high-quality, traditional rotary kiln system. It is characterised by a higher length to diameter

ratio compared to the ROTAX-2 kiln. It has a balanced design that ensures optimal combination of stiffness and flexibility to minimise kiln crank and misalignment.

The ROTAX-2 kiln uses tangential suspension support of kiln tyres, whereas the 3-base kiln normally uses floating suspension. Both kilns also share a number of design details. For more information on the differences – and similarities – please turn the page.

Guidelines for standard cement kiln dimensions (where D_i = free diameter inside refractory)

Nominal output of kilns with In-Line Calcliner and Cross-Bar® cooler



Kiln length is variable within a range and can be designed for special cases. The nominal output is based on normal clinker quality and kiln volumetric loading of 5.0 ton/day/m³ for 3-base kilns and 5.3 ton/day/m³ for ROTAX-2 kiln. The potential output of a kiln also depends on the burnability of the raw materials. The kiln rotational speed is designed for 5.0 rpm (revolutions per minute) with a nominal speed of 3.6.

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www.flsmidth.com

Project Centre Denmark

FLSmidth A/S
Vigerslev Allé 77
DK-2500 Valby
Copenhagen
Tel: +45 3618 1000
Fax: +45 3630 1820
E-mail: info@flsmidth.com

Project Centre USA

FLSmidth Inc.
2040 Avenue C
Bethlehem, PA 18017-2188
Tel: +1 610-264-6011
Fax: +1 610-264-6170
E-mail: info-us@flsmidth.com

Project Centre India

FLSmidth Private Limited
FLSmidth House
34, Egatoor, Kelambakkam
(Rajiv Gandhi Salai, Chennai)
Tamil Nadu – 603 103
Tel: +91-44-4748 1000
Fax: +91-44-2747 0301
E-mail: indiainfo@flsmidth.com

