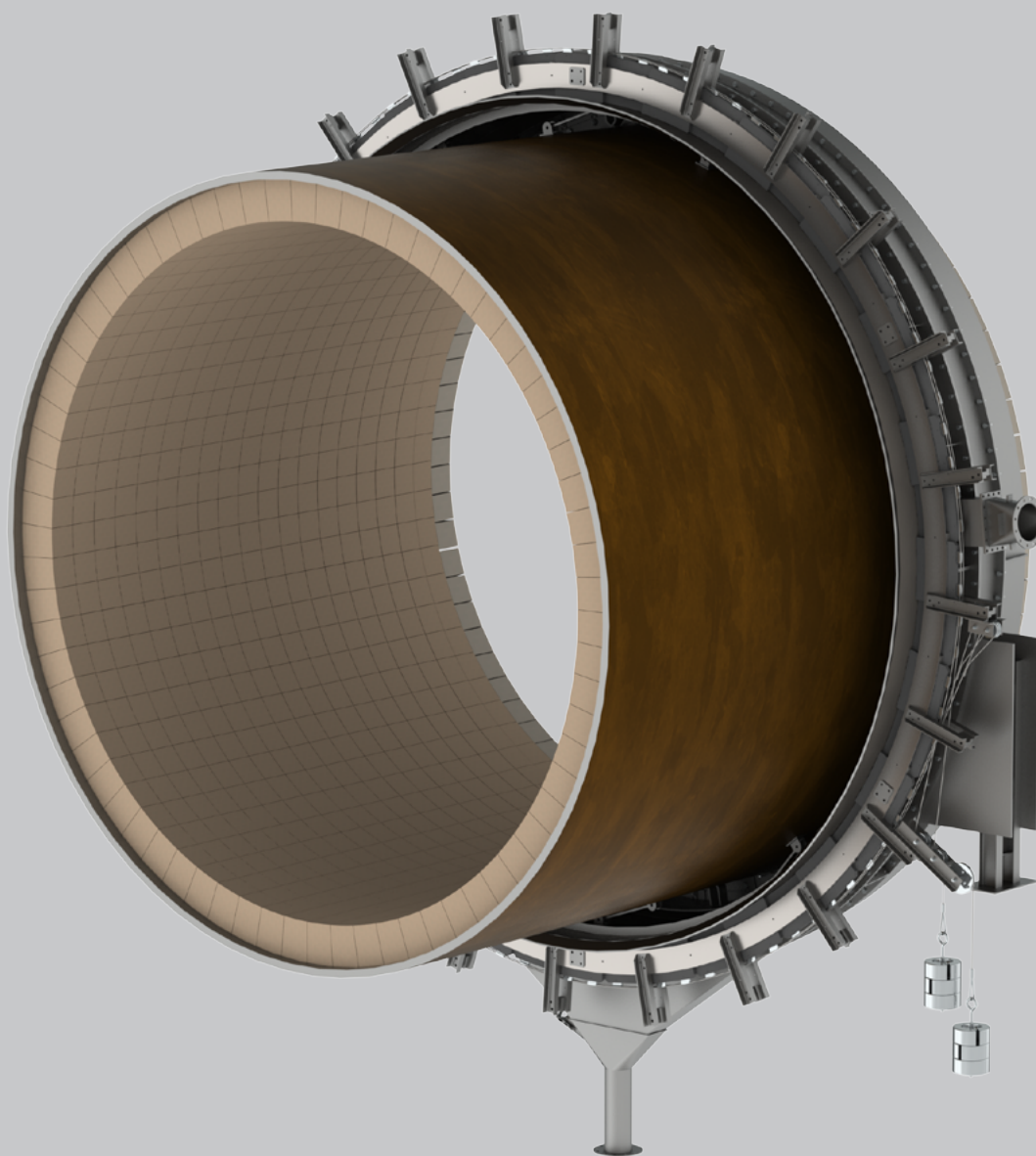


# Kiln graphite seal



# Efficient sealing

## Key benefits

- **Minimises false air intake**
- **Fast return on investment due to reduced power consumption**
- **Increases production and kiln availability**
- **Reduced, easy and predictable maintenance**
- **Estimated 3-5 years life of graphite blocks**
- **Easy and fast installation**
- **Adaptable to all types and sizes of kilns**

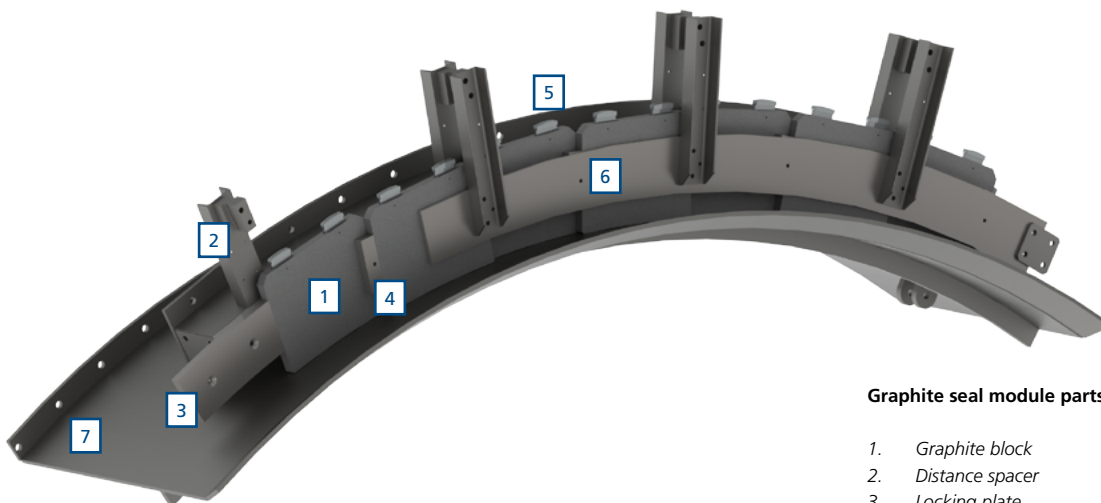
FLSmidth offers a kiln graphite seal that reduces fuel consumption and the need for maintenance, while increasing production capacity and the lifetime of vital sealing components. This product is the result of FLSmidth's aim to maximise production capacity and decrease production costs and downtime through continuous dialogue and cooperation with customers.

### Efficient sealing

The new FLSmidth kiln graphite seal is designed to optimise the operation pressure stability by preventing false air from entering the system. Furthermore, the seal reduces the release of hot gasses and dust particles from the kiln.

Unlike other block seals on the market, the FLSmidth 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.

The design allows the graphite blocks to move independently with the radial movement of the kiln without the graphite blocks getting stuck or damaged. Locking plates installed on the rear flange prevent false air from entering into the kiln system. The graphite seal is designed to withstand radial runout up to  $\pm 50$  mm as standard – this can be increased on request.



**Graphite seal module parts**

1. Graphite block
2. Distance spacer
3. Locking plate
4. Guide block
5. Rear flange
6. Front flange
7. Air casing

# Easy installation and predictable maintenance

## Fast, easy installation

To reduce downtime during installation, the kiln graphite seal is designed with a modular frame that allows for a large amount of pre-assembly. To ensure optimal quality and the straightness of the flanges, all FLSmidth graphite seals are preassembled in the workshop to ensure the straightness of flanges. The modular frame includes locking plates, distance spacers and guide blocks that guide and secure the position of the graphite blocks, thus maintaining an efficient sealing.

Depending on the scope, the typical installation requires 7 to 10 days.

## Retrofitting kiln seals

The kiln graphite seal is highly flexible in design and easily adaptable to any size of kiln – regardless of whether the kiln is manufactured by FLSmidth. The graphite seal modules are designed to integrate with the existing casing and cooling mantle without any modification. Other existing equipment such as kiln shell, fans and hoppers can easily be adjusted, which helps keep the installation cost to a minimum.

## Predictable maintenance

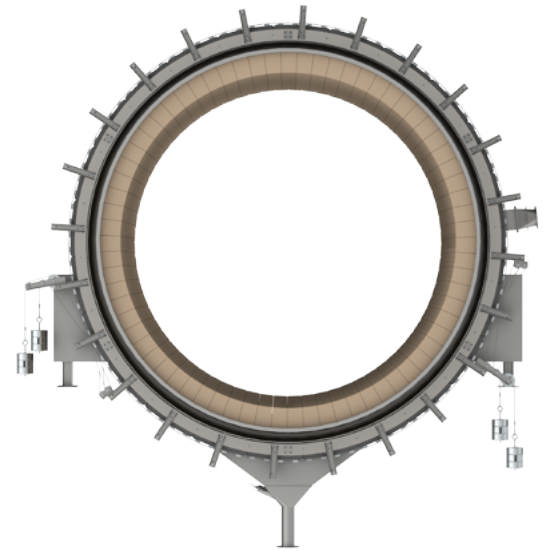
Maintenance of the kiln graphite seal is easy to predict by simple visual inspection. When needed, the wire rope system and modular frame allow for secure and fast replacement of the graphite blocks. The distance spacers are designed to allow replacement of the graphite blocks without dismantling the flanges.

## The wire rope system

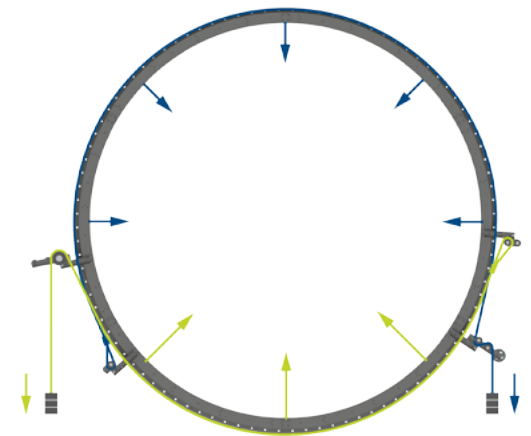
The wire rope system is comprised of counterweights and independent ropes covering both rows of graphite blocks. The ropes keep the graphite blocks in place and ensure that the graphite blocks adapt quickly to any movement caused by kiln runout, ovality or expansion, thus maintaining the thrust against the rotating parts.

The wire rope system is split into four - two covering the bottom 120 degrees and two covering the top 240 degrees. The split wire rope system makes it possible to increase the weight on the bottom wire in order to compensate for the additional gravitational pull of the lower graphite blocks, thus securing a uniform thrust on the entire circumference.

In the unlikely event of a wire failure, the graphite blocks will still be kept in the frame by a simple locking system.



*Wire rope system for efficient sealing*



*Wire rope system for a full row of graphite blocks - Identical wires are used to cover both rows of graphite blocks*

**Outlet seal**

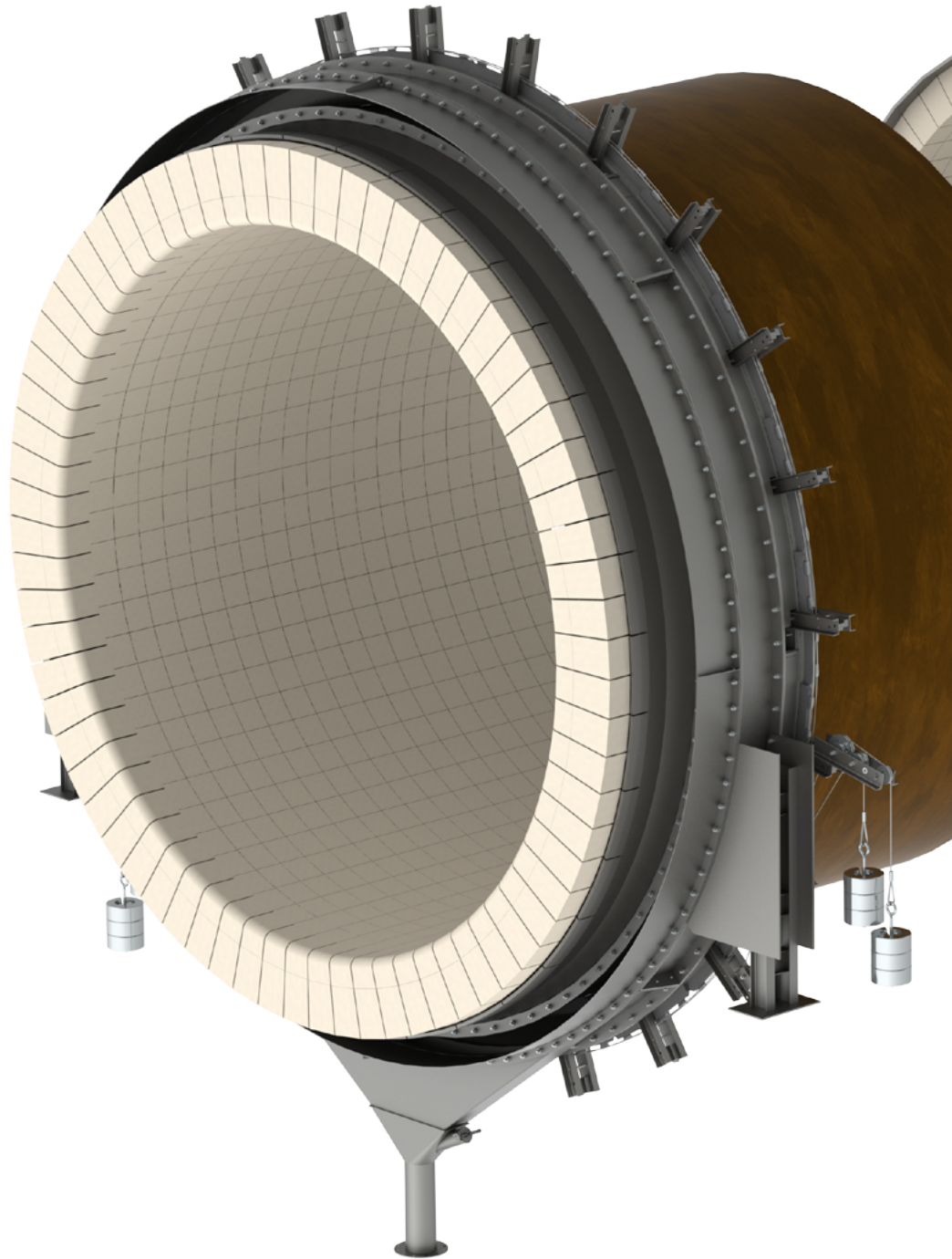
The outlet graphite seal provides improved sealing efficiency and reliability at the interface between the kiln and the cooler.

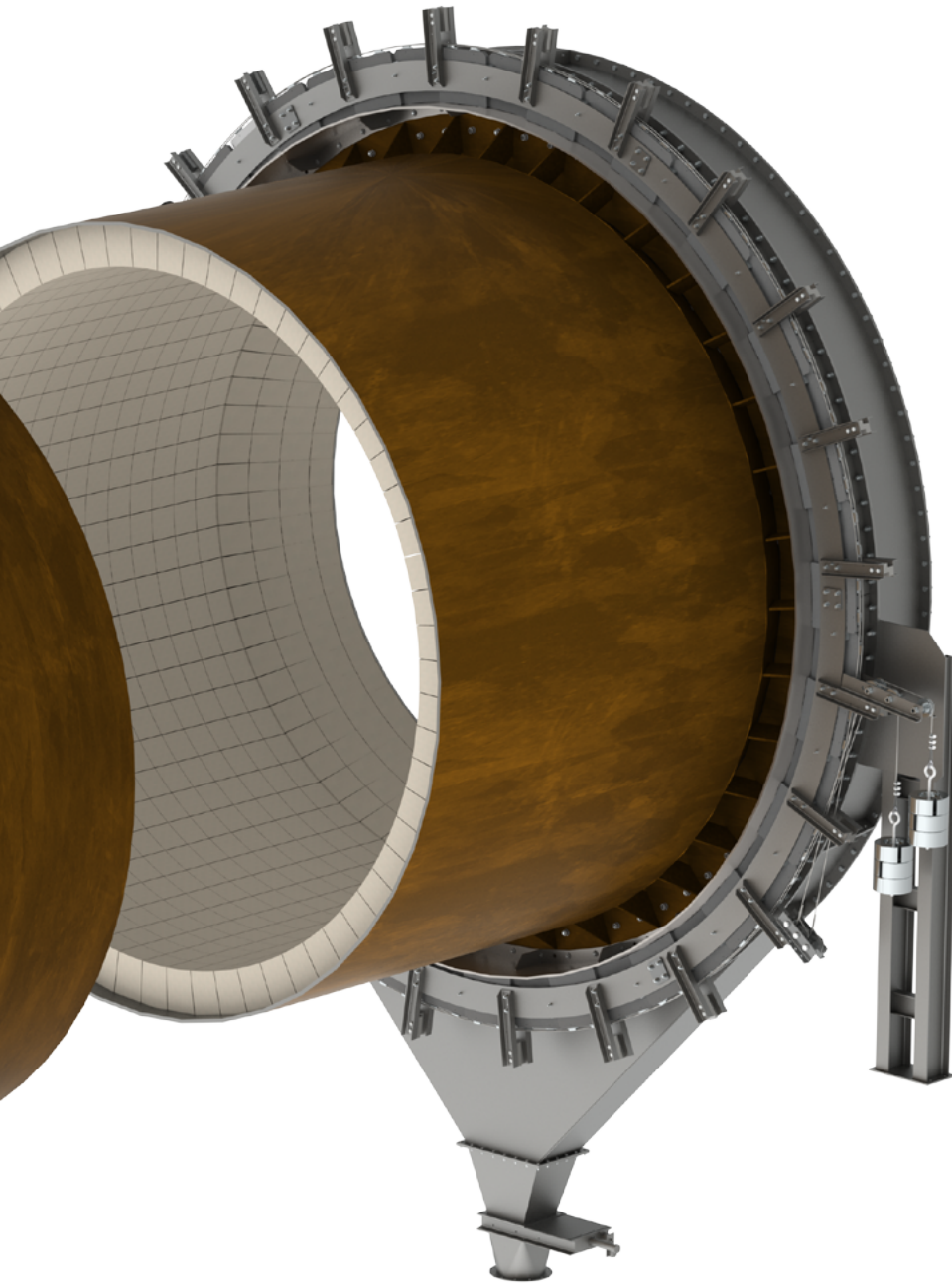
**Dust handling system**

Depending on customer requests, the dust handling system can be designed to ensure that escaping dust from the kiln outlet is collected in a concentric dust chamber and returned directly to the cooler – either to the first grate or to the external drag chain system via a chute.

**Heat shield**

A heat shield is installed in the casing to protect the graphite blocks from the radiant heat and from coming into direct contact with the clinker dust.





### **Inlet seal**

The inlet graphite seal provides improved sealing efficiency and reliability at the interface between the kiln and the preheater. The graphite seal construction allows the kiln inlet sectors to be replaced without removing the seal parts.

### **Dust handling system**

Depending on the kiln design and the ability for integration of the existing dust handling system, the graphite seal can be delivered with a heat-resistant steel shovel arrangement, which effectively collects any back spillage and returns it to the kiln.

The casing, hopper and ducting serve as a material buffer and guide the excess raw meal to a bin or conveyor system. The hopper is designed with a sloping plate to avoid the dust build-up at the graphite sealing. A slide gate installed in the bottom of the hopper will allow any accumulated material to be disposed to the bin or conveying system when required.

**FLSmidth provides the expertise to supply and install graphite seals on any kiln on-site around the world**



**Scan here**  
to view the  
product site

Learn more at [FLSmidth.com](https://www.flsmidth.com)

# Air cooling system

## Inlet cooling

The inlet cooling system consists of a fan and a closed isolated ducting system to cool vital sealing components. The cooling air is distributed to the rear flange and the air casing attached to the kiln riser. The air will escape into the atmosphere.

## Outlet cooling

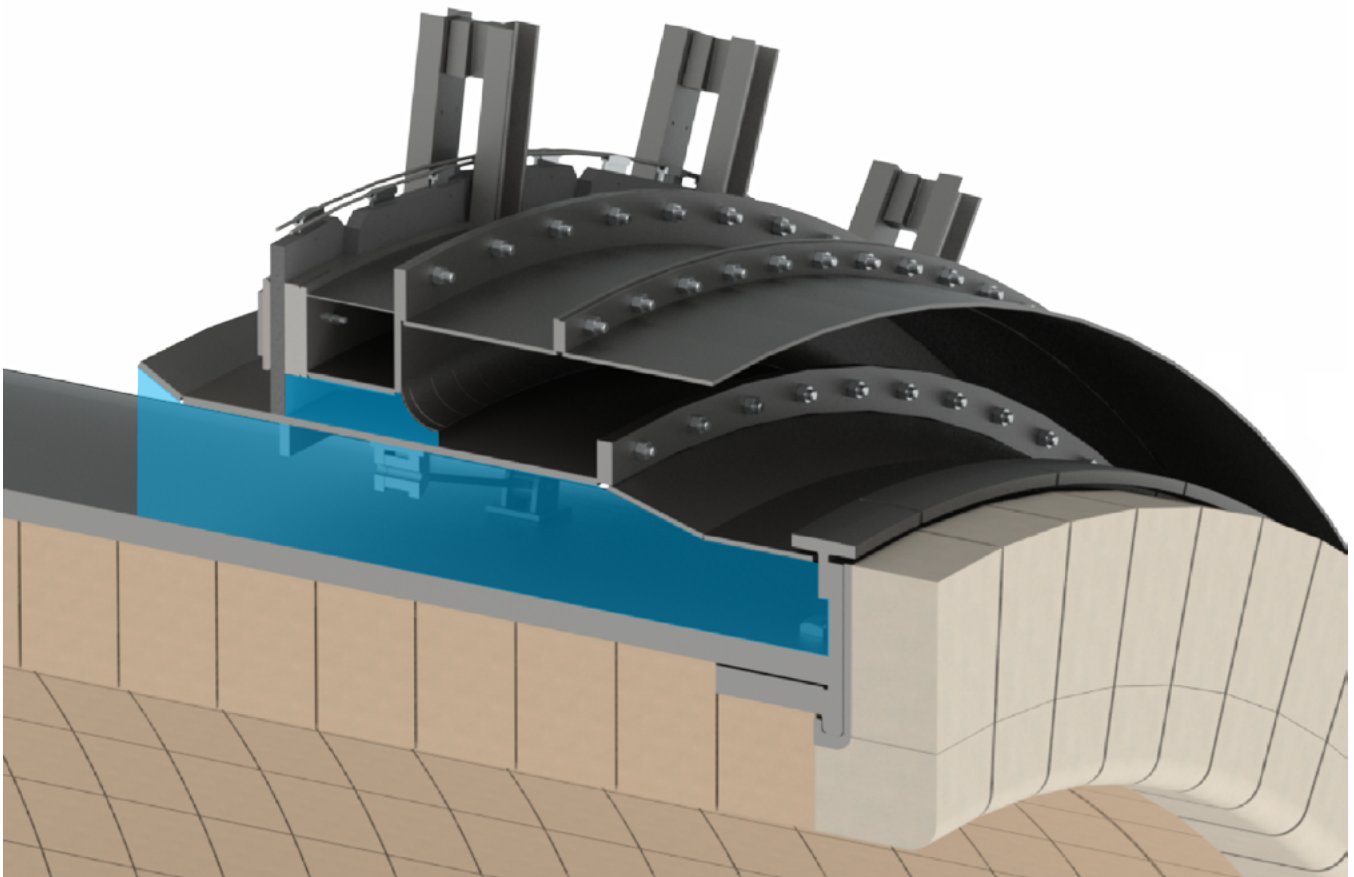
The outlet cooling system is separated into two independent systems – one for the kiln shell and nose ring cooling and one for the graphite cooling.

The graphite cooling is designed to maintain the temperature of the graphite blocks below oxidation temperature and secures the flatness of the flanges.

The closed rectangular cooling duct attached to the rear flange is cooled on a continuous basis, whereas part of the cooling air will be used to protect the graphite blocks from reaching high temperatures.

The graphite cooling system includes a fan, a pneumatically operated shut-off valve, temperature probes and a local control panel.

The cooling duct and bottom part of the shovel chamber has a cone to avoid duct accumulation before the graphite.



Outlet cooling zones

# Graphite seal spare parts

The need for spare parts is limited, as the graphite blocks and wire ropes are interchangeable between the inlet and outlet seals. The graphite blocks for the FLSmidth graphite seal are designed to ensure long life and optimum performance while keeping the required maintenance to a minimum.

The expected wear on the graphite blocks is 5-8 mm per year, which amounts to an expected lifetime of 3-5 years depending on conditions.

The wire is designed to run for a full production campaign.

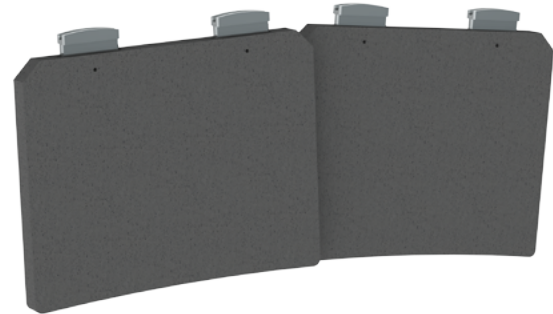
## **Graphite as the seal material**

The mechanical and thermal properties of graphite make it an ideal sealing material. The carefully selected material means that the graphite blocks are very hard and resistant to wear, yet flexible enough to conform to mating faces, thus ensuring a tight seal.

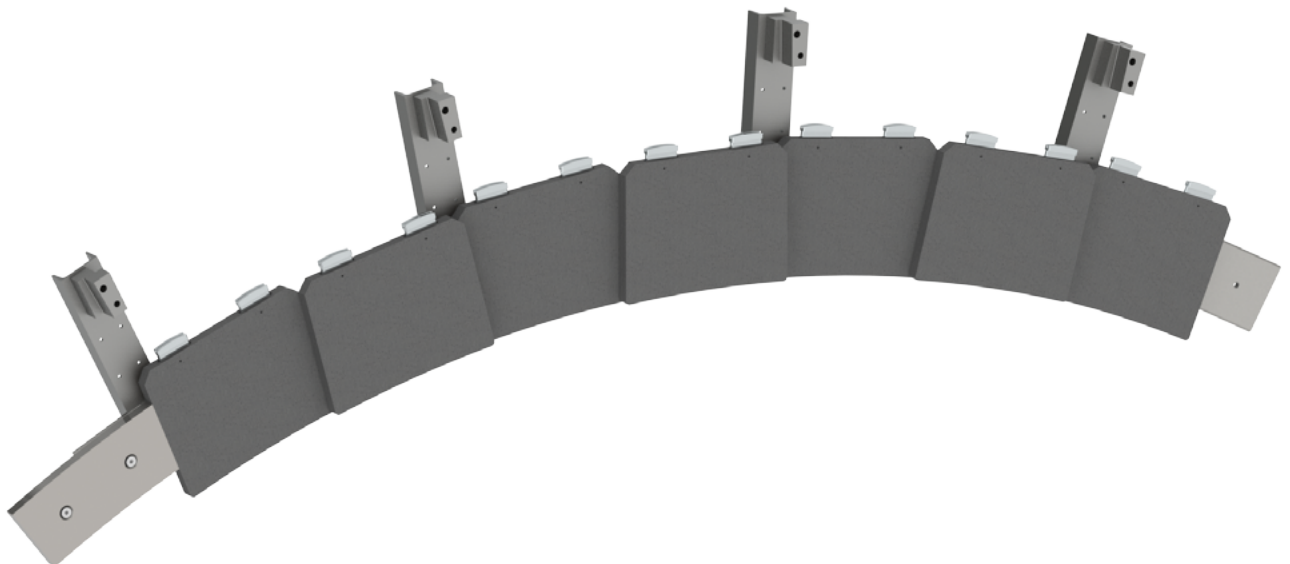
The low coefficient of friction and the self-lubricating properties of graphite make it ideal for application where normal lubricants cannot be used. It also extends the graphite blocks' lifetime.

Even high temperature application is not a problem for graphite due to its dimensional stability under wide temperature variations and its low coefficient of thermal expansion. Furthermore, graphite is highly resistant to chemicals, corrosion and oxidation.

FLSmidth graphite blocks are manufactured in highly specialised workshops using CNC equipment, which ensures high precision tolerance and a smooth surface finish.



*Graphite blocks*



*Graphite block arrangement*

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