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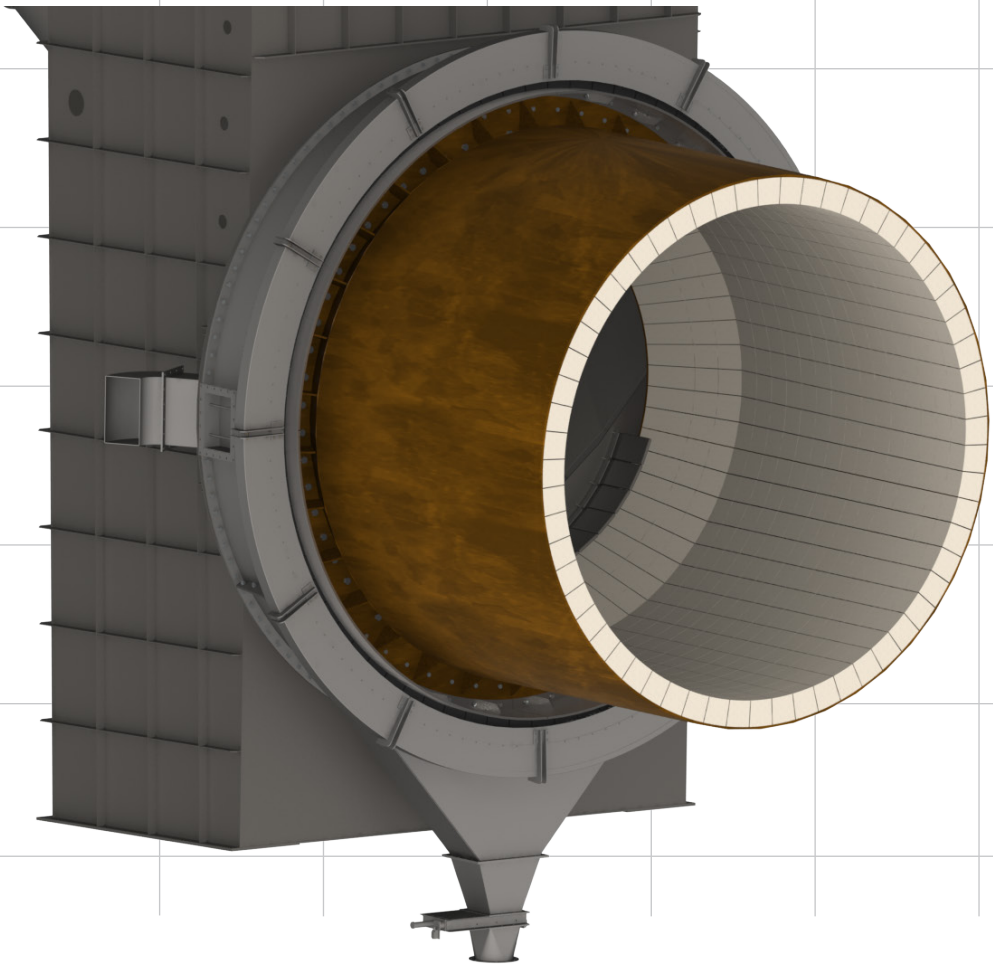


SPRING TENSIONED GRAPHITE SEAL

Reliable and efficient kiln sealing

RELIABLE AND EFFICIENT KILN SEALING

Efficient and reliable kiln sealing improves energy efficiency, reduces emissions and extends equipment life, helping you meet your environmental targets as well as your production goals. That's why we've enhanced our kiln seal with a new thrust mechanism design that improves sealing efficiency and service life.

KEY BENEFITS

Efficient sealing

Reliable long-lasting operation

Low maintenance

Reduced power and fuel consumption

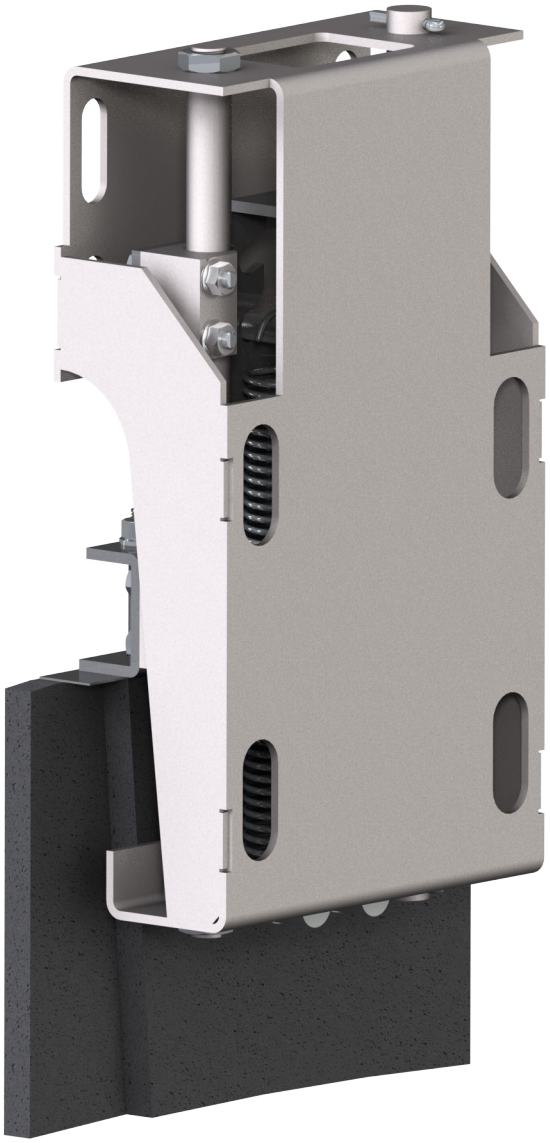
WHAT'S NEW WITH THE SPRING TENSIONED GRAPHITE SEAL

The high sealing efficiency of our new Spring Tensioned Graphite Seal prevents false air from entering the system and reduces the release of hot gasses and dust particles from the kiln.

Reduced fuel and power consumption go hand in hand with high sealing efficiency, providing you with a swift ROI. It's an easily adaptable solution for almost any kiln type. Immediate benefits, with no compromises.

Three key features contribute to the success of the Spring Tensioned Graphite Seal:

- Unique mechanism to thrust the graphite block against rotating parts
- Linear guide for each graphite block to control lateral movement
- A design that can handle a runout of up to ±50mm



Easy sealing

The inline row of graphite blocks that make up our Spring Tensioned Graphite Seal are actuated by individual thrust modules, which ensure efficient sealing towards the rotating parts – i.e. the sealing ring or the cooling mantle – at inlet and outlet, respectively. This arrangement allows the graphite blocks to move individually with the movement of the kiln without any risk of getting stuck or damaged. We've also added a linear guide system to the tensioning module to prevent lateral movement and stop false air entering the kiln system.

The thrust module – how it works

The compact thrust module generates the individual thrust to each graphite block by a spring suspended/tensioned in the module. Four bearings operate with low friction on two hardened stainless-steel shafts to secure a controlled and fast response to the kiln runout. The module easily takes up any movements of up to ±50mm caused by kiln runout, ovality or expansion. With an individual tensioning arrangement for each block, we eliminate the risk of failure across numerous blocks compared to other tensioning systems, such as wire ropes. The spring force can be adjusted as the graphite blocks wear.

A simple solution for kilns of all sizes

The Spring Tensioned Graphite Seal is highly flexible and easily adaptable to any size of kiln – both of Fuller and third-party design. The graphite seal modules are designed to integrate with the existing casing and cooling mantle without any modification – they are the same irrespective of the kiln size. Other equipment, such as kiln shell, fans and hoppers can easily be adjusted, which helps keep the installation cost to a minimum.
Fast and easy installation

To reduce downtime during installation, the kiln graphite seal is designed in flanged modules that can be easily pre-assembled. The thrust modules are built in the workshop where the linear guide is tested and various graphite seal assemblies are match-marked for ease of installation. Depending on the scope, the typical installation of a new Spring Tensioned Graphite Seal requires 7 to 10 days.

Built to last

The wear parts are made to run for a period of 3-5 years without any need to replace the parts during normal operations conditions. Maintenance is limited to a visual inspection and cleaning. When the wear parts need to be replaced, they are easily accessible and easy to replace.

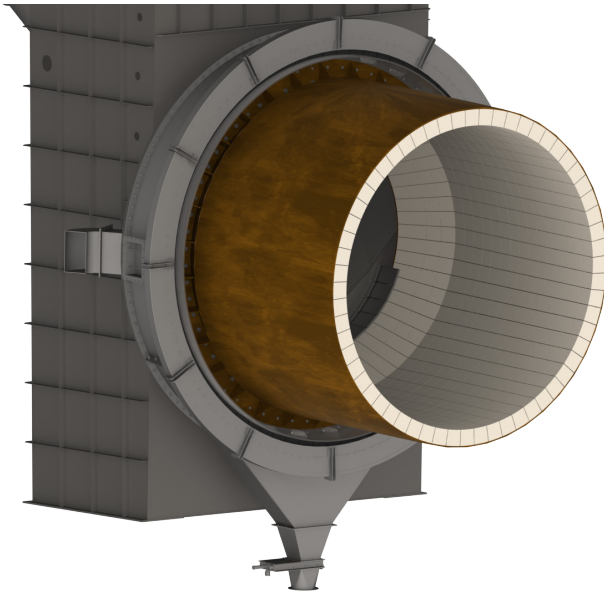
With most of the wear parts being visible and easily accessible the maintenance needs of the seal are easy to predict by simple visual inspection.

KILN INLET SPRING TENSIONED GRAPHITE SEAL

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.



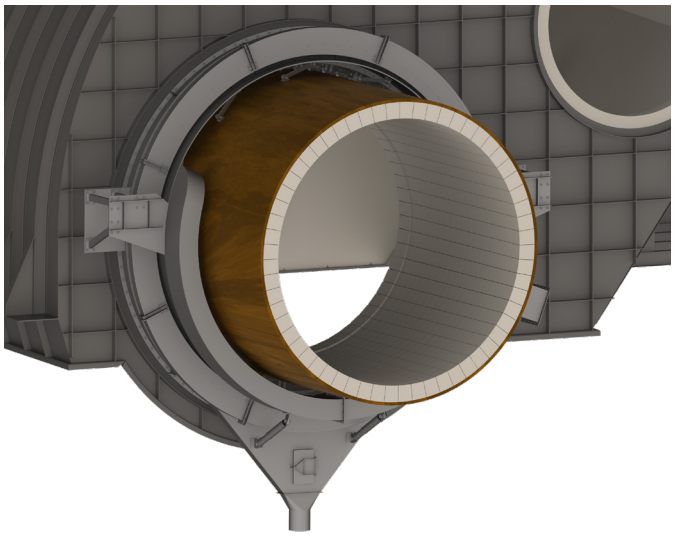
KILN OUTLET SPRING TENSIONED GRAPHITE SEAL

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.

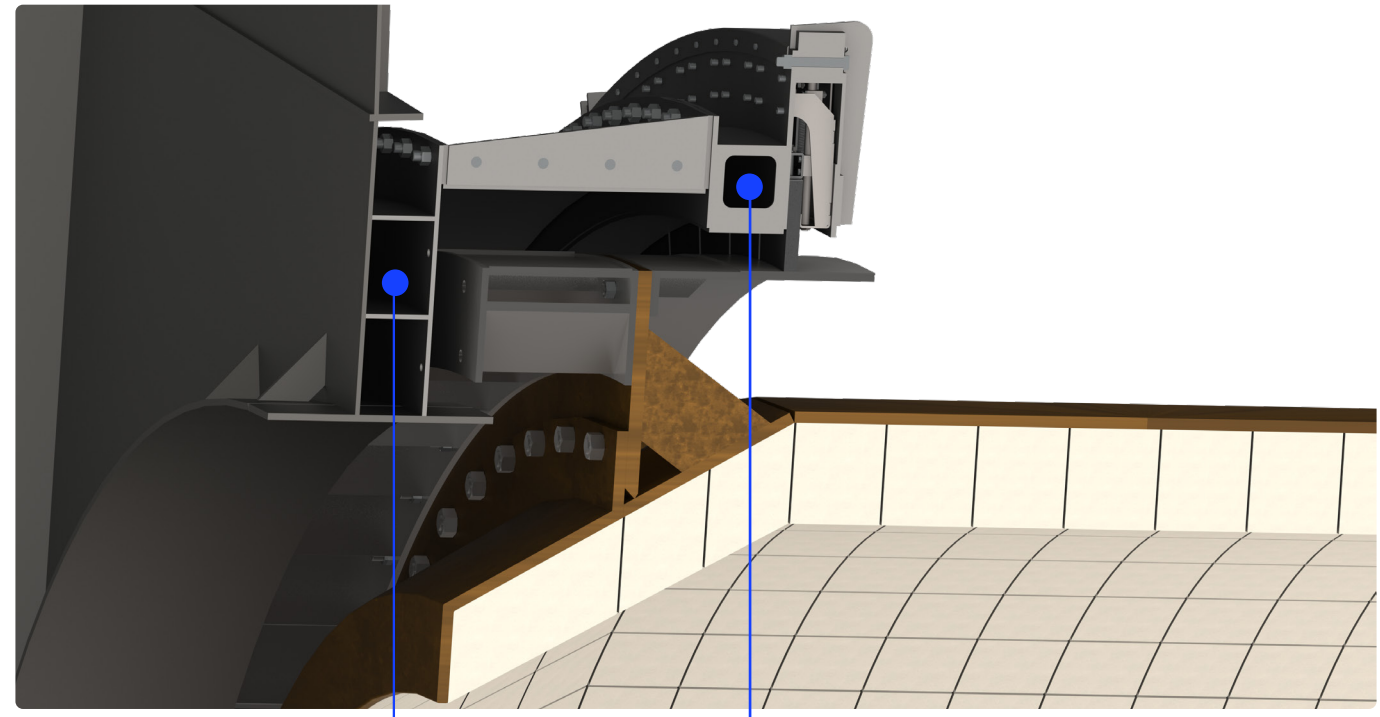
The bottom part of the shovel chamber and cooling duct has a cone to avoid dust accumulation before the graphite.
Heat shield

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 via a chute.



AIR COOLING SYSTEM

Inlet



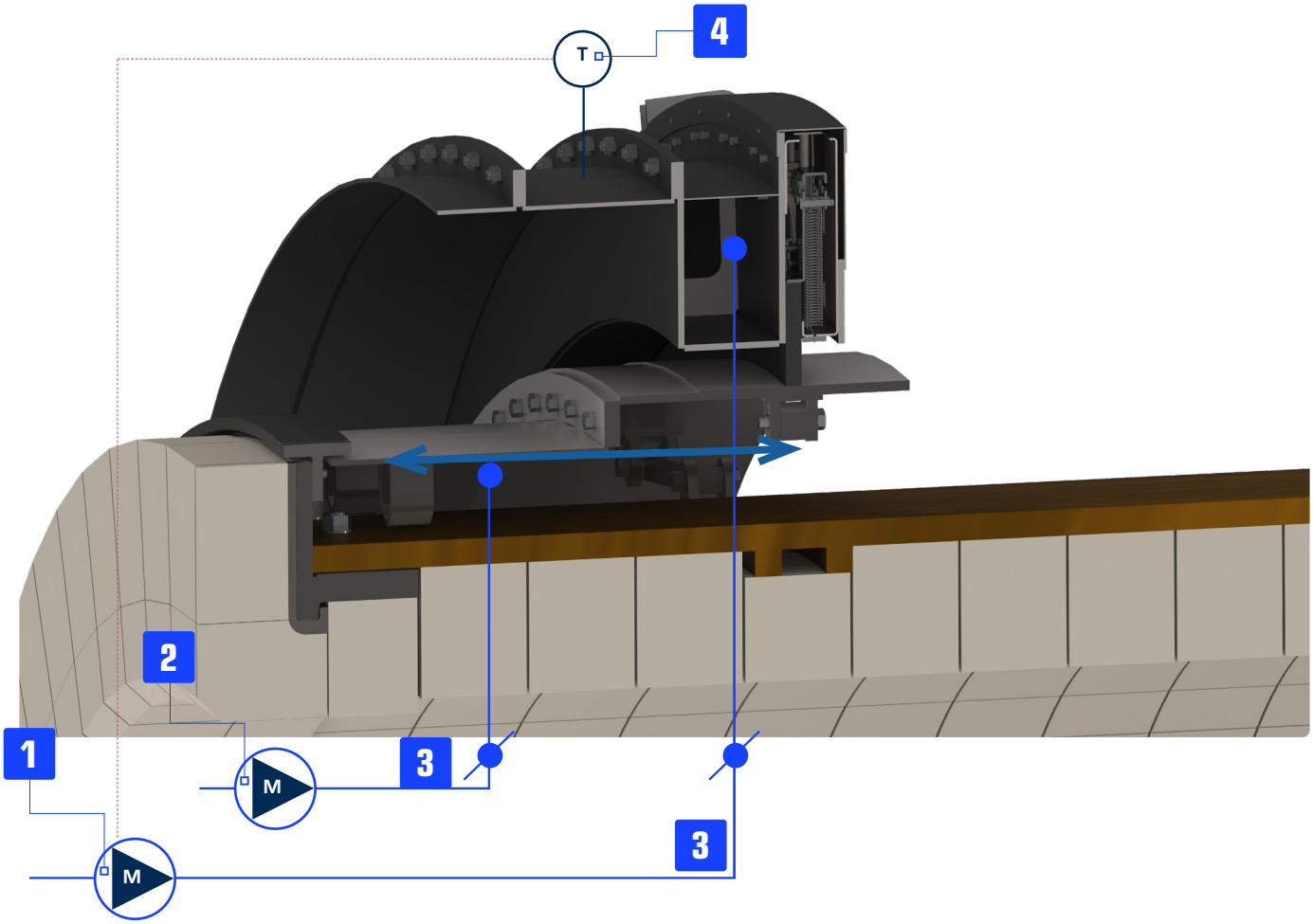
The inlet cooling system consists of a fan and a closed isolated ducting system to cool vital sealing components. The cooling air is distributed to the rear flange and the air cooling chamber attached to the kiln riser. The air will escape into the atmosphere.

Cooling arrangement:

1 FAN AND MOTOR

2 MANUAL VALVES AND DUCTING Ø500/Ø350

Outlet



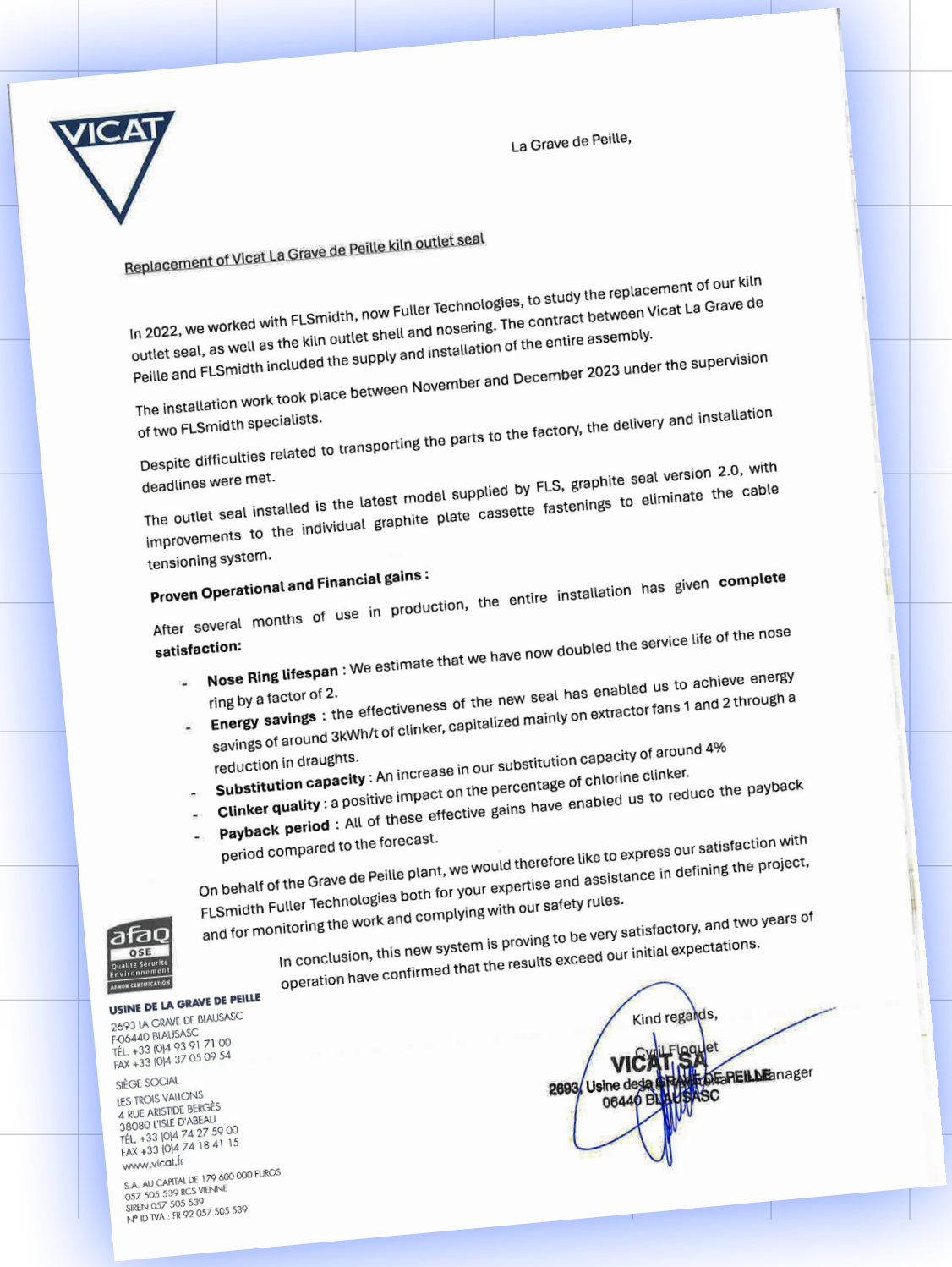
The outlet cooling system is separated into two independent systems – one for the kiln shell and nose ring cooling and one for the graphite cooling. The graphite cooling is designed to maintain the temperature of the graphite blocks below oxidization temperature and secures the flatness of the flange module.

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.

Cooling arrangement:

1. FAN AND MOTOR FOR GRAPHITE COOLING
2. FAN AND MOTOR FOR NOSE RING
3. DUCTING Ø500/Ø350
4. TEMPERATURE SENSOR

TESTIMONIAL: SPRING TENSIONED KILN SEAL



VICAT

La Grave de Peille,

Replacement of Vicat La Grave de Peille kiln outlet seal

In 2022, we worked with FLSmidth, now Fuller Technologies, to study the replacement of our kiln outlet seal, as well as the kiln outlet shell and nosering. The contract between Vicat La Grave de Peille and FLSmidth included the supply and installation of the entire assembly.

The installation work took place between November and December 2023 under the supervision of two FLSmidth specialists.

Despite difficulties related to transporting the parts to the factory, the delivery and installation deadlines were met.

The outlet seal installed is the latest model supplied by FLS, graphite seal version 2.0, with improvements to the individual graphite plate cassette fastenings to eliminate the cable tensioning system.

Proven Operational and Financial gains :

After several months of use in production, the entire installation has given **complete satisfaction:**

- **Nose Ring lifespan** : We estimate that we have now doubled the service life of the nose ring by a factor of 2.
- **Energy savings** : the effectiveness of the new seal has enabled us to achieve energy savings of around 3kWh/t of clinker, capitalized mainly on extractor fans 1 and 2 through a reduction in draughts.
- **Substitution capacity** : An increase in our substitution capacity of around 4%
- **Clinker quality** : a positive impact on the percentage of chlorine clinker.
- **Payback period** : All of these effective gains have enabled us to reduce the payback period compared to the forecast.

On behalf of the Grave de Peille plant, we would therefore like to express our satisfaction with FLSmidth Fuller Technologies both for your expertise and assistance in defining the project, and for monitoring the work and complying with our safety rules.

In conclusion, this new system is proving to be very satisfactory, and two years of operation have confirmed that the results exceed our initial expectations.

Kind regards,

Cyril Floquet
Plant Manager

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