FULLER®

IN-LINE CALCINER PREHEATER SYSTEM

OPTIMAL COMBUSTION, WHATEVER YOU'RE WORKING WITH

Modern cement plants are navigating varying feed stocks, diverse fuel types, evolving cement mixes – all amid continuous demand. Every part of the process must be optimized to maximize sustainability, efficiency and profitability, but getting the pyroprocess right is fundamental to cement quality, environmental responsibility and process reliability. Our preheater calciner systems have been developed through decades of field expertise combined with cutting edge R&D. The result is a trusted solution that is successful on every level.

KEY BENEFITS

01
Effective emission control

02
Easy operation

03
Highly reliable

04
Optimized fuel and power consumption

05
Excellent suitability for low-grade fuels

06
Flexible design for easy upgrades

INTRODUCING THE ILC

The In-Line Calciner (ILC) preheater was introduced to the market in 1976 as a combined multi-stage cyclone preheater/calciner system in which the majority of the calcination process takes place in a separately-fired, stationary calciner before the rest of calcination and clinkerization take place in the adjoining rotary kiln.

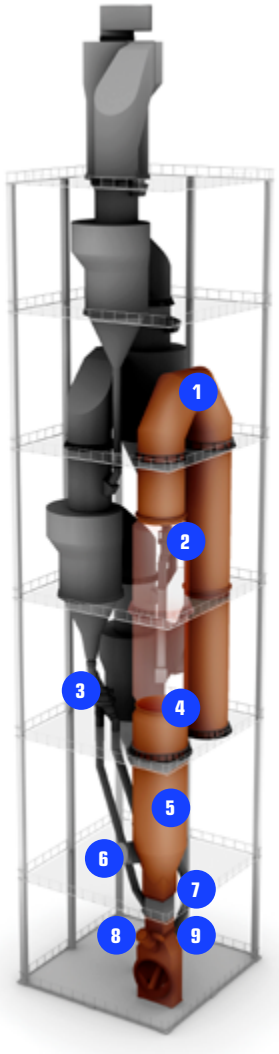
Continuously developed since its launch, the ILC remains at the forefront of technology, evolving to meet new demand for higher throughputs and greater alternative fuels firing. Today, hundreds of cement plants around the world rely on this technology to achieve daily production capacities up to 14 000 tons, with some plants achieving 100% alternative fuel firing in the calciner, and even eliminating the need for ammonia addition for NOx emission control.

How the ILC preheater works

Raw meal is introduced at the inlet gas duct to the Stage I (top) cyclone. Moving through the cyclone stages, it is preheated by hot, countercurrent gas flow from the kiln and calciner system to achieve temperatures up to 800˚C before it reaches the calciner.

Fuel is burned in the calciner to achieve 92-95% of the total material calcination before collection in the bottom cyclone and entrance into the kiln. Combustion air for the calciner is taken from the kiln via the riser duct and through a separate tertiary air duct from the cooler.

1. Calciner outlet loop duet
2. Meal dividing gate for “hot zone”
3. Meal dividing gate for NOx reducing zone
4. Calciner vessel notch
5. Optional “hot zone”
6. Tertiary air inlet
7. NOx reducing zone
8. Optional kiln gas bypass
9. Calciner firing point



Effective emission control

The ILC simply and effectively reduces NOx and CO emissions by incorporating only one firing location, one meal split and one tertiary air stream entering tangentially to the calciner.

- The raw meal is split from the second-lowest stage cyclone between two feed points: the kiln riser duct and calciner. Between these two feed points, the riser duct widens to form a dedicated NOx reduction zone.
- All calciner fuel is introduced to the kiln riser duct under sub-stoichiometric conditions, reducing the NOx carried up from the kiln.
- The main calciner vessel, situated above the reduction zone, is divided into two or more sections separated by a notch, creating turbulence that ensures effective mixing of fuel, raw meal and gas.
- The calciner outlet loop duct ensures optimum gas retention time, further mixing and complete fuel combustion.

This design is so flexible that where further NOx and CO reduction is needed, we can simply split the second- or third-lowest stage cyclone again to allow a portion of the meal to be diverted directly into the upper section of the calciner. This creates a “hot zone” in the lower section of the calciner that helps both with burning difficult fuels and reducing NOx.

SIMPLE, PROVEN DESIGN

For easy operation and minimal maintenance

Easy operation

The ILC's uncomplicated design – with single points of entry for calciner fuel and tertiary air – makes it straightforward to control and maintain. High-efficiency LP cyclones with low pressure drop keep fuel and power consumption predictable, while the high calcination rate at the kiln inlet supports stable, consistent kiln operation. For plants seeking further operational optimization, the ILC is fully compatible with Fuller's ECS/ProcessExpert® (PXP) advanced process control software, which stabilizes pyroprocess operations, reduces process variability by up to 40%, and enables higher alternative fuel utilization rates.

Highly reliable

The ILC's simple, proven design creates minimal maintenance demands. LP cyclones are engineered without internal horizontal surfaces to prevent raw meal accumulation and ensure stable, uninterrupted operation. Robust dividing gates, cast central pipes with hanging suspension systems, and a solid refractory tertiary air duct damper all contribute to a system built for long service life and minimal unplanned downtime.

Optimized fuel and power consumption

High-efficiency LP cyclones minimize pressure drop across the preheater, reducing the load on the induced draft fan – the most power-intensive component in a kiln system. With 55 – 65% of total firing taking place in the calciner, the kiln operates at lower thermal load, extending refractory life and improving overall heat economy. A calcination rate of 92 – 95% at the kiln inlet means your kiln can focus on clinkerization rather than carrying the burden of calcination.

FUTURE-READY DESIGN, BUILT FOR FUEL FLEXIBILITY

Excellent suitability for low-grade fuels

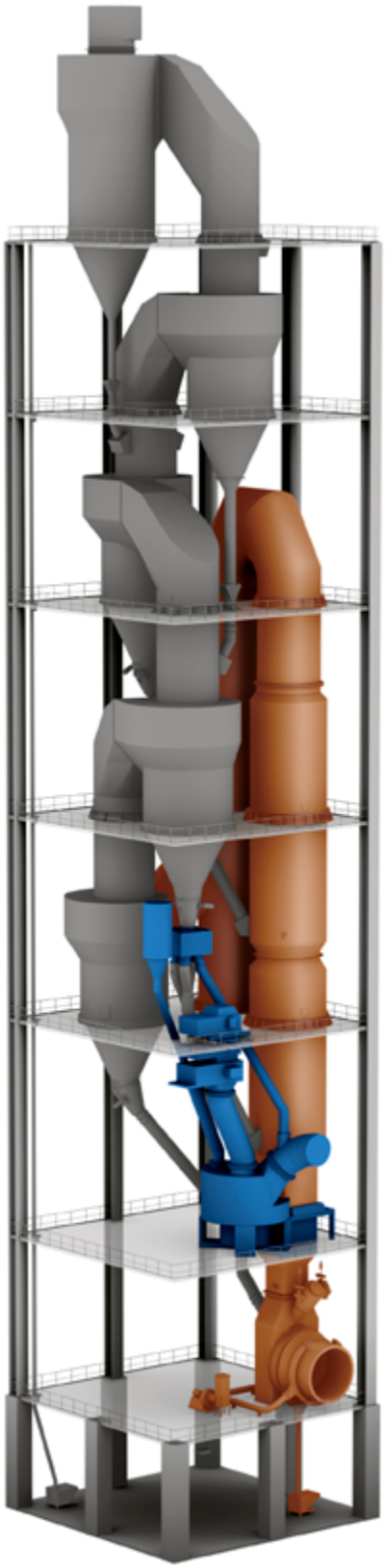
The ILC is designed to burn both traditional and alternative fuels and can be integrated with the HOTDISC® Reactor and/or the FUELFLEX® Pyrolyzer to achieve high substitution rates using a range of fuel types. The optional hot zone in the lower calciner provides the elevated temperatures needed for difficult-to-burn fuels, while the notched calciner vessel and outlet loop duct ensure complete burnout regardless of fuel variability.

Flexible design for easy upgrades

The ILC can be retrofitted to virtually any existing kiln system, whether a conventional suspension preheater, another calciner design, or a long dry or wet kiln – regardless of original supplier. Its modular design allows individual LP cyclones to be upgraded independently, and the system can be expanded from single to multiple preheater strings as capacity demands grow. Where NOx reduction requirements tighten, the hot zone upgrade requires only an additional meal split, with no fundamental redesign of the system.

Key design characteristics

- Full capacity range of today's plants of 14 000 tpd or more
- Built with single or multiple preheater strings with up to 6 cyclone stages
- Ratio of firing in calciner: 55 – 65%
- Calcination at kiln inlet: 92 – 95%
- Allowable bypass of kiln gas: 0 – 60%
- For bypass of kiln gas up to 100%, special ILC version applies
- Optional "hot zone" in lower section of calciner
- Available with or without the HOTDISC® Reactor for burning coarse alternative fuels
- Can be retrofitted with FUELFLEX® Pyrolyzer



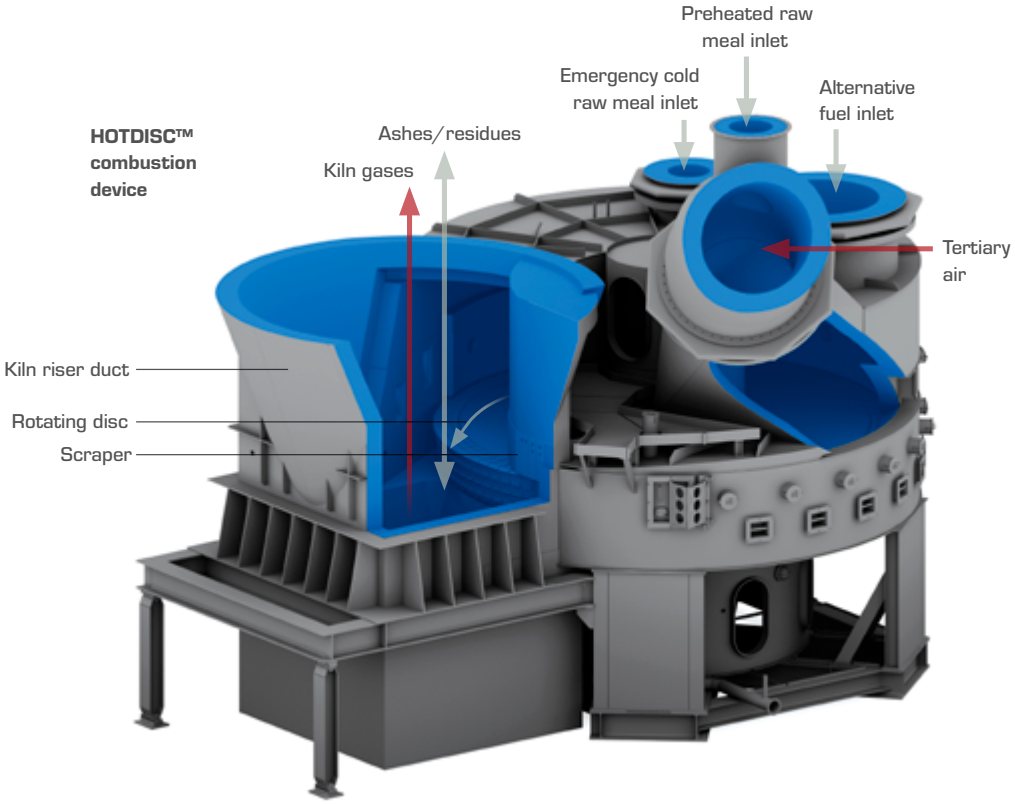
OPTIMIZING ALTERNATIVE FUEL FIRING

The ILC preheater is designed to flex to your needs – not only by extending residence time and enhancing mixing, but also by connecting with other systems that increase your ability to burn alternative fuels.

HOTDISC® – the waste fuel solution

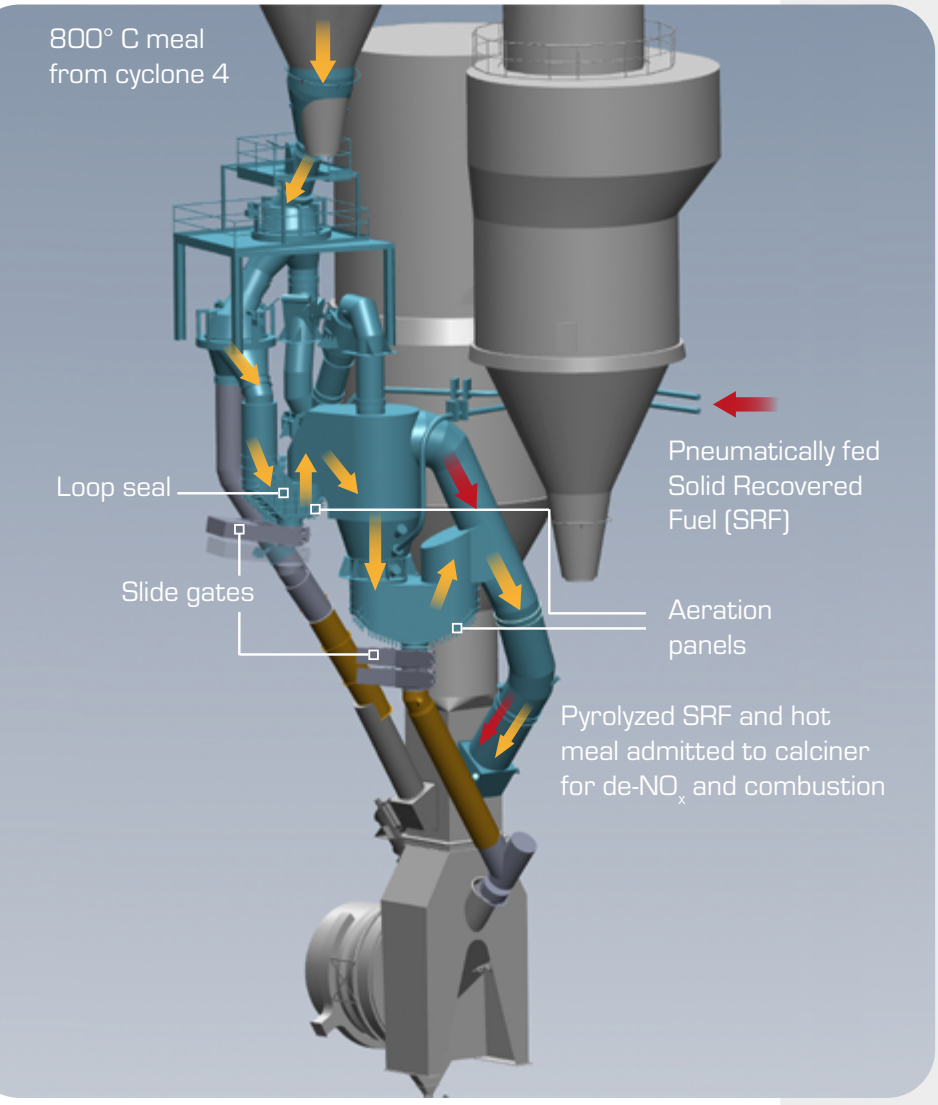
Increasingly, plants are burning solid waste fuels to achieve a variety of benefits. By integrating the ILC with our HOTDISC® Reactor, it is possible to achieve unsurpassed fuel flexibility with minimal impact on process stability and performance.

The HOTDISC is a safe, simple and effective combustion device that has proven to be the best available technology for substituting calciner fuel with coarse, three-dimensional alternative fuels. With the HOTDISC, plants can burn all kinds of solid waste in sizes up to 1.2 meters. This eliminates the need for expensive shredding of lumpy waste material.
Fuel is burned in the calciner to achieve 92-95% of the total material calcination before collection in the bottom cyclone and entrance into the kiln. Combustion air for the calciner is taken from the kiln via the riser duct and through a separate tertiary air duct from the cooler.



FUELFLEX® PYROLYZER – PROVEN RESULTS WITH 2D FUELS

The FUELFLEX® Pyrolyzer can be added to the ILC calciner to enable up to 100% alternative fuel firing, using RDF, biomass, or other high-volatile solid recovered fuels. It uses hot meal from the lower preheater cyclones to dry and pyrolyze the fuel, producing a highly reactive stream that feeds directly into the calciner – significantly reducing NOx emissions and eliminating the need for ammonia injection.



Yours by design

Preheater and calciner design has a strong influence on operational efficiency, emissions and fuel flexibility. Every Fuller system is optimised for your specific plant, drawing on decades of process expertise delivered by our global network of engineers. Here's how the key design decisions work:

1 How many cyclone stages do you need?

Fuller systems can be configured with up to six cyclone stages. The right number is primarily determined by your grinding system's drying requirements, but emissions targets and how you use the preheater exit gas also play a role – as can practical constraints like local building codes or site height restrictions.

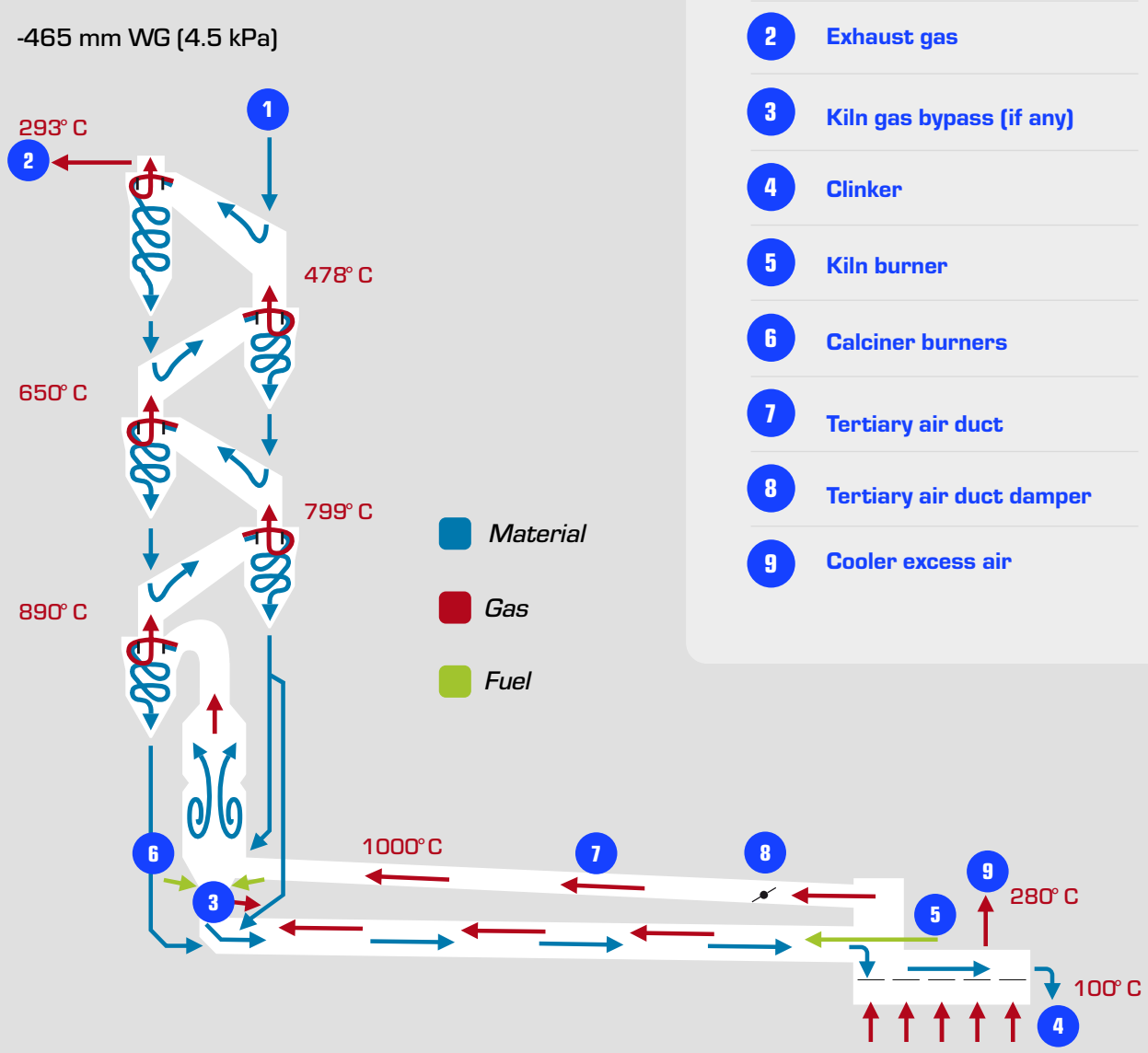
2 How many strings?

String count is essentially a capacity question: the higher your throughput requirements, the more strings you'll typically need. Most plants operate with one or two strings, with additional strings considered only for the largest capacities. Moving from one string to two is driven by cyclone size and the resulting preheater structure volume.

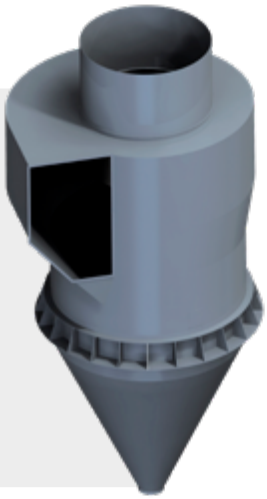
3 What size cyclones?

Cyclone sizing is a careful balance: smaller cyclones reduce the physical footprint, but pressure drop must be kept as low as possible to minimise induced draft (ID) fan power consumption – the single most energy-intensive component in a kiln system. Larger cyclones reduce pressure drop, but stable operation requires maintaining a minimum gas velocity to prevent raw meal from falling back through the riser ducts. We find the optimum for your specific conditions.

TYPICAL PROCESS FLOWSHEET OF AN ILC KILN SYSTEM

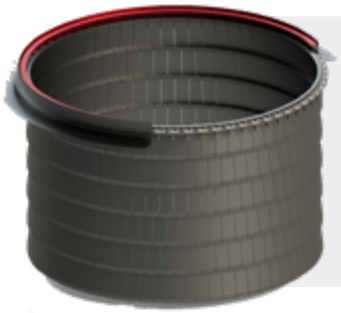


PREHEATER COMPONENTS



Cyclones

Fuller preheaters are based on proven low-pressure loss (LP) cyclones. The unique design of the LP cyclone ensures high thermal efficiency and low pressure drop while enabling a flexible and space-saving layout. LP cyclones have no horizontal surfaces on the inside for material to accumulate, thereby securing stable operation. The top stage has a special geometry to provide the lowest dust loss while maintaining low pressure drop. LP cyclones are not just for completely new preheaters but may be individually fitted to upgrade existing preheaters.

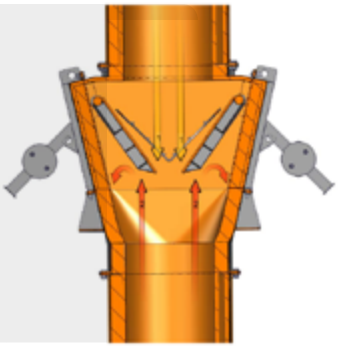


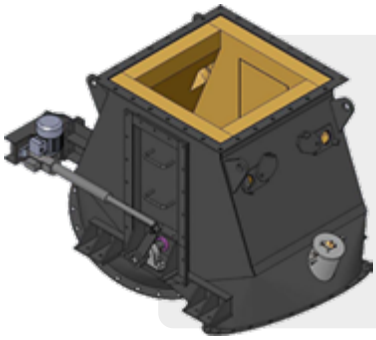
Central pipes

Central pipes (thimbles) are standard in all cyclone stages to provide high separation efficiency. The lowermost cyclones feature a cast, segmented design with a hanging suspension system and common elements throughout. This enables easy installation and maintenance.

Sluice flaps and distribution boxes

To prevent gas from bypassing up through the material pipes between the cyclone stages, the pipes are equipped with sluice flaps (tipping valves) designed for full opening. Good meal distribution in the cyclone riser ducts is ensured by adjustable spreader plates in the distribution boxes.



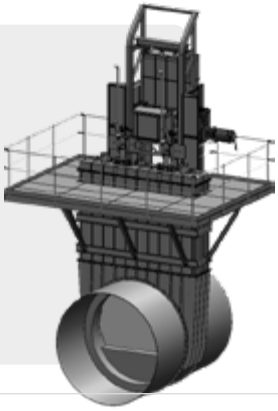


Dividing gates

Robust dividing gates are used to precisely and consistently distribute meal to the different sections of the riser duct and calciner. Our gates are capable of dividing meal into two, three, or four different streams.

Tertiary air duct damper

To balance the combustion air flow between the kiln and calciner, a tertiary air duct damper is provided for reliable regulation of the tertiary air gases. The damper design features a solid refractory blade for long, reliable life.



UPGRADES, SERVICES AND SPECIAL SOLUTIONS

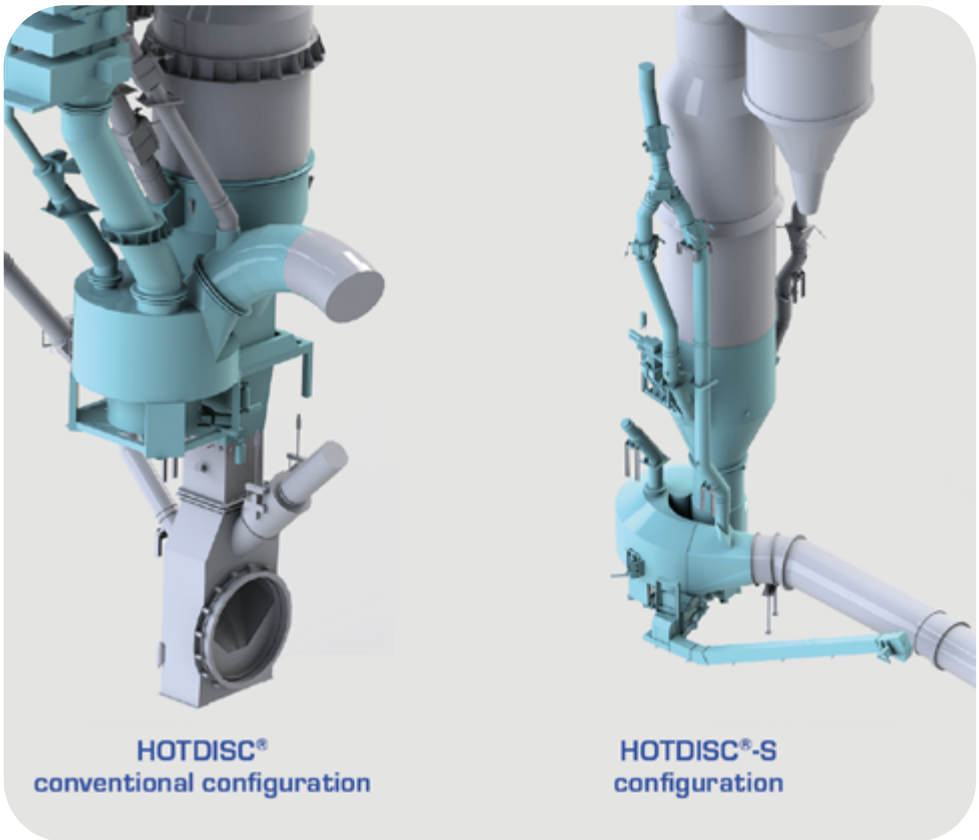
ILC upgrades

It is possible to upgrade virtually any existing kiln system into the modern ILC – regardless of whether it comes from Fuller or another supplier. This includes not only conventional suspension preheaters (SP) and other calciner systems, but also complete transformations of long dry and wet kiln systems.

SLC-D preheater calciner system

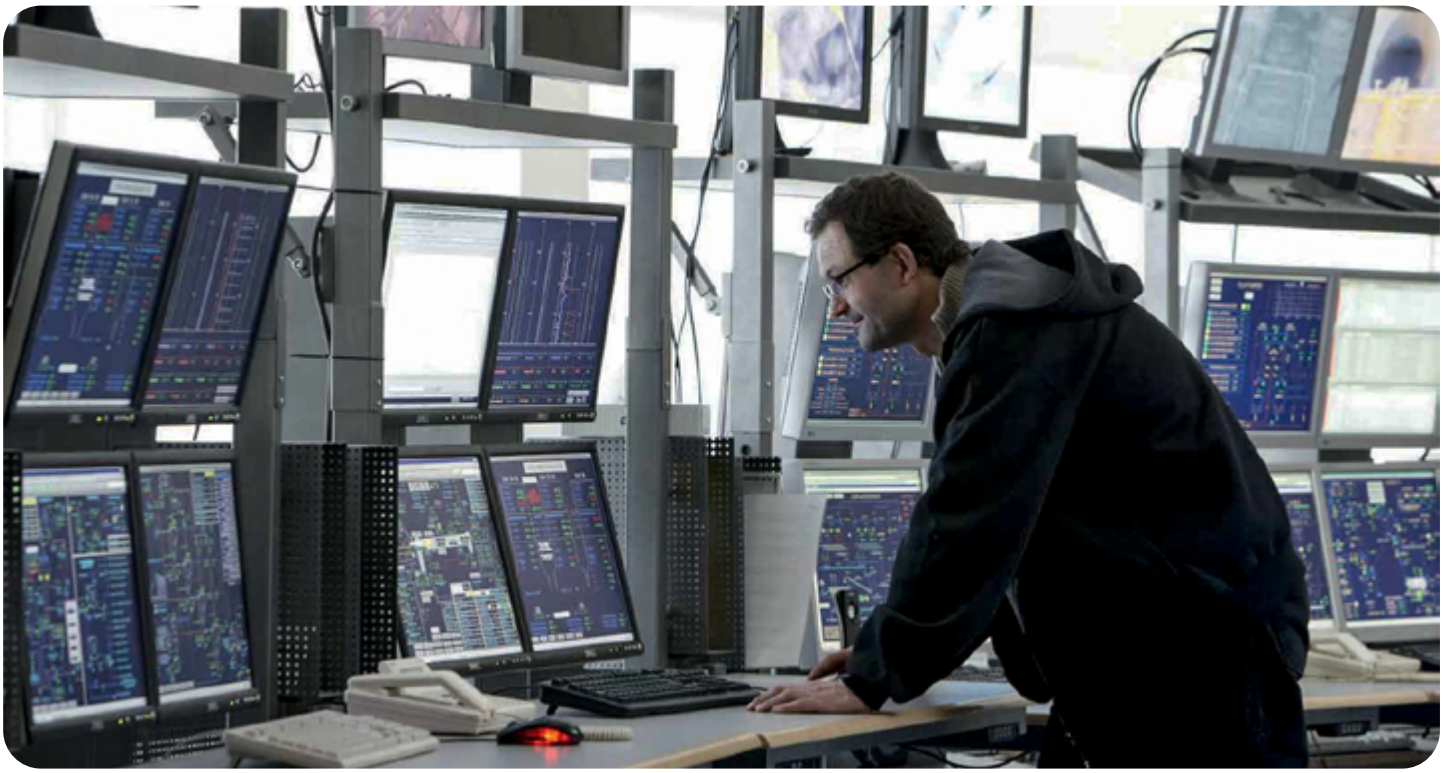
As an optional preheater calciner system, Fuller also offers the SLC-D. With its high-temperature pre-combustion chamber, the SLC-D (Separate-Line with Downdraft Calciner) offers unique flexibility in fuel use. Choose it as a new system or quickly upgrade an existing ILC or SP preheater.

The separate-line features of this system enable a substantial portion of the total retention time to be located parallel to the kiln riser duct. The placement of the combustion chamber outside the preheater structure makes this calciner design well suited for upgrades, since downtime is minimal.
The SLC-D combines the advantages of separate-line calciners with the low NOx features of the in-line calciner when a portion of the calciner fuel is directed to the kiln riser duct.
A hybrid arrangement that combines the SLC-D with a HOTDISC® Reactor is also available to further optimize waste fuel firing.



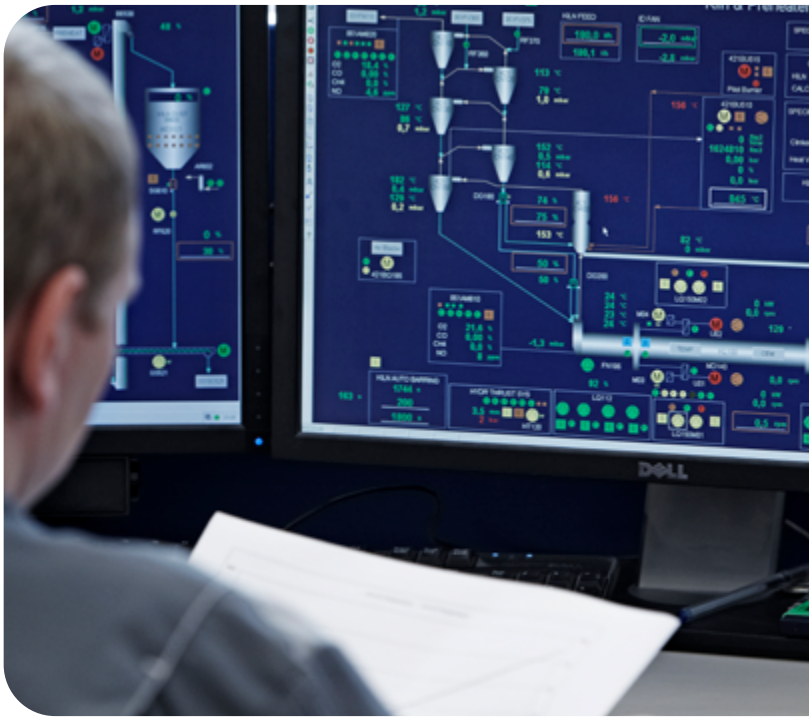
HOTDISC®
conventional configuration

HOTDISC®-S
configuration



ECS/ProcessExpert

ECS/ProcessExpert is our advanced process control solution, designed to optimize every aspect of your process. In the pyro line, it continuously analyses process conditions in the kiln and cooler and then makes precise process adjustments that ensure performance targets are consistently achieved. These adjustments are made far more frequently and reliably than any human operator could manage, ensuring your operation really is optimized in real time. Add ECS/ProcessExpert to your line and achieve up to 7% increase in production, up to 7% reduction in fuel consumption, and up to 2% reduction in your overall CO2 footprint.



Full lifecycle support

From planning to implementation, and on through the life of your plant, we are here to help with onsite and remote support, advice, guidance and more. Our experienced field services engineers will be happy to help you optimize your pyroprocess and meet your operational goals. From digitalization to maintenance, audits and more – your success is our success, and our global network of engineers is at your service.

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