

# Cooler Aftermarket and Support Services



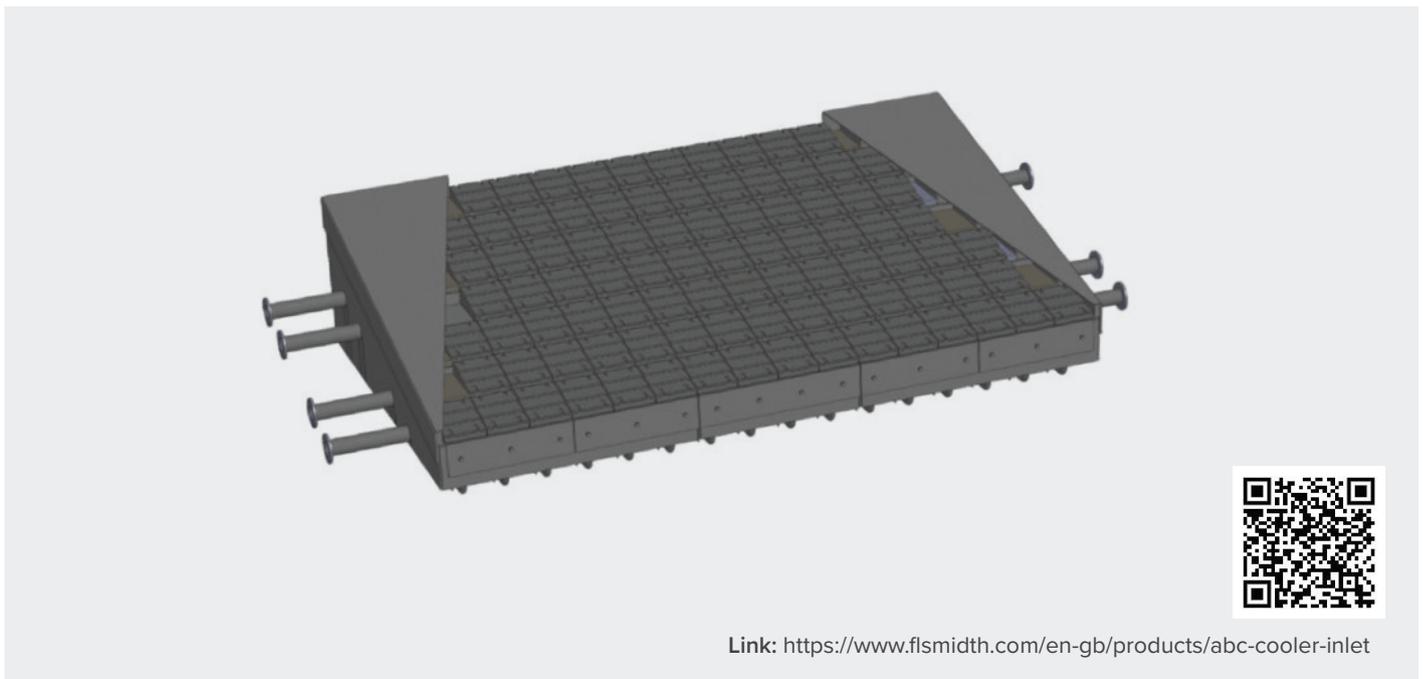
# Contents

<b>1. Fixed Inlet</b> .....	3
1.1 ABC™ Inlet.....	3
1.2 CIS upgrade to ABC™ Inlet.....	6
1.3 Fixed inlet drop zone compartment.....	6
<b>2. Split cast parts and inlet seal upgrade</b> .....	7
<b>3. Lubrication</b> .....	9
3.1 Centralized automatic lubrication.....	9
3.2 Semi-automatic lubrication.....	10
<b>4. Clinker Crushing</b> .....	11
4.1 HRB MF – Heavy-duty Roller Breaker Modular Frame.....	11
<b>5. Hot air recirculation</b> .....	13
<b>6. Clinker Bed Stabilizer</b> .....	15
<b>7. MFR Pattern optimization</b> .....	16
<b>8. Wave grate upgrade</b> .....	17
<b>9. SF – CB upgrade</b> .....	18
<b>10. Cross-Bar® Cooler extension upgrade</b> .....	19
<b>11. Thermo couple upgrade</b> .....	20
<b>12. Inside-the-box upgrade (Full/Partial upgrade)</b> .....	22
<b>13. Inspection hatches</b> .....	24
<b>14. QCX®/AutoSampling</b> .....	25
14.1 QCX® PSC101/ 111/ 112 Mk II Clinker Sampler.....	26
14.2 QCX® PSK101/ 111/ 112 Hot Clinker Sampler.....	28
<b>15. Productivity Partner Services</b> .....	30
15.1 Cooler inspection.....	30
15.2 Repair and refurbishment services.....	31
15.3 Cooler start-up and finetuning.....	32
15.4 Onsite Training.....	32
15.5 Service agreements.....	33
<b>16. Productivity Partner Offerings for Cooler</b> .....	34
16.1 PXP upgrade pyro or cooler.....	34
16.2 SiteConnect™ Mobile Insights App.....	37
<b>17. Comprehensive Matrix of benefits</b> .....	39

# 1. Fixed Inlet

## 1.1 ABC™ Inlet

Folax	Coolax	SF	MMC	CB	SF-CB	Non-FLS
✓	✓	✓	✓	✓	✓	✓



The ABC Inlet (**A**ir **B**last **C**ontrolled) is a fixed inlet section of the clinker cooler which is standard for new coolers and also available as retrofit for any existing grate type coolers. It is fixed inlet, which means no moving grates and thereby no derived problems from that. It features air blast-controlled technology to remove snowmen and avoid clinker agglomerations thus preventing related production downtime. The purpose of the ABC Inlet is to receive the hot clinker from the kiln, quench cool and distribute it evenly across the cooler width before reaching the cooler without undesired agglomerations and snowmen formations. In addition, it comes with a lot of benefits compared to other inlet types.

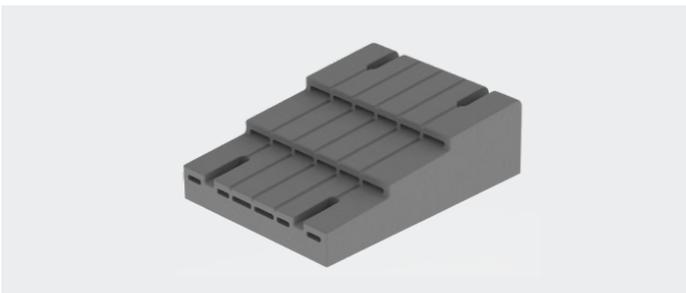
### Key benefits

- Reduce fuel consumption and associated emissions
- Eliminate snowmen
- Ability to reduce the clinker factor, thanks to improved clinker quality
- Energy-efficient cooling and controlled air blasting
- Better clinker distribution across the cooler width
- Opportunity to increase the use of alternative fuels, now that snowmen aren't causing a bottleneck



### How does the ABC™ Inlet work?

The ABC fixed inlet consist of cast grate plates with forward facing air slots providing regulated cooling air to the clinker bed. The cooling air from the fan(s) is regulated with Mechanical Flow Regulators (MFR) under each grate plate and ensures a constant flow to the entire clinker bed. Bigger ABC Inlets come with a separate drop zone compartment giving better quench cooling control of the clinker and better distribution. Besides the regulated cooling air, each grate is connected via a manifold system to an air blaster, which can release compressed air in powerful bursts in order to remove early clinker agglomerations on the ABC™ Inlet. With the flexibility of blasting in the grates, combined with blasters in the inlet wall, the foundation for snowmen formation is eliminated. The grate plates are divided into zones on the ABC™ Inlet with typically between 8 and 20 grates depending on ABC™ Inlet size and each zone can be blasted individually. The blasters will activate in predefined sequences divided into multiple programs, and the auto control will choose the program optimal for the current operation condition.



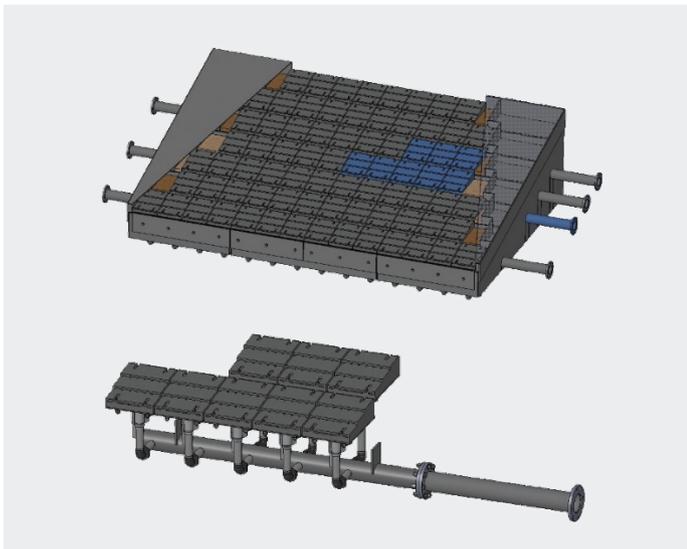
### Grate plates

The casted grates are essential parts and they have been subject to design changes to better fit the application and improve performance. Features such as the three-level grate design together with the forward-facing air slots offers a smooth inlet grate line with small steps and low friction, plus it enhances the clinker flow during operation. The grate plates are made from alloys with high wear- and heat-resistance and can be supplied in two grades depending on the location of installation.



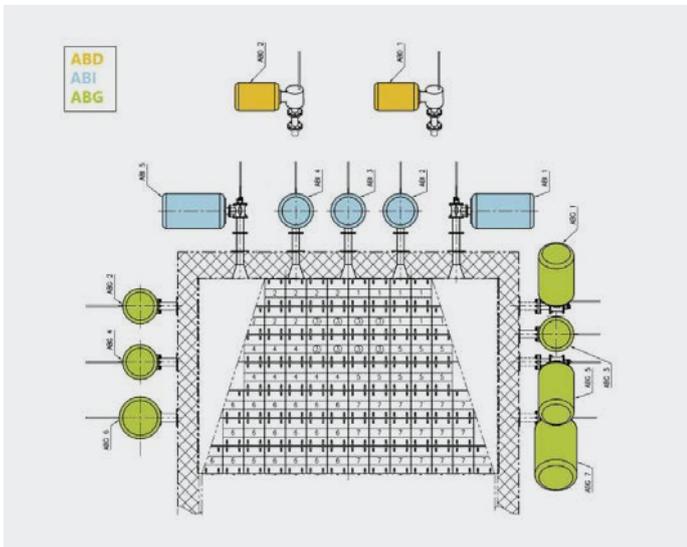
### MFR and Check valve

Installed underneath the grate plates is well-known MFR technology. Each MFR ensures a constant air flow regardless of the clinker bed resistance on top of the grate. Inside the grates there are installed two check valves: one big for MFR air stream (MFR valve), and one small for compressed air stream (air blast valve). The valves are simple disc valves and will ensure air is led out through the grate air slots and not bypassing backwards in the system. When the air blaster activates, a pulse of air is led into the volume under the grate plate and the MFR check valve will close thus the compressed air will be led out through the grate air slots. Both the check valve and the grate plate are fixated to the support frame with strong T-bolts tightened from the compartment below.



## Piping arrangement

Inside the ABC™ inlet the piping arrangement ensures the distribution of compressed air to the correct blast zone (cluster of grates) via the underlaying manifolds. The horizontal main pipe has several outlet pipes which goes vertical up towards the grates. The outlet pipe is connected to the air blast valve in the grate by a burst-proof flexible pipe for easy installation tolerance. The horizontal main pipe is connected via standard flanges to the connection pipe which goes out through the ABC support frame and cooler casing. Lastly the air blasters are connected to the flanges on the outside of the cooler. The internal piping arrangement is welded to the support frame.



## Air blast system

Part of the ABC's core functions come from the air blast system. It is a system of several air blasters connected to the ABC™ Inlet via standard flanges. Air blasters are divided into three groups: ABI, ABG and ABD.

**ABI:** Air Blaster for Inlet wall - connected to nozzles inside the inlet wall refractory above grate line and shooting into the clinker bed.

**ABG:** Air Blaster for Grates - connected to the ABC piping arrangement and shooting into the grate plates.

**ABD:** Air Blasters for Dust return system - connected to the Kiln seal dust return (if applicable).

The air blasters are connected to plant compressed air line of 6-10 bars and they are activated thru solenoid valves which are located in a nearby cabinet.

## Viability for retrofit/upgrades

The ABC™ Inlet is included as standard on all new coolers, but it is also available as an upgrade to existing coolers – whether or not they were supplied by FLSmidth. This relatively simple upgrade can be completed in 2 – 3 weeks and has an immediate impact on cooler performance – and on your finances. Savings on fuel consumption and maintenance, as well as gains in clinker quality, all add up to a generous and swift return on investment. The design and geometry of the ABC™ Inlet components makes it very suitable for inside-the-box retrofits on older coolers, as it is easy to adapt to existing cooler casing.

## 1.2 CIS upgrade to ABC™ Inlet

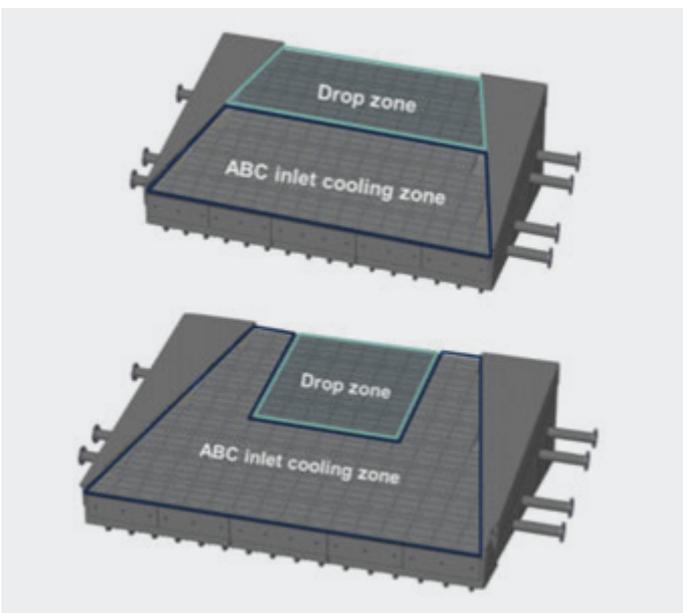


A simple modification can be done to an existing CIS inlet, with the purpose of upgrading to ABC™ Inlet and getting all its benefits. Typically, the support structure will be modified and reused, and existing air blasters can be reused as part of the ABC air blast system.

### Key benefits

- Existing support structure can be reused / modified
- Existing air blasters can be reused
- Existing fan might be reused
- Existing undergrate compartment can be reused

## 1.3 Fixed inlet drop zone compartment



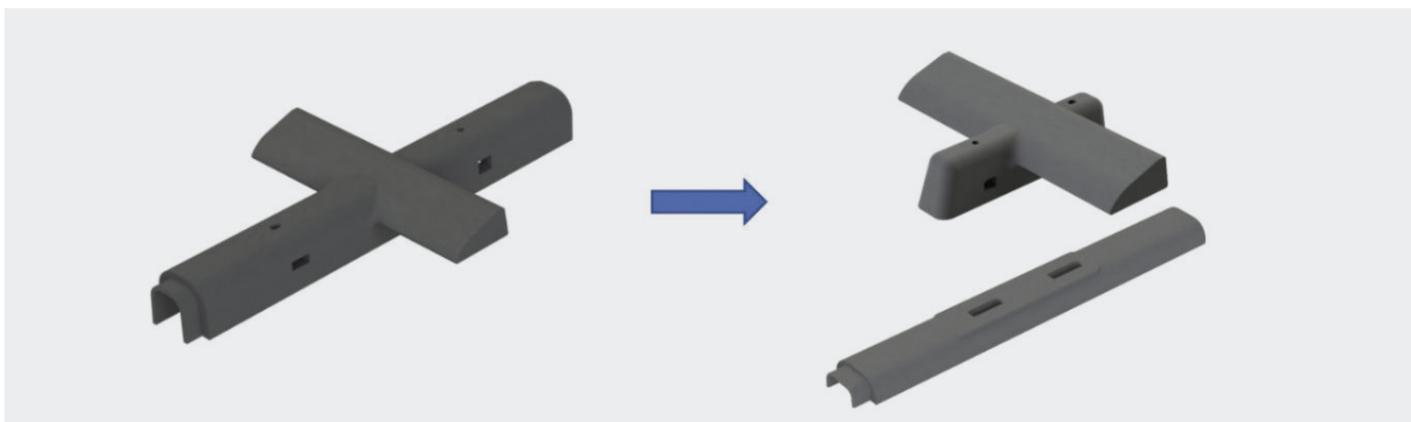
The drop zone is the location on the cooler inlet onto where the hot clinker from the kiln drops. This is the first point of contact, and where the clinker is being quenched to preserve C3S minerals, maximizing its strength potential. Better penetration of cooling air through the dead piles of the clinker will make sure that the dead pile of clinker is fluidized to distribute itself uniformly over the width of the cooler. Compartment split is done based on the size and layout feasibility of the cooler. Each compartment has a dedicated fan, and the drop zone is provided with increased air flux.

### Key benefits

- Improved quench cooling and clinker distribution
- Reduced temperature peaks as measured from the thermocouples
- Reduced risk of thermal damages of the grate line
- Improved cooler operation

## 2. Split cast parts and inlet seal upgrade

Folax	Coolax	SF	MMC	CB	SF-CB	Non-FLS
				✔		



### Introduction

The Cross-Bar® Cooler first generation was supplied with integral cast parts, meaning crossbar and u-profile was one piece of casting. A newer and better design called 'split cast parts' divides the one-piece into a separate crossbar piece and u-profile piece. Furthermore, the first crossbar will be installed closer towards the fixed inlet thus improving the pull of clinker from the fixed inlet and enhancing the overall cooler performance and reliability. In the same upgrade the inlet/outlet seal will be changed to latest version with better sealing effort.

### Key benefits

- Better cooler performance
- Higher reliability
- Elevated crossbar position enhances stationary clinker layer
- Avoid clinker build up on fixed inlet
- Better prevention of clinker spillage
- Less weight for cast parts (wear parts)

### How does it work?

#### What does the upgrade include?

In order to upgrade your existing Cross-Bar Cooler to split cast parts with new inlet/outlet seal, the following operations will be carried out:

- Existing Drive plates replaced by new design
- Existing Integrated crossbars replaced by split crossbars and u-profiles
- Existing wedges and pins replaced by new design
- Modification of existing inlet and outlet tray
- Existing inlet/outlet seal replaced by new design
- Inlet/outlet c-profiles replaced by new design



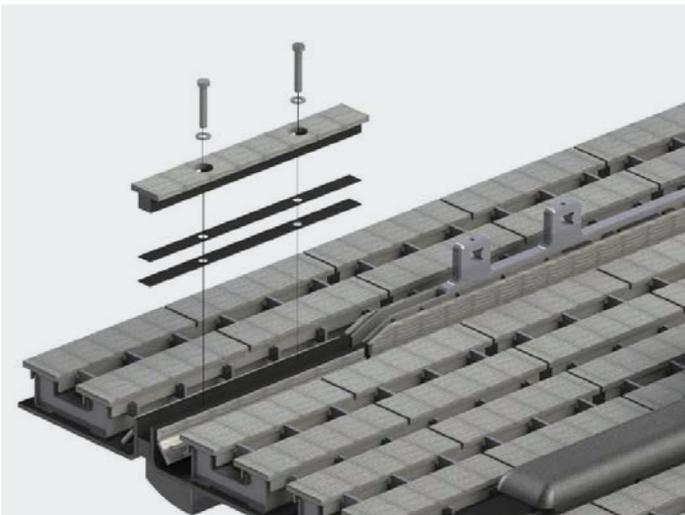
### **U-profile**

Serving as protector against clinker spillage, the U-profiles are placed on top of the drive plates. They are part of the movable arrangement for the Crossbar Cooler and will act as clinker seal and wear protection shield for the underlying drive plate and tray. In the erratic case of a crossbar going loose and falling out, the U-profile may stay in place and prevent cooler stoppage.



### **Crossbar**

The crossbars are casted parts installed on top of the u-profiles. They are part of the movable arrangement for the Cross-Bar® Cooler and will act as main part in the clinker conveying system. The crossbar will convey clinker in its forward stroke and penetrate the clinker bed in the return stroke. The length of the "wing" is shorter on the first crossbar to ensure a clinker layer will be present after the fixed inlet. The crossbars are fixated to the drive plate with wedges, locking pins and retaining plates.



### **Inlet/outlet seal**

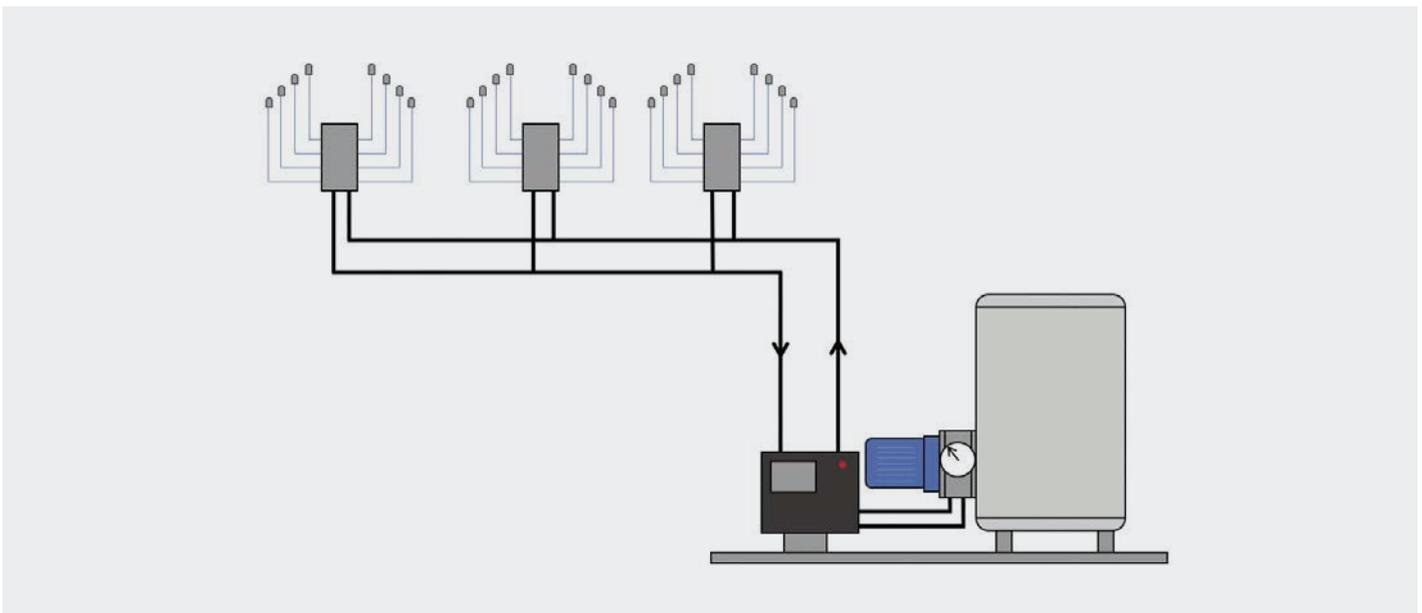
In each end of the Cross-Bar® Cooler the transition between movable frame and the fixed frame is called the inlet/outlet seal. It consists of a fixed seal block with a hard-faced wear plate on top together with some shims for adjustment. The first and last U-profile moves on top of the seal block and has a plough-like shape to push the clinker free from the seal block.

The inlet/outlet seal block is locked with countersunk screws protected from the clinker and is easy to replace from top of grate line when it is worn.

# 3. Lubrication

## 3.1 Centralized automatic lubrication

Folax	Coolax	SF	MMC	CB	SF-CB	Non-FLS
✓	✓			✓		



### Introduction

When maintenance of multiple lubrication points is hard to manage, a perfect solution is a centralized automatic lubrication unit. The system will automatically lubricate the cooler bearings in the optimal intervals and with exact grease quantity, saving a lot of labour-intensive work.

### Key benefits

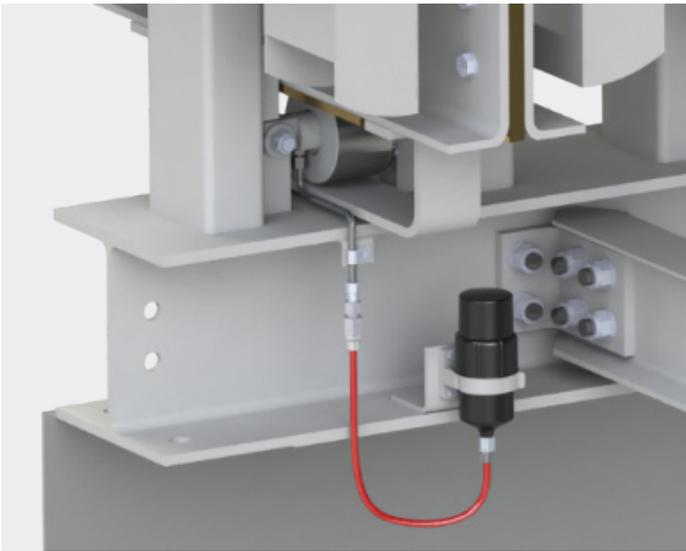
- Easy maintenance
- Preventing unforeseen bearing failures
- Precise lubricant discharge in every bearing
- Precise lubrication intervals (program)

### How does it work?

The automatic lubrication systems basically consist of a pump unit, grease storage tank and a control unit. Grease will be pumped via pressurized feeding pipe out to distribution blocks located close to the machine based on the control setting. From the blocks, pipes or hoses are connected to the lubrication points on the machine and will from here distribute the grease to each bearing.

## 3.2 Semi-automatic lubrication

Folax	Coolax	SF	MMC	CB	SF-CB	Non-FLS
		✓	✓	✓	✓	✓



### Introduction

An alternative to the centralized automatic lubrication is a semi-automatic lubrication solution also called single-point lubrication system. With the lubrication unit connected directly to every local lubrication point (bearing), the unit will automatically dose an amount of grease in continuous intervals once it is activated.

### Key benefits

- Easy maintenance
- Preventing unforeseen bearing failures
- Precise lubricant discharge in every bearing
- Precise lubrication intervals (program)

### How does it work?

The lubrication unit has an electromechanical drive which automatically doses an amount of grease into the bearing in a given interval through a connected flexible pipe. The unit is placed close to every lubrication point, typically inside the cooler where access is constrained during cooler operation. The cartridge with grease and battery pack will be replaced typically during a yearly maintenance stop.

# 4. Clinker Crushing

## 4.1 HRB MF – Heavy-duty Roller Breaker Modular Frame

Folax	Coolax	SF	MMC	CB	Non-FLS
✓	✓	✓	✓	✓	✓

The HRB MF is a clinker crusher that breaks down cooled clinker nodules to the desired size and is generally placed at the discharge end of the cooler. For new CB coolers or extension of existing coolers, HRBs can also be placed near to the middle of the cooler to break down boulders, improve heat transfer, improve hot gas generation and subsequent clinker cooling. This is the intermediate HRB configuration. The HRB MF is, as per standard, available with electro-mechanical drives, and there is no requirement for either cooling air or water when installed, as standard, at the end of the cooler.



### Sustainable benefits

- Reliable operation, effective crushing of clinker boulders
- Simple, low-cost maintenance
- High availability with long wear life
- Easy operation
- Flexible for capacity upgrade

### How does it work?

The HRB MF consists of a combination of transport and crushing rolls in series. The transport rolls rotate in the direction of the clinker flow and permit clinker fines to pass through predetermined gaps between the shaft assemblies. The voids between the shaft assembly teeth are filled with clinker and, as the shafts rotate, these particles are deposited into the material handling system. Larger pieces are transported to the crushing rolls, where the remaining oversize material is broken down to the required size by two heavy-duty crushing rolls that rotate in opposite directions, pulling the material into the nip.

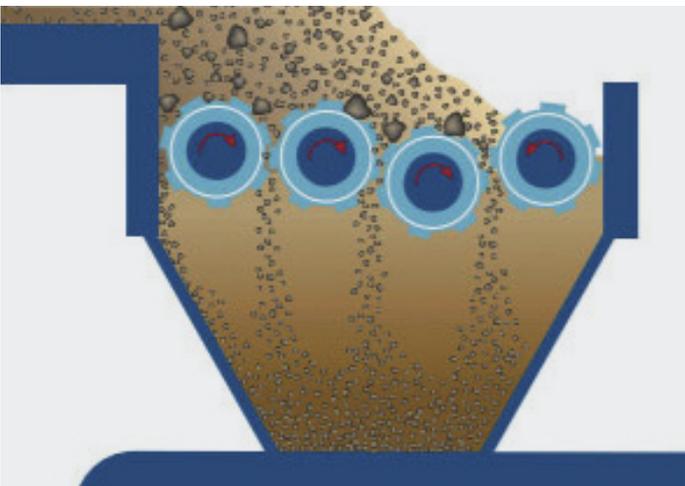
## Roller Segments

The roller/crushing segments are wear segments with 15 protrusions each known as a tooth. They are placed on/ around the rotating shaft with 'keys' that connect them to the shaft to keep them in place. They are stainless steel casted and have an expected wear life of typically 3-5 years.



## Shaft arrangement

The transport rolls are on a common horizontal plane. However, the first crushing roll is located below the centre line of the transport rolls and the final crushing roll. This shaft arrangement forms a cavity which enables the HRB MF to effectively grab and crush very large clinker lumps.



## Upgrade/ Retrofit options

### ▪ Clinker crusher to HRB upgrade

- Targeted for cases with high maintenance and undesired stops on hammer crusher
- Existing clinker crusher and grizzly bar to be removed and replaced by HRB MF with cooler casing modification
- Civil and Layout feasibility to be checked to remove or retain existing foundation and beams
- Standard unit roll out in new installations allows access to HRB wear components for removal and replacement. Modular, bolted frame construction enables fast and simple assembly onsite. Capacity can also be upgraded in the future by addition of roll modules.
- 14 days of installation time achieved (will differ with scope of project and layout)

### ▪ Hydraulic drive to electro-mechanical drive HRB upgrade

- This economical and simple upgrade is beneficial for cases where the hydraulic system is old, exhausted and consuming high spares
- The gearbox and hydraulic motors are replaced with the electro-mechanical drive
- This upgrade typically takes 3-5 days

### ▪ HRB segments upgrade

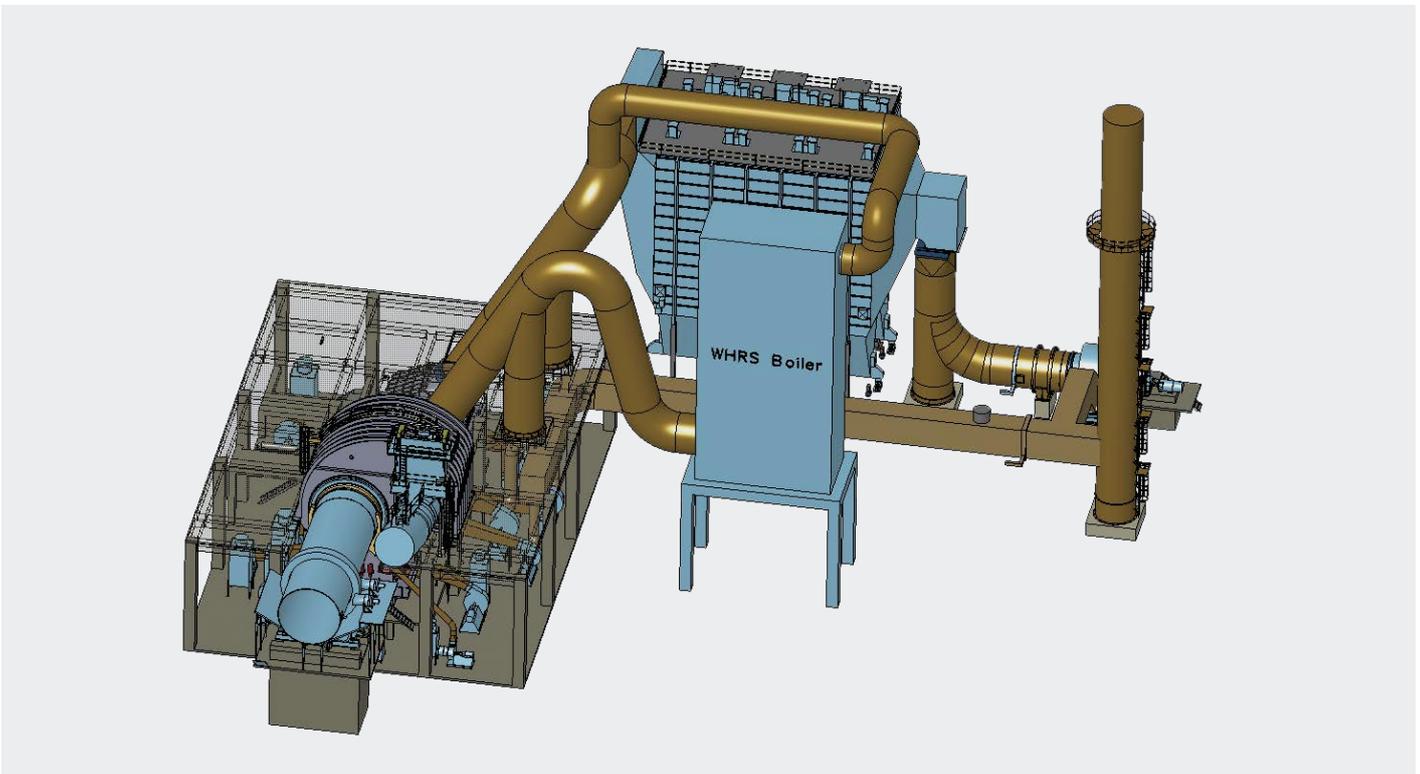
- An updated design that can be purchased while changing worn out roller segments.
- The number of teeth on each segment has been increased from 7 in the old design to 15 which gives an advantage while dealing with boulders
- Segment arrangement on both transport and crushing rollers are of the same pattern - Chess checked where the teeth of the alternate segments align between the gaps of the other segments (Kindly refer figure 1 in 4.1).

## Links:

- <https://www.flsmidth.com/en-gb/products/heavy-duty-roll-breaker>
- <https://flsmidth-prod-cdn.azureedge.net/-/media/brochures/brochures-products/crushing-and-sizing/2021/heavy-duty-crusher.pdf?rev=322f490e-d31d-44c1-aaec-22261b07377b>

# 5. Hot air recirculation

Folax	Coolax	SF	MMC	CB	SF-CB	Non-FLS
		✓	✓	✓	✓	



## Introduction

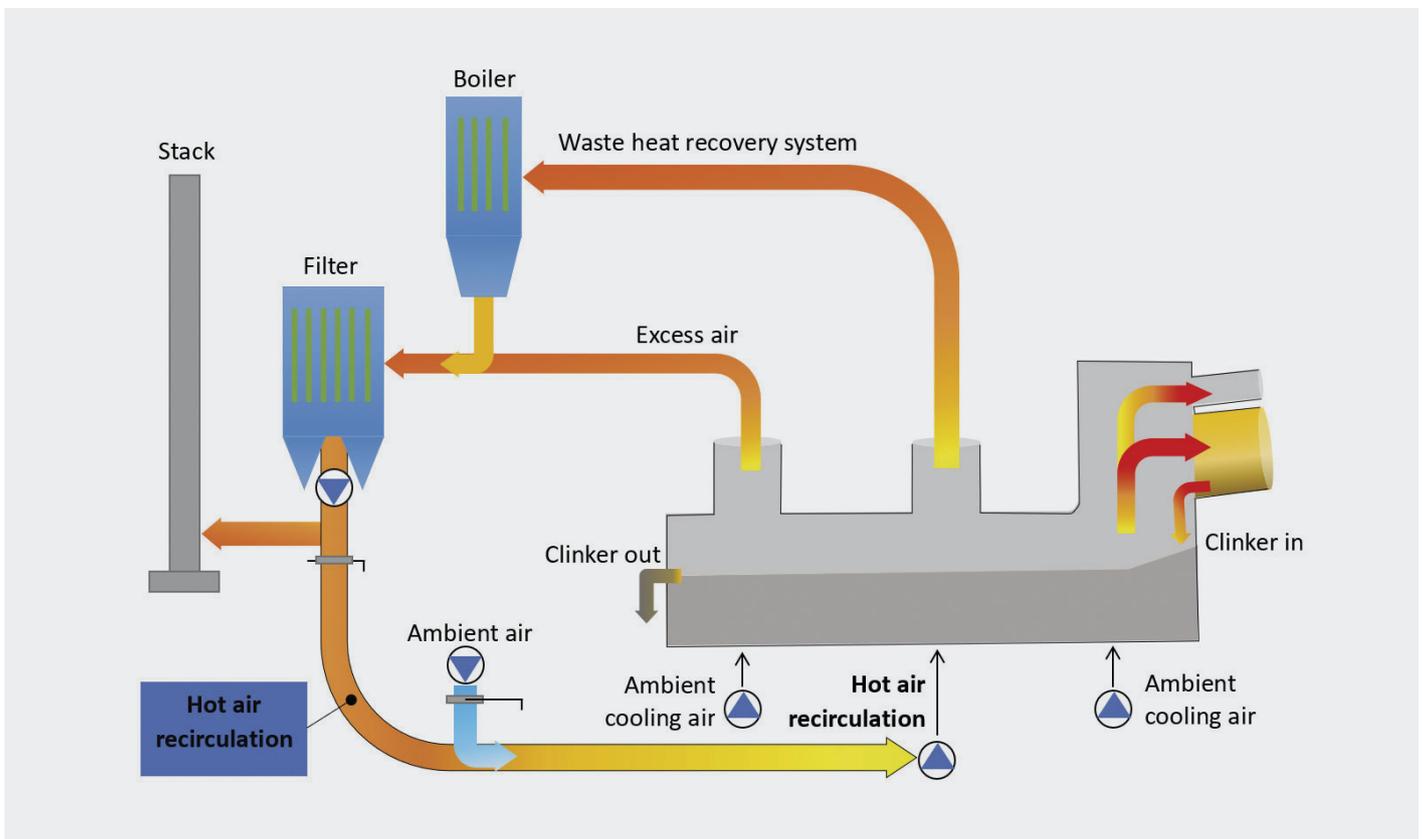
'Hot air recirculation' or HAR is a term used when the air lead into the cooler undergrate compartment is recirculated into the cooler at elevated temperature from another machine in the plant – this could for example be air from Waste Heat Boiler and/or excess air that is passed through a filter and back into the cooler. Typically, the temperature of the air is between 80°C and 130°C. The HAR solution is beneficial for the overall energy balance as it keeps the energy in the pyro system instead of blowing it out through the stack. For instance, if a boiler is present the HAR will help the temperature increase in the Waste Heat Recovery duct, giving the boiler better operational conditions to produce more electricity. For the cooler to operate with HAR, it requires some minor replacements of heat-sensitive components in the under-grate compartments.

## Key benefits

- Optimized process and heat energy utilization
- Reduce emission point
- Reduced emissions
- Suitable for Carbon Capture technology
- Helps WHR temperature to potential boiler

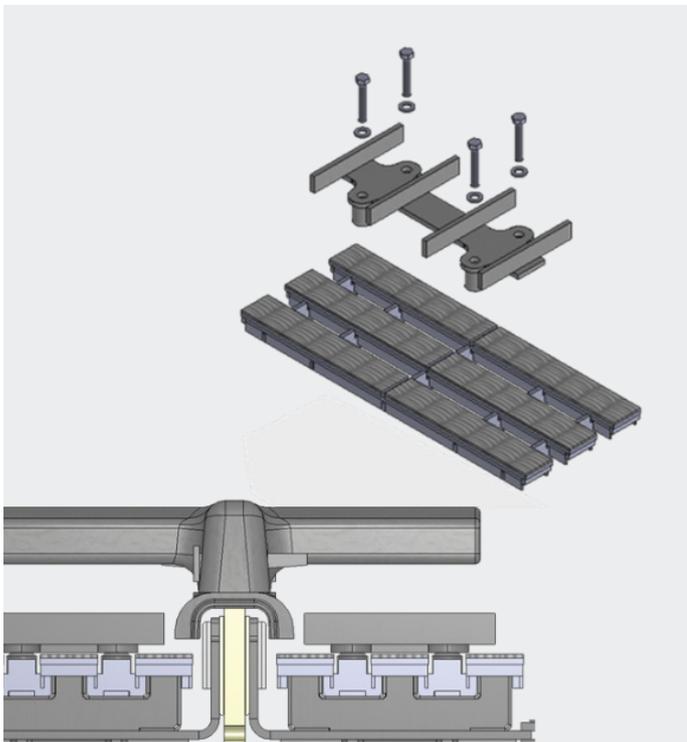
## How does it work?

Normally the cooling air is dragged from the ambience through the cooling fans and into the cooler. But when using HAR, the cooling air is a partial mix of ambient air and hot air from e.g., the cooler excess air duct. The mix is regulated with a flap gate, and it is necessary in order to control the temperature of the cooling air lead into the cooler. The hot air is blown into the cooler undergrate compartment(s), and the affected compartments are selected based on the purpose. If the plant has a boiler installed in extension of a waste heat recovery system, it is normally desired to have the HAR in compartments below the WHR duct.



# 6. Clinker Bed Stabilizer

Folax	Coolax	SF	MMC	CB	Non-FLS
				✓	



## Introduction

The Clinker Bed Stabilizer, previously known as DLD, is placed on top of each Grate plate to prolong its life. As the name suggests, it maintains a stationary layer of clinker up to 90mm between the grate line and the crossbars.

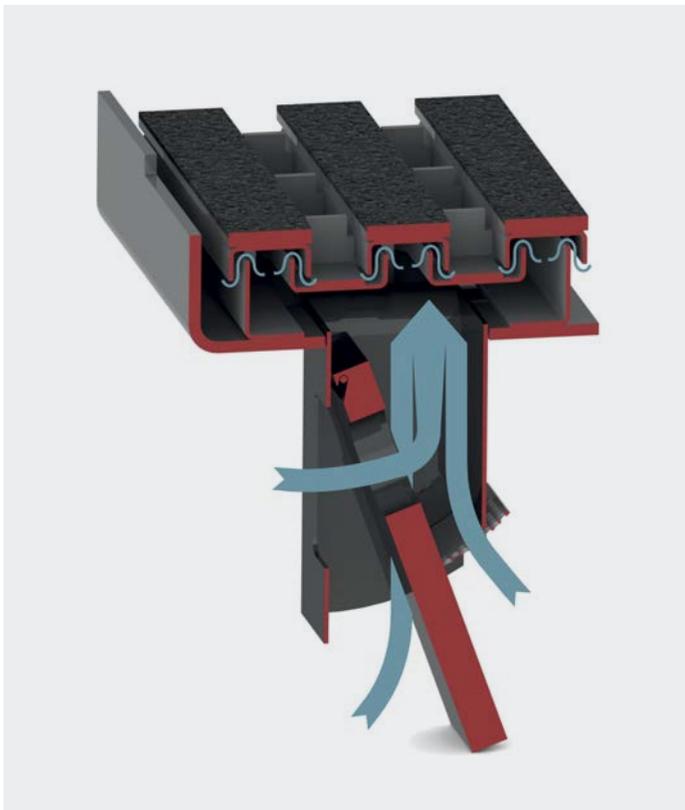
## Sustainable benefits

- Protection of the grate line from thermal exposure
- Longer life for grate plates and other grate line components

This is generally recommended in the recuperation zone of coolers which are being operated with fine/dusty clinker or face major wear/thermal damages to the grate line. Please note that the CBS offering requires split cast parts (Section 2 on page 7).

# 7. MFR Pattern optimization

Folax	Coolax	SF	MMC	CB	Non-FLS
		✓	✓	✓	



MFR - Mechanical Flow Regulators limit the airflow via a self-adjusting orifice to maintain constant airflow through each air distribution plate and the clinker bed without operator intervention. This quick and simple optimization can be completed in less than 2 days at site.

### Sustainable benefits

- Optimized airflow, increased thermal efficiency
- Stable cooler operation

### How does it work?

The MFR only relies on air flow and gravity to work. The regulator design is varied (along the cooler's length) to compensate for changes in the resistance of the clinker layer as the clinker temperature decreases. It is possible to employ a higher specific airflow to the air plates at the inlet to the cooler simply by using one regulator design over another. It is also possible to vary the regulator design across the width of the cooler.

The operating condition of the MFR can be observed through observation ports in the cooler lower casing. The optimum operating condition for an MFR is when it is hanging down and just beginning to move. This means the air flow through is as designated and that the pressure drop across is at minimum (~5mbar). When the MFR is hanging down with no movement it is a sign that the air flow through it is lower than the designated value. When the MFR is fully closed the MFR is trying to limit the air flow, but it has reached the upper end of its regulation interval and the real air flow is above the designated value. To gain the last kcal in heat savings it is therefore required to match cooler fan flow and MFR layout to the target kiln production.

# 8. Wave grate upgrade

Folax	Coolax	SF	MMC	CB	SF-CB	Non-FLS
		✓	✓		✓	

Link: <https://www.flsmidth.com/en-gb/products/grate-for-the-sf-and-the-multi-movable-cross-bar-cooler>

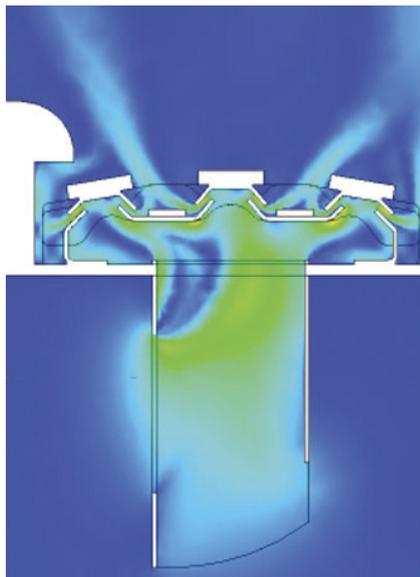


## Introduction

The Wave grate is designed for the SF™ Cross-Bar® Cooler and for the Multi-Movable™ Cross-Bar® Cooler with the purpose of giving a lower pressure drop and enhance wear life. It fits in existing holes in the cooler, making it very easy and quick to replace older grate types. The split design consists of an upper and lower part which makes it very easy to maintain.

## Key benefits

- Reduce power consumption
- Increase cooling air flow
- Fast and simple installation
- Easy to clean and maintain
- Increase grate wear lifetime



## How does it work?

The Wave grate is a two piece design that differentiates the wear and non wear part, so going forward only the upper part needs to be changed upon wear, thereby reducing the maintenance spent. the Airflow deflection oath is less compared to that in the traditional grates thereby reducing the internal flow resistance and lowering the pressure drop. The reduced airflow resistance and resulting decreased pressure drop across grates gives significant savings on cooler-fan power consumption.

The top of the grates include wear-resistant plates making the wear plates extremely wear resistant. Due to its symmetric design, the grate upper part can be rotated and thereby used for a longer period as the wear occurs typically at the side close to the moving parts.

# 9. SF – CB upgrade

Folax	Coolax	SF	MMC	CB	Non-FLS
		✔			

Upgrade the transport mechanism and reduce the maintenance cost significantly of an SF™ cooler with the SF™ Cross-Bar® Cooler upgrade. Each existing drive frame is split into two individual drive frames, the existing stationary cross bars are removed, and the movable crossbars are replaced with a different type of crossbar which spans the width of 2 grates, against the previous type of crossbar which spans the width of 4 grate plates. This enables more accurate control across the width of the cooler. This upgrade can be completed in approximately 2 weeks' time.

## Sustainable benefits

- 10% higher capacity with same grate area
- Lower maintenance cost due to fewer cast parts
- Longer lifetime on key wear parts
- Improved control of clinker bed and avoid red river

## Steps involved

- Replacement of bars with a new design
- Mount wave grate (section 8 on page 17) or new grate protection plates
- Divide each existing drive frame into two independent drive frames (i.e., remove the connection between the two lanes of drive plates and also the original cylinder bracket)
- Replacement of cylinder brackets and inter-modular straps
- Installation of hydraulic proportional valves, individual lane control (existing hydraulic cylinders reused)
- Installation of required hydraulic piping
- New PLC panel for the drives control

All existing hydraulic cylinders are reused. Depending on cooler size, it may be required to add a few hydraulic cylinders. In most cases it is not required to modify hydraulic pumps/motor.



## Links:

- <https://flsmidth-prod-cdn.azureedge.net/-/media/brochures/brochures-products/pyro/2000-2017/sf-cooler-upgrade.pdf?rev=edee845f-fc52-4e49-8eaf-c4b16d6f69af>
- <https://www.flsmidth.com/en-gb/customer-stories/cooler-upgrade-increasing-productivity-the-sustainable-way>
- <https://www.flsmidth.com/en-gb/customer-stories/a-simple-cooler-upgrade-boosts-clinker-transport-efficiency>

# 10. Cross-Bar<sup>®</sup> Cooler extension upgrade

Folax	Coolax	SF	MMC	CB	SF-CB	Non-FLS
		✓	✓	✓	✓	

The Crossbar extension upgrade provides more grate areas for coolers which are heavily loaded and/or would benefit from increasing the handling capacity of the cooler. The extension can be done length-wise and width-wise as per layout feasibility and this upgrade can take as little as 2 weeks.

### Sustainable benefits

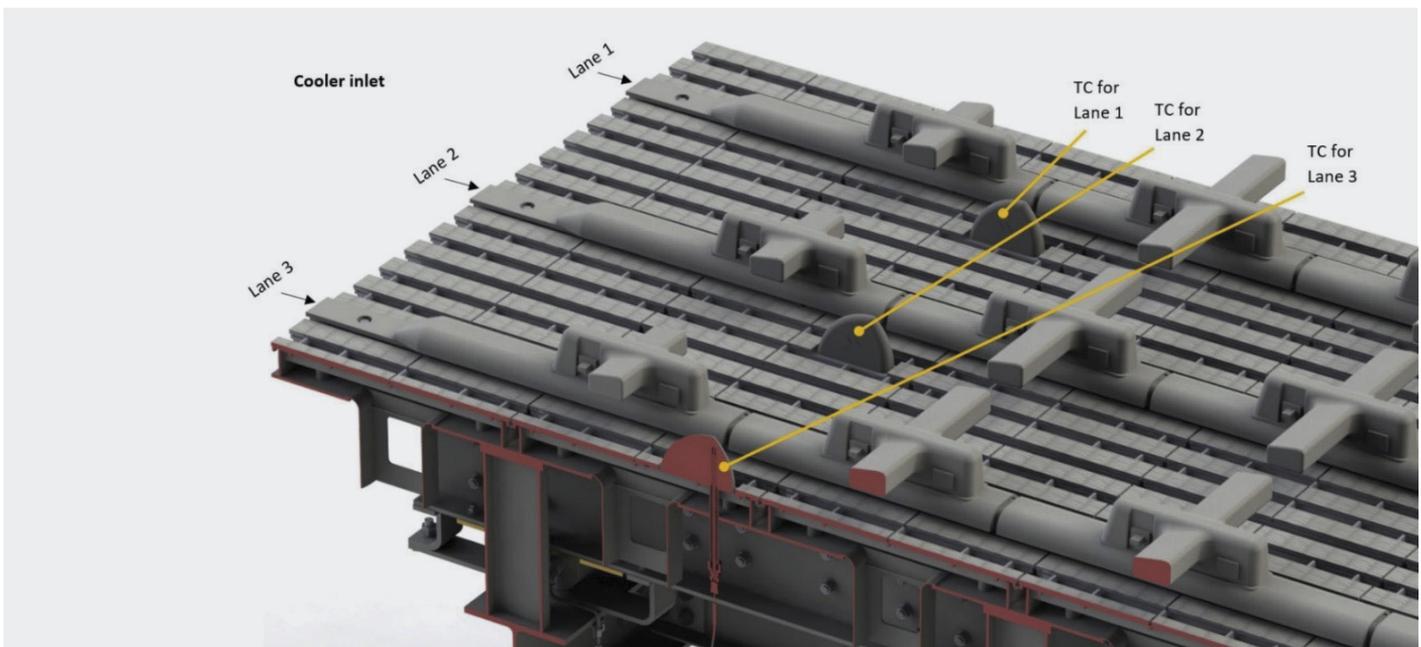
- Increased production
- Reduced clinker exit temperature/ vent air temperature
- Increased life on wear parts (in case of width-wise extension)

### Upgrade feasibility

- The extension is generally done at an intermediate module to maintain the alignment of the cooler.
- In the case of extension with a different version of the crossbar cooler, for example SF cooler extension with CB module, it can either be done after the clinker breaker or by creating a step between the modules.
- The HPU is replaced or upgraded in case pumps do not have enough margin.
- Additional cylinders may/ may not be required – to be determined on a case basis.

# 11. Thermo couple upgrade

Folax	Coolax	SF	MMC	CB	SF-CB	Non-FLS
				✓	✓	



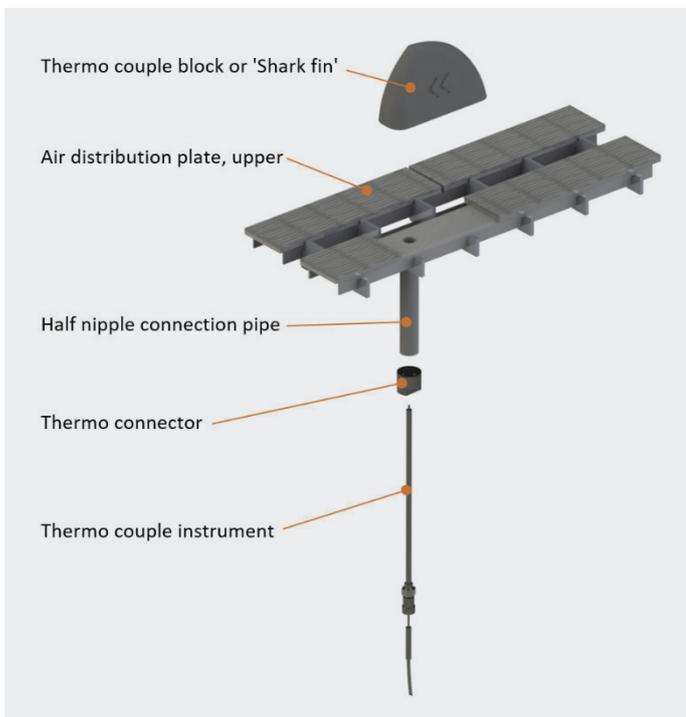
## Introduction

Cross-Bar® Coolers have over time had some kind of temperature sensor/ Thermo couple or TC, installed to survey the grate line temperature and give alarm to the control room in case of risk of overheating. With the Cross-Bar® Cooler's ability to control the movement of individual drive lane, it is possible to use the temperature reading to control the stroke length based on the local temperature for each individual lane. That gives a much better operation of the cooler as it is not necessary to lower the entire cooler speed in case of a single point of high temperature peak. The latest thermo couple block, or 'Shark fin' as it is popularly called, is designed to measure the temperature of the clinker bed

at the level of the crossbars. When upgrading the older cooler with additional thermo couples, the control system typically needs more signal inputs and a new software to control it. Thus, the upgrade relies much on the current installed control system.

## Key benefits

- Better protection of cooler grate line
- Individual lane control for agile operation
- Faster reaction on temperature peaks



### How does it work?

The thermo couple instrument is installed from below in a thermo connector which is screwed onto a connecting pipe. The thermo couple instrument reaches through an opening in the Air distribution plate upper and pushes against the inside of the thermo couple block. The thermo couple block is installed at site and is to be welded from above to the air distribution plate. When a too high temperature is being measured via a thermocouple instrument the control logic will automatically reduce the stroke length of that particular movable lane to reduce the conveying and allow further cooling of the hot clinker. A further benefit is that the clinker bed height on that particular movable lane will gradually increase thereby lifting the hot clinker further away from the grate line.

# 12. Inside-the-box upgrade (Full/Partial upgrade)

Folax	Coolax	SF	MMC	CB	SF-CB	Non-FLS
✓	✓	✓	✓		✓	✓

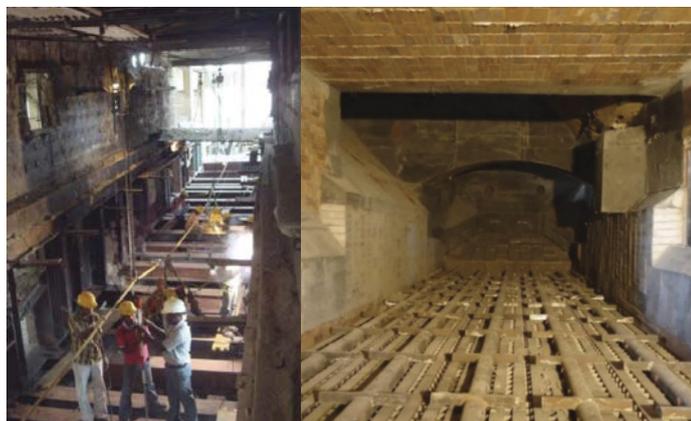
The Cross-Bar® Cooler is the latest generation clinker cooler. Any existing clinker cooler regardless of type and OEM can be upgraded to a Cross-Bar cooler

Some of the key features contributing to the higher efficiency and applicability of the cooler are:

- ABC™ Inlet (Air Blast Controlled)
- Separate cooling and conveying mechanism
- Individual lane control
- High transport efficiency
- No under-grate spillage
- Mechanical Flow Regulators (MFR)
- Modular design

An existing cooler can be completely replaced with the FLSmidth Cross-Bar cooler (with or without new casing) or partially replaced until recuperation zone or extended length and/or width-wise with the above.

## In-box upgrade in India



Before

After

### Sustainable benefits

- No snowmen with ABC™ Inlet
- High thermal recuperation
- Low maintenance
- High availability
- Hot air recirculation (up to 130°C) to maximise WHR

### Upgrade feasibility

- Reusability of whole casing (for in-box replacement)
- Kiln hood modification to be considered in case of extension or increase in grate area.
- Existing civil/ foundation supports can be reused with additional supports which will be checked with drawings on case-to-case basis.
- Reusability of fans to be checked.

A complete in-box upgrade (including ABC™ Inlet and HRB MF) can be completed in typically around 4 weeks depending on scope and setup. For partial upgrade/ half Cross-Bar® cooler upgrade, the existing drive system and automation program to be checked to match speed of additional drive.

For more information scan this code:





### Open Loop Hydraulic system

The CB Cooler is hydraulically driven with a state-of-the-art open loop hydraulic system. The open loop hydraulic drive system was introduced for at minimum maintenance and high reliability. Compared to the closed loop system and hydraulic drive systems offered by other OEMs, the FLSmidth Open loop hydraulic system has:

- Reduced number of hydraulic pumps & motors
- Lower Installed power
- Fewer Hydraulic cylinders
- Smaller footprint
- Lower Power consumption
- Built-in standby provides redundancy (optional)

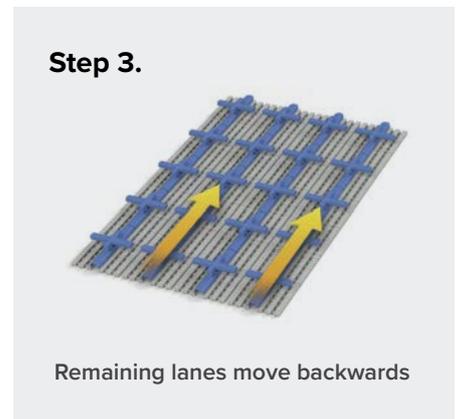
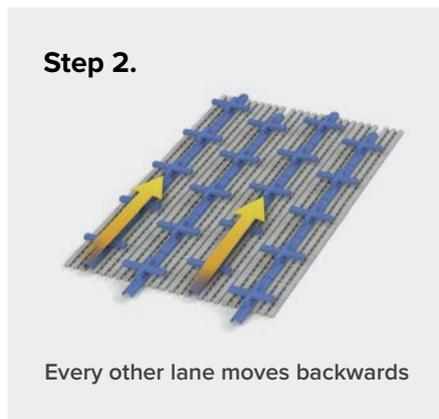
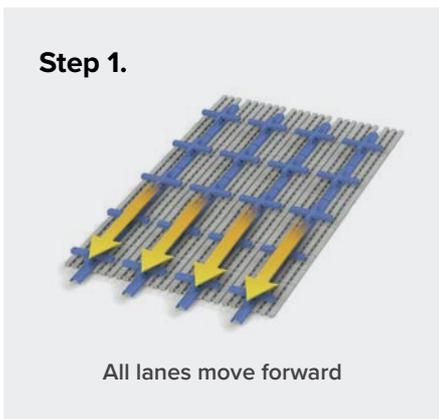
Each lane is equipped with thermocouples and hydraulic cylinders with a stroke length of 300mm, providing the functionality to control each lane individually for various operating condition.

### Optimised Transport Method

To ensure the highest reliability and availability, the FLSmidth Cross-Bar® Cooler drive system is designed to obtain optimal transport efficiency and stable, reliable operation. A type of ‘Shuttle motion’ is used (as illustrated in the figure) and the movement of each row of crossbars can also be separately adjusted to accommodate diverse clinker bed conditions. The high transport efficiency allows horizontal construction, to minimize installation height or maintain overgrate and kiln hood velocities in cooler upgrades to reduce dust circulation.

Individual lane control and the possibility to adjust the stroke length across the width ensures ability to adjust for varying operating conditions and clinker granulometry. For example, in the case of a red river, the stroke lengths of those lanes can be reduced to control the situation.

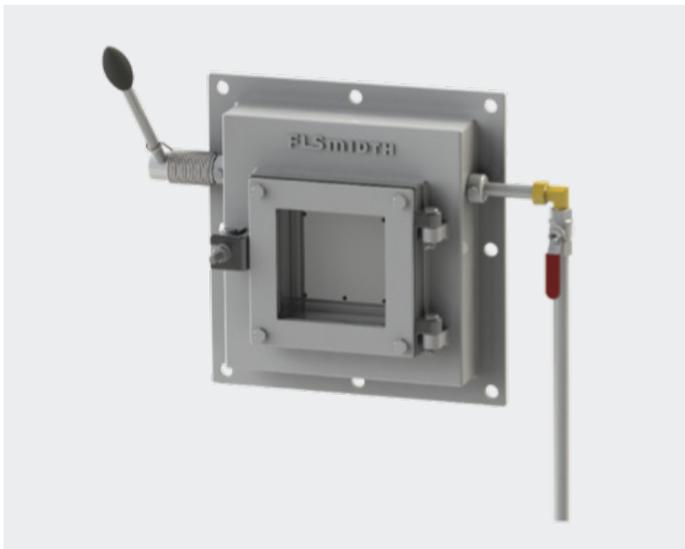
This also enables the crossbar cooler to continue in operation even if one or two lanes (depending on cooler size) are stopped for any unforeseen reasons.



**Link:**  
<https://flsmidth-prod-cdn.azureedge.net/-/media/brochures/brochures-products/pyro/2021/cross-bar-cooler.pdf?rev=366e8dce-b8f1-49ac-a4e6-d7b178afd0e2>

# 13. Inspection hatches

Folax	Coolax	SF	MMC	CB	SF-CB	Non-FLS
✓	✓	✓	✓	✓	✓	✓



## Introduction

The air-cooled inspection hatch is suitable for hot applications such as in the cooler above grate line, burner door or kiln hood. But it can also be used for other equipment on the cement plant. The inspection hatch is air cooled by either under-grate compartment air or by compressed air from the plant, depending on the application. Inspection hatches are installed by 8 bolts directly in the casing and will be partly covered by refractory for the high temperature areas.

## Key benefits

- Better view access to the process
- Glass replacement during operation
- Stainless steel flap protects the glass during operation
- Spring on handle allows installation 30° from vertical to give downwards view

# 14. QCX<sup>®</sup>/AutoSampling

## **Clinker sampling plays an increasingly important role in any cement plant's chemical quality control scheme.**

Historically a main objective of taking frequent clinker samples has been operational control of the fuel consumption. Measurement of the Free Lime content (F-Cao) or clinker litre weight or by applying more advanced approaches with full phase analysis via XRD provided the data for the fuel optimization, often via computerized expert control systems. Typically, spot samples are used for the fuel optimization objective. Fast control response is the key here. Traditionally the raw meal sampling point has been regarded the key sampling point with focus on chemical control of the raw meal and clinker composition. The main rationale is that the proportioning of raw materials take place ahead of the raw mill. That has not changed, but what has indeed changed is that nowadays the typical cement kiln sees material flows from alternative fuel and waste materials added at the kiln inlet, the raw meal and kiln feed sampling locations. And often several types of alternative fuels/ waste material from multiple, interchangeable sources are utilized. Thus, the variations originating from the chemical composition of fuel ash and/or waste materials are often of a sizeable magnitude and cannot be measured and quantified before at the clinker product stage. Also have in mind that “quality control” in a world with much increased environmental focus is not solely about optimizing the clinker phase composition. It’s certainly also about monitoring and documenting that minor elements (some at trace levels) do not cause operational problems or violate threshold limits set by regulating authorities.

The scenario that a clinker sample shall support not only the fuel optimization objective, but also chemical composition monitoring, has the built-in contradiction that spot sampling is seen as the optimal sampling concept for fuel optimization, while the chemical composition monitoring objective calls for composite samples collected over a period of time, say one hour. Increased focus on clinker sampling also inherently calls for high focus on theoretical correct sample taking and operational robustness. Also, typically higher degrees of automation of the sampling process is requested to provide results faster and more reliably than obtainable with conventional manual clinker sampling procedures. As a market leading supplier of cement plant sampling solutions, customized clinker sampling solutions have been in the FLSmidth product portfolio for decades with >100 orders booked. Installation of clinker sampling solutions are often met by challenges due to space limitations at the possible sampling locations. In a recent product redesign, FLSmidth has focused on robust, modular components with proven track records and addressing the above-mentioned objectives. Thus, the ability in same solution to support both spot and composite sampling is a noticeable new feature. This product re-design includes the market introduction of a new hot clinker sampling device, which installed at a kiln outlet/cooler inlet location allows for a significant shortening of the cycle time from the hot burning zone conditions to lab data available. The device has undergone rigorous industrial testing with very satisfactory performance, in both robustness and sampling quality.

# 14.1 QCX® PSC101/ 111/ 112 Mk II Clinker Sampler

The range of PSC Clinker Samplers have been designed to take samples of free-flowing, coarse, granular material from a vertical falling material stream. In practice that means that sample is taken directly under the grate cooler outlet or at the top of the clinker silo, at the transition point in the clinker transport system from cooler outlet to clinker silo. Electrically powered for easy and efficient movement, the sampler is ejected on demand into and out of the material flow. A reliable performer, there is no risk of failure, blockages in the material flow or damage of the sampler.

The spoon that collects the sample has a 10-litre sample volume, making it larger than the spoons in other samplers in its class. This means the sample is not only larger, it contains the full range of particle size distribution. The sample truly is representative of the material flow.

The Clinker Sampler supports your sampling efficiency and can collect up to six samples per hour. Typically used with materials up to 40 mm in size and ranging in temperature from 80 – 250°C, the Clinker Sampler has proven its ability to perform in harsh environments.

## Advantages:

- **Reliable and robust:** the Clinker Sampler is engineered to handle high temperature sampling and to perform reliably, without interruption to the material flow or damage to the sampler.
- **Representative sampling:** the large sampling spoon, with its 10-litre sample volume can collect the full range of particle size distribution ensuring truly representative sampling.
- **QCX integration:** the Clinker Sampler seamlessly integrates with your automated QCX system to maximize your sampling accuracy and efficiency.

## How does it work?

After being processed by a crusher, the free-flowing granular material is sampled by the Clinker Sampler from the chute. The sampling spoon enters the flow and retrieves a precise volume and representative sample, with full range particle size distribution.

## Possible configurations

- **Automated clinker sampler w/ manual sample collection (PSC101)**

The Clinker Sampler may be integrated with a designated sample collection container, further enhancing its ease of use.

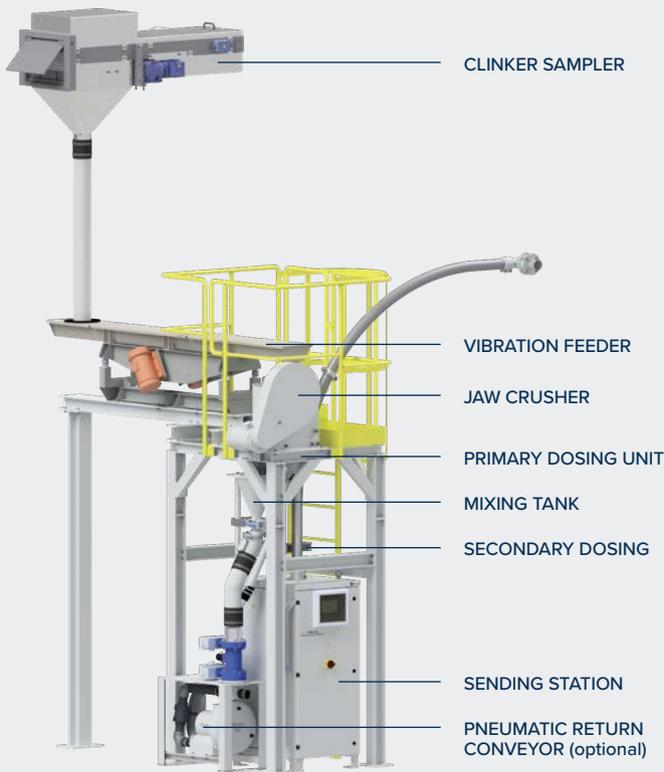
- **Automated clinker sampler w/ preparation tower and manual sample collection (PSC111)**

The Clinker Sampler can also support an automatic sampling and sample preparation system with the use of a designated sample contained for manual transport, promoting further efficiencies.

- **Automated clinker sampler w/ preparation tower and sending station (PSC112 Mk II + PTS102)**

When integrated with an automatic sample transport sending station for automatic sample collection, sampled material is transported in a carrier via pneumatic tube transport system to laboratory, saving time and minimizing waste.

Specification of sampler		
Stroke	600mm	1,200mm
Sample material	Dry, non-sticky, up to 250°C, top size 40mm	
Sampling location	Material stream in vertical chute	
Sampling type	Spot sample	
Sample quantity	10 l	
Sample frequency	< 6 samples / hour	
Power supply	3 x 380 - 500v, 50/60 Hz	
Compressed air supply	0.6 - 1.0 Mpa (Quality 2.4.2 as per ISO 8573-1)	
Operating conditions	Temperature: -10°C to 40°C, optional -20°C to 55°C Humidity: 0 - 100%	
Weight	Approx. 310 kg	Approx. 360 kg
Dimensions (W x D x H)	1,770 x 650 x 1,000 mm	2,370 x 650 x 1,000 mm



**PSC112 Mk II + PTS102**



**PSC101**

## 14.2 QCX® PSK101/ 111/ 112 Hot Clinker Sampler

The range of PSK Hot Clinker Samplers takes samples of hot materials, such as cement clinker falling from a rotary kiln, directly after the material leaves the kiln and before it enters the grate cooler. It can also be used for nickel reduction kilns or other pyro-processes. Complete with in-built damage protection, this is a robust machine that offers exceptional safety and requires low maintenance.

An external ventilator cools the sample directly on the spoon. This allows for more frequent sampling intervals, which helps control heat and reduce fuel consumption. It also minimizes wear on kiln bearings and linings.

The sample cooling feature also means that if the hot sample material quickly reacts when exposed to the ambient environment, there is the option to seal it in a container with inert gas.

The sampler is especially beneficial when combined with an at-line analyzer or an automatic sample transport system. This speeds up access to information so your operators can optimize their kiln process. Overall, the Hot Clinker Sampler provides a safe and reliable solution for representative material sampling, aiding efficient production quality control.

### Advantages:

- **Low maintenance:** damage prevention features allow the sampler to automatically withdraw from the process environment if there is a loss of power or compressed air. This ensures the sampler is not damaged by prolonged exposure to the hot process.
- **Fast processing:** with a sampling frequency of up to one sample every 15 minutes at 1,450°C, the Hot Clinker Sampler gives you fast feedback loops. Frequency can be increased at 900°C or lower to one sample every four minutes.
- **Automatic systems:** the Hot Clinker Sampler seamlessly integrates with your QCX system and other automatic sampling systems. Automation helps protect your operators from the hot, dangerous environment. It also gives you a future-proof solution ready for fast extensions and upgrades.

### How does it work?

The Hot Clinker Sampler is intended to directly sample the hot material falling from a rotary kiln. The sampler consists of a sampler frame, an output chamber with an output chute, and sampling spoon. Sampling takes place by moving the sampling spoon into the flow of material and back into the cooling position. The sample is then delivered to the output chute, which is connected to a manual, semi-automatic or fully automatic system. There is also an option to cool the sample with inert gas if required.

### Possible configurations

- **Automated hot clinker sampler w/ manual sample collection (PSK101)**

The Hot Clinker Sampler may be integrated with a designated sample collection container, further enhancing its ease of use.

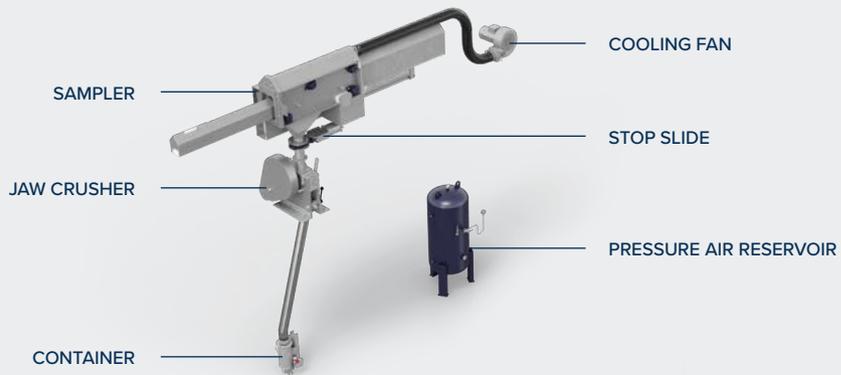
- **Automated hot clinker sampler w/ preparation tower and sending station (PSK112)**

When integrated with an automatic sample transport sending station for automatic sample collection, sampled material is moved via a transport tube system to your laboratory, saving time and minimising waste.

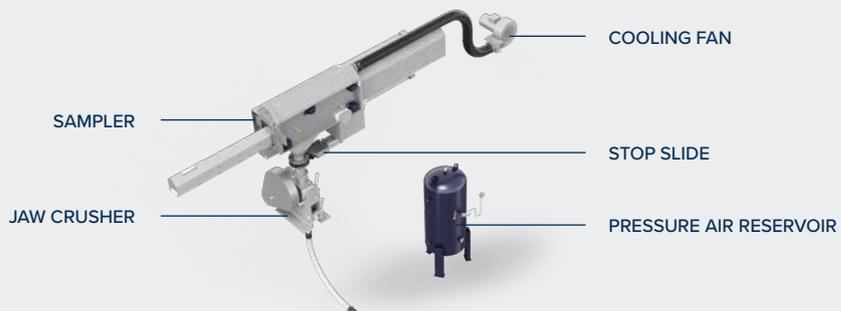
Specification	
Sample material	Hot clinker and granular up to 1,450°C, top size 40mm
Sampling location	Kiln outlet
Sampling type	Spot sample
Sample quantity	1.5 l
Sample frequency	< 4 samples per hour (1,450°C) < 12 samples per hour (900°C)
Stroke (reach of sampler into process)	Max. 1,600mm
Power supply	3 x 380 - 500v, 50/60 Hz
Compressed air supply	0.6 - 1.0 Mpa (Quality 2.4.2 as per ISO 8573-1)
Operating conditions	Temperature: -10°C to 40°C, optional -20°C to 55°C Humidity: 0 - 100%
Weight	Approx. 700 kg
Dimensions W x D x H)	847 x 565 x 2,775

**Seamless integration for even greater reliability and faster processing**

**PSK101**



**PSK112**



# 15. Productivity Partner Services

## 15.1 Cooler inspection

Two-stage inspection for optimal cooler availability.

### Key benefits

- Optimised hydraulic system performance
- Electronic data logging and evaluation of both operation and standstill conditions
- Optimal cooler availability
- Uninterrupted production
- Predictable maintenance costs
- Professional evaluation for your maintenance team
- Complete cooler department analysis

The two-stage inspection helps avoid:

- Clinker fall through
- “Red rivers”
- Excessive wear on grate line and under grate compartment
- Hydraulic system issues
- Reduced heat recuperation

Many issues leading to excessive wear of cooler parts can be eliminated with regular preventive inspections. An inspection by FLSmith provides a complete evaluation of your cooler. Since a problem detected in one area can have its root cause in another, each individual element is given an in-depth analysis. FLSmith uses the latest fault-finding technologies, such as electronic data loggers and thermal cameras. This provides the best means for targeting and eliminating root causes in order to maintain production levels, reduce downtime and minimise production costs. Inspections are carried out in two stages. The first is before shutdown to evaluate operating parameters, and the second after kiln stop to assess the cooler's parts. We recommend cooler inspections to be carried out annually.

## 15.2 Repair and refurbishment services

### Cooler alignment

To achieve the best possible cooler performance, we offer supervision, installation, and alignment of:

- Linear bearings
- Drives and cylinders
- Frames
- Mechanical parts
- Fixed inlet

### Overhaul of hydraulics

To get the best performance of your hydraulic components, we offer:

- Overhaul of piping system by specialists
- Site flushing of hydraulic systems to ensure maximum lifetime of the system

## 15.3 Cooler start-up and finetuning

After a complete cooler overhaul, we can stay on-site and assist in finetuning the operational parameters during start-up to ensure optimal heat operation of the cooler, thus achieving and sustaining a higher cooler performance. The service can be delivered as part of an overhaul or separately. A few references for cooler overhaul and finetuning include: Cimsa Mersin and Cementas Izmir (Turkey), CRH Rohoznik (Slovakia), CRH Platin (Ireland), Cementos Molins (Spain).

### Optimisation services

#### Cooler performance audit

An audit is highly recommendable in situations where there are problems or there can be improvements in the cooler performance, for example:

- Formation of snowman or red river
- Inadequate performance
- High clinker temperature
- Potential for waste heat recovery

With a cooler performance audit, an experienced FLSmidth process specialist evaluates the performance of the cooler during the current operation and determines the available upgrade and optimisation potential of the cooler, delivering a report with recommendations.

#### Pyro process audit

With a pyro process audit, we evaluate performance on the pyro equipment to identify bottlenecks and improvement potentials available on the plant. Our pyro specialist thoroughly examines the clinker burning process – from kiln feed to clinker transport and delivers an extensive evaluation of the pyro system performance, covering both production economy and equipment.

#### Follow-up and implementation support

To complement our audits which provide expert recommendations for process optimisation, we can support you with implementing the recommendations, so that the needed adjustments, settings, and goals are achieved while the FLSmidth expert is on site. We also support with following up on the achieved improvements, so that can ensure maximum benefits of the audit reports and reap the full potential of your equipment.

## 15.4 Onsite Training

### Case: NPC Simuma

FLSmidth Institute performed three weeks of mechanical maintenance training at the South African plant NPC Simuma. More than 40 mechanical engineers were trained and certified by four experienced FLSmidth specialists. The training was customised, onsite training, which included general maintenance, vertical mill maintenance, ball mill maintenance and kiln system maintenance. The course took participants through the relevant maintenance theories and concepts, while also taking a hands-on approach to maintaining the specific equipment onsite. The customer and the participants were very satisfied with the training:

### Hydraulic installation

This training provides participants with knowledge for the main functions of a hydraulic installation in the FLSmidth vertical roller mill and clinker cooler hydraulic installation.

### Benefits

Your operation will benefit from participants' ability to make maintenance decisions and advise on preventive maintenance procedures and actions.

### Learning objectives

You will learn how to:

- Maintain the main hydraulic flow and functions in the installation
- Identify and relate to the standard operation and maintenance documentation
- Perform inspection of LCP mimics

*"The team is much more confident now that they know the equipment. They make much better decisions and take responsibility for their actions. Due to the training, they understand the equipment in more detail. I expect that the reliability, utilisation, MTBF and productivity percentage will increase dramatically this year."*

Willie Joste  
Maintenance Manager, NPC Simuma

### Course contents

- Basic hydraulics
- Hydraulics safety
- Installation and main documentation
- Oil flow and cleanliness
- Filters and reduction rate
- Main components and functions
- Basic settings
- Local control panels and CCR
- Inspection route and main points

### INFORMATION

- Duration: 3 days
- Audience: Maintenance managers, maintenance shift engineers
- Number of participants: 5-12
- Location: Onsite

# 15.5 Service agreements

We drive efficiency and optimisation through tailored service agreements that reduce operating costs by minimising downtime, boosting productivity, and increasing sustainability. Our services are powered by product and process knowledge, onsite experience, and digital technologies.

The service agreements can apply to individual products, departments, to the full plant and across various plants. They can be customised by including further add-on services to cover all needs across all equipment. They can also be combined with other existing service agreements such as PlantLine Agreement, which covers Digital Products. We combine product and process expertise with digital tools to deliver these agreements and to support the customer’s digitalisation journey. For example, we use advanced analytical models in online condition monitoring, standardised digital checklists for many of the mechanical and operational services; and focus on cybersecurity (secure remote connection, antivirus, data security).

### Single services

- Training
- Audits and optimization
- Cooler repairs and refurbishments
- Cooler inspection

### Service agreements

- Customer partnership service agreements - committed improvements on selected KPIs for the equipment, a department, or the entire plant
- Customer membership service agreements can include cooler, kiln and other pyro equipment
- Cooler inspection or maintenance service agreements

Customer Membership - Optimisation	Customer Partnership - Reliability and performance
Online package with continuous support for <ul style="list-style-type: none"> <li>• Equipment availability and reliability</li> <li>• Productivity and capability-building</li> <li>• Ease of doing business</li> <li>• Support agreement</li> </ul>	Comprehensive online and on-site support, ensuring improvements from baseline on: <ul style="list-style-type: none"> <li>• Selected equipment and plant performance KPIs</li> <li>• Implementation of maintenance procedures, upskilling and certifications for on-site personnel</li> <li>• Pay-per-performance agreement</li> </ul>
Enabled by advanced digital tools, supporting your digitalisation journey	

# 16. Productivity Partner Offerings for Cooler

## 16.1 PXP upgrade pyro or cooler

### Asset Optimization

An unstable kiln and cooler leads to inefficient production and inconsistent clinker quality. ECS/Process Expert stabilizes the kiln and cooler using advanced process control, resulting in increased production, reduced cyclone blockages and kiln ring formations, while delivering consistent clinker quality.

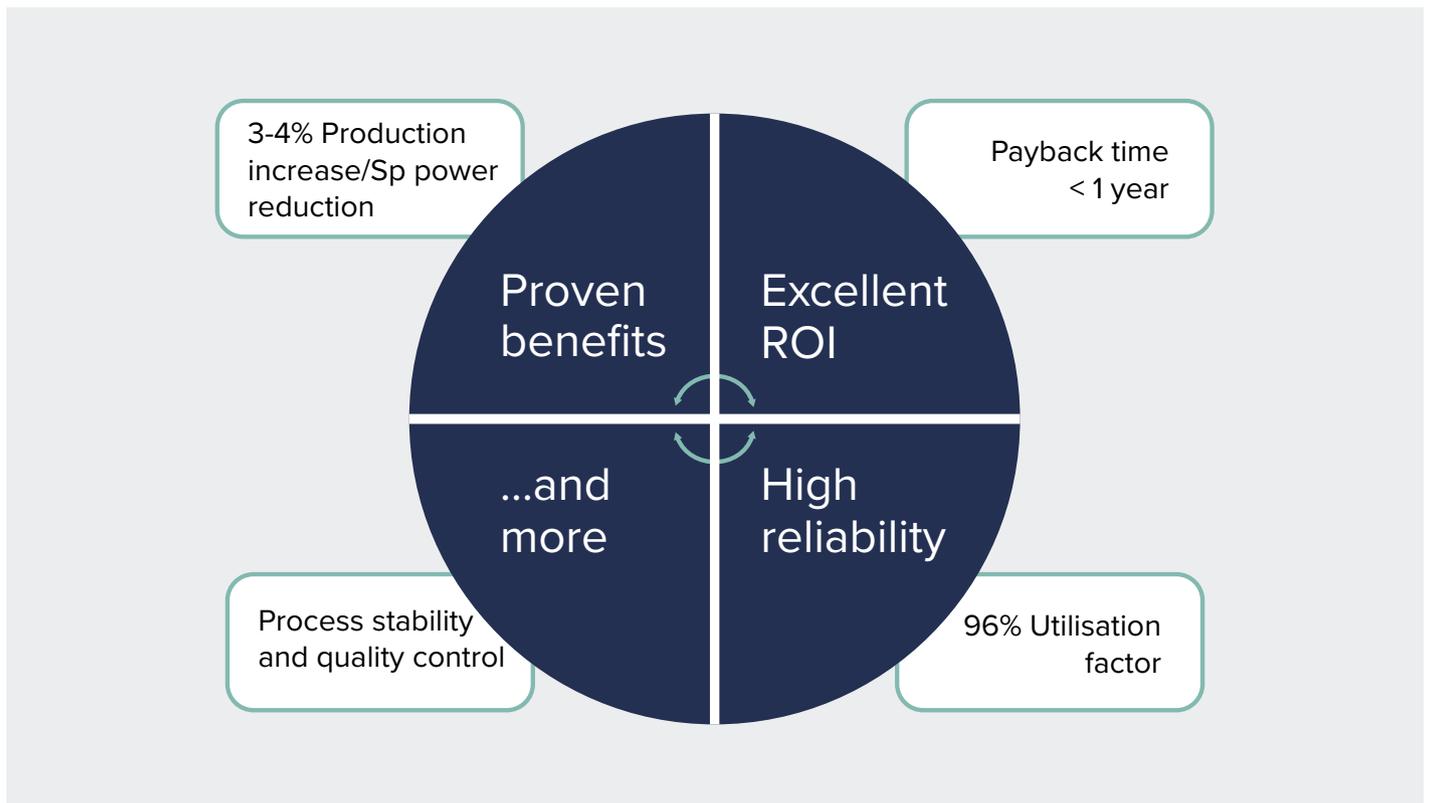
### Why ECS™ Process Expert?

- More than 100 years of process knowledge
- More than 30 years of Advance Process control knowledge
- Latest Control Technologies (Intelligent PID, Fuzzy Logic, Neural Networks and MPC)
- More than 200 installations all over the world with continuous monitoring

*References available on request*

### Benefits

- Production increased by up to 4%
- Reduced cyclone blockages and kiln ring formations
- Consistent quality with a reduction in standard deviation by up to 30%
- Efficient Calcination and burning
- Heat recuperation improved up to 4%
- Improved Cooling with Clinker temperature maintained within the band



## Control challenges

Controlling a cement kiln has always been a challenging task for cement plant operators. These days, a computer-based pyro control system is not merely nice to have, it is a practical necessity. Kiln process control is divided into three control strategies: normal, upset control and optimization. The optimization mode tries to maximize production and save energy with low emission by varying the Burning zone indicator targets. The upset mode is activated for various upset conditions like coating fall and raw mill start stop. Normal conditions try to control the Burning zone index by varying the speed, feed, and Fuel.

### Actuators:

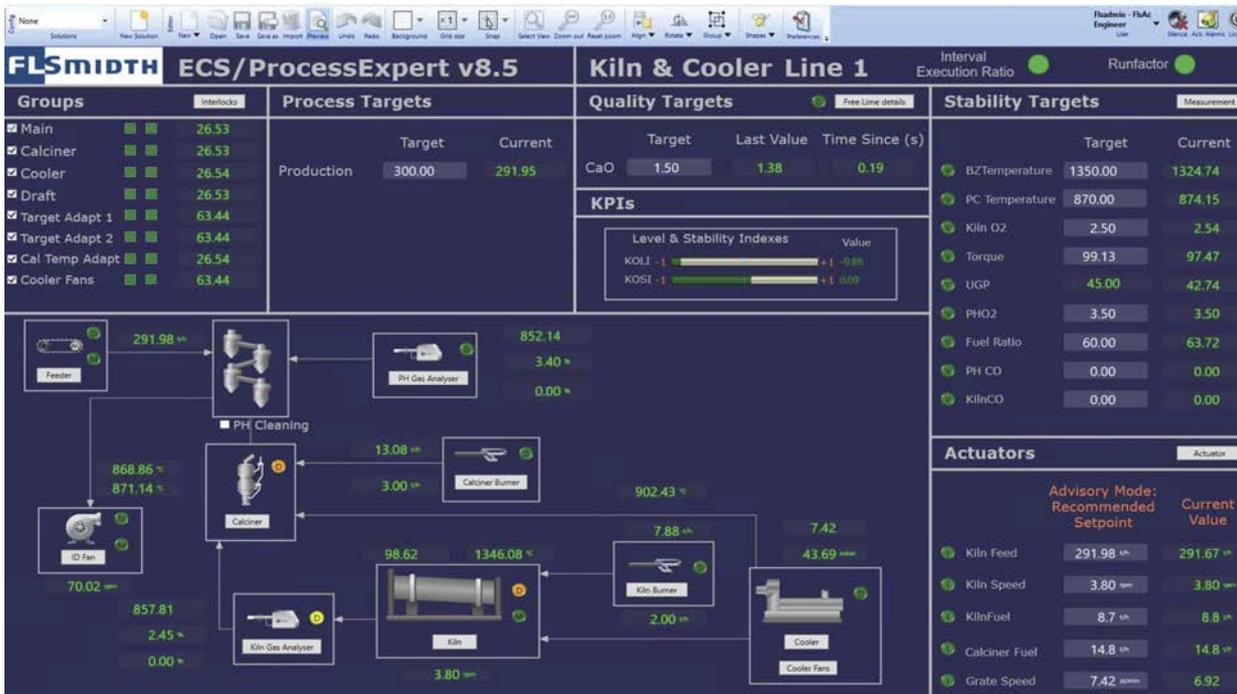
- Grate Speed
- Cooler Fans
- Under grate pressure target

### Measurement:

- Cooler Under grate pressure
- Cooler Fan Flow
- Cooler Outlet Temperature
- Tertiary Air temperature
- Calciner temperature
- Kiln stability

### Key benefits

- Production increased by up to 4%
- Reduced cyclone blockages and kiln ring formations
- Consistent quality with a reduction in standard deviation by up to 30%
- Efficient Calcination and burning
- Heat recuperation improved up to 4%
- Improved Cooling with Clinker temperature maintained within the band



## IOT Foundation

FLSmidth IoT solution is a combination of inhouse designed Edge solution with the well-established Azure cloud solution from Microsoft. This unique combination makes sure to bring data from any factory floor securely analysed and packaged, to the cloud. The event driven data flow makes the product not only perfect for monitoring applications, but also for enabling the IoT systems to get control. With FLSmidth designed Edge Gateways, you have the possibility to access data remotely and securely while also allowing for full remote device management. IOT platform supports: Modbus RTU/ TCP Master, Ethernet, Analog/Digital I/O. OPC UA, MQTT Client, FTP.

## Ease of use

The FLSmidth Edge Gateways are built for ease of use. Configuration and deployment can be done remotely via a simple cloud interface. Data sharing is through REST APIs which makes any data consumer to create data representation models and tools rapidly. The gateways are designed based on FLSmidth extensive industrial knowledge both in cement and mining and can withstand extreme site conditions

## Security and device management

Security and proper device management are important cornerstones for the FLSmidth IoT ecosystem. The FLSmidth Edge Gateways keeps your data properly encrypted and enables devices to stay updated and ready for future threats, in real time. The security of the IoT platform has been tested and verified by third party cyber security experts.

## Features and benefits

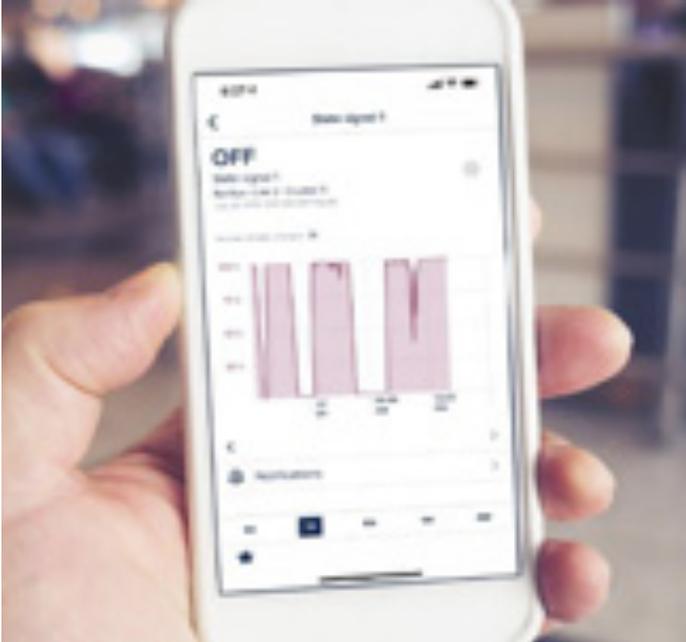
- Azure IOT Hub connectivity
- Enable easy remote control and management
- Provide Modbus-TCP client/server and Modbus-RTU master/slave interfaces
- Enable OPC UA, MQTT, FTP
- Cloud configuration interface
- Root user authentication
- Device initiated connections
- Central device management
- Mass deployable updates
- Real-time status information
- Alerts and automatic responses

## Azure cloud capabilities

Azure IoT Hub is a fully managed service that enables reliable and secure bidirectional communications between millions of IoT devices and a solution back end. Azure IoT Hub:

- Provides reliable device-to-cloud and cloud-to-device messaging at scale
- Enables secure communications using per-device security credentials and access control
- Provides extensive monitoring for device connectivity and device identity management events
- Azure IoT Hub can scale automatically to support traffic surges based on the service tiers subscribed
- Event-based device-to-cloud ingestion. IoT Hub can reliably receive millions of events per second from your devices
- IoT Hub retains the event data for up to seven days to guarantee reliable processing
- IoT Hub provides a File upload feature to push non-time-critical data to the cloud

## 16.2 SiteConnect™ Mobile Insights App



Monitor real-time performance and health of your critical assets anywhere. Bring the control room with you with FLSmith SiteConnect, the smart phone app that provides real-time access to equipment operation, health and performance data, and send event notification to users wherever and whenever you need it. With SiteConnect app, it is easier to stay connected and informed, empowering users at various level (Executives from Headquarters, Plant Manager, Department Manager from Plant office, Engineer & Technician from Field) to make faster and better decisions based on plant and equipment insights, promptly and with confidence.

### Key benefits

- Improve visibility of plant and equipment performance
- Optimize asset management
- Use live data to respond quickly to unplanned events
- Instantly share valuable insights with your peers to improve your team's efficiency

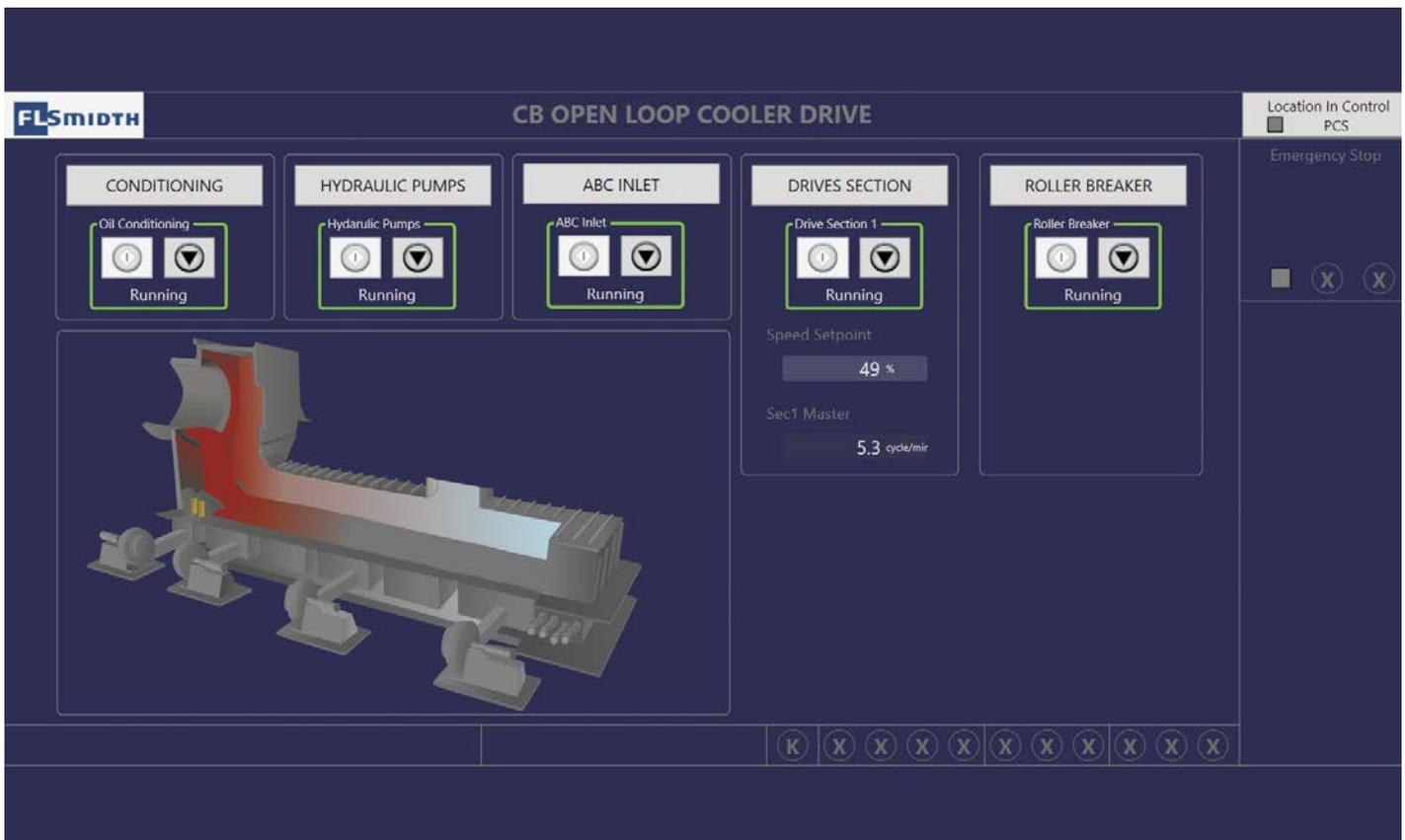
## Control solutions, powered by our ECS/Product Control™ Platform

ECS Product Control is our fast and flexible digitally connected control system software that builds on FLSmidth's extensive expertise to deliver faster commissioning, minimized downtime through online troubleshooting, and the possibility to automate the asset for better performance and productivity while reducing operator errors; all of which helps the business run at its peak.

### Key benefits

- Secure Personnel & Asset Safety
- Optimal control of your equipment
- OEM-solution
- High Performance and reliability
- Rapid troubleshooting
- Enables progress toward sustainable operations
- Supports business success through digitalization
- Expedite Remote Support
- Easy integration to DCS and Cloud services

The asset can be configured to be controlled and monitored locally from the HMI or remotely by network data exchange of all relevant control and supervisory data with a plant control system. The Local HMI includes 'Maintenance Mode' with all the data and screens for maintaining and troubleshooting the machine. Integration with plant control systems that use ECS™ Product Control gives the plant control operator the ability to see mimics identical to those on the Local HMI. For non ECS plant control systems, an optional client PC can be added to the system to give the control room operator direct access to the product Control System HMI. For non ECS plant control without optional client PC, integration is configured via the network signal exchange list.



# 17. Comprehensive Matrix of benefits

Page number	Product Improvement	Mechanical	Electrical	Process	Operations	Quality	Reliability	Shut-down
3	ABC™ Inlet	5-yr wear life	-	>5 kcal/kg	No snowman stop, low comp. air	Alite size, Strength	↑	< 2 weeks
6	Fixed inlet drop zone compartment	-	-	-	Improved recuperation	Alite size, Strength	-	< 1 week
7	Inlet seal upgrade	Insulation layer	-	-	Improved recuperation	-	↑	< 1 week
9	Automatic lubrication	Preventive maintenance	-	-	-	-	↑	None
11	Heavy Duty Roller Breaker	5-yr wear life	Up to 35% lower installed power	Fine clinker PSD, FM capacity	No crusher stop	-	↑	< 3 weeks
16	Wave grates (SF™, MMC)	3-yr wear life	Up to 15% lower absorbed power	Lower clinker temperature	Improved recuperation	-	↑	< 1 week
17	SF - CB upgrade	Inc. wear life, lower spare inventory	Up to 10% lower absorbed power	Lower clinker temperature	Inc. bed control, +10% capacity	-	↑	< 3 weeks
18	Cross-Bar® Cooler	3-yr wear life, movable parts	Modern controls	Cooler loss ~100, lower clinker	Improved recuperation	Alite size, Strength	↑	< 4 weeks
22	Open loop hydraulic system	Fewer parts to maintain / spare	Up to 30% lower installed power	-	Simplified controls	-	↑	< 3 weeks
24	QCX/ AutoSampling™	Easy maintenance	Automated	-	Safe	Consistent sampling	↑	< 1 week
28	Service partnership	Know-how, One-point contact	-	-	Know-how, One-point contact	-	↑	-
32	ProcessExpert	Lower maint. cost	Automated	Improve capacity and energy ~4%	Stable pyro system oper.	Consistent quality	↑	-

# FLSMIDTH Mission Zero

TOWARDS ZERO EMISSIONS IN CEMENT



Zero  
emissions



100% fuel  
substitution



Zero  
waste

Contact us



[flsmidth.eco/contact](https://flsmidth.eco/contact)



Copyright © 2022 FLSmidth A/S. All Rights Reserved. FLSmidth is a (registered trademark) of FLSmidth A/S. This brochure makes no offers, representations or warranties (express or implied), and information and data contained in this brochure are for general reference only and may change at any time.