

KILN INLET GAS ANALYSIS

# Consistent control in high temperature applications



# Consistently precise results

*Get more from your kiln with reliably accurate analysis that helps you optimise combustion and reduce emissions.*

The insights from kiln inlet gas analysis enable you to monitor your pyroprocess, helping you adjust operating parameters to increase combustion efficiency, reduce fuel consumption and minimise emissions. What's more, real-time gas analysis alerts you to dangerous kiln conditions as they occur, enabling you to act quickly before damage occurs.

But if your gas analysis equipment lets you down, you miss out on these opportunities and risk harm to your equipment, product quality and the environment.

Our KilnLoq® gas analysis systems are designed to withstand the hostile conditions of the kiln inlet, delivering robust and reliable analysis so that you can achieve consistent monitoring. Your kiln operation, in your control.

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## Key benefits

■  
Continuous insights

■  
Low maintenance

■  
Accurate  
and sensitive  
measurements

■  
Optimised  
combustion

■  
Swift ROI

■  
Kiln stop  
prevention

# Why you need a reliable kiln gas analysis system

Every kiln stop has a major consequence. Lost productivity. Huge expense. Disruption across the flow chain. But unplanned downtime is not inevitable. Continuous monitoring of kiln gases through your KilnLoq® kiln inlet gas analyser will give you the insight you need to not only act on early warnings of dangerous kiln conditions, but also to optimise kiln performance.

When you capture this information in real-time it enables you to:

- **Control kiln conditions** – maintain optimal levels of O<sub>2</sub> and avoid a toxic build-up of CO.
- **Prevent kiln stops** – advanced warning of O<sub>2</sub>, CO and SO<sub>2</sub> build-up, which would necessitate a kiln stop. Kiln outages affect productivity, clinker quality and operational stability. Avoiding kiln downtime is one of the big economic advantages of kiln inlet gas analysis.
- **Optimise fuel consumption** – enabling you to control O<sub>2</sub> levels so that you can choose between burning fuel more slowly and efficiently for lower production costs and burning it faster for greater throughput. This flexibility helps you tailor your production strategy to market needs.
- **Reduce emissions** – helping to regulate O<sub>2</sub> and CO for optimum combustion and emissions reduction
- **Stay safe** – to avoid the disastrous consequences that can result when your pyroprocess is out of control.
- **Improve clinker quality** – using insight into kiln gases to make fine adjustments that optimise clinker quality and help you avoid overburning.
- **Control volatiles** – preventing the blockages and kiln damage that can occur when volatiles such as SO<sub>2</sub> build up in your process.

## Critical for your sustainability objectives

Being able to control kiln conditions to minimise emissions is one major advantages of kiln inlet gas analysis. The other is the flexibility gas analysis gives you to burn more alternative fuels.

100% fuel substitution and reducing our carbon footprint are critical goals for the cement industry, but in order for this to be possible you need firm control of your pyroprocess and real-time updates on kiln conditions. Our KilnLoq gas analysis solutions enable you to do this, and are also built to withstand the harsh conditions that can arise from the use of alternative fuels.

## Suitable for any rotary kiln process

The KilnLoq system is not only suitable for measuring process gasses in cement kilns. It is also widely used in other industries, such as nickel, lime, and pulp and paper. In any application utilising a rotary kiln, the KilnLoq gas analysis solution will benefit operators seeking to optimise combustion, reduce their carbon footprint and avoid the risks that come with an unstable pyroprocess.

Additionally, our customers use KilnLoq in cement calciners, where gas analysis helps operators to adjust parameters to ensure maximum efficiency.



# The patented KilnLoq® probe - built for harsh environments

Since its launch in 2004, the KilnLoq probe system has become the preferred system for the cement industry. Typically used in kiln inlets and calciner exits, the KilnLoq probe is designed to withstand the harsh, high-temperature environment of your pyro process.

Handling the extreme temperature and high dust load is a simple enough engineering task. All of our pyroprocess equipment is designed to handle these conditions. The real challenge comes when gas condenses in the raw material, which can happen if high concentrations of volatiles occur in the process. The result is sticky scaling on any surface exposed to the hot volatile-loaded gas – including the probe. Blockages can cause downtime of up to a couple of hours, during which you're running your process blind. What's the point of a gas analysis system that goes down when you need it the most?

## One-Pipe design

The KilnLoq probe system offers a better solution. We borrowed some ideas from the design of the air cannon to create the patented One-Pipe layout of the KilnLoq probe: one straight pipe with unmatched cleaning power. There are no mechanical plungers or rotating parts. There are no complex mechanical solutions. Just one straight pipe through the probe that can be manually cleaned (if needed) and returned to operation in less than 3 minutes.

The result? Continuous gas sampling that enables you to precisely monitor your process through our GasLoq gas analysis system.

## A quick clean, and then back to work

We would love to tell you the KilnLoq gas analysis probe never gets blocked. But the reality is that all probes experience blockages. That's the nature of the high temperature, high dust environment we are dealing with. The KilnLoq probe system is built with an automatic cleaning process, which at most plants keeps the system running for a long time. When it does eventually block, the KilnLoq probe can be manually cleaned and returned to use in less than 3 minutes.

## KilnLoq One-Pipe - Automatic cleaning

The KilnLoq One-Pipe system has three cleaning systems that work in harmony to clean the sample path thoroughly from end to end.

Firstly, the probe tip is cleaned to remove any deposits that could reduce the effectiveness of the main One-Pipe cleaning process. **(2)** A jet of compressed air is then blasted through the entire length of the One-Pipe probe. **(3+4)** At the same time, air is blown backward through the filter, lifting dust deposits off the filter filaments. This dust is swept up by the blasts of compressed air in the main body of the pipe and blown back into the kiln.

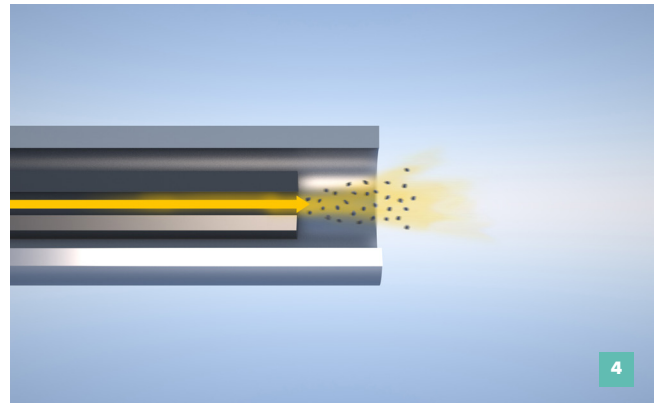
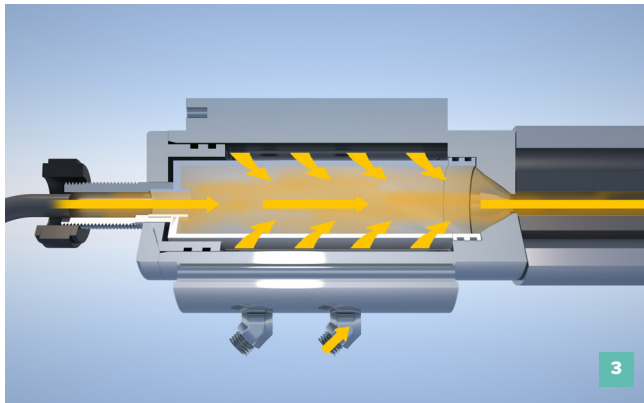
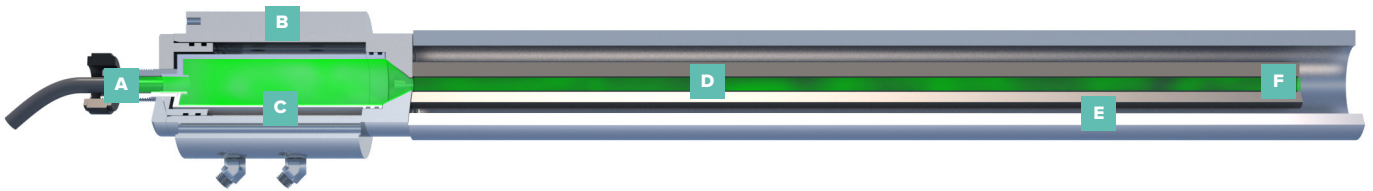
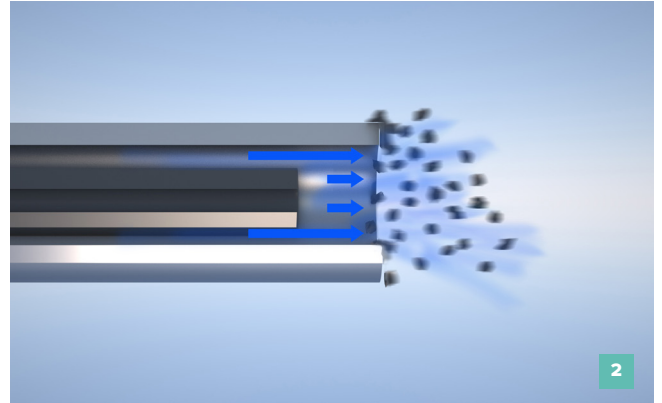
## KilnLoq One-Pipe maintenance

The One-Pipe sample path is easy to service and keep clear. The access port at the end of the One-Pipe length can be opened in seconds, providing full access to the sample path's entire length.

If aggressive kiln operation blocks the probe, One-Pipe allows you to clean out the entire length of the probe in a couple of minutes. As a result, you will rarely have to open the filter housing during operation because you can carry out all maintenance through the rear access port **(A)**. And when the access port is open, the sample path can be visually inspected in seconds **(1)**.

## KilnLoq One-Pipe layout

- A. Rear end access port
- B. Filter house body with heater
- C. Coaxial filter
- D. One-Pipe sample system (Green)
- E. Water cooled cooling Jacket
- F. Electrical heated sample probe



**Protecting the probe**

The KilnLoq probe has a steel cooling jacket so it can resist the high temperatures in cement plants, while the central pipe where the gas is sampled, and the filter housing, are electrically heated to 180°C, so water or acid cannot condense. The probe's closed-loop water circuit re-circulates water at a low temperature, so lime deposits are minimal, resulting in less maintenance and less need for a regular de-scaling.

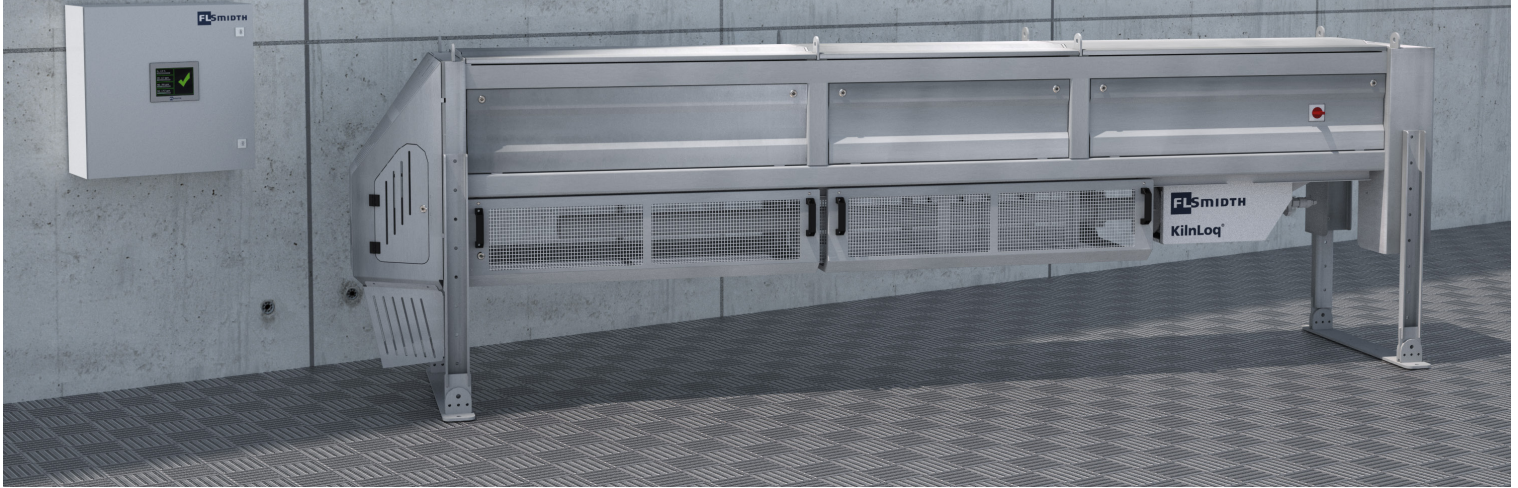
Cooling the steel probe prevents bending and distortion along its length. It also causes volatiles in the process gas to condense on the cold surface and bond with the raw materials in the kiln to form a hard coating, but at FLSmidth, we have proven that the KilnLoq probe's cool surface makes the condensation so brittle that it is relatively easy to remove.

**Extraction device**

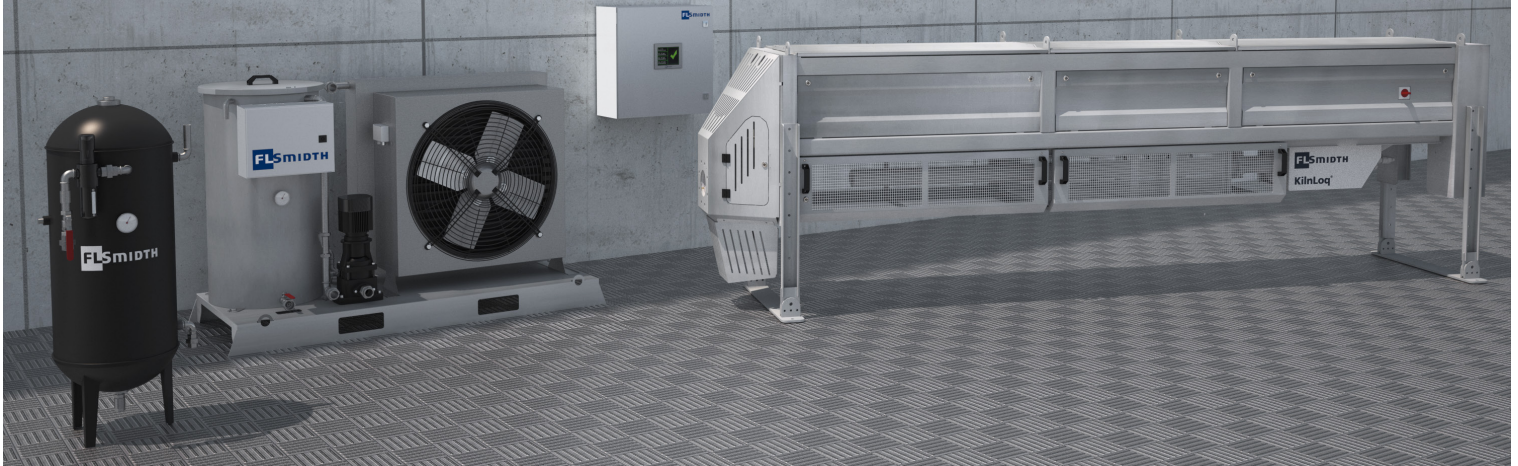
The kiln inlet can be a dangerous place, especially under off-set kiln conditions. That's why we install the KilnLoq probe in an extraction device. The extraction device is equipped with an automatic process shutter to keep everyone safe, and the system allows the probe to be operated from a safe distance so there is no risk of exposure.

The extraction device also protects the probe in the event of a power failure, or a failure in the cooling system, to ensure the probe doesn't get too hot.

Basic configuration of a KilnLoq® probe and extraction device housing. The control panel is shown on the wall to the left.



KilnLoq shown with optional utility air supply and probe cooling equipment which can be connected to any existing analysis system.



A complete system configuration showing gas analysers and a gas conditioning system installed in a GASloq cabinet with utility air supply and probe cooling equipment.



# The GASLoq<sup>®</sup> gas conditioning system

## **GASLoq – gas analysis system**

The layout of the equipment is based on extractive analysis. A sample of the gas is continuously being drawn out from the process by a probe. The process gas is kept hot at any point of the system during transport to prevent any damaging condensation to take place. A gas conditioning system is utilised to remove all dust and to dry the gas and any contaminating components. The gas is then delivered to the analysers with a fixed reference of dew point, flow, pressure, and temperature to establish correct analytical correlation with any data taken at any other time.

With data gathered from the KilnLoq<sup>®</sup> sample, operators can adjust the process to correct unstable conditions swiftly and effectively. Furthermore, the KilnLoq system monitors potential scaling tendencies in the process and on the probe. This feature will support proactive measures by maintenance staff and operators and help keep the process and probe system running without unnecessary production cuts.

The gas analysis system GASLoq comes in two configurations:

1. The GASLoq 1200 cabinet module which contains all the gas analysis system components. All the components for conditioning of the process gas as well as the analysers are placed in this cabinet.
2. The GASLoq CUBE is an analyser room where all the components and gas analysers for conditioning of the process gas are mounted directly on the wall in operating height. The analyser room provides optimal ambient conditions with air conditioning and heating.

Regardless of the GASLoq configuration being GASLoq 1200 or GASLoq CUBE, the system controller will be integrated into the analysis system. The controller allows the operator to operate and monitor the status of the system without even opening the cabinet door. Communication to the control room is available as hardwire or as an optional serial connection standard, such as Modbus, Profibus, Ethernet TCP/IP, and they are all supported by a fibre-optic uplink.

## **Gas conditioning**

Only well-documented components that have proven their ability to handle very aggressive process gas is used. Sulphur acid condensation prevention is important when it comes to maintenance for a gas conditioning system.

We do not produce our own gas analyser units. Instead, we select the best analyser for the job from a range of suppliers, including ABB, Emerson, MKS, Siemens and others. The best analyser will be defined according to the customer, the application in question and the potential preferences of the end user.

## **Traditional cold/dry system**

The traditional cold/dry gas conditioning comes in two optional versions. If SO<sub>2</sub> is not analysed, peroxide dosing is used, and all sulphur oxidized and washed out together with the water in the gas conditioning cooler. If SO<sub>2</sub> is analysed, a super gas cooler -30°C is utilised to lower the dew point and thereby minimise the risk of formation of sulphur acid in the conditioning system.

# KilnLoq<sup>®</sup> hot/wet laser system

## The acid challenge – and a new solution

Many cement plants are opting to minimise their environmental footprint by increasing the use of alternative fuels, such as tyres and plastic. But what is good for the planet can be tough on the process. High sulphur content in raw materials and fuels can leave cement plants facing the burden of expensive repairs and long downtime for their acid-damaged gas analyser systems. Acid damage persists even when using ultra-low temperature coolers, which dramatically lower the gas-phase H<sub>2</sub>O concentrations in the conventional cold/dry gas analysis system.

Reliable and effective operation can be ensured with the KilnLoq<sup>®</sup> HW Laser Gas Analysis System which is designed for these high sulphur conditions. It's a state-of-the-art hot/wet gas analysis system based on laser technology that works in combination with our KilnLoq kiln inlet probe system.

The temperature of all parts is kept at 180°C – above the acid dew point – so that acid damage is entirely avoided. No expensive maintenance. No equipment downtime. No more prolonged data blackouts. Just fast, precise measurements.

This one-of-a-kind solution is designed for plants with high sulphur processes but it's also an ideal option for:

- Plants wishing to measure water-soluble components such as HCl
- Plants finding it interesting to know the concentration of H<sub>2</sub>O
- Plants wishing to measure SO<sub>2</sub>
- Plants that do not want to use H<sub>2</sub>O<sub>2</sub> dosing due to safety and maintenance issues
- Plants wishing to reduce maintenance
- Plants that want to reduce the number of wear parts

## Combining proven solutions

The KilnLoq HW Laser System is a combination of two proven technologies: FLSmidth's patented KilnLoq probe and the Rosemount hot/wet laser.

FLSmidth's KilnLoq HW Laser System utilises robust, low-maintenance Rosemount CT5100 laser technology, which has been around for over 20 years. During that time, this technology has successfully proven to offer reliability, a long lifetime and instant response time.

## Hot/wet laser technology: A unique combination

The KilnLoq HW laser analyser is:

- The only laser-based hot/wet analyser solution on the market
- The simplest hot/wet analyser solution with the least maintenance requirements
- The most accurate hot/wet gas analysis solution available

## Cost benefits of the KilnLoq HW Laser System

- Less consumption of wear/spare parts
  - Expected saving over 5 years: EUR 20,000
- Savings on maintenance hours.
  - Reduced from 2 hours/week to 2 hours/month
  - Expected saving over 5 years: 400 hours
- Savings on man-hours for calibration due to less drift on analyser
  - Reduced from once per week to once per year
  - Expected saving over 5 years: 250 man-hours
- Savings on repairs due to acid problems
  - Expected savings on repairs over 5 years: EUR 35,000.



# Solving sulphur challenges at Cementos Lemona

Customer story about the challenges of acid-damaged equipment  
and the KilnLoq® HW Laser solution

Like any cement plant, Cementos Lemona (part of the CRH group) wanted to be able to accurately monitor their process. But their gas analysis probe kept clogging, resulting in continuous maintenance and downtime. The high-temperature, dust-laden kiln environment is hard on gas analysis probes. It's not a question of if they'll clog, but when. And while they're being cleaned, the gas analysis system is effectively useless with no possibility of keeping a watchful eye on the process.

## Dream becomes reality

After living with these problems for years, Cementos Lemona took the decision to upgrade to a new gas analysis system from FLSmidth with the patented KilnLoq probe. The new system completely eradicated the probe problems Cementos Lemona had been experiencing – and enabled the gas analysis system to do its job. The precise and reliable measurements resulted in much better fuel regulation, which led to savings in fuel costs.

## Acid problems and the ideal solution

Unfortunately, that was not the end of the story. The clogged probe had been masking other issues in the system. With the probe blockages resolved, it came to light that the service team experienced gas analysis failures, unreliable O<sub>2</sub> measurements, low gas flow issues and more. The cause was acid formation in the gas conditioning system.

The solution was an installation of the KilnLoq HW Laser System which is designed for high sulphur conditions. The benefits were immediate and remarkable. No more acid damage. No more extensive downtime for repairs. Continuous and reliable measurements of O<sub>2</sub>, NO, CO and SO<sub>2</sub> restored the plant operators' trust in the measuring results.

“The implementation of the KilnLoq HW Laser System delivered immediate benefits. We avoided the long downtimes caused by acid-damaged gas analysers and achieved both a significant reduction of maintenance and the money spent on analyser repairs.”

- IÑIGO SAN-JOSÉ ORTIZ, PROCESS MANAGER AT CEMENTOS LEMONA



Reduction  
**IN GAS ANALYSIS MAINTENANCE**  
from approximately 5 hours per week  
to maximum 2 hours per month

Reduction  
**IN TIME SPENT ON CALIBRATING THE ANALYSER**  
from approximately 1 hour per week  
to 1 hour per year

Savings  
**OF 100.000 EUR OVER 5 YEARS**  
thanks to elimination of repairs  
related to acid damage problems

# Increase your equipment's availability and lifetime

## by upgrading your gas analysis systems

### Upgrade old extraction device to new

Upgrade your old KilnLoq® extraction device (delivered before 2016) to our newest and even better performing EXD3. Instead of replacing old, worn-out parts, investing in a brand new, high-performance extraction device is a better and more profitable choice.

The EXD3 offers increased safety for your personnel due to the integration of an automatic shutter function. Furthermore, the introduction of new valves results in even more powerful cleaning. Easy to install, due to fewer cables, and very easy access to the probe, as it is now possible to extract the probe fully. This renders maintenance of the system even more simple and convenient for your maintenance staff. The protection of the electronic parts has been improved, and the amount of moveable parts has been reduced, resulting in less wear and tear of the equipment.

### Upgrade from cold/dry to hot/wet

Do you experience acid damage to your analysers, requiring expensive repairs and long downtime? Do you use alternative fuels or raw material with a high sulphur content? Would you like even less maintenance of your gas analysis system? If so, changing from a traditional cold/dry system, which cools and dries the sample, to a KilnLoq hot/wet gas analysis system, where everything is heated up to 180°C, may be the perfect choice for you.

The KilnLoq HW Laser system is a state-of-the-art gas analysis system where the temperature of all parts is kept above the acid dew point to prevent acid damage. No expensive maintenance, no cooler, no pumps, no valves, no filters and no equipment downtime. It is accurate and measures up to 12 gases simultaneously. The low, long term drift minimises calibration intervals, and thus time spent on maintenance.

### Replacement of probe system

If you're experiencing probe problems such as clogging, leakages or issues with the extraction devices, upgrading to a KilnLoq probe will help cut downtime. If your gas conditioning system works satisfactorily, our probe may be installed with an interface to your existing system.

The patented KilnLoq probe ensures high availability with the unique One-Pipe technology giving the market's most powerful cleaning. Accurate gas analysis. Long maintenance intervals. Upgrading to a KilnLoq probe will give you a better run factor with uninterrupted insight through your continuous analysis.



# Supporting services

Service is an essential component of a successful operation. We're on hand to provide real-time, reactive support, as well as proactive assistance to optimise your operation.

## PlantLine Service Agreements

Our PlantLine Service Agreements are designed to provide remote and on-site assistance on an ongoing and as-needed basis.

Services include:

### *Advanced Online Troubleshooting*

Advanced Online Troubleshooting gives you quick access to experienced specialists via telephone, email or through Go2FLS during business hours. We'll assist with problem analysis, propose solutions and undertake minor corrective actions.

### *24/7 remote emergency support*

FLSmith knows that faults and breakdowns don't only happen during normal business hours. For that reason, we can provide a 24/7 add-on to the Advanced Trouble-shooting service to ensure you have access to a strong team of experts around the clock.

### *Performance and Asset health report*

This proactive service is manned by a large global team of experienced specialists, who analyse your data and trends to determine if your gas analysis system is performing at optimum levels. We'll provide a report on our conclusions, giving you further recommendations such as recommended maintenance tasks or performance optimization measures.

### *Preventive maintenance remote support*

Preventive Maintenance Remote support is a cost-saving alternative to onsite support that helps you plan your maintenance schedule and tasks for optimum efficiency and efficacy. As well as helping to prepare for maintenance jobs, we'll use a range of digital tools to assist the site team with the tasks.

### *SiteConnect – mobile app.*

SiteConnect™ keeps you updated on equipment, process and performance round the clock, when you are onsite or on-the-go. Get plant information directly on your iPhone, iPad or Android phone.

## Repairs

We have a specialised analyser workshop carrying a full range of spares for major brands. The turn-around time for an analyser is aimed to be less than 12 days after reception. Our repair and support services also extend to external brands, including ABB, Siemens, Emerson/ Rosemount, Durag, NEO, etc.



Contact us



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

