



APPLICATION NOTE Minerals & Mining

Flow measurement of natural gas for quicklime production

- Gas burner control and process monitoring for heating calcium carbonate in a lime kiln
- Reliable process monitoring by using Vortex flowmeters with integrated pressure and temperature compensation
- Predictive maintenance of burners through early detection of soot formation and clogged lines

1. Background

A lime manufacturer operates a production site for quicklime in Portugal. The plant comprises a state-of-the-art calcination unit with a natural gas fired lime kiln. In this furnace calcium carbonate (CaCO_3) extracted from nearby quarries is exposed to high temperature. This lime-burning process causes carbon dioxide (CO_2) to detach from the CaCO_3 , leaving calcium oxide (CaO) or quicklime.

2. Measurement requirements

Several gas burners supply the kiln with the necessary heat. Every burner is attached to a closed natural gas circuit. Only if the lime-burning process is kept at an optimum temperature range between $+900\dots1100^\circ\text{C}$ / $+1652\dots2012^\circ\text{F}$ can CO_2 be liberated from the limestone to obtain the desired quicklime product. It is therefore very important for the customer to control the burning process and to monitor burner performance. This requires stable and accurate flow measurement at fluctuating temperature and pressure conditions.

The customer had so far not used any measuring devices to solve this application. Having had frequent issues with decreasing burner performance due to soot formation, however, they decided to equip the plant with process instrumentation. The customer needs precise information about the standard volume flow of natural gas consumed. By the same token, the measuring device was to provide further information to continuously monitor the operating conditions as well as the performance of the burners. The customer preferred using a measuring device that was not only able to measure the flow rate but also to determine other parameters at the same time. It was expected that this instrument be cost-effective and maintenance-free, yet reliable and long-term stable.

Medium	Natural gas
Volume flow rate	50 Nm ³ /h
Operating density	1.46 kg/m ³
Pressure	1.2 bar / 17.400 psi
Temperature	+ 20°C / +68°F
Viscosity	0.01 mPas

3. KROHNE solution

KROHNE delivered 37 OPTISWIRL 4200 C Vortex flowmeters to measure the natural gas quantities supplied to the burners that are used to heat the lime kiln. For this application, the measuring devices not only feature flow measurement, but also temperature and pressure measurement. Unlike other conventional Vortex devices, the KROHNE device can therefore output the flow directly pressure and temperature compensated as standard volume flow.



OPTISWIRL 4200 C measuring natural gas

The customer could even perform an online mass calculation if required. All measuring instruments were delivered as flange version (DN25). As per customer requirement the KROHNE flowmeters are ATEX Ex-ia IIC certified.

4. Customer benefits

The OPTISWIRL 4200 C enables the customer to supply their burners with gas in such a way that the temperature inside the kiln is always within an optimum range for the lime-burning process. Fluctuating process conditions are compensated for by the all-in-one device. By measuring flow, pressure and temperature in one device, the customer was able to save up to 45% installation costs compared to Vortex flowmeters with external temperature and pressure sensors and an additionally required computer unit. The overall accuracy of the system is also increased automatically, as all measured values are only taken at one single measuring point.



Vortex flowmeters installed into the supply lines to the gas burners



Pressure and temperature compensated flow measurement

The multi-parameter measurement of the OPTISWIRL 4200 does not only allow natural gas consumption to be determined. The measuring device is also suitable for determining the maintenance requirements of gas burners, increasing system availability. For every time the nozzles of the burners start sooting, the pressure in the pipelines raises which can be effectively detected by the KROHNE device. In this way, the Vortex flowmeter also gives an indication as to when predictive maintenance of the burners should be carried out. This is an additional value to the quicklime manufacturer as it prevents unforeseen and costly process interruptions as well as gradually decreasing burner performance.

5. Product used

OPTISWIRL 4200 C

- Vortex flowmeter for utility applications in the building materials industry, in mining and other industries
- For liquids, (wet) gases, saturated and superheated steam (+240°C / +464°F)
- Integrated P+T measurement possible: direct output of mass, nominal flow, energy, gross/net heat
- With flange or space-saving sandwich (wafer) design
- Also available as version with remote converter (up to 50 m / 164 ft)



Contact

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Do you require technical advice for your application?
application@krohne.com

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