One Source

Kiln gas bypass systems

FLSmidth

Maximum efficiency and reliability

Main features

- **Quench chamber with dual layer dip tube**
- **Quench air inlet flap valve**
- **Control scheme for maximum stability**
- **Special lining design in transition pipe section**
- **Constant force support system**
- **Multiple layout possibilities**

The key to good performance
All bypass systems are not created equal. At the take-off point from the kiln system, a properly designed quench mixing chamber is critical for the highest performance efficiency and minimum interference to stable kiln operation. FLSmidth has developed such a chamber through a number of innovative design features. Kiln gas bypass systems have traditionally only been used in regions where the local raw materials are naturally high in chloride, sulfur or alkalis. The growing use of alternative fuels and other materials is also increasing the input of chloride to kiln systems to the point that may require a bypass in order to maintain process stability or product quality.

FLSmidth has extensive experience with the design and use of kiln bypass systems. While the fundamental principles of a bypass system have not changed, state-of-the-art technology and design tools have been incorporated to improve bypass efficiency and maximise reliability. Most projects today will at least have the space for a future small chloride bypass (less than 10%) with respect to use of alternative fuels and materials.

Dual layer dip tube
A dip tube eliminates short-circuiting of quench air directly to the outlet of the chamber. The dip tube ensures that the complete amount of quench air always enters the gas swirl and mixes with the kiln gas. As the dip tube is exposed to the cold quench air on the outside and the hot kiln gas on the inside, it is designed as a dual cone system with a thermal insulation between the two steel sections This ensures long lifetime of the components. By keeping the inside hot, the risk of sticky buildups on the inside is minimised.

Quench air inlet flap valve
The quench air inlet flap valve offers control of the inlet velocity, which enables the swirl and the mixing of hot gas and cold air to be optimised in a wide capacity span. The flap valve is operated with an electrical linear actuator.

Bypass system quench chamber

System control
The flow rates of the quench air and mixed gas after the quench chamber are measured continuously, so that the exact amount of gas extracted from the kiln system is known at all times. Control loops will maintain flow stability so that the burning zone conditions of the kiln, notably oxygen level and temperature, remain constant despite any operational disturbances.

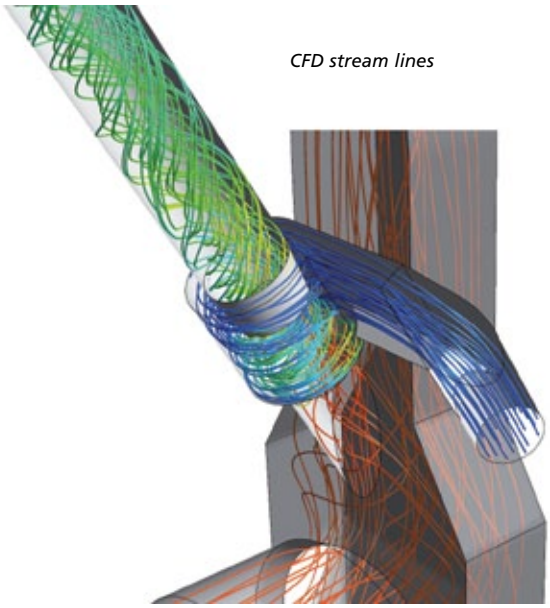
Thermal insulation in transition pipe
To keep the surface of the transition pipe before the quench chamber hot, it is equipped with a highly insulating lining design. This effectively reduces any potential for buildup in this area.

Constant force support system
The complete quench chamber is supported in a constant force spring system, which eliminates the need for a thermal expansion joint on the transition pipe without stressing the structure of the riser duct.

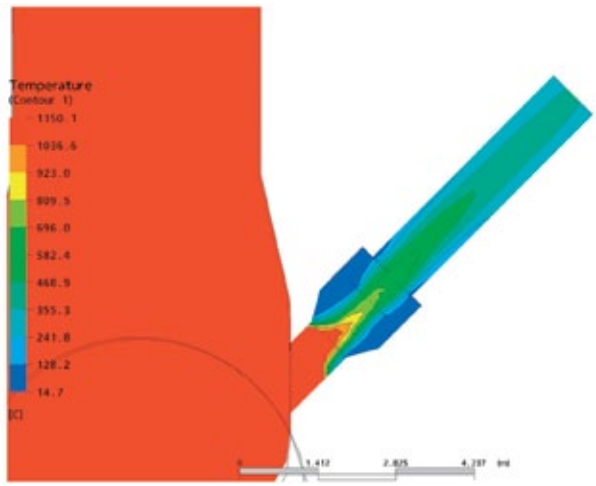
Superior mixing of hot kiln gas and cold air
Superior mixing of hot gas and cold air is created by the inlet flap and the dip tube for a wide capacity span. Good mixing is synonymous with an even temperature profile, which is one of the overall criteria for optimum operation of the chamber. Local areas with high temperatures and increased stickiness of dust are effectively avoided. It also eliminates the problem of having surface areas exposed to either higher or lower temperatures than anticipated, which could create structural failure on hot areas and severe condensation on cold surfaces.

Reduced off-gas volume
Good mixing allows operation with high exit temperature from the mixing chamber so that a higher proportion of the cooling may be provided by water instead of air. In this way the volume of gas to be treated by a filter installation and later discarded is greatly reduced. This can be translated into reduced investment and/or operational costs (kWh per kg gas removed) for the quench air blower, filter, bypass fan, ductwork and stack.

Reduced risk of build ups in transition pipe
The special lining concept and no requirement of a thermal expansion joint in the transition pipe generates a hot and smooth surface that greatly reduces the risk of getting buildups in this critical area.



CFD stream lines



CFD temperature map

Layout Arrangements

FLSmidth offers a number of different solutions for bypass installations to fit specific plant requirements and layout. The traditional arrangement with spray tower and fabric bag filter is shown in the schematic.

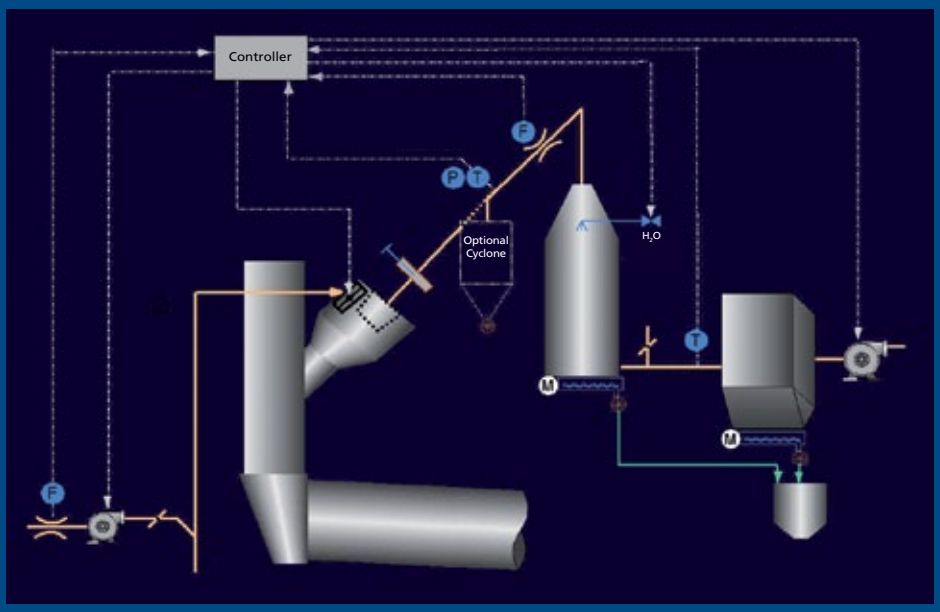
Other system types could include:

- Small systems without the spray tower and only bleed air cooling
- Systems that return the de-dusted gas back to the preheater, calciner, clinker cooler, or raw mill system
- Systems with return of coarse dust fractions from the inlet section of the filter back to the kiln system
- Systems with cyclone to catch coarse dust fraction for return back to the kiln or cement grinding systems

Full or partial kiln bypass systems are available for both new and existing plant installations, supported by a full process design assessment based on the type of kiln and the raw fuel and materials analyses. Complete supply is available from FLSmidth with all the required equipment and controls.

FLSmidth's solutions for kiln gas bypass systems are further examples of the commitment to being the preferred partner and leading supplier of equipment and services to the global cement industry.

Typical bypass system control scheme



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