Two Years Of Clean Air

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Introduction

In 2007, Dyckerhoff, a company of the Buzzi Unicem Group, began a major investment in its Geseke plant and replaced the electrostatic precipitator with an energy-efficient and more effective bag filter.

To ensure that clinker production continues to keep limit values under all conditions in the future, an optimised procedure had to be introduced to reduce fine particle emissions. The existing ESP, located after the rotary kiln, was unable to comply with the legally specified limits.

The motivation for the change was the authorisation to use alternative fuels. In many cases, the fossil fuels primarily required to produce clinker can be substituted with appropriate secondary fuels. By recycling the energy of these materials in the rotary kiln, the economic efficiency is enhanced while contributing to the protection of resources. According to a study from the Institut der Deutschen Wirtschaft (German Economic Research Institute), the economic value creation effect of secondary resources and secondary fuels in Germany amounted to €3.7 billion in 2005.

The application of secondary fuels ensures that cement manufacturing is in line with the strict provisions of the 17th Federal Emission Control Act, which transposes the European Directive 200/76/EC for incineration. The dust emission limit values of <20 mg/m³, enforced by the 17th BIMSchV, can only be met reliably with modern filter installations.

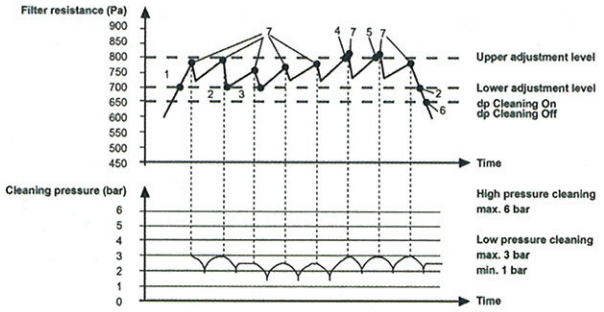


Figure 1. Schematic diagram of the cleaning arrangement.

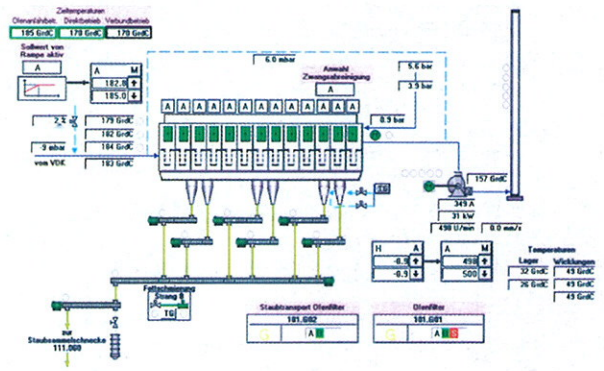


Figure 2. Filter monitoring in the control centre.

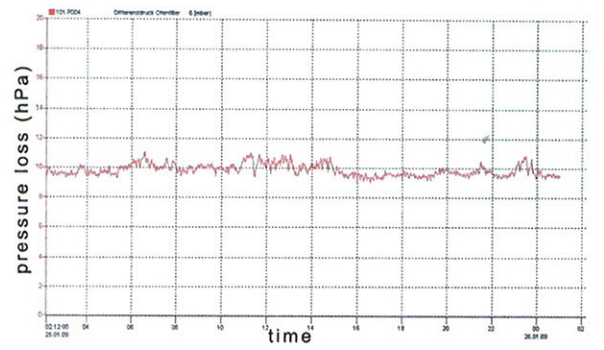


Figure 3. Pressure loss in bag filter for dust removal in rotary kiln/ raw mill application.

Table 1. Design data	
Application	Rotary kiln/raw mill dedusting
Original ESP:	
Gas volume	<240 000 m³/h
Temperature	<230 °C
Intensiv-Filter type: IF JCN 85/13 7000 Eco	
Filter surface area	4010 m² gross 3701 m² net (semi-offline cleaning)
Filter medium	Glass fibre bags with PTFE membrane
Down time	5 weeks
Residual dust content	≤10 mg/m³ (n)
Pressure loss	≤10 - 11 hPa
Cleaning pressure	~2.5 bar
Compressed air consumption	<45 m³/h (n)
Cleaning method	Semi-offline

Dedusting with Intensiv-Filter

Looking for a suitable dust removal specialist, the company decided on Intensiv-Filter. The discernable benefits of Intensiv bag filters are as follows:

- Greater consistency and less dust content in clean gas, especially when using secondary fuels to comply with determined limit values.
- Efficiency of bag filters is not dependent on changing operating parameters.
- Dust collection is not determined by water content or the characteristics of the gas to be dedusted.
- No CO deactivation for dedusting of rotary kilns.
- Simple access from the clean-gas-side.

In addition to the optimised procedure for reducing dust emissions, it was possible to implement a cost-effective variant. In place of the old ESP, a completely new housing was attached to the dust collection hopper. All the existing dust transportation systems continue in use. Prefabricated modules and a preassembled filter housing meant that the refitting time was kept to a minimum. Within the space of five weeks and during downtime that had already been scheduled, the equipment was installed, connected and commissioned.

The characteristics of the bag filter used can be distinguished by the following:

- Cleaning at low pressure and in a semi-offline procedure.
- 7 m glass fibre bags with PTFE membrane.
- "Intelligent" cleaning control system with the JetBus Controller®.

Cleaning arrangement

The filter installation's operation is automatically adjusted to prevailing requirements by the JetBus Controller®, which regulates cleaning prepressure and controls the shut-off flaps when necessary.

The filter bags are cleaned by a periodic compressed air pulse at pressures of 1.5 - 3.5 bar, depending on the filter differential pressure. In the Dyckerhoff plant, a customised nozzle system from Intensiv-Filter was used, which significantly improved the cleaning efficiency. The Intensiv-Filter nozzle cleans the filter bags ideally and economically, thereby protecting the filter media.

It is possible to significantly reduce the use of compressed air in the cleaning system, due to the high efficiency of the nozzle injector and by adjusting the cycle time or the cleaning prepressure. When combined with an "intelligent" cleaning control system, it is possible to lengthen cleaning cycle times, reduce the cleaning pressure and make major savings.

A JetBus controller® with microprocessor technology is used as an "intelligent" cleaning control system in the Intensiv-Filter system. The system's modular structure means that the controller can be configured flexibly and easily changed or extended at a later date. The filter can be operated either in online or offline mode. The JetBus Controller® regulates the cleaning prepressure and controls the pneumatically-activated clean gas flaps. It is linked to higher-level systems via standard coupling modules that switch between the controller and the existing process control system.

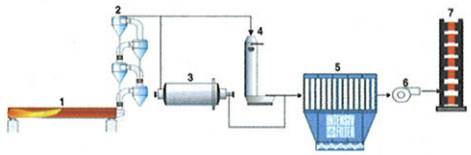
In addition to its uses in standard solutions, the JetBus Controller® is particularly suitable:

- For energy reasons.
- For filtering installations with varying strains.

- For creating a defined filter cake.
- If using sensitive filter media.

The benefits of the system are:

- Ideal cleaning adjustment to meet the operating conditions in the dust removal installation.



Legend

1 Rotary Kiln
2 Cyclone preheater
3 Raw mill
4 Gas Conditioning Tower
5 EcoJet-Filter
6 Filter fan
7 Exhaust stack

Figure 4. Simplified flow chart of dust removal for kiln/raw mill dedusting in the Geseke plant.

Figure 5. Installation of pre-assembled filter housing (2007).

Figure 6. The installation today.

- Flexible parameterisation of the system functions.
- More precise monitoring and direct assessment of the cleaning system.
- Saving and processing operating results.
- More precise error analysis and identification of the sources of errors.
- Optimising and reducing compressed air consumption.
- Longer filter media service life.
- Optimising and homogenising dust discharge.
- Reducing overall energy costs.

The compressed air vessel pressure needed for cleaning is specified by the plant parameters. The plant's operations are automatically adjusted to the operating conditions. The filter resistance is an important control variable here.

Figure 1 shows a schematic diagram of the cleaning arrangement. At point 1, the cleaning system is switched on. The cleaning pressure remains unchanged until the upper permitted limit is reached (point 4). At this point, the cleaning pressure is increased and the plant is "observed" by the system. When the resistance drops below the lower limit (point 2), the cleaning pressure is reduced. Within a specified measuring time, the cleaning system checks the plant parameters and adjusts itself to the changing data. The operating data from the dust removal installation is therefore permanently optimised.

Residual dust under the limits

Dyckerhoff production manager at Geseke, Grosse-Frie, comments:

"We take environmental and labour protection very seriously in our cement plant at Geseke. We specified to Intensiv-Filter that we wanted to comply with a residual dust content of 10 mg/m³ in normal state. This was achieved with the commissioning and is permanently under the value to this day.

"The short switch-over time was carried out on schedule despite poor circumstances. The old electrostatic precipitator was dismantled, removed piece by piece and scrapped, all with military precision. In a spectacular manoeuvre, the preassembled bag filter was lifted onto the existing dust collection hopper by a special crane and then connected.

"Two years later, we're still very pleased with Intensiv-Filter's concept."

Another important advantage is the filter material used. Very few materials ensure safe operation with temperatures up to 230 °C. In the case of the Geseke plant, Intensiv-Filter decided on glass fibre bags with a PTFE membrane.

Intensiv-Filter designed the dust removal and gas cleaning systems to work with the modern design variants already described. On the basis of the specific customer conditions, the company's filtering installation represents a complex waste gas treatment plant that required process engineering solutions to be implemented. In order to design the gas cleaning installations and to implement this optimum solution within the remit specified by the Dyckerhoff plant, it is essential to know each procedure in detail and to specify the framework parameters in consultation with the operator. It is only possible to plan the gas cleaning installation for a specific requirement if all the circumstances that are relevant to measuring, operating methods and selecting materials are known. This is particularly true when providing a technical warranty. Plant concepts from Intensiv-Filter are far more than simply dust collectors.