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Kiln bag filter conversion at Dyckerhoff Zement's Geseke plant

The substitution of fossil fuels with alternative combustibles and simultaneous consideration of increasing environmental regulations will force cement producers world-wide to improve their electrostatic precipitator (ESP) installations. This paper will introduce the advantages and benefits of ESP conversions, showing different concepts as well as one example of Intensiv-Filter's successful projects in Germany.

Intensiv-Filter has designed several conversions of existing ESPs to high-performing bag filters over the last five years, equipped with the latest features of modern bag filters. Economical bag filter design using low pressure off-line cleaning in combination with bag length up to 8m can be foreseen for ESP conversions, to decrease the pressure drop across the bag filter and to increase the bag life time.

The low operation cost of Intensiv-Filter's ECO design, in conjunction with the benefits of ESP conversions like re-use of existing casing, duct work and auxiliary equipment will realise very short amortisation times compared to new installations. Flexible and pre-assembled filter head module design reduces down time to a minimum and enables the plant to execute ESP conversions during regular plant shutdown times.

Left: Dyckerhoff Zement's Geseke plant, complete with a new bag filter designed by Intensiv-Filter.

Advantages of Intensiv-Filter bag filters (versus electrostatic precipitators)

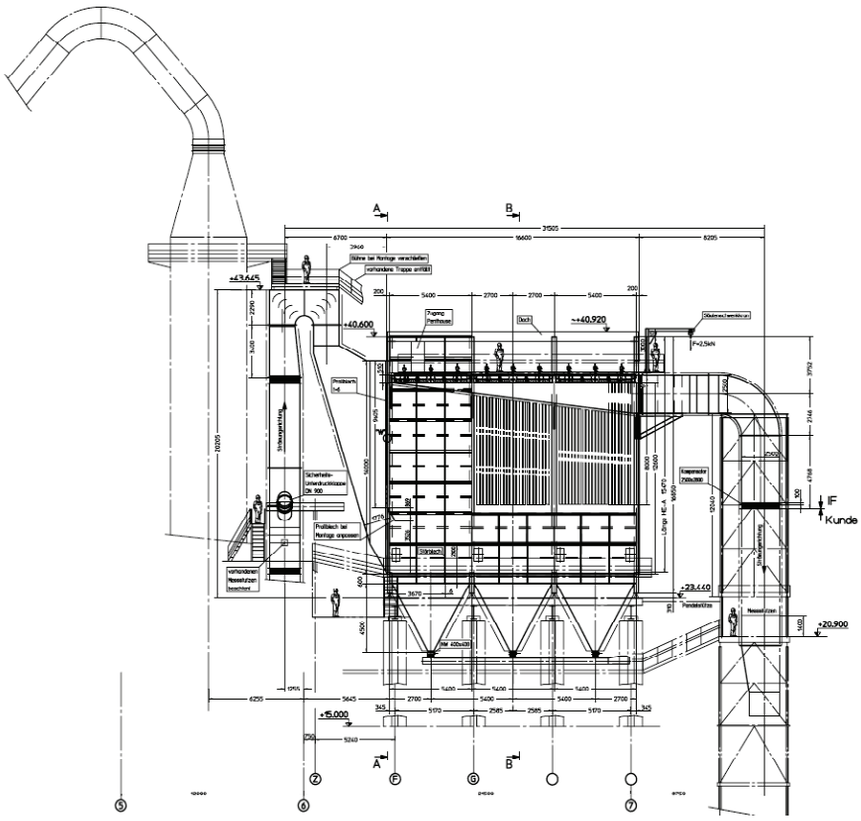
The most important advantages of bag filters compared to ESPs can be summarised as follows:

- Lower and constant clean gas dust emissions for the use of secondary fuels as kiln fuel to meet strict authority regulations;
- Performance is independent on changing parameters and operating modes (e.g. compound and direct mode);
- Precipitation does not depend on moisture and chemistry of the gas and dust;
- No CO – trips for kiln dedusting applications;
- Online maintenance and easy maintenance access (from the clean gas side).

Benefits for ESP conversions and retrofits made by Intensiv-Filter

In addition to the general advantages of bag filters, the following important and economic benefits can be taken into consideration for such an investment:

- Lower clean gas dust emissions compared to the ESP operations;
- Economical bag filter design using low pressure off-line cleaning in combination with bag length up to 8m can be foreseen for ESP conversions, to decrease the pressure drop across the bag filter and to increase the bag life time;
- Re-use of existing casing, duct work, steel support, dust transport and auxiliary equipment;
- Flexible and pre-assembled filter head module design reduces down time to a minimum and enables the plant to execute ESP conversions during regular plant shutdown times;
- Low cost solution (compared to the cost of a new installation).



Above: Schematic drawing showing pre-assembled filter head modules inside the ESP casing and upper casing used as a penthouse.

Different concepts of ESP conversions executed by Intensiv-Filter

The major question relating to ESP conversions is to fit into the existing footprint with the required filtration area of the new bag filter. As much of the existing ESP casing should be used as possible, while taking into consideration the new gas distribution requirements as well as the different gas velocity philosophies between ESP and bag filters. The following case studies illustrate three different concepts.

1) Pre-assembled filter head modules inside ESP casing and upper casing used as a penthouse

Head modules or sleeve bottom plates can be integrated into the existing casing to use the upper part of the former ESP casing as a penthouse. This is especially true for electric field heights of more than 10m.

2) Pre-assembled filter head modules (including new penthouse) on top of ESP casing

The most common version is to cut off the ESP roof, to remove all of the internal ESP components and to add a new base frame for installing the new bag filter head modules on top of it.

3) Pre-assembled casing on top of existing ESP hoppers

This concept used the existing concrete support including the former ESP hoppers and dust discharge system. A complete pre-assembled bag filter was lifted in one piece on top of the existing structure.

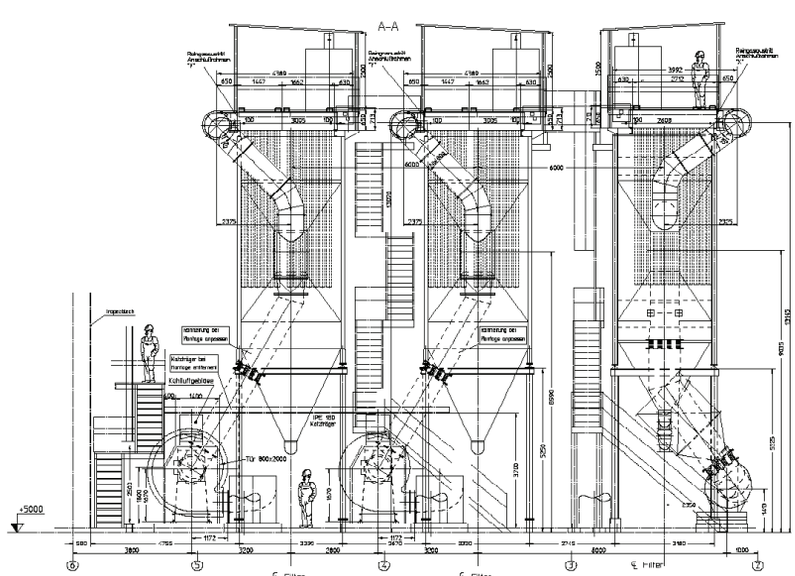
Kiln bag filter conversion at Dyckerhoff Zement's Geseke plant

The previously utilised electrostatic precipitator technology can no longer keep emissions within current limit values. Moreover, rotary kiln exhaust gases are nowadays dedusted by modern bag filters. The installation is designed for two different operation modes. It enables combined operation with the raw meal grinding plant or direct operation via a cyclone preheater and gas conditioning tower.

At the old location of the electrostatic precipitator a completely new housing was positioned on the dust hopper. All existing dust transport systems can continue to be used as before. The pre-erection of the new filter-housing took place during operation and kept downtime to a minimum.

Microprocessor technology in the form of a JetBus-System developed by Intensiv-Filter (otherwise known as "intelligent cleaning control") was used. The modular construction of the system enables a flexible control structure which is easy to change or extend retrospectively.

The filter can be operated either in ON- or OFF-line mode. Here, the JetBus-Controller controls the cleaning pre-pressure and drives the pneumatically operated clean-gas valves. Coupling to higher-level systems occurs via standard-coupling modules which are activated between controller and process-control system.



Right: Schematic drawing showing pre-assembled filter head modules (including new penthouse) on top of the ESP casing.

When using the JetBus-Controller, the compressed air pressure needed for cleaning is set by the unit's parameters. The operation of the unit is automatically adapted to the prevalent conditions by regulating the cleaning level. The regulating factor here is the filter resistance. Within a predetermined 'measuring period' the cleaning system checks the unit's parameters and sets itself to self-changing data. The operational data of the dedusting unit are permanently adapted in this way. Filter resistance and compressed air consumption are minimised and the life of the filter bags increased. The Intensiv-Filter solution offers the following advantages:

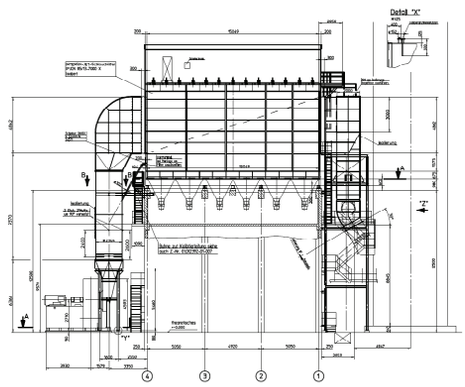
- Reduction of operational costs (filter resistance, compressed air consumption, longer filter bag life);
- Adapts to changing demands (e.g., combined and direct operation);
- Construction of a defined filter-cake;
- Utilisation options of efficient but sensitive filter media;
- Filter bags of up to 8m in length can reduce investment costs.

The design and operational results data for Intensiv-Filter's dedusting unit at Geseke are tabulated in Tables 1 and 2 respectively.

Conclusions

Conversions and retrofits are proven and reliable modernisation concepts to improve dust collection efficiencies. These help to meet strict authority regulations without major capital expense. The main arguments for any cement plant can be summarised as follows:

- Low and clean gas dust emissions independent of gas and dust properties;
- Economical bag filter design can be foreseen for ESP conversions, to decrease the pressure drop across the bag filter and to increase the bag life time;
- Re-use of existing equipment;
- Reduced down time, enabling the execution of the conversion during regular plant shutdown times;
- Short amortisation time due to it being a low investment cost solution.



Left: Schematic drawing showing the pre-assembled casing on top of existing ESP hoppers.

Table 1, (below): Design data and information for Intensiv-Filter's Geseke project.

Process	Kiln/raw mill bag filter
Original ESP supplier	KHD, Germany
Gas volume design	≤240.000Am^3/h
Gas temperature range	≤230°C
Intensiv-Filter type	IF JCC 85/13 7000 Eco
Installed filtration area	4.010m^2 gross 3.701m^2 net (semi off-line cleaning)
Filter media	Glass fibre with PTFE membrane
Shut down time for refit	5 weeks

Clean gas load	<10mg/Nm^3
Differential pressure	<10hPa
Cleaning pressure	~2.5bar
Compressed air consumption	<45Nm^3/h
Cleaning mode	Semi off-line

Table 2, (left): Operational results data for Intensiv-Filter's project at Geseke.

Left (clockwise): Lifting of the pre-assembled bag filter (9 February 2007); Parallel pre-assembling of bag filter (23 January 2007); Disassembling of ESP casing and parallel pre-assembling of bag filter (30 January 2007).