Successful conversion of Electrostatic Precipitators into Bag Filters

نجاح تحويل المرسبات الإلكتروستاتيكية إلى فلاتر قماشية

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تستعرض الشركة مزايا الفلاتر القماشية التي تنتجها بالمقارنة مع المرسبات الإلكتروستاتيكية ويقدم المقال دراسة حالة لعملية تحويل نظام الترشيح من المرسبات الإلكتروستاتيكية إلى الأكياس القماشية في مصنع إسمنت DEUNA في ألمانيا .

New, tougher restrictions on emissions coupled with the use of secondary fuels make it necessary to take a closer look at filtration procedures in the cement industry.

Today's cement industry needs to cope with a variety of challenges. Fixed and variable costs in capital-intensive cement manufacturing need to be reduced by means of procedural innovations, while EU plans to design emissions trading in the future considerably increase burdens on the cement industry. In addition, guidelines on dust collection are going to become more stringent too.

The greatest dust sources are raw mills, rotary kilns, clinker coolers and cement mills. Generally speaking, bag filters or electrostatic precipitators are used for these.

At 26% of the gross added value, energy costs for the manufacture of cement are among the highest for all industry sectors. Cement manufacturers therefore have a vested interest in conserving valuable, expensive raw material deposits for use as a basis in cement production. By using secondary fuels, fuel costs can be lowered. However, requirements for environmentally-responsible recycling of these materials need to be observed. In order to do this, conversion of electrostatic precipitators into bag filters is essential and indeed unavoidable.

Compared to electrostatic precipitators, the benefits of Intensiv-Filter bag filters are many:

- constant and less raw gas dust content, especially when using secondary fuels to comply with requirements of authorities
- efficiency of bag filters not dependent on changing operating parameters
- dust collection not determined by water content or gas properties
- no CO trips for kiln dedusting applications
- online maintenance capabilities
- simple access clean-gas-side

Besides the above benefits, converting electrostatic precipitators into Intensiv-Filter bag filters also brings further significant advantages and gains for cement manufacturers:

- Cleaning is offline or semi-offline and within the low pressure range with the reduction in mechanical load on the filter sleeves leading to a longer service life.
- Filter sleeves of 8 m length enable existing electrostatic precipitators housings to be used so there's no need to increase the floorspace.
- Duct work and dust discharge systems can also continue to be used.
- Conversion time is reduced considerably by filter heads with variable filter head sizes and can be carried out during scheduled downtime

- Investment for a conversion is considerably less than the cost of a new installation

Each conversion has its own prerequisites meaning a separate concept is required. As a supplier of complete system solutions, Intensiv-Filter will plan this concept precisely by carrying out detailed analyses. A typical case was the upgrading to bag filter for kiln- / raw mill dedusting at Deuna Zement GmbH.

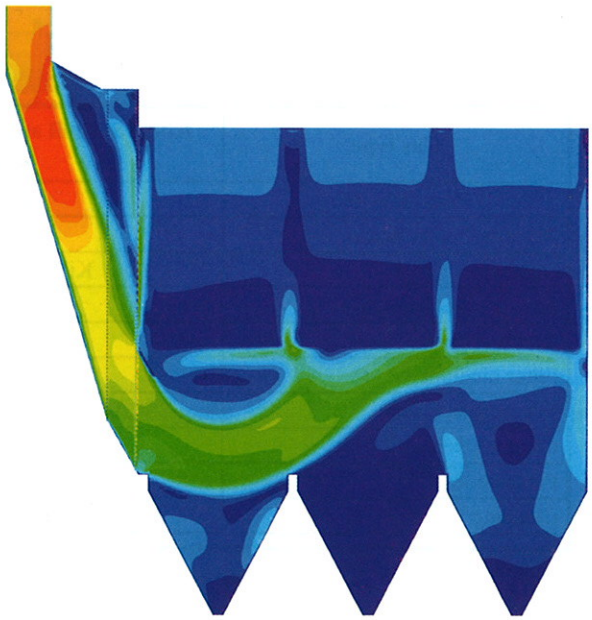
In order to comply with lower dust emission values, the existing electrostatic precipitator was upgraded to an Intensiv-Filter bag filter with low pressure, semi-offline cleaning and 8 m sleeve length. Regeneration of the filter was realised by means of intelligent cleaning control using the JetBus Controller®, which regulates cleaning prepressure and controls the shut-off flaps when necessary. The filter installation's operation is automatically adjusted to prevailing requirements by the JetBus Controller®.

The head plates were removed from the existing electrostatic precipitator housing and Intensiv-Filter head modules (known as compartments) welded on. The compartments were then insulated on the clean-gas-side and equipped with pneumatic shut-off valves which are activated automatically as well as being externally accessible for maintenance purposes.

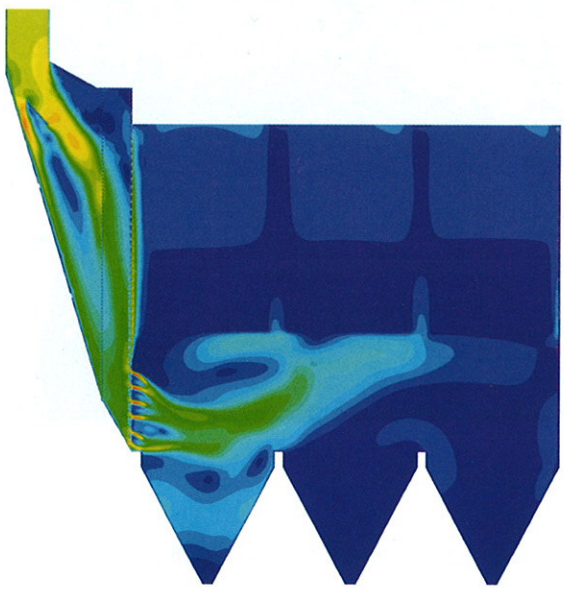
The clean gas side of the new bag filter was connected at each side to the existing clean gas duct work and filter fan. Access is via the remaining, upper section of the electrostatic precipitator housing - a penthouse design with a weatherproof roof. The existing electrostatic precipitator outlet was removed and then sealed with a new insulated housing wall. There was no need to convert the dust discharge system.

The goal, besides extensive use of the existing electrostatic filter housing, was to realise an air to cloth ratio of 1.0 $m^3/m^2/h$. To do this, unlike with conventional electrostatic precipitator upgrades, the raw gas plenum was fitted entirely with sleeves. Owing to these spatial restrictions, the raw gas inlet in particular had to be optimised and the associated bag inflow optimised. In order to do this a lamella system specially developed by Intensiv-Filter was used. Besides reducing inflow speed, it was also possible to achieve uniform distribution of the volume flow to the bag packages. The high-efficiency Intensiv-Filter cleaning system is aided by the ensuing reduction in upward flow between the bags. Further advantages of flow optimisation include a significant reduction of filter resistance and associated operating costs plus an optimised dust settlement into the hoppers due to uniformly low speeds in the entire raw gas plenum.
Optimisation of measures is by means of comprehensive flow simulations in various versions using CFD software (Fluent). The spread of speeds in the filter can be seen in the flow simulation diagram. The uniformity of the bag inflow and low differential pressure in the filter have also been proven in practice.

Picture 1: Velocity before optimisation



Picture 2: Velocity after optimisation



As part of the regular winter shutdown, approx. 130 t of electrostatic precipitator materials were dismantled and scrapped and the prefabricated bag filter components were fitted - an operation which caused quite a stir. After a total of six weeks of

assembly and commissioning work, the new filter was in operation.

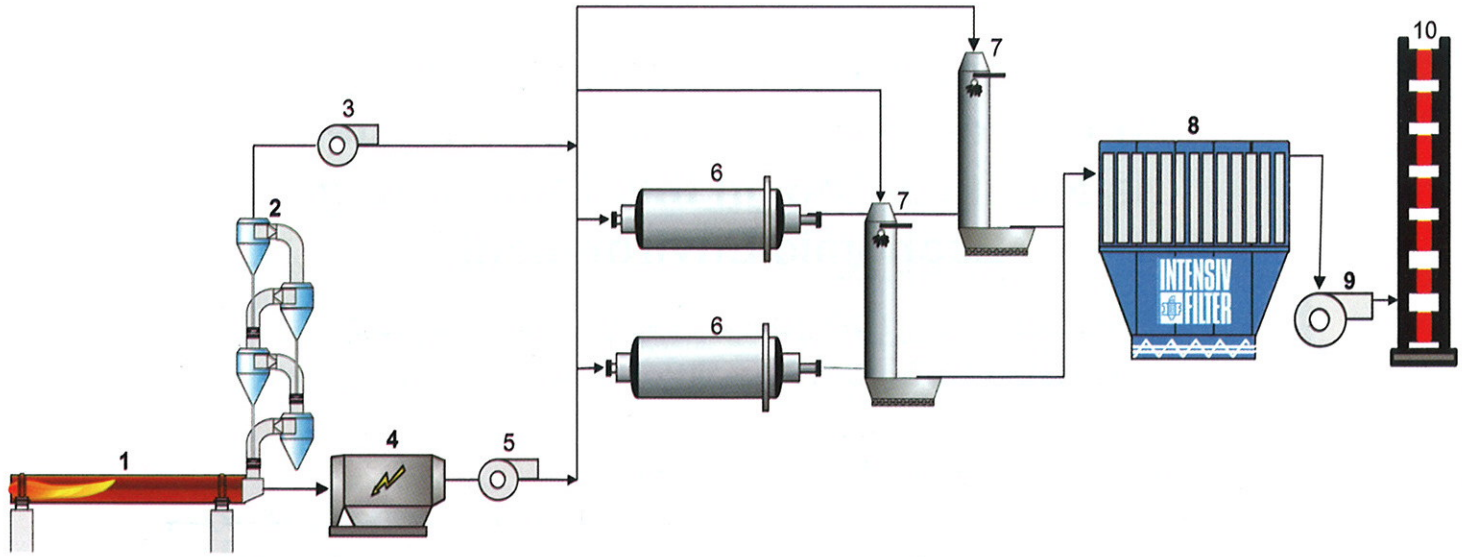
Cement manufacturers view investments in modern filter technology as the best way to achieve environmentally-friendly cement production. Reduction of emissions is an important factor here. With the Intensiv-Filter bag filter, legal limit values are undercut considerably when compared to an electrostatic precipitator.

In short, there is no doubt that conversion of an electrostatic precipitator into a bag filter represents an important contribution to sustainability in cement production. As well as consistent measures to reduce costs and conserve fossil fuels, a further goal is to maintain air purity and reduce emissions at all times.

Gas type	**Kiln, raw mill and pre-dusted bypass off-gas**	
Gas flow rate	550,000	m^3/h
Max. gas temperature	240	°C
Dust type	Kiln /raw mill dust	./.
Raw gas dust content	60- 80	g/m^3
Residual dust	< 8	$mg/N\ m^3$
Filter medium	GL/PTFE 750	./.
Filter surface area	approx. 9,300	m^2
Cleaning pressure	0,1 – 0,4	MPa
Pressure loss	1200	Pa
Cleaning	Semi-offline	./.

Picture 3: Installation, February 2008

Picture 4: After successful commissioning



Legende

1	Rotary kiln	4	Electrostatic precipitator for alkali bypass	7	Gas conditioning tower
2	Cyclone preheater	5	ESP fan for alkali bypass	8	Bag filter
3	ID – fan	6	Raw mill units 1+2	9	Filter fan
				10	Stack

Picture 5: Simplified flow diagram for kiln No I at Deuna Zement GmbH

About the company:
Intensiv-Filter GmbH & Co. KG has been one of the largest and most successful system providers for dedusting technology and product recovery for more than 85 years. Intensiv-Filter offers a full range of products and services for filtering and dedusting systems, from planning, engineering and production, to installation, commissioning and service. The product range includes process bag filter systems for up to 2 million m^3/h, standard filters, circular filters, CIP-Filters, cyclones, cooling systems and fans. Intensiv-Filter also manufactures and distributes customised filter media and guarantees optimal selection and maximum quality and fit.

The Intensiv-Filter Group includes Infastaub GmbH and Solidux GmbH & Co KG, in addition to Intensiv-Filter GmbH & Co. KG. Infastaub and Solidux complete the product range with series-produced small filters and dust collectors, as well as sound insulation. Intensiv-Filter is represented in all major industrial sectors. With companies and representatives worldwide and over 400 employees, the Intensiv-Filter Group provides customised solutions for clients in environmental protection. The Group's annual turnover is approximately € 70 million.

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