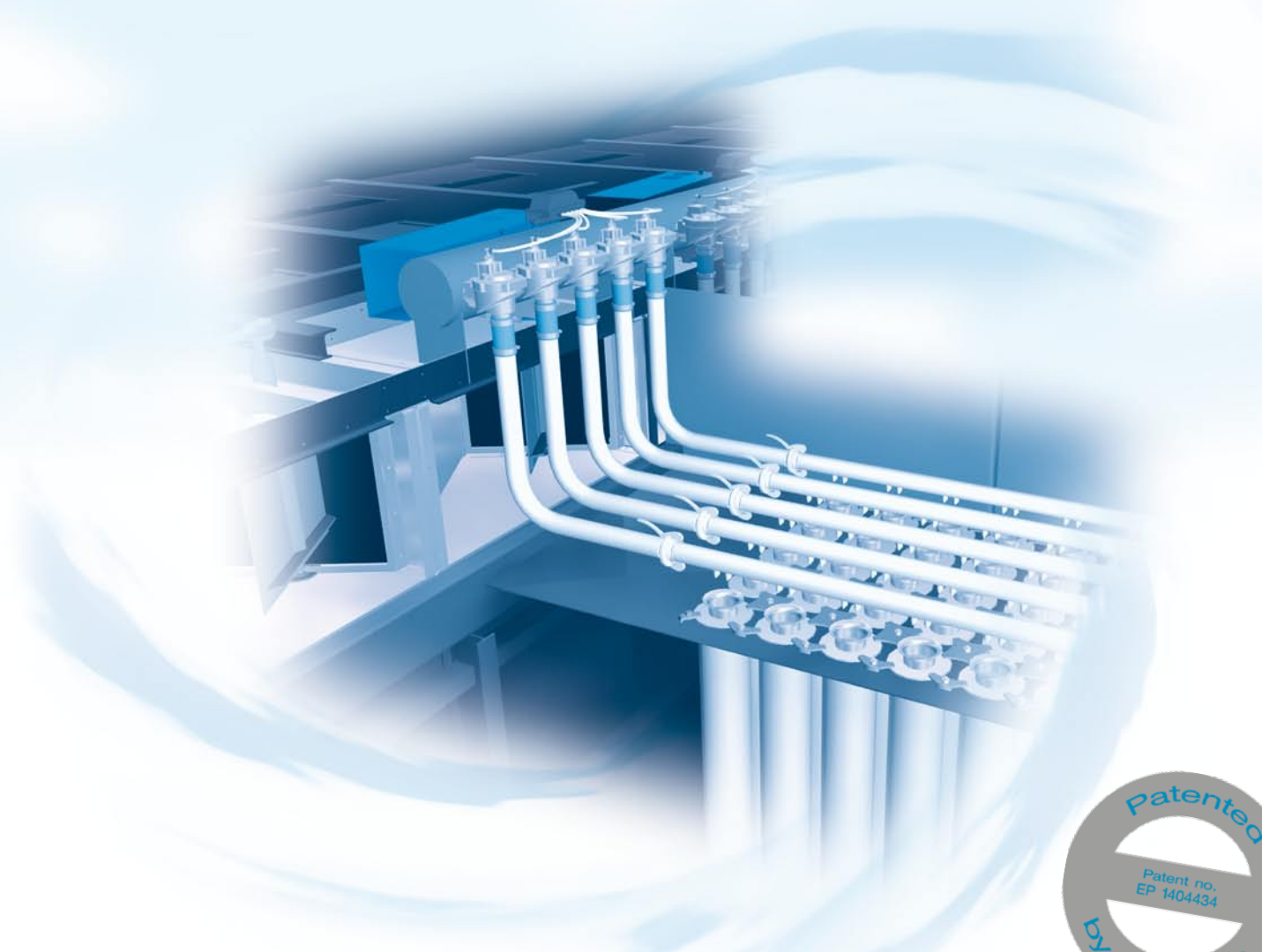


EMAC

ENERGY MINIMIZING CONCEPT



BAG FILTER TECHNOLOGY

THE BENCHMARK FOR LOWEST LIFE CYCLE COSTS

scheuch
TECHNOLOGY FOR CLEAN AIR

EMC: THE ORIGINAL IS AND REMAINS THE STANDARD

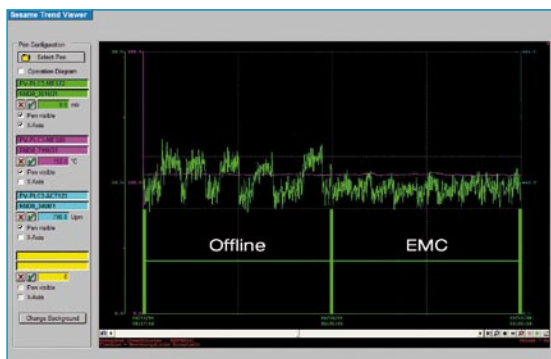
THE SUCCESS STORY

In the last ten years, Scheuch's EMC filter technology has revolutionized the dedusting process in the cement industry. The technology was able to set new standards with respect to bag length, pressure loss, cleaning pressure and the service life of filter bags. **The result has manifested itself in a significant reduction of life cycle costs (LCC).** The patented EMC concept is absolutely unique and is considered to be the Best Available Technology (BAT) for process filters – also when compared to electrostatic and reverse-air filters. The use of 8-meter long filter bags (EMC 8M) has since become the industry standard and 10-meter long filter bags (EMC 10M) are already in use with filtration systems with rated capacities of more than 500,000 m³/h. More than 160 EMC installations in the first ten years underscore the superiority of this technology.



THE EMC PATENT

When compared to other systems, the sum of all its advantages makes EMC filter technology the industry standard. EMC combines the advantages of online and offline cleaning.



Differential pressure behavior: Comparison Offline – EMC

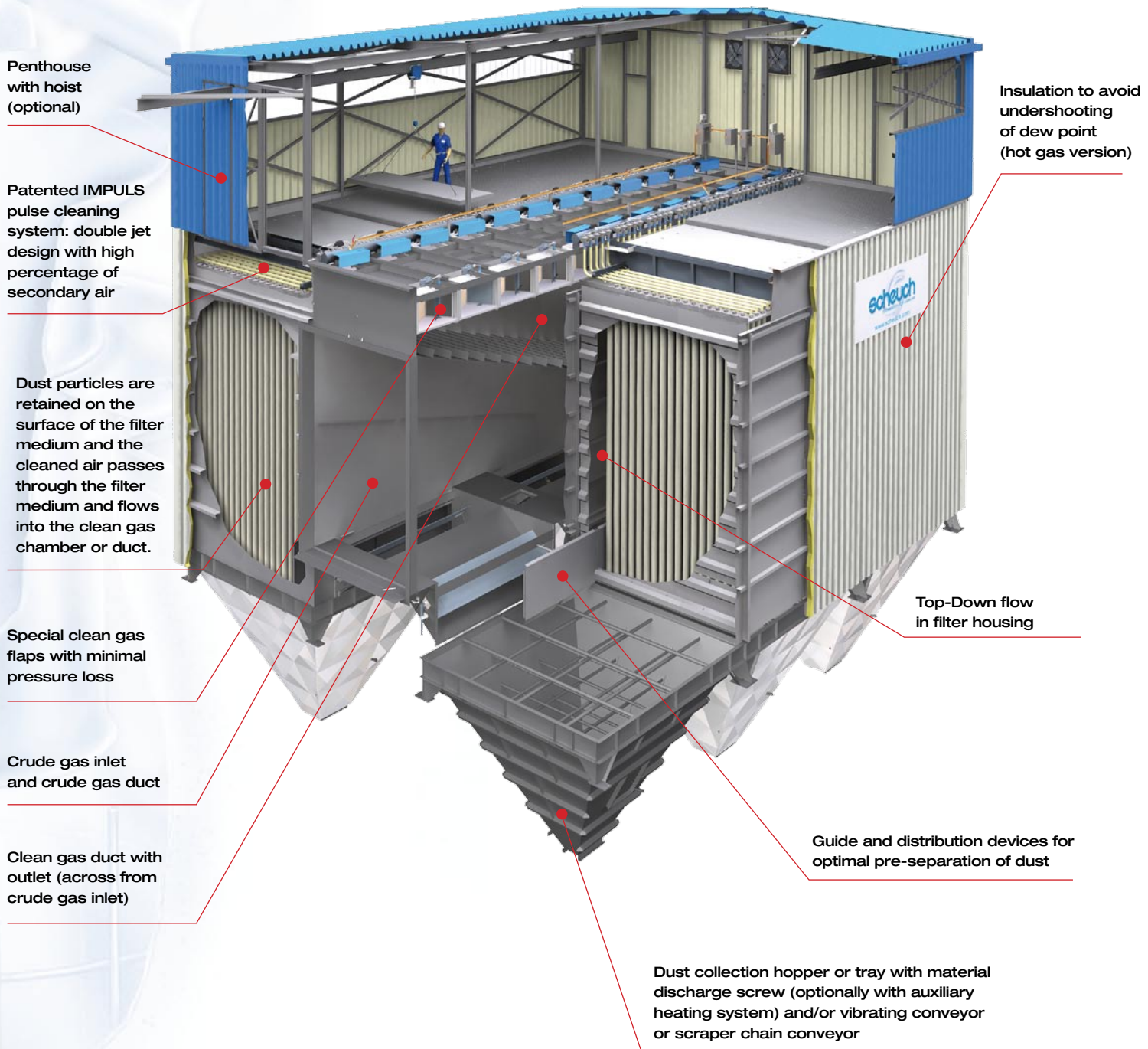
Offline cleaning offers two decisive advantages over online cleaning systems: a significantly lower filter differential pressure and an increased bag service life as a result of the gentle cleaning of the filter bags in a no-flow state. Disadvantageous, however, are strong fluctuations in the filter differential pressure due to periodic changes in the active filter area resulting from

the opening and closing of the shut-off devices for the filter chambers and/or individual modules.

In online operating mode, however, the filter differential pressure is stable because of the uniform filter area. Offline and semi-offline filters cannot be used or can be used only in a limited way because maintaining a constant filter differential pressure is an important prerequisite with a process filter in order to avoid negative effects on the overall process and product quality.

Only with our patented EMC technology is it possible to maintain a constant active filter area and thus a stable filter differential pressure. This stable differential pressure is achieved as a result of the system's mirror image control of the shut-off devices of the individual modules. This also makes it possible to exploit the well-known advantages of the system's no-flow state in combination with the proven IMPULS cleaning system.

EMAC IN DETAIL



Design Criteria:

- Volume flows up to 3,000,000 Am³/h
- Filter areas up to 40,000 m²
- Bag lengths up to 10 meters
- Dust amounts over 1,000 g/m³
- Hot gas versions for temperatures up to 280 °C

THE PATENTED IMPULS CLEANING SYSTEM

Proven a thousand times over in actual use, EMC filter technology is based on the patented IMPULS cleaning system with its specially shaped double-jet nozzle. This nozzle operates not only with a low overpressure on the filter bag, but also with a low required volume of compressed air (LPVL = Low Pressure - Low Volume-Cleaning).

Due to the optimization of the nozzle cross-section in the IMPULS cleaning system, the deviation of the maximum pressure buildup in the filter bag can be limited to $\pm 10\%$, relative both to the filter bag length and the installation position. This guarantees uniform regeneration of all filter



bags and ensures "uniform aging" of all filter bags as a result of the positive impact on the behavior of the filter differential pressure.

The interactive fine-tuning and interplay between the individual components produce an efficient overall system that also assures the cleaning of 10-meter long filter bags. The strong reduction in noise emissions is another positive effect. In comparison to other so-called low-pressure cleaning systems, this system's most prominent differentiating characteristic is the

way it combines low overpressure acting on the filter bag with the maximum cleaning effect.

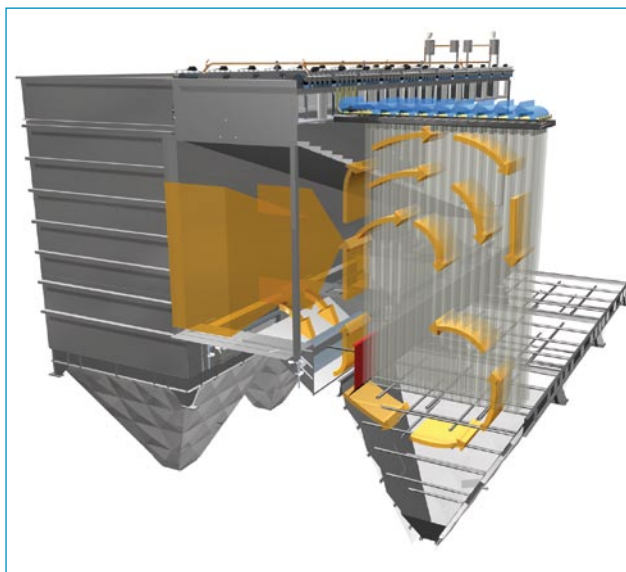
OPTIMAL FLOW CONFIGURATION

Flow regulation in the filter housing was optimized using CFD simulation to further refine the design of inlet and outlet geometries, as well as guide and distribution devices, resulting in a pre-separation process that is already effective in reducing the burden on the actual downstream filtration process. In addition to uniform impacting of the filter bags and optimal utilization of the filter area, the

already well-known low filter differential pressures also remain assured when using 10-meter (EMC 10M) filter bags.

The guide devices achieve what is essentially a **Top-Down flow effect** in the area of the filter

bags. **The dust is already guided towards the dust discharge area during operation of the filtration system.** In order to be able to ensure uniform impacting of the filter bags, optimal utilization of the filter area and the already well-known low filter differential pressures, Scheuch's specialists use flow



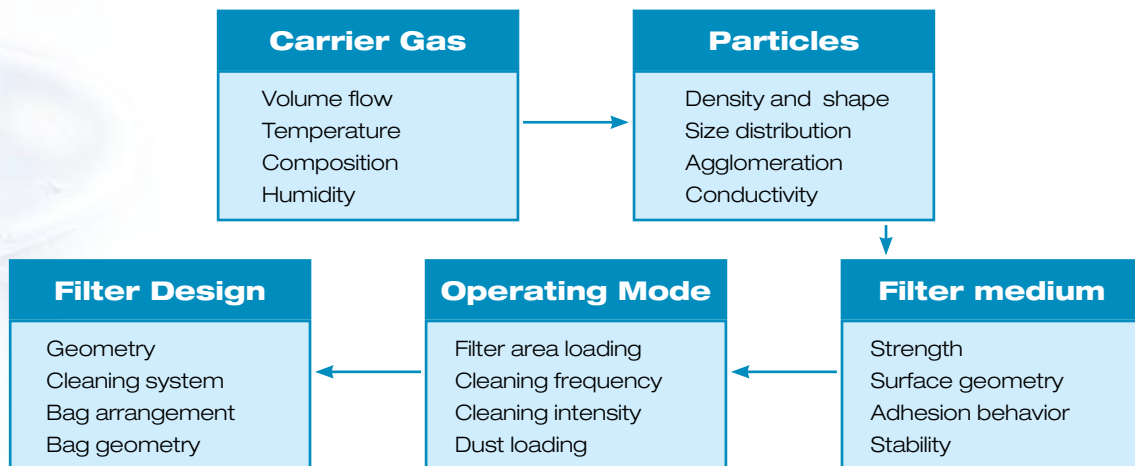
analyses to create their own proposals for solutions to regulate the inflow and outflow of the filtration plant.

THE CORRECT DESIGN POINT

The most important prerequisite for the optimal design of a dedusting plant is an excellent understanding of the customer's production process, in order to be able to develop the economically best plant solution for the respective application. This includes the use of modern

and flexible work methods during the planning and proposal phases, allowing for quick modifications, adaptations or alternatives during the project development phase. And finally, the right innovative technology to achieve the lowest possible life cycle costs on a lasting basis.

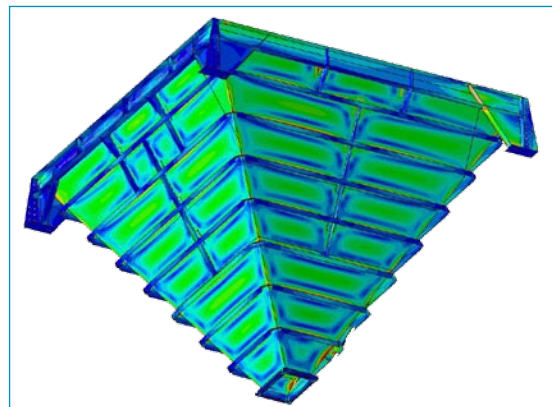
INFLUENCING FACTORS IN SURFACE FILTRATION SYSTEMS



The more precisely and comprehensively the influencing factors are defined at the very beginning of the planning phase, the easier it is to maintain reliable and efficient filter function during continuous plant operation. Mutual openness and commitment regarding the design data in consideration of the anticipated operating data are the guarantee for achieving the right design point and the optimal operating point during day-to-day operation.

Scheuch has at its disposal a finely tuned modular system for producing a pinpoint design of the filtration plant. Through the use of the so-called Finite Element Method (FEM), it is possible from the beginning to further optimize the design in accordance with customer-specific requirements. Amongst other things, this results in the correct dimensioning of the plant with optimal utilization of the design, the structural analysis and finally a reduction in weight and manufacturing costs.

The evaluation of a database containing a vast amount of recorded operating data shows **that standard industry values such as filter loading area, filter differential pressure, can-velocity, the bag length and the bag service life are no longer to be considered "authoritative" for the design of a plant.**



Strength calculation using the Finite Element Method (FEM)

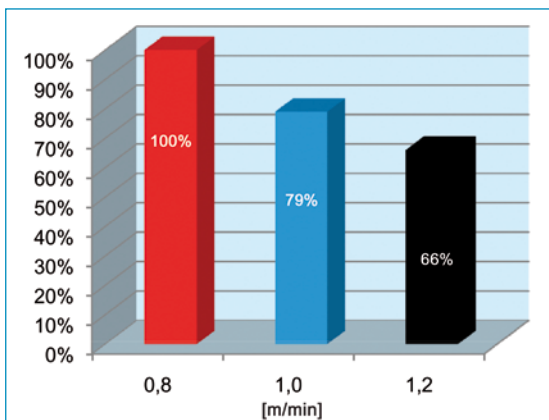


THE RESULT: LOW

CAPITAL COSTS

Higher filter area loading (FAL) results in a reduction of the filter area and allows the size of the filtration plant to be reduced, resulting in lower capital costs.

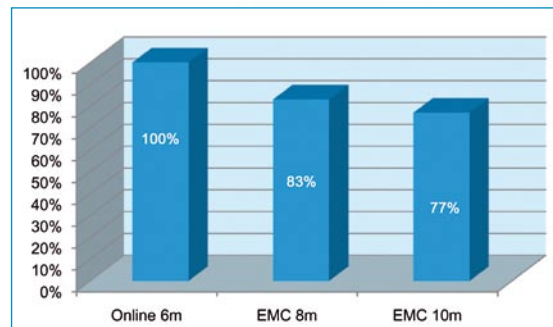
Besides the compact and therefore more favorably priced execution of the overall system, the higher FAL subsequently results in a reduction in the cost of cleaning system components, such as diaphragm valves and support cages including bag material. While the resulting increase in the filter differential pressure does lead to higher operating costs, these however play a subordinate role in EMC operating mode. **Even when the FAL exceeds 1.3 m/min, stable, continuous operation is assured with EMC.** This fact is important above all when two different operating points must be taken into account, e.g., interconnected and mill bypass operation, or when a filter chamber is shut down for maintenance purposes.



Capital costs expressed as a percentage relative to the filter area loading

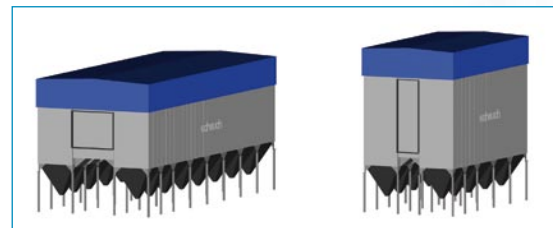
When EMC technology was introduced in the year 2001, users in many cases still specified 4.5 meters as the maximum permissible bag length. Since then, Scheuch has prioritized the use of 8-meter long filter bags (EMC 8M) and these have already become the industry standard with more than 40 installations worldwide up to the year 2011. Already in use as well are 10-meter long filter bags, whereby the potential of EMC technology with respect to bag length has certainly not yet been fully exploited.

These bag lengths are the principle reason for the lower acquisition costs. The compact design made possible by this manifests itself in a weight reduction of up to 30% — compare EMC 6-meter : EMC 10-meter.



Capital costs expressed as a percentage relative to the filter bag length

Moreover, applications using 10-meter filter bags require only half the installation footprint of the 6-meter filter variant. In terms of the so-called secondary capital costs, this results in an immense savings with respect to filter substructures or mill buildings, the foundation and access/inspection facilities for the filtration plant.



Comparison of footprint size for filter types EMC 6M : EMC 10M dimensioned for 1,000,000 Am³/h

Upgrades Of Existing Plants

EMC filter technology also opens up the possibility of **cost-effectively upgrading** existing filter systems equipped with 6-meter long filter bags to 8-meter or 10-meter systems in order to boost performance and efficiency. **When upgrading in this way, the filter area can often be increased by 30 to 60 percent without having to expand upon the filter's basic design.**

The use of EMC 10M is already of interest starting at volume flows of 500,000 Am³/h and can cover a range of up to 3,000,000 Am³/h.

LIFE CYCLE COSTS



OPERATING COSTS

Operating costs are determined primarily by the cost of fan energy, the cost of replacement filter bags, and the consumption of compressed air, whereby the costs for fan energy, filter bags and compressed air behave interdependently as a function of the filter differential pressure. Depending on the application, the overall operating costs increase as the filter differential pressure decreases.

The assumption that minimal operating costs can be achieved by keeping the filter differential pressure as low as possible is thus not helpful.

The increase in overall operating costs with increasing filter differential pressure is smaller. Therefore, a filter differential pressure above the optimum range has less of a negative effect than an operating point below it.

Advantage: Fan energy consumption up to 45% lower

If an optimal differential pressure is assured, the fan can be designed with a lower total pressure increase and lower drive power. Besides this, the optimized flow characteristics in the filter housing also have a positive impact on fan energy consumption, so that, for example, the percentage pressure loss of the housing amounts to just 15% of the filter differential pressure with a typical FAL of 1.0 m/min.

Advantage: Doubling of filter bag service life

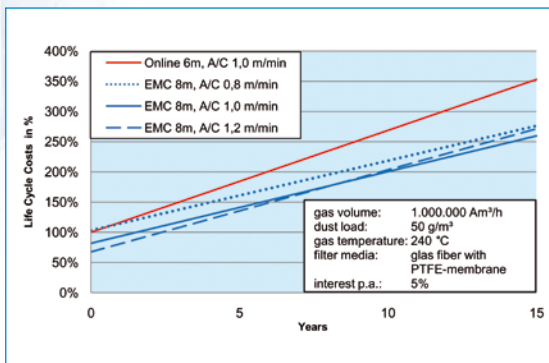
The second biggest contributor to the operating costs of a filtration plant is the cost of replacing the filter media. Because cleaning takes place in a no-flow state, regeneration of the filter bag requires one-fourth of the pressure buildup in the filter bag in comparison to online operating mode.

As a result of the low cleaning intensity, the filter bag is gently and carefully cleaned and recoil of the filter medium on the support cage is prevented. The number of cleaning impulses is also cut in half because of the system's efficient cleaning method. The result is a significantly longer service life for the filter bags, which can be up to 8 years depending on the application and filter bag quality.

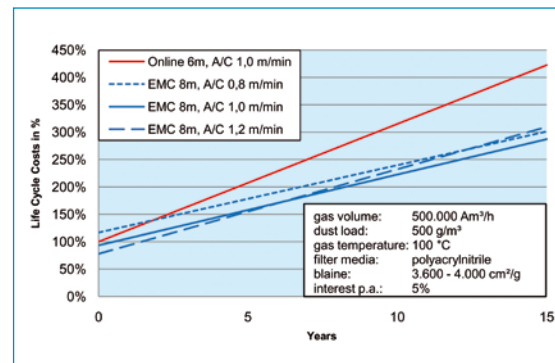
Advantage: Up to 80% reduction in the cost of compressed air

The patented IMPULS double-jet cleaning system reduces consumption of compressed air due to its low primary air requirements. The low cleaning overpressure on the filter bag, as well as the reduction in the number of cleaning impulses, lowers the costs for compressed air by 60 to 80 percent.

OPTIMAL OPERATING POINT



Comparison of the life cycle costs of Online and EMC kiln dedusting filters with different filter area loadings

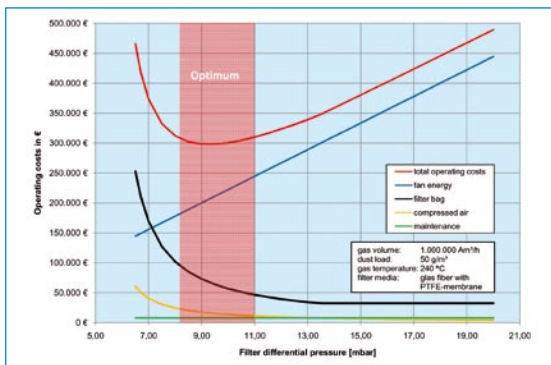


Comparison of the life cycle costs of Online and EMC cement mill dedusting filters with different filter area loadings



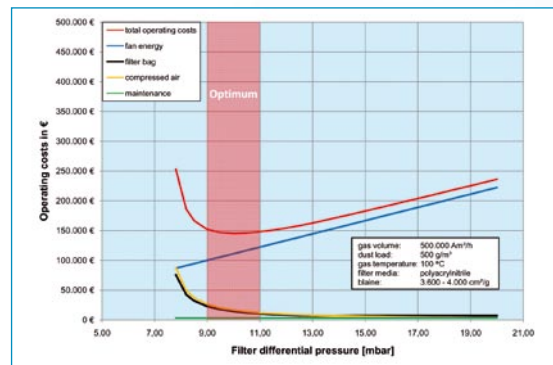
THE OPTIMAL OPERATING POINT

The right design point is only “one side of the coin”. Continual adjustment of the optimal operating point as a function of the upstream processes and with a view to the expected operating costs over the entire lifetime of the plant is the “other side of the coin”.



Individual operating expense items of a kiln dedusting EMC filter as a function of the filter pressure difference

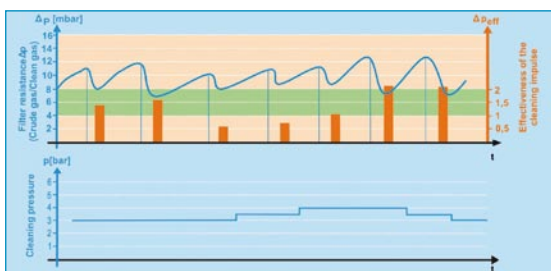
This can be achieved only by a filter system whose flexible characteristics support the variable operating modes. **And that has a control system that automatically regulates the filter unit and adjusts to the optimal operating point.**



Individual operating expense items of a cement mill dedusting EMC filter as a function of the filter pressure difference

EMC PULSEMASTER CONTROL SYSTEM

Developed especially for controlling the cleaning of process filters. It provides, for example the best possible adjustment of the cleaning system to different operating modes (interconnected and bypass operation of kiln and raw mill).



Pressure adjustment according to the effectiveness of the cleaning pressure

The integration of sensors in the filter makes it possible to continuously collect process-specific data such as temperature, gas flow rate and pressure for the purpose of setting the optimal filter operating point.

Using four different operating modes, the EMC PulseMaster control system is able to automatically set the minimum required cleaning pressure, even under fluctuating operating conditions.

Increased filter bag service life

In addition to the well-known cleaning programs “Time Dependent” and “Time- and Differential Pressure Dependent”, there are also the programs “Volume Flow- and Differential Pressure Dependent” as well as “Cleaning Pressure- and Differential Pressure Dependent”. The last program automatically regulates the cleaning pressure and cleaning frequency as a function of the filter differential pressure. An optimal filter differential pressure with gentle cleaning of the filter bag significantly increases the service life of the filter bags.

Lower compressed air consumption

Compressed air consumption is also very significantly reduced because of Scheuch’s patented system for adjusting the cleaning system pressure to the respective operating point of the filter. The PulseMaster system adjusts the cleaning system as a function of different parameters to achieve the highest possible level of efficiency. As a result, compressed air consumption can be additionally reduced by more than 50% — even in the case of fluctuating operating conditions. Because of this, cleaning takes place only as often as absolutely necessary.

PLANT AVAILABILITY ABOVE 99 PERCENT

Plant downtime means an interruption in production resulting in lower plant efficiency and leading to reduced profitability. Highest reliability is therefore the prerequisite for the highest operational availability of a filtration plant. This is provided first and foremost by the mature, stable EMC filter system. In addition, it also offers operating personnel easy access for necessary maintenance work.

EMC PulseMaster

The control system developed by Scheuch has a very significant influence on the operating reliability and availability of the EMC filtration plant. It is also possible to control the discharge of materials at the filter in such a way that uniformity in finished products such as cement or gypsum dust is achieved. Additional optimizations are possible using the integrated system for measuring the consumption of compressed air, which also makes it possible, for example, to immedi-

tely identify defective or open cleaning valves. With an appropriate Internet connection, plant operation, optimization of the filtration plant's operating state, as well as a check of the current condition of the filter, can be performed online from anywhere in the world.



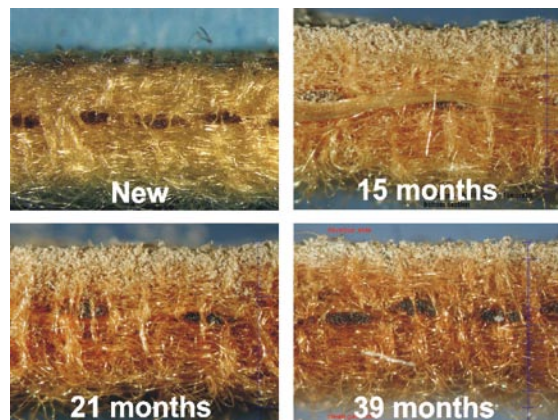
Simple operation using a Touch Panel with logical menu navigation.

EFFICIENT COMMISSIONING PROCESS

Scheuch's competent service personnel are available to assist as required during the start-up phase so that operating personnel can sign-off on the plant and take full responsibility for its operation.

In a black-light test, for example, the mechanical connections between the crude- and clean gas areas of the filter are checked for absolute gas tightness. Correct installation of the filter bags is also checked and for certain processes the filter bags are given a protective "pre-coat" that is decisive for the service life of the filter bags. Adjustment of the cleaning pressure is especially important when "breaking in" the fil-

ter bags during the start-up phase in order to avoid the so-called over-cleaning effect.



Bag aging

EMC – A MAINTENANCE-FRIENDLY SYSTEM

To generally facilitate the performance of maintenance work in the filter head area of EMC filtration plants, special emphasis was placed on excellent accessibility, ease of access and serviceability.

This makes it possible to perform checks at any time during filter operation of the diaphragm valve actuator and the flexible connections between the jet pipe and the diaphragm valve.

PRACTICAL RESULTS

KILN DEDUSTING

In high temperature applications, a solid design, gentle operation with longer cleaning intervals and minimal intensity are the basic prerequisites for a long service life of the filter media, which has a significant impact on operating costs. **It can also be more economical, for example, to operate the filtration plant with a higher differential pressure in favor of achieving a maximum service life for the filter bags.** The advantage of the gentle EMC cleaning system becomes fully apparent in such applications. The system is insensitive to short-term overloads that occur, for example when adding secondary fuels or

replacing kiln shell sections, during switching procedures, etc. – this assures the highest levels of plant availability.

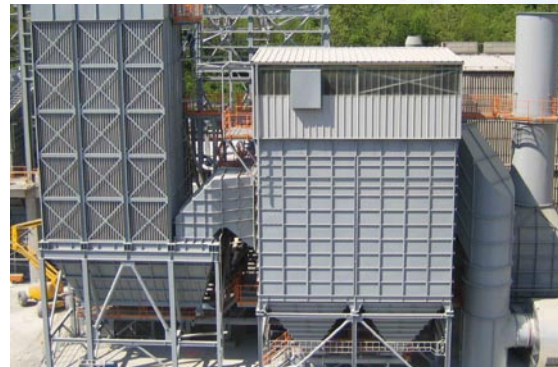


A look at interim results from plants currently in operation (as of December 2010):

Customer	Application	Airflow	Bag material	Service life of filter medium	Remarks
Schretter & Cie Austria	Dry process kiln & raw mill	158,000 m ³ /h	Polyimide (P 84)	in 9 th year	Original filter bags
Lafarge Le Teil/France	Dry process kiln & raw mill	2 x 175,000 m ³ /h	Glass fiber with PTFE	in 7 th year	Original filter bags
Gulf Cement Company/UAE	Dry process kiln & raw mill	1,550,000 m ³ /h	Glass fiber with PTFE	in 5 th year	Original filter bags
Cementos Balboa/Spain	Dry process kiln & raw mill	600,000 m ³ /h	Glass fiber with PTFE	in 5 th year	Original filter bags

CLINKER COOLER DEDUSTING

The significantly longer service life of the filter bags is the main advantage of EMC technology in clinker cooler dedusting applications. Consequently, the use of hot gas filter bags is economically interesting and results in a clear reduction in operating costs over the life cycle of the plant. The energy amounts released by exhaust gas cooling can be fed using heat extraction to a regenerative waste heat recovery system.



Customer	Application	Airflow	Bag material	Service life of filter medium	Remarks
Tudela Veguin La Robla/Spain	Clinker cooler	246,000 m ³ /h	Polyester 550	in 6 th year	Original filter bags
Cementos Balboa/Spain	Clinker cooler	340,000 m ³ /h	Aramid	in 6 th year	Original filter bags
Holcim Rohoznik/Slovakia	Clinker cooler	276,500 m ³ /h	Polyester 550	in 6 th year	Original filter bags

PRACTICAL BENEFITS

CEMENT MILL DEDUSTING

In the case of **low temperature applications**, the decision to use less expensive filter media is an obvious one. Seen from the viewpoint of operating costs, **special attention must therefore be paid to achieving the lowest possible filter differential pressure and optimizing the power consumption of the fan unit to the greatest possible extent**. This is especially the case both with extremely fine types of dust and with high dust loading, which naturally leads to higher differential pressures in the filtration plant. The most efficient method of cleaning the filter bags can only be offered by a system that operates in a “no-flow state” and thus ensures a very low level of pressure loss.

EMC filtration technology offers these advantages and these advantages are confirmed in actual practice. The system operates indepen-

dently of the type of mill or sifter with a constant and low differential pressure, low levels of pressure loss, and minimal consumption of compressed air. Besides clearly reduced operating costs over the entire life cycle of the plant, the system also ensures uniform product quality for the user.



Measurement results from plants currently in operation (as of December 2010):

Customer	Airflow	Temperature	Dust load	dP	Service life of filter medium
SPZ Germany	76,000 m ³ /h	90 °C	1,000 g/m ³	10 mbar	Exchanged in 9 th year
Atlantica Bilbao/Spain	300,000 m ³ /h	102 °C	410 g/m ³	7.5 – 8.9 mbar	Original filter bags in 5 th year

BYPASS DEDUSTING

When using a high percentage of secondary fuel, process-related concerns can make it necessary to reduce the alkaline content of the kiln exhaust gases. These kinds of dust are difficult to clean because they frequently produce caking. Complete solutions ranging from collection via the cooling system and continuing through to filtration using EMC filtration plants are available for airflows up to 300,000 Am³/h.



Customer	Airflow	Temperature	Dust load	dP	Service life of filter medium
Lafarge Perlmöser/Austria	55,000 m ³ /h	230 °C	25 g/m ³	12 - 14 mbar	Exchanged in 7 th year

THE PROGRAM FOR THE CEMENT INDUSTRY

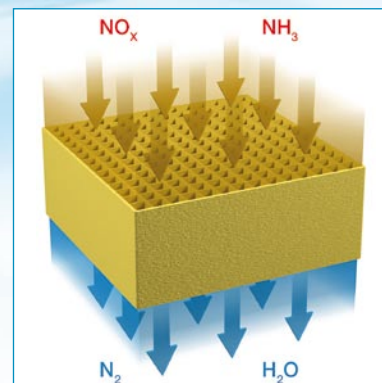
Dedusting

The application spectrum of the basic IMPULS filter product program with its efficient IMPULS cleaning system and many different variations ranges from classic dedusting to the filtration of process gases and hot gas. The IMPULS-COMPACT filter series for so-called "secondary dedusting" applications is factory pre-assembled, equipped with hoses and delivered ready for connection, optionally supplemented with an integrated fan unit and sound suppressor.



Exhaust Gas Cleaning

Different process-adapted SCR technologies are available for the reduction of NO_x emissions: configured as a crude gas circuit, as a clean gas circuit, or configured as a semi-dust crude gas circuit with a dry electrostatic precipitator as a pre-separator and an integrated gas conditioning tower in the catalytic converter system. Scrubber systems and adsorption and absorption processes supplement the program for removing pollutants from exhaust gases.



Exhaust Gas Cooling And Heat Extraction

In order to be able to use economically available filter media for clinker cooler dedusting, an exhaust gas cooling system (air/air heat exchanger) is used to adjust the gas temperatures to the filter inlet temperature. The energy amounts released in this process are fed via heat extraction to a regenerative waste heat recovery system.



Special Fans

These are system-specific designs for achieving maximum efficiency. With our comprehensive know-how in plant engineering and manufacturing and the assured quality of our own in-house manufacturing program, Scheuch's radial fan units guarantee high plant availability and long service lifetimes.



Life Cycle Service

For high performance levels during the entire life cycle with the services plant analysis and consultation, measurements (dust, pollutants, noise), repairs, inspection and maintenance, factory overhauls of component groups/exchange program, original spare parts service, and modernization/updates to improve performance and/or save energy.



Scheuch GmbH Weierfing 68, 4971 Aurolzmünster, Austria, Phone: +43/7752/905-0, Fax: -370
office@scheuch.com, www.scheuch.com