



Efficient reduction of emissions with GEA ECOpuls filter

Flexible and reliable solution with low pressure bagfilter technology

Nearly zero emission at lowest cost of ownership

Bag filters are the preferred solution to separate and collect fine dust. Installations in the field of industrial processes like cement, iron & steel and non-ferrous stand for the success of this technology. Demanding conditions caused by high dust loads and sorption processes of gaseous pollutants (e.g. SO_2 , dioxins/furans and heavy metals) are the different kinds of challenges for a modern gas cleaning solution to master. Being capable of extremely low emissions, bag filters are considered as best available technology (BAT).

GEA is in the business of emission control with a long supply record for more than 120 year. We apply the GEA Elliptical COncentric puls filter with the intention of combining the de-dusting performance of conventional bag filters with the reliability, extended lifetime and energy saving capabilities of low pressure cleaning technology.

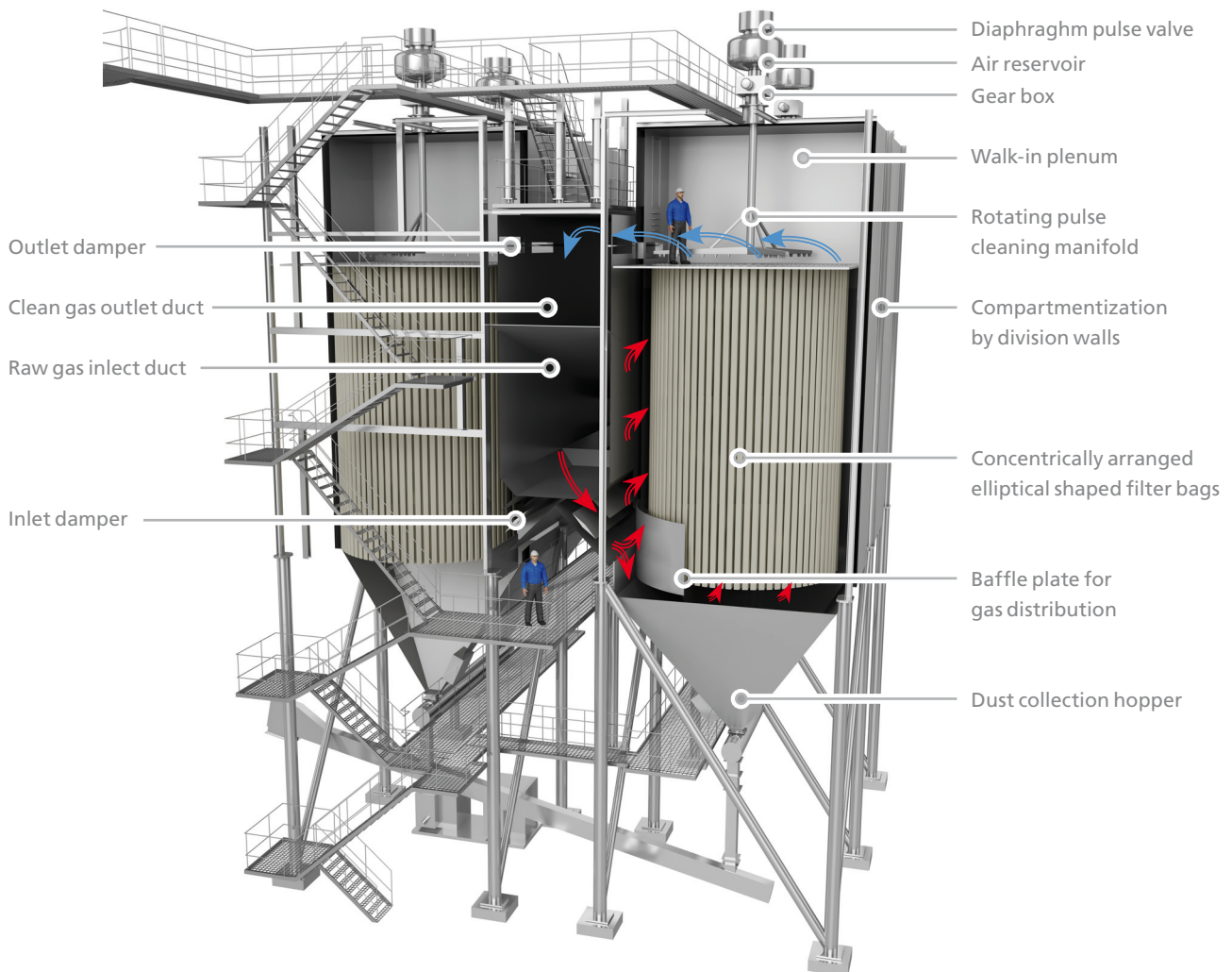
Having less moving and wear parts, the GEA ECOpuls filter also excels in requiring less maintenance when compared to a conventional system.



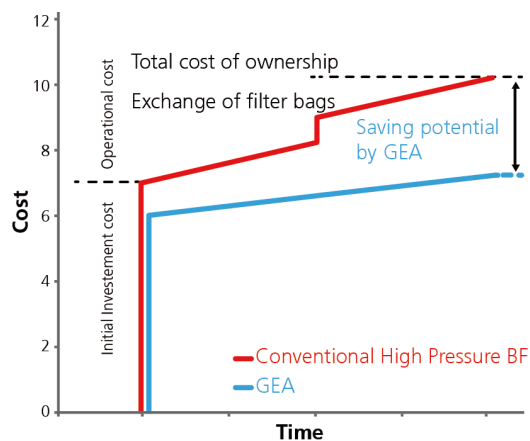
GEA ECOpuls filter key characteristics

- GEA low pressure cleaning concept
- Low energy consumption
- Low clean gas dust content ($<1 \text{ mg/m}^3$)
- Extended bag lifetime
- Optimized system for bag length up to 10 m
- For dust loads up to $> 1.000 \text{ g/m}^3$ even at larger gas flows
- Multi compartment, customized and modular solution
- No compressor & drying-system required
- Maintenance friendly
- Small footprint

GEA ECOpuls filter



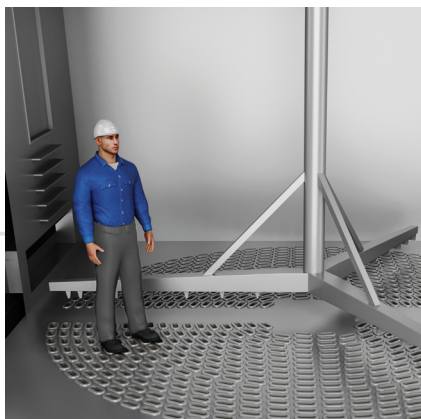
Total Cost of Ownership



The reduced amount of individual parts, the high gas cleaning efficiency and the small plant footprint allow for minimum invest cost of the GEA ECOpuls filter solution. However, also the operational costs need to be considered when comparing different solutions. Due to the GEA low pressure technology, the air used for bag cleaning needs to be compressed to only 0,8 bar (g). This compression is achieved by use of reliable and energy efficient roots blowers. No additional compressor station or air dryers are required. In contrast, the compressor station of a conventional high/medium pressure system will have a substantially higher energy consumption. The low overall pressure drop of the GEA ECOpuls filter and the extended filter bag lifetime help to reduce further operational cost. As a result, the GEA ECOpuls filter not only is technologically superior, it also offers lowest cost of ownership.

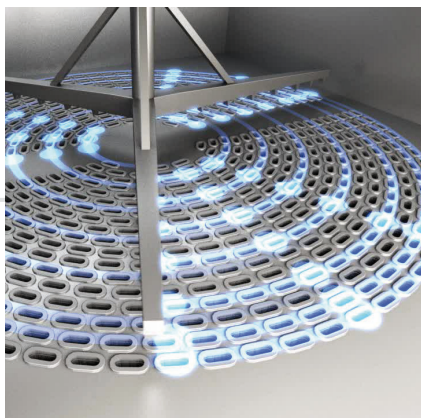
WALK-IN PLENUM

The walk-in plenum is gas tight welded and affords an easy access to the filter bags during maintenance, the GEA ECOpuls filter is equipped with a walk-in plenum. Individual filter bags can be pulled or exchanged on the spot. Alternatively, as an intermediate solution broken bags can also be sealed easily. No dismantling or additional cranes are required for bag exchange work.



ROTATING CLEANING MANIFOLDS

Each clean gas chamber is equipped with a low speed rotating manifold with cleaning air nozzles at its bottom side. The rotating movement ensures that all filter bags are provided with cleaning air at reduced pressure losses. It is not required to have individual valves or nozzles for each filter bag to having as few moving and wear parts as possible. Hot cleaning air prevents condensation effects during pulsing.



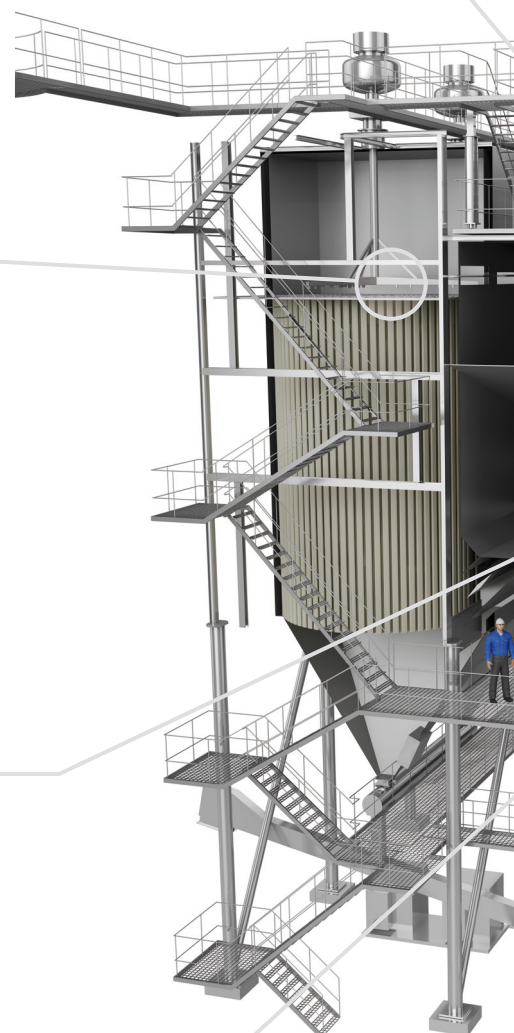
SEGMENTED CAGES

GEA ECOpuls filter bags are held in position by special segmented cages. The cages feature a smart designed and convenient snap in connection for quick mounting. The wear and high temperature resistant coating of the cage wires contributed to the long lasting quality of GEA ECOpuls filter bag cages.

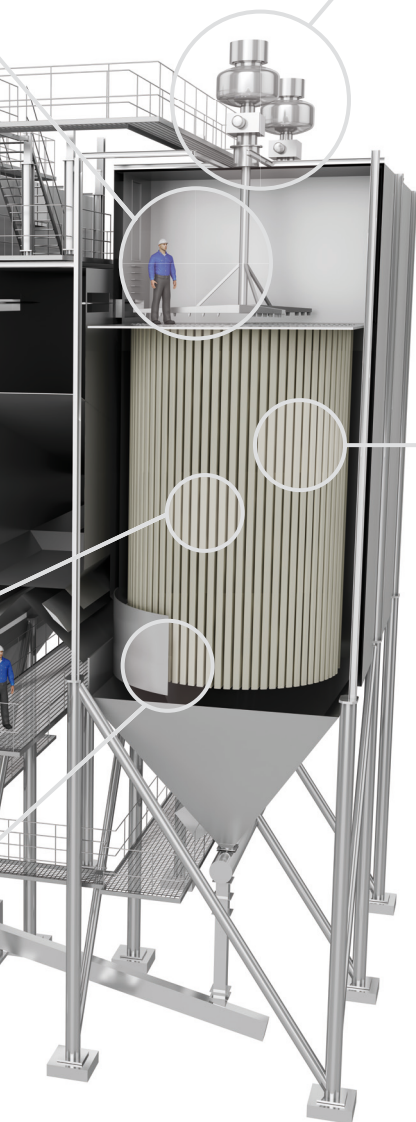


BAFFLE PLATE FOR OPTIMIZED GAS FLOW

To prevent the direct impact of dust laden raw gas on the filter bags immediately after entering, each GEA ECOpuls filter chamber is equipped with a baffle plate. This results not only in an optimized gas distribution within the filter chamber but also helps to reduce bag wear, which is an important precondition for long lifetime.



ECOpuls filter features

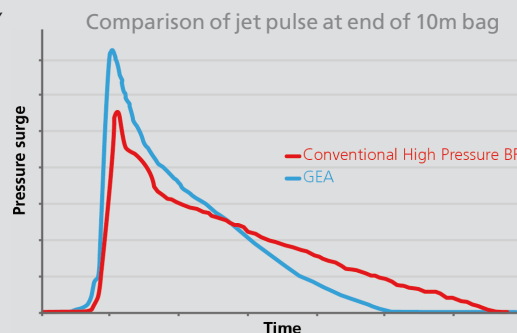


LOW PRESSURE - HIGH EFFICIENCY

To perform bag cleaning the GEA ECOpuls filter utilizes air with 0.8 barg (at reservoir) supplied by standard roots blowers.

Bag cleaning requires three phases:

- (1) Inflation with fast acceleration
- (2) Buildup of sufficient cleaning pressure
- (3) Purging of the filter bag

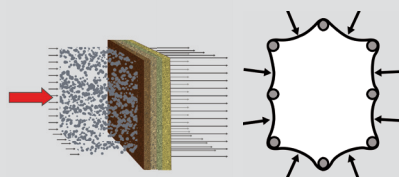


While pressure is low, the actual cleaning efficiency is higher than with conventional systems. Jet pulses with up to 3 times higher volume of cleaning air expand directly into the bag rows, without the need of a venturi system. Tests have shown that GEA low pressure technology results in highest utilization of cleaning energy along the complete length of the filter bag. This technology allows for ON-LINE cleaning even of longer bags and results in less wear and extended filter bag lifetime at reduced energy consumption.

UNIQUE ELLIPTICAL SHAPED FILTER BAGS

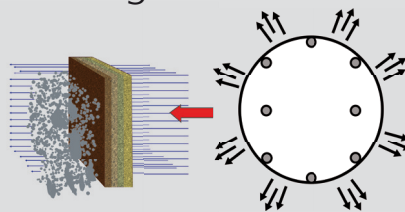
Key feature of each GEA ECOpuls filter is the elliptical shape of the filter bags. The bags are arranged in concentric circles – thus forming circular shaped bundles. The circular geometry allows for the use of only one single rotating cleaning manifold per filter chamber.

Filtration



During normal filtration the filter bags are held in place by the wires of the bag cages, preventing collapsing by differential pressure. During bag cleaning phases, low pressure pulses of cleaning air are injected into the filter bags.

Cleaning



The resulting overpressure inside the filter bags lead to the acceleration of the bag fabric towards the outside. The lateral movement of bag material comes to an end when the full extent of bag circumference is reached. In consequence, precipitated dust on the outer surface of the bags is separated from the filter fabric by mass inertia. As the dust already has been agglomerated into a solid filter cake – falling down into the hopper – reentrainment of dust is minimized.

ONLINE CLEANING

The GEA ECOpuls filter concept allows for online pulse cleaning. It is not required to isolate the individual filter chambers from gas flow for bag cleaning. As a result, the GEA ECOpuls filter is always working with the full efficiency, without the need to operate at n-1 condition and therefore allowing for a minimized plant footprint. Still, individual chambers can be separated by dampers in case required. The GEA ECOpuls filter uses sufficiently sized, long lasting 12" diaphragm valves, excelling in reliability.

The system is optimized for up to 10 m bag length. The design is ready for even longer bags.

GEA ECOpuls filter - a reliable solution for our customers

Cement

For decades GEA has been serving the cement industry with reliable and highly efficient gas cleaning solutions. The GEA ECOpuls filter is suitable for a wide field of gas cleaning applications related to cement production.

GEA ECOpuls filter- applications for cement include:

- Kiln
- Clinker cooler
- Raw, mill and coal
- Bypass extraction and dedusting

Our bag filters are compliant with latest U.S. NESHAP requirements, allowing for clean gas dust emissions less than 1 mg/m³.



Iron & Steel

Latest regulations affecting iron&steel making plants in most parts of the world are demanding for extremely low dust outlet concentrations. This especially applies for sinterplants, where in addition to dedusting the reduction of SO_x and dioxins/furans is an important issue.

Providing the GEA ECOpuls filter technology as a proven solution, GEA is the ideal partner for customers requiring a significant reduction in emission levels.

GEA ECOpuls filter- applications for iron & steel include:

- Blast furnace cast- and stock house
- Sinter process gas
- Sinter waste gas
- Secondary dedusting



Non-Ferrous

Production facilities of non-ferrous industry, e.g. copper and zinc smelter, require secure and reliable dedusting equipment. GEA ECOpuls filter is mainly used for:

- Secondary dedusting

Like in other industries the GEA ECOpuls filter allows the recycling the separated dust to the production.



Conversion from existing ESPs to GEA ECOpuls filter



While environmental regulations getting more strict, older existing electrostatic precipitators often are pushed towards and even beyond their design limitations. The advanced and flexible GEA ECOpuls filter design makes it possible to convert existing electrostatic precipitators into bag filters, while allowing for re-use of existing casing, hopper, support and discharge system.

With the relatively small amount of additional pressure drop induced by the filter bags, for many applications the existing ID-fans can be kept also in the future without further upgrade. While clean gas outlet concentration of $50 \text{ mg/m}^3 - 100 \text{ mg/m}^3$ are typical for older existing electrostatic precipitators, these easily can be reduced to 5 mg/m^3 or even less when changing to filter bags.

As shown on the picture, the clean gas chambers can be installed as a pre-assembled module, shortening installation and saving valuable downtime.

GEA Emission Control Service



At GEA, we take great pride in offering dedicated and highly personalized service. Our project managers not only keep track of each single step of the different project phases, they also serve as your direct contact person. Having in-depth knowledge of your industry and international regulations, our project manager will work closely with you to ensure that your business requirements over the lifecycle are met.

GEA will also be available for all your questions and needs after the plant has been put in operation. GEA After Sales Service offers inspections and preventive maintenance as well as parts replacement and upgrades.

With the safety and protection of our customers and their environment as a primary concern, GEA is certified according to DIN EN ISO 9001:2008 and Safety Certificate Contractors (SCC**:2011).

GEA R&D Efforts Behind Success



R&D work is the only way to preserve technological leadership, we will continue implementing latest scientific findings in our gas cleaning solutions.

Therefore, we have our own R&D center located in Frankfurt, Germany. Among many other improvements currently under development, the optimization of flow design and approved bag cleaning efficiency is an important task of GEA R&D.

In addition, GEA R&D is able to offer a range of services to customers who seek our expertise for gas cleaning processes and equipment, including:

- Technical studies for optimization of plant performance
- CFD studies for optimized gas flow and distribution
- Operation of pilot plants in customer production site
- Measurement services



We live our values.

Excellence • Passion • Integrity • Responsibility • GEA-versity

GEA Group is a global engineering company with multi-billion euro sales and operations in more than 50 countries. Founded in 1881, the company is one of the largest providers of innovative equipment and process technology. GEA Group is listed in the STOXX® Europe 600 Index.

GEA Emission Control

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