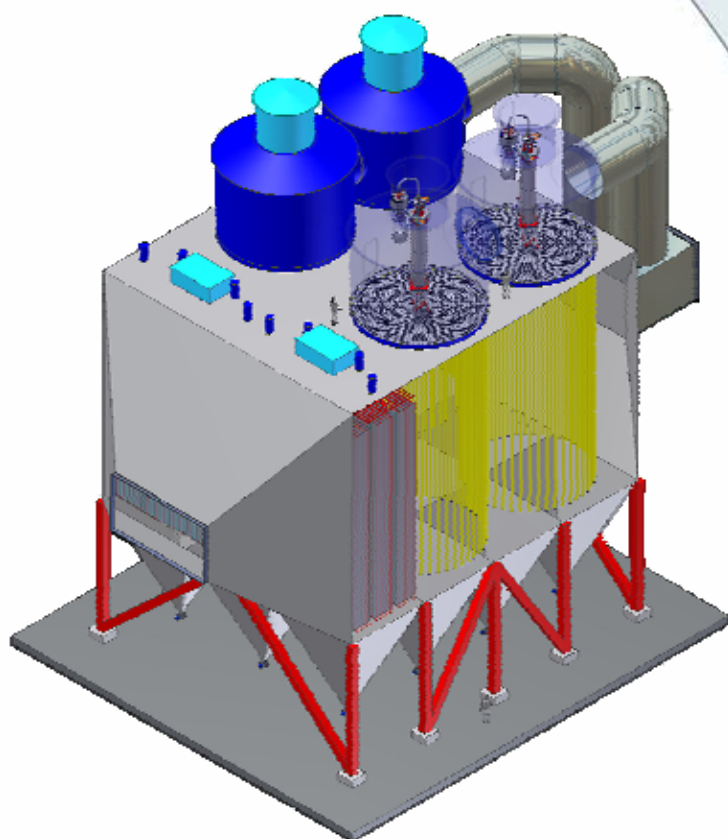


COMPENDIUM - Retrofitting of Electrostatic Precipitators

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Retrofitting of Electrostatic Precipitators

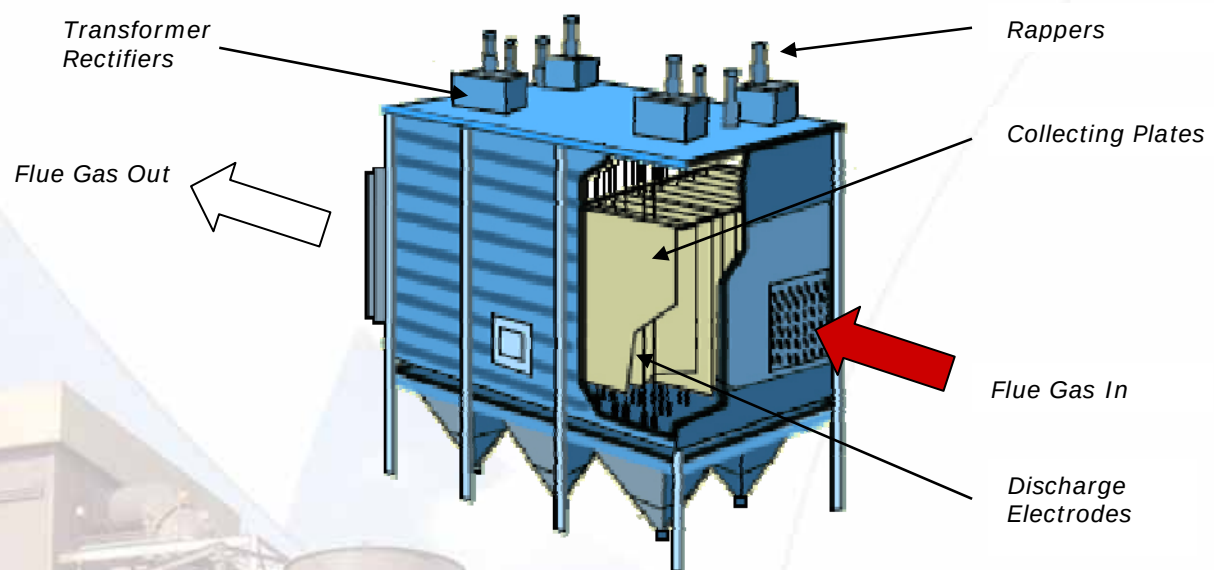
Electrostatic Precipitators (ESP)

For decades the Electrostatic Precipitators (ESPs) have been identified as the traditional solution for particle filtration of substantial gas volumes, especially within the fields of power plants and the cement industry.

In spite of continuously optimizing and expanding the ESP concept, the ESP technology now seems to have been caught up by the restricted emission requirements, resulting from the authorities' focus on a targeted reduction of the industrial air pollution over the past years.

Until now the ESP technology has been thought of as the optimum particle separation method fulfilling the legal emission requirements of the time.

Today a large number of ESPs globally are subject to a requirement of retrofitting or replacement by up-to-date technology, such as modern pulse-jet bag filters.



ESPs are in operation in a wide range of industrial segments, with a dominant presence within:

- A. Power plants (flue gas cleaning in connection with the combustion of fossil fuel)
- B. Cement industry
- C. Smelting furnaces (ferrous and non-ferrous products)

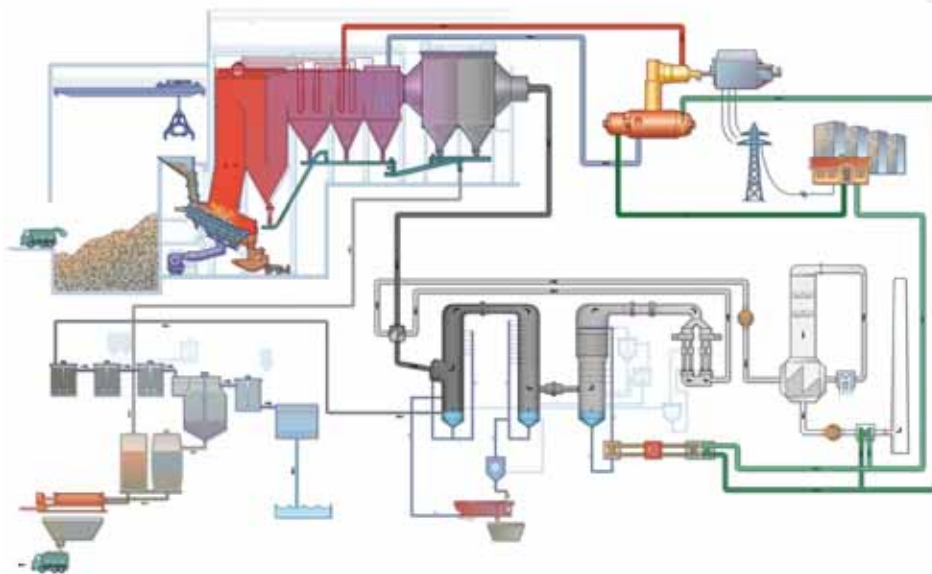
Many plants are heavyweights, operating with gas volumes of more than 1 million m³/h.

Climatic Considerations

Fossil Fuel - Biomass Fuel

The ongoing discussions of how to combat climatic changes often bring about the improvement to be achieved by replacing fossil fuel by more CO₂-neutral ones, such as biomass fuel.

Seen from a fundamental basis it is a complicated job for an ESP to ensure an efficient cleaning of the flue gas from a biomass combustion compared to the flue gas from a coal-fired boiler.



Replacement and Retrofitting of ESPs

If there is an explicit demand for a marked reduction of the emission from an existing ESP plant, there are basically three possible solutions:

- A. Demolition and replacement of the existing ESP by a new pulse-jet bag filter
- B. Retrofitting into a pulse-jet bag filter (existing housing and steel structures are reused)
- C. Retrofitting into a combined ESP and pulse-jet bag filter (a hybrid filter in existing housing)

Pulse-Jet Bag Filters

Features

Self-cleaning and temperature-resistant pulse-jet bag filters have for several years been in operation in flue gas cleaning applications.

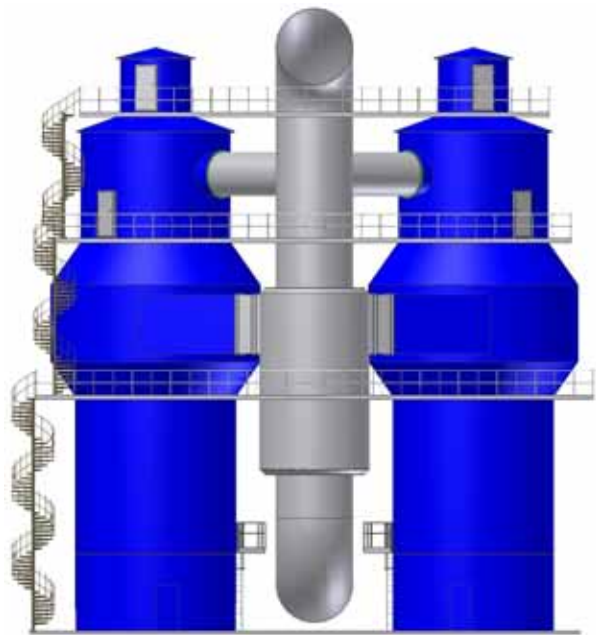
Technical improvements of the filtering fabric as well as the cleaning systems (typically pulse-jet cleaning of the filter bags by compressed air) have put the pulse-jet filter technology in a position at the forefront of the tightened, legal emission requirements.

Today's filtering fabrics are fully applicable in the high-temperature flue gas environments and economically ensure a long lifetime of the filter bags. The applied membrane and microfibre technology ensures an efficient separation of even submicron particles.

Furthermore the pulse-jet bag filter technology is relatively easily combined with processes for sorption of acid gases, heavy metals, and dioxins.

Simatek's latest generation of low-pressure bag filters type SimPulse 3CS with 16 metres long filter bags.

By a standard Filter Cluster, consisting of 4 filter modules, a maximum capacity in excess of 5 million m³/h is achieved.



A. Demolition and Replacement of the Existing ESP by a New Pulse-Jet Bag Filter

The space available will often form the basis when deciding on the size of filter.

Depending on the flue-gas flow, the choice will be between square or cylindrical, modular filter designs.

The features of the very pulse-jet system range from traditional high-pressure systems to advanced low-pressure systems with a high pulse energy. The latter system consumes only very little energy, which may have a decisive influence on large filter plants.

Retrofitting

Bag Filter and Hybrid Filter

B. Retrofitting into a Pulse-Jet Bag Filter (Existing Housing and Steel Structures are Reused)

In recent years a large number of ESPs have been retrofitted into pulse-jet bag filters. By a typical retrofitting the internal parts (discharge electrodes and collecting plates) of the ESP are removed for replacement by fabric filter bags. Finally you have a custom-designed layout including a traditional pulse-jet cleaning system with conventional pulse-jet valves.

The task of creating sufficient filter area within the frames of the existing filter housing may pose a challenge, as an ESP housing usually offers plenty of height, but only a limited cross-sectional area. In such cases the capability of providing an efficient pulse-jet cleaning of long filter bags is crucial.

C. Retrofitting into a Combined ESP and Pulse-Jet Bag Filter (Hybrid Filter in the Existing ESP Housing)

When retrofitting existing ESPs, a natural consideration is to evaluate the possibility of combining the ESP facilities with the pulse-jet bag filter facilities in one unit. As it is not very costly to maintain part of the ESP - and the pulse-jet bag filter could benefit by a pre-separator - the transformation into a so-called *hybrid filter* is obvious.

The *hybrid filter* has obvious advantages over the common pulse-jet bag filter:

- A reduced dust load on the filter bags → a longer lifetime of filter bags
- A lower pressure drop across the filter bags
- A reduced filter area
- Protection against sparks
- Better gas distribution

Most ESPs are built in modules of serial fields. Whenever possible, the first serial field at the inlet section is maintained and the other fields are replaced by pulse-jet bag filter modules.

The transformation into a hybrid filter including part of the existing ESP, places high demands on the design of the pulse-jet bag filter as well as its ability to pulse-jet clean extra long filter bags.

Pulse-Jet Bag Filter Technology

Next Generation

State-of-the-Art Filter Technology for Retrofitting of ESPs

Simatek A/S recently introduced the next generation of pulse-jet bag filter technology distinguished as the most advanced technology in the market for replacement and retrofitting of ESPs.

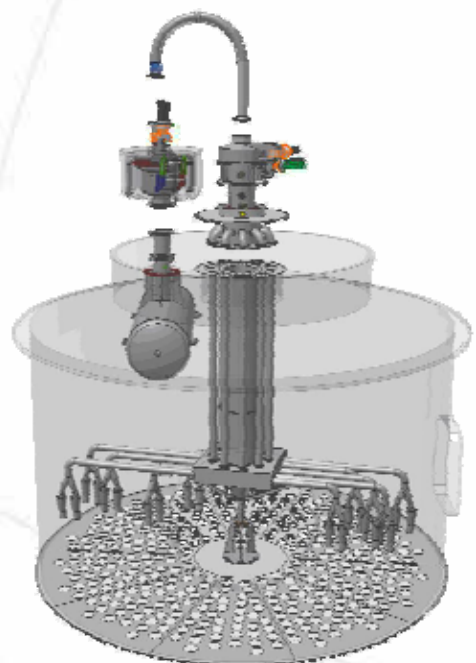
This state-of-the-art filter technology holds a number of features outpacing known technology, which are essential for the retrofitting of ESPs.

1. The conventional pulse-jet valves have been exchanged by new technology ensuring an efficient cleaning of very long filter bags - typically of 16 metres length.
2. Servo-controlled indexing system facilitating cleaning of more than 10,000 m² filter area per pulse valve.
3. Massive reduction of energy consumption for cleaning of the filter area.
4. Intelligent cleaning function, automatically adapting the jet-pulse profile and energy to the actual demand.
5. Modular system for easy retrofitting of almost any kind of ESPs.

SimPulse 3CS Pulse Air Distributor (PAD)

Servo-controlled pulse-jet system for easy implementation in existing ESP constructions.

The concept ensures a uniform cleaning of all filter bags at the exact same high pulse-jet energy at a low cleaning pressure (0.3-0.5 bar).



Hybrid Filter

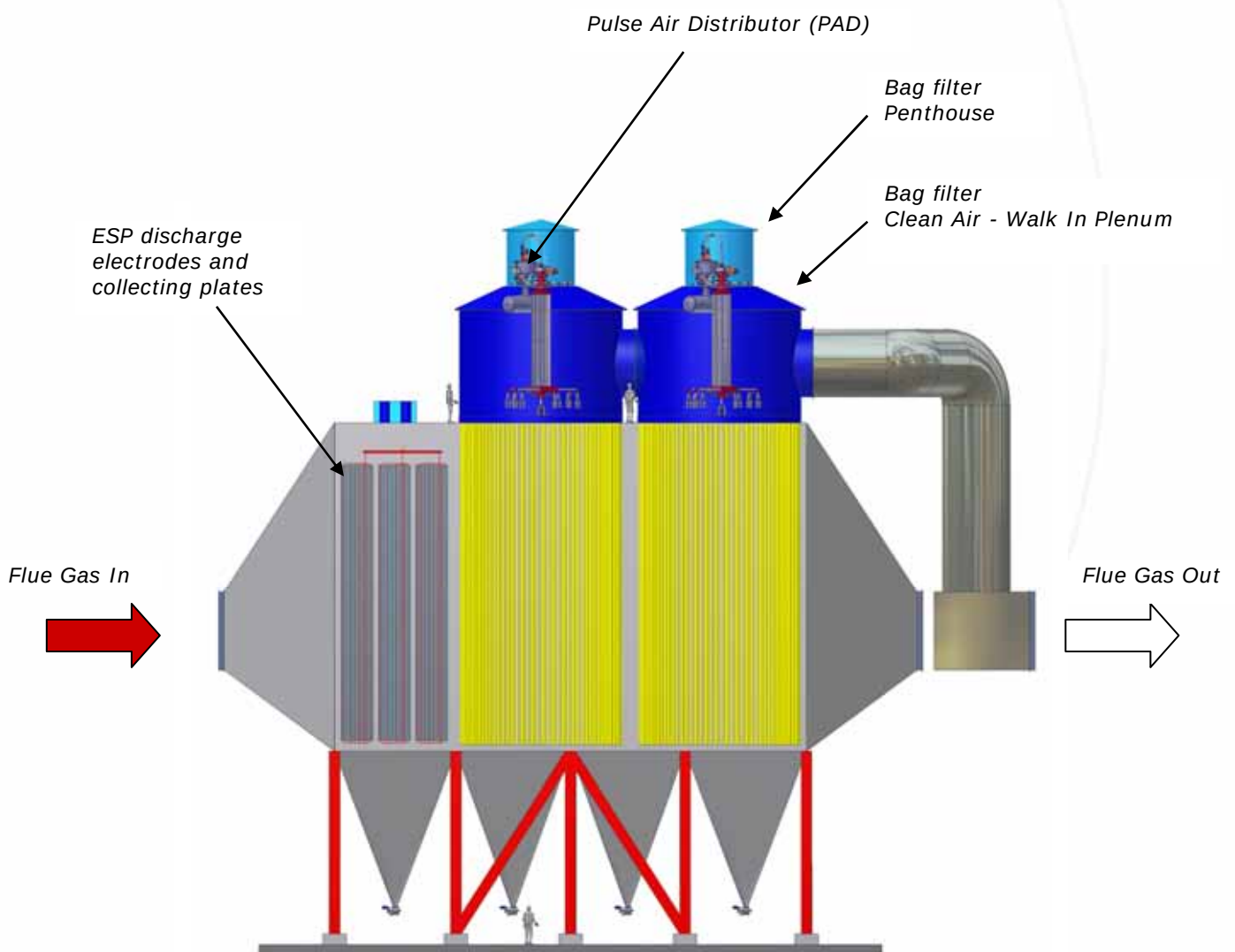
Combined ESP and Pulse-Jet Bag Filter Unit

Hybrid Filter based on SimPulse 3CS Filter Modules

Unlike traditional filter technology, the SimPulse 3CS filter modules provide for the required filter area without any need to expand the existing ESP housing.

The SimPulse 3CS filter modules are vacuum resistant, - no need of extraordinary pressure-reinforcement of a traditional Walk In Plenum.

The concept is based on standard modules which are easily implemented in existing ESPs, involving only little engineering work.



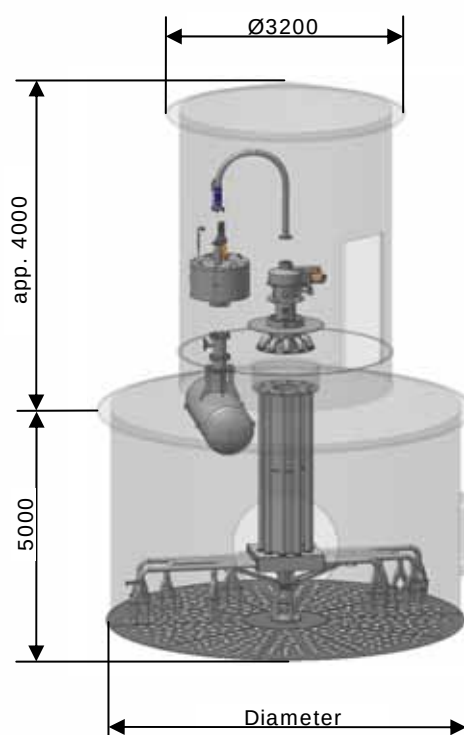
SimPulse 3CS

PADs for ESP Integration

SimPulse Pulse Air Distributors (PADs) in modular design for flexible and easy integration into Electrostatic Precipitators (ESPs).

The PADs are available in 6 different standard sizes to match different ESP layouts and most capacities.

Typically 2 to 6 PAD modules will meet the needed capacity within the frame of the ESP.



SimPulse 3CS Standard PADs

PAD	Diameter	Weight*	Filter area (m ²) - by bag length (m)			
	mm	kg	10,0	12,0	14,0	16,0
JM 400	5.600	11.900	2.011	2.413	2.815	3.217
JM 624	6.900	14.700	3.137	3.764	4.391	5.019
JM 816	7.700	16.600	4.102	4.922	5.742	6.563
JM 1008	8.600	20.000	5.067	6.080	7.093	8.107
JM 1248	9.400	24.600	6.273	7.528	8.782	10.037
JM 1488	10.200	27.300	7.480	8.975	10.471	11.967

*Excl. bags and cages

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