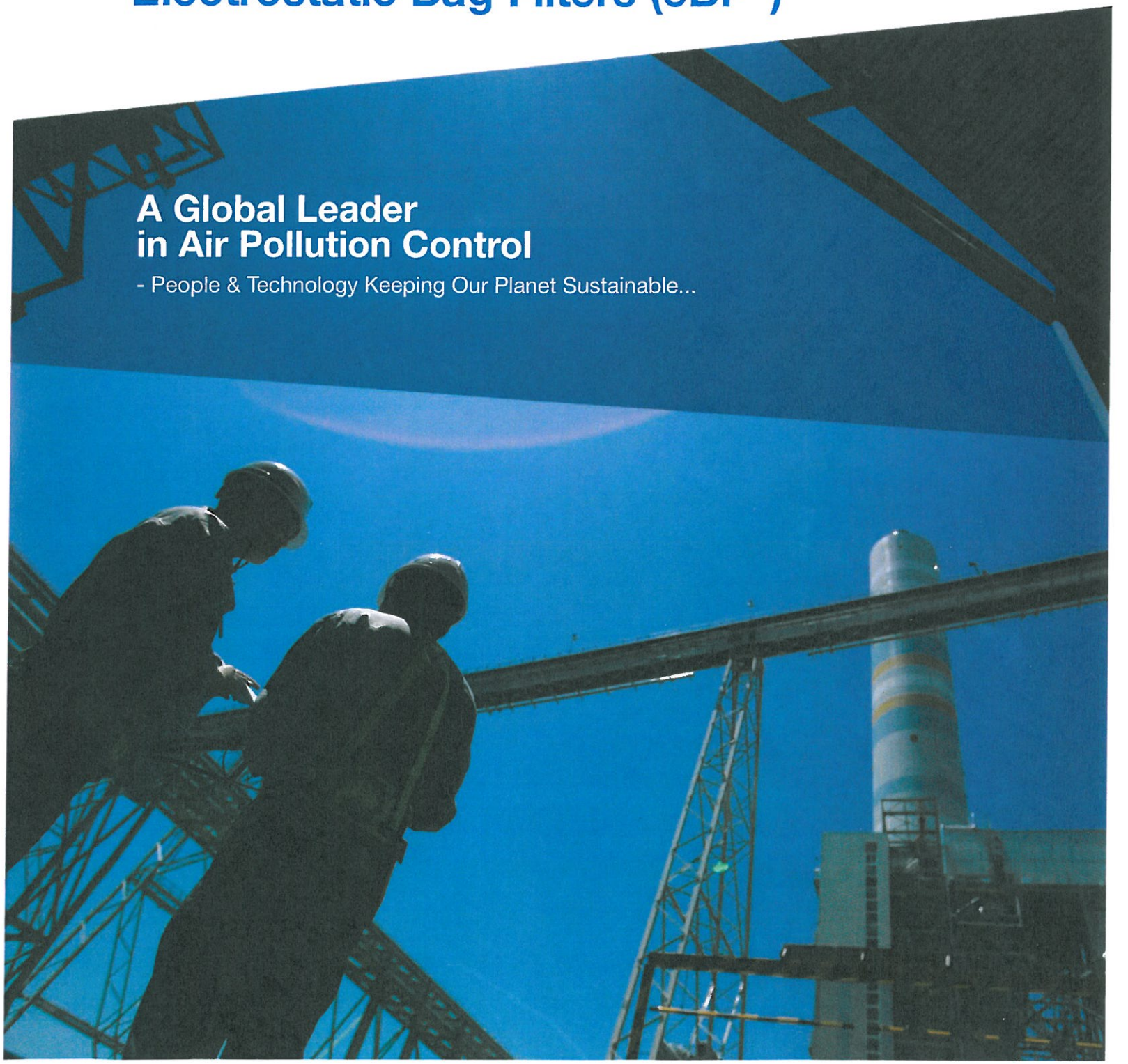
KC Cottrell

Electrostatic Precipitators (ESP)
Fabric Filters
Electrostatic Bag Filters (eBF™)



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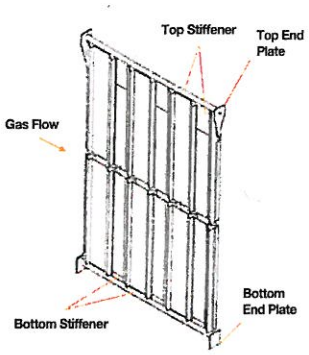
Electrostatic Precipitators (ESP)

1 Dry Type ESP

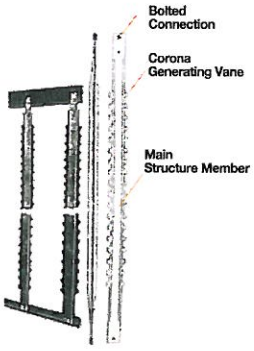
With an electrostatic precipitator (ESP), direct high voltage is applied to create a corona discharge to charge particles suspended in the gas and collect them through electrostatic attraction. An ESP is useful in removing particles in the sub-micron(0.1ß≠) range which are difficult to capture with gravitational or centrifugal force.

Advantages

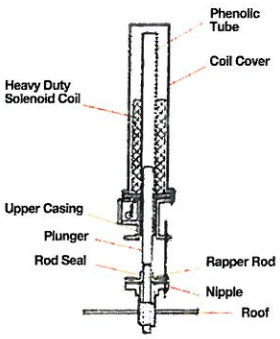
- Customized system design
- Collection with KC-Optimum Plate
- KC-Trode discharge electrode
- MI. Type.(Magnetic Impulse) rappers
- Semipulse and Multipulse for high collection and energy efficiency



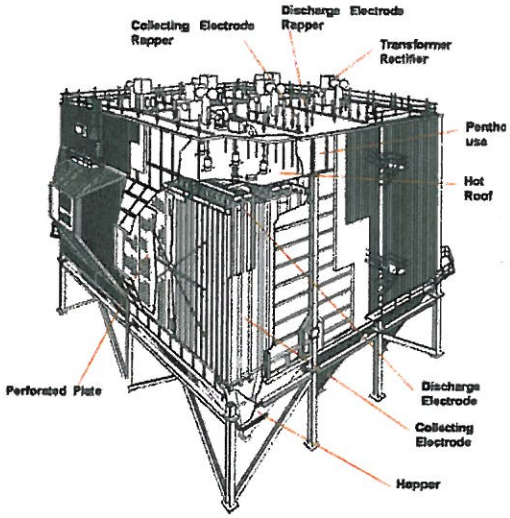
• KC-Optimum



• KC-Trode



• MI Rapper



• Structure of ESP

Projects

- Boryeong Thermal Power Plant Units 1~8 500MW, Korea (1983~2006)
- Kasima Power Plant, Japan (2000)
- Taean Thermal Power Plant Units 7~8 500MW X 4, Korea (2004)
- Taichung Thermal Power Plant Units 9~10 550MW X 2, Taiwan (2001)
- Pohang Sintering Plants 1~4 (POSCO), Korea (1986~2008)
- Gwangyang Ferronickel Plant (POSCO), Korea (2007)

• Taichung Steam Power Units 9, 10 ESP

• Boryeong Thermal Power Plant Units 1~8

• Kasima Power Plant

• Taean Thermal Power Plant Units 7~ 8

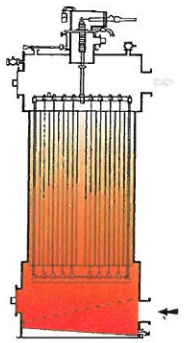
2 Wet Type ESP

Wet type ESPs have many similarities with dry type units in terms of principle and design. However, a basic difference is that the wet type is used in environments where the gas temperature is at or below dew point. Also, the rapping gear associated with dry units is replaced by an intermittent washdown system using water or other liquids to remove deposits from the collecting plate.

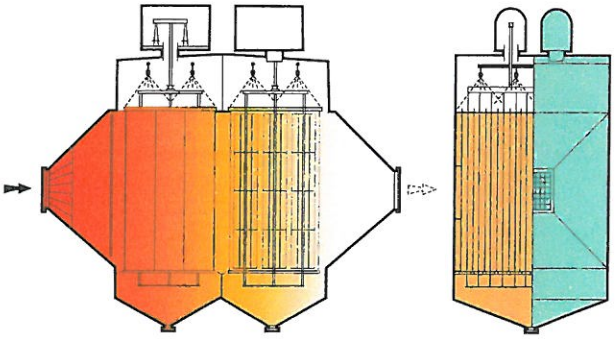
Wet type ESPs collect particulates that are sticky or suspended in the flue gas close to saturation temperature. It can also capture high resistance particulates and substances in a gaseous state. Two standard models of wet type ESP are available: Honey Comb Type (vertical flow) and G-Opzel Type (horizontal flow).

Advantages

- Low particulate emission
- Excellent collection efficiency for high resistance dust and mist
- Effective water film design
- Multiple designs of discharge electrode
- Comprehensive waste water treatment



• Wet Type Vertical Flow ESP



• Wet Type Horizontal Flow ESP

Projects

- Gwangyang MiniMill 2, POSCO, Korea (1997)
- STS 3rd Steel Plant (TCM), POSCO, Korea (2001)
- Pohang TLC Slag Treatment System, POSCO, Korea (2002)
- Gwangyang Continuous Casting Plants 1~2, POSCO, Korea (2003)

3 De-Tar ESP

This device also removes tar from the coke oven with a byproduct recovery system used in high temperature carbonization.

Projects

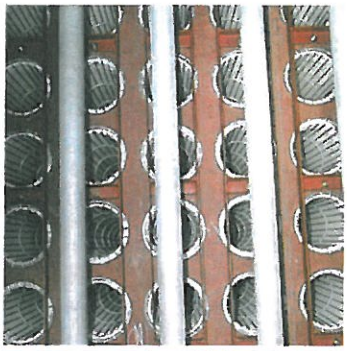
- Gwangyang Continues Galvanizing Lines 5~6, POSCO, Korea (2004)

Fabric filters are used for a broad range of industries including steel, non-ferrous metal, cement, power generation, chemicals, lumber and incineration plants. The choice of filter technology and filter media used depends on the type of gas being cleaned and the properties of the dust particles being removed.

(1) Reverse Air Fabric Filter
- Suitable for large facilities (range: 1,500~100,000m³/min)
- Low air to cloth ratios
- Simple design with few moving parts
- Easy maintenance
- Compartment ventilation during maintenance

(2) Pulse Jet Air Fabric Filter
- Wide variety of applications (range: 50~25,000m³/min)
- Bags are kept on the clean side, eliminating the need for ventilation during maintenance
- High air to cloth ratios
- Less space required for installation

• Filter Bag



Projects
- Danyang Plant, Sungshin Cement, Korea (2002)
- Retrofit Pohang Limestone calcination Plants 1~2, POSCO, Korea
- Yeongwol Plant , Ssangyong Cement, Korea (2003)
- Pohang Steel Plant 2, POSCO, Korea (2003)
- Gwangyang Sintering Plants 1~ 4, POSCO, Korea (2005)
- Asia Special Steel Plant, Japan (2008)

• Sungshin Cement Danyang Plant

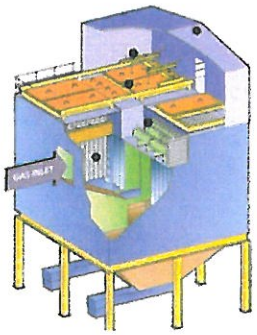
• Gwangyang Sintering Plants

(3) Ceramic Filters

Ceramic filters boasts reliability and high efficiency and can trap dust at temperatures above 250°C, which has been regarded as the critical temperature for conventional fabric filters. Because it functions at high temperatures, there is no need for a flame prevention system, spark prevention device, cooler, or spraytower. Ceramic filter also leads to energy and water savings.

Ceramic filters can be used even at a temperature of 900°C and shows high filtration efficiency against fine particles. In addition, it has resistance to sparks, incandescent particles, and accidental flame. The Ceramic filters are resistant to acid and alkaline corrosion and do not require a lot of space as air dilution is not necessary.

1. Easily removed access doors for maintenance
2. Trolley
3. Ceramic filter elements
4. Pulsed cleaning system
5. Optional weatherproof tophousing



• Ceramic Filter Flow Diagram

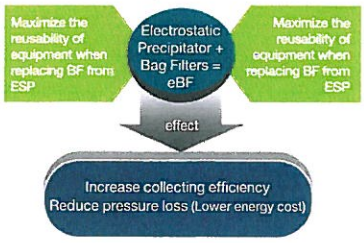
Advantages
- $NaHCO_3$ and slaked lime injected as sorbents for HCL and SO_2 removal
- Enhanced dioxin ratio
- Integration with optimal dust removal system lengthens catalyst lifespan and removes the need to reheat gas
- Can be used in Heat recovery Plant
- Greater efficiency throughout entire process

• Metal producer

• Aluminum producer

eBF™, electrostatic Bag Filters

Featuring a charging device installed before flue gas passes through the bag filter, the electrostatic bag filter is designed to lower equipment and operating cost compared to using only a bag filter. It combines the benefits of the ESP and bag filter.



Electrostatic force is used to address the increase in pressure loss, a problem associated with conventional bag filters. Electrostatically charged dust particles form a dendrite layer on the filter surface which prevents fine particles from penetrating into the filter and reduces filter clogging. Electrostatic bag filter is a high performance dust collection system with enhanced collection efficiency.

Advantages

- Formation of dendrite layer of dust by using electrostatic force
- Less clogging by preventing fine particles from penetrating into the filter
- Enhanced collection efficiency
- Less friction loss due to increase in filtration surface
- Reduced pressure loss
- Increase in filtration speed and amount (assuming identical facilities)
- Longer filter lifespan due to longer dust removal cycle
- Low initial investment and operating (energy) cost

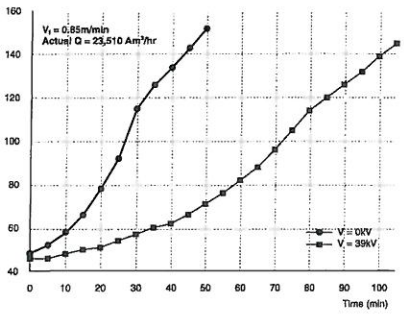
• Yeongwol Plant, Ssangyong Cement

Projects

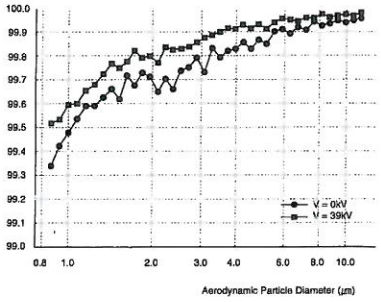
- Yeongwol Plant Units 3, 5, Ssangyong Cement, Korea (2003)
- Lime Conveying Line, Dangjin Thermal Power Plant, Korea (2007)

* Korea Patent No. : 0227127 (Registration Date 30th July 1999)
* Capacity Certificate No. : 15-386, Small and Medium Business Administration in Korea (Date of issue 7th May 2008)

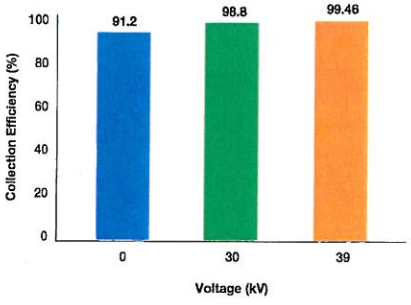
● Difference between other BF Pressure Loss



● Difference between other BF Collecting Efficiency



• Collecting Efficiency by particular size

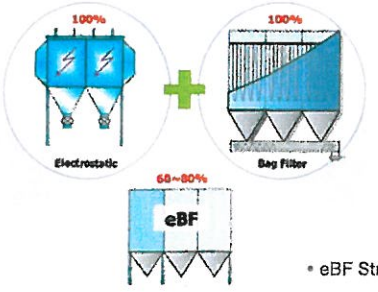


• Collecting Efficiency by weight

• Capturing uncharged particles

• Capturing charged particles

- Trapped particles gain properties of an electrostatic filter due to polarity of the filter. As a result, particles are also captured by already trapped particles. Particles branch out in the shape of twigs as they collect dust.
- Less pressure drop, savings in maintenance and energy cost, longer filter lifespan



• eBF Structure

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