KC Cottrell

KC Cottrell Co., Ltd.
Head Office
160-1 Donggyo-dong, Mapo-gu, Seoul, 121-817, Korea
TEL +82.2.320.6114
FAX +82.2.320.6100
www.kc-cottrell.com

Factory
253 Singi-ri, Seoun-myeon, Anseong-si, Gyeonggi-do,
456-853, Korea
TEL +82.31.674.9660
FAX +82.31.674.9670

KC Cottrell China Co., Ltd.
No.9576 Donghuancheng Rd., Changchun Economy &
Development Zone, Changchun City, Jilin Province,
130033, P.R. China
TEL +86.431.8587.7500
FAX +86.431.8587.7522
www.cckc.com.cn

KC Cottrell Vietnam Co., Ltd.
Floor 6, VINAFCO building, No.36 Pham Hung street,
Tu Liem District, Ha Noi, Viet Nam
TEL +84.4.768.9904/5
FAX +84.4.768.9902

KC Cottrell Co., Ltd. Taiwan Branch
15F-7, No.77, Sec.1, Shintai 5th Rd., Shijr City,
(Far East World Center) Taipei, 221 Taiwan
TEL +886.2.2698.8139
FAX +886.2.2698.8179

KC Cottrell Co., Ltd. Beijing Branch
Room1002 Tianheng Bldg, No.46 Dongzhimenwai Rd.,
DongchengQu, Beijing, 100027, P.R.China
TEL +86.10.8460.8738/9
FAX +86.10.8460.8732

Lodge Cottrell

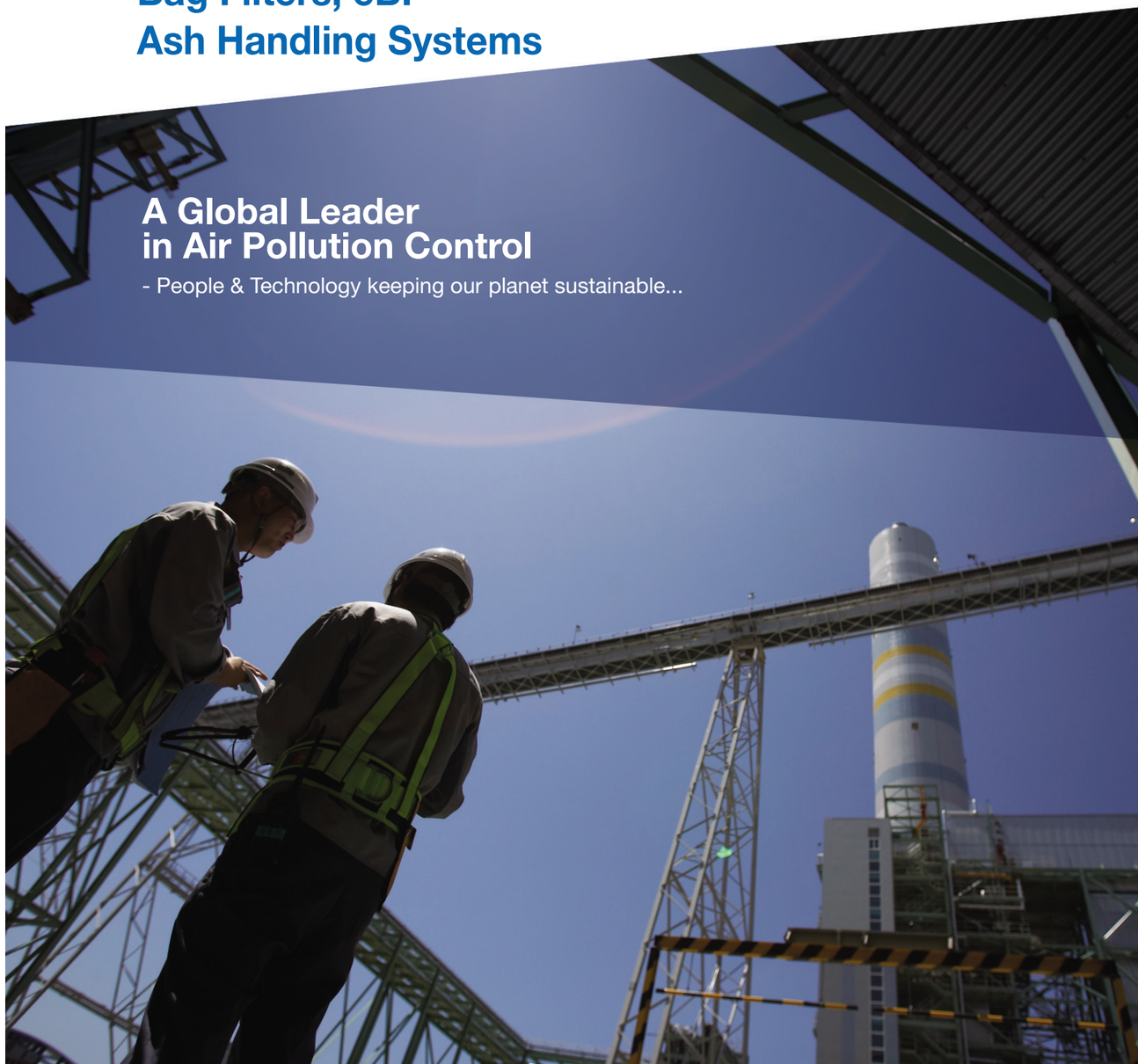
Lodge Cottrell Ltd.
21 George St, Birmingham, B3 1QQ, England
TEL +44.121.214.1300
FAX +44.121.200.2555
www.lodgecottrell.com

Lodge Cottrell Inc.
2319 Timberloch Place, Suite E, The Woodlands,
TX, 77380, USA
TEL +1.281.465.9498
FAX +1.281.465.9366
www.lodgecottrell.com

Lodge Cottrell India Pvt. Ltd.
7F Park Centra Tower-B, 32nd Milestone, NH8,
Sec.30, Gurgaon Haryana 122001, India
TEL +91.124.331.5278
FAX +91.124.331.5277

KC Cottrell

Electrostatic Precipitators (ESP)
ESP For Tunnel/Underground Use
Bag Filters, eBF ™
Ash Handling Systems

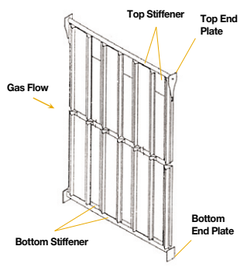


1 Dry Type ESP

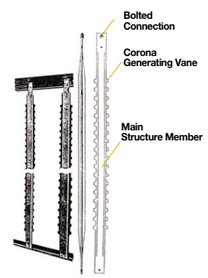
With an electrostatic precipitator (ESP), direct high voltage is applied to create a corona discharge to charge particles suspended in the gas and collect them through electrostatic attraction. An ESP is useful in removing particles in the sub-micron(0.1ß≠) range which are difficult to capture with gravitational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

Advantages

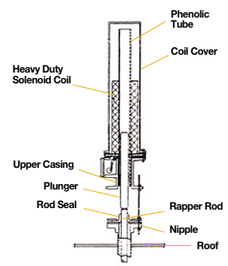
- Customized system design
- Collection with G-Opzel™ Plate
- DURATRODE™ discharge electrode
- MIGI™ (Magnetic Impulse Gravity impact) rappers
- Semipulse and Multipulse for high collection and energy efficiency



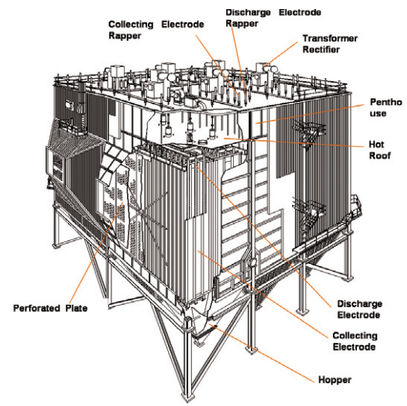
• G-Opzel™



• DURATRODE™



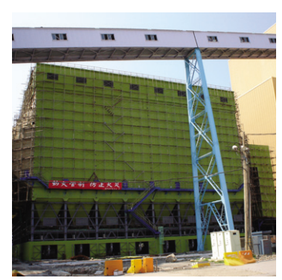
• MIGI™



• 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

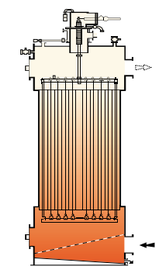
2 Wet Type ESP

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.

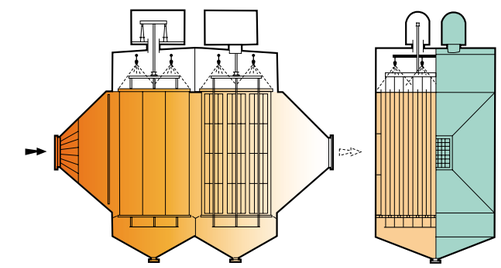
Wet type ESPs collect particulates that are sticky or suspended in the flue gas close to saturation temperature. It can also capture high resistance particulates and substances in a gaseous state. Two standard models of wet type ESP are available: Honey Comb Type (vertical flow) and G-Opzel Type (horizontal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



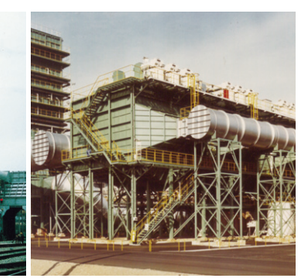
• Wet Type Vertical Flow ESP



• 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

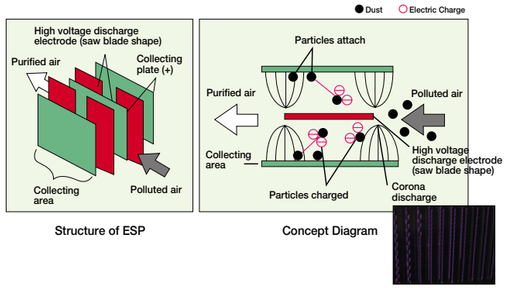
- Gwangyang Continues Galvanizing Lines 5~6, POSCO, Korea (2004)

ESP For Tunnel/Underground Use

This unit removes fine dust particles and purifies air in tunnels and underground space. Tunnel air containing dust passes through the ESP, which features negatively charged electrodes and positively charged collecting plates. Dust is absorbed by the collecting plates so that only clean air is emitted. The system deals with the captured dust particles through periodic cleaning with water.

This system can maintain over 90% collection efficiency even in high speed air streams (over 7m/sec). The ESP is equipped with discharge electrodes of a saw blade shape and has a compact structure. It is ideal for treating large volumes of dust containing gas or air.

Principle behind ESP (-)



Structure of ESP

Concept Diagram

Advantages

- Maximized corona discharge due to saw blade shaped discharge electrodes
- Compact single-stage ESP with simultaneous dust collection and discharge in the same space
- Use of commercial charging device (transformer rectifier)removes the need for a separate power grid
- GVC method for precision control and optimalization of voltage and electric current
- Can be operated for high speed air streams

* Korea Patent No. : 10-0871601 (Registration Date 26th Nov. 2008)
* NET(New Excellent Technology) No. : 0258, Ministry of Knowledge Economy (Registration Date 26th Aug. 2008)

Comparison with Other Technologies

	Product	Import (Japan)	Import (Europe-no longer available)	Remark
Dust collection system	Single stage	Dual stage	Dual stage	
Charged area	Plate type	Fan or plate type	Fan or plate type	
Collecting cell quality	STS304	STS304	Aluminum	
Collecting cell area	1	1.2	1.2	Relative comparison
Applicable current speed	> 7m/sec	> 7m/sec	> 7m/sec	
Voltage switching scheme	14KV Single voltage	Charged area - 11KV Collecting area - 5.5KV	Charged area - 12KV Collecting area - 6KV	
Cleaning device	Unit embedded in collecting cell	Unit embedded in collecting cell	Placed externally	

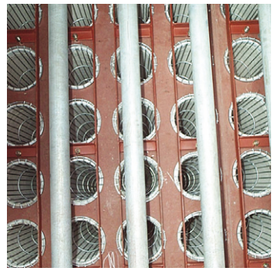
Structure of ESP for Tunnel

Bag Filters

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

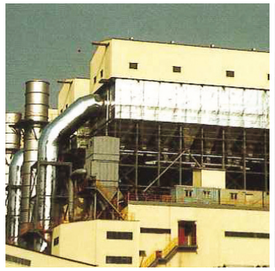
(2) Pulse Jet Air Fabric Filter
- Wide variety of applications (range: 50~25,000m³/min)
- Bags are kept on the clean side, eliminating the need for ventilation during maintenance
- High air to cloth ratios
- Less space required for installation



• 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

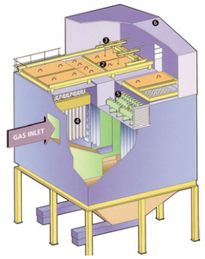
• Gwangyang Sintering Plants

(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.

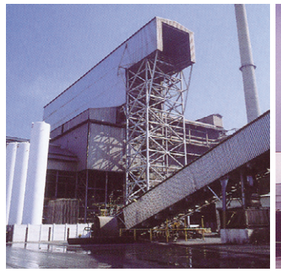
1. Easily removed access doors for maintenance
2. Trolley
3. Ceramic filter elements
4. Pulsed cleaning system
5. Optional weatherproof tophousing



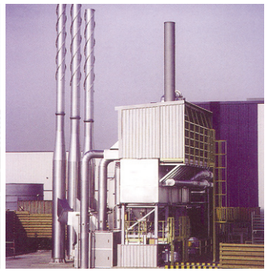
• Ceramic Filter Flow Diagram

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

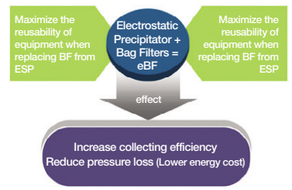


• Aluminum producer

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

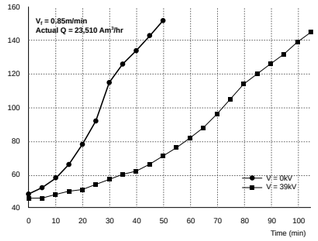
• Yeongwol Plant, Ssangyong Cement

Projects

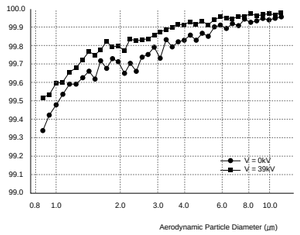
- Yeongwol Plant Units 3, 5, Ssangyong Cement, Korea (2003)
- Lime Conveying Line, Dangjin Thermal Power Plant, Korea (2007)

* 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)

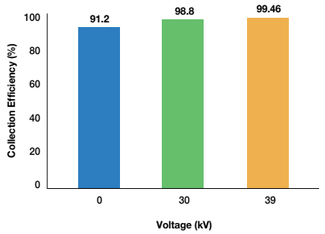
● Difference between other BF Pressure Loss



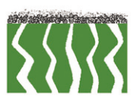
● Difference between other BF Collecting Efficiency



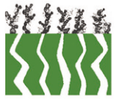
• Collecting Efficiency by particular size



• Collecting Efficiency by weight

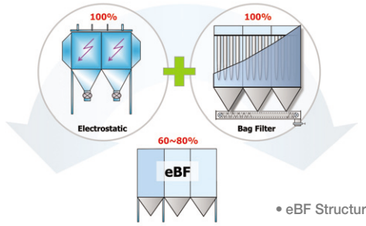


• Capturing uncharged particles



• 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

Ash Handling

1 Bottom Ash Handling System

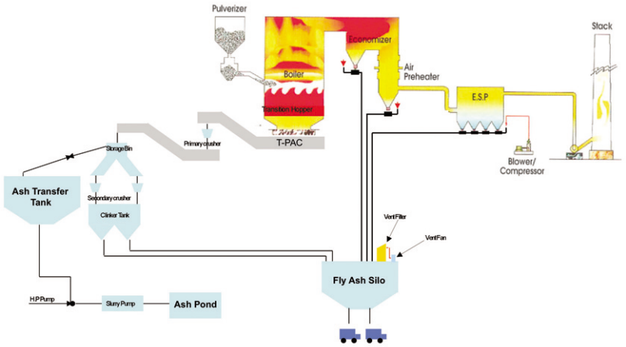
Slag and ash falling from the furnace are temporarily stored in the bottom ash silo. They are then sent to the ash pond using a hydro ejector. Alternatively, they are sent back to the bottom ash silo to be recycled after going through a submerged drag chain conveyor or dry ash extraction conveyor.

- Bottom Ash Hopper System utilizing Hydro-ejectors
- SDCC (Submerged Drag Chain Conveyor) System
- Dry Ash Extraction System
- Ash Water & Slurry System

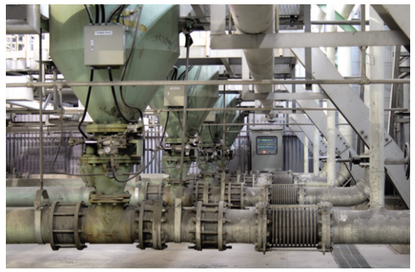
2 Fly Ash Handling System

Air pressure from the blower or air compressor is used to transport ash to the ash silo via appropriately sized pipes.

- Positive Pressurized Conveying System
  - Lean (Dilute) Phase System
  - Medium Phase System
  - Dense Phase System
- Negative Pressurized Conveying System (Vacuum System)
- Combination System
- Economizer & Air Preheater Ash handling System / Ash Disposal System



• Ash Handling System Flow Diagram



• Bottom & Fly AHS, Dangjin Thermal Power Plant

Projects

- Yeongnam Thermal Power Plant Units 1~2, Korea (2002)
- Ulsan Thermal Power Plant Units 4~6, Korea (1997)
- Samcheonpo Thermal Power Plant Units 1~2, Korea (2002)
- Jeju Thermal Power Plant, Korea (2004)
- Dangjin Thermal Power Plant Units 5~6, Korea (2004~2006)
- Retrofit for Ulsan Thermal Power Plant Units 4~6, Korea (2007)
- Boryeong Thermal Power Plant Units 7~8, Korea (2006)