



TUNA
CORPORATION



ZHEJIANG TUNA ENVIRONMENTAL SCIENCE&TECHNOLOGY CO.,LTD

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Professional Flue Gas Treatment

Solutions For Ultra-Low Emission Control

ABOUT TUNA

Zhejiang TUNA Environmental Science & Technology Co., Ltd. (stock code: 603177) is a national key high-tech enterprise that specializes in flue gas treatment industry. TUNA has become an integrated service enterprise that covers desulfurization(FGD), denitration(DeNOx), high-efficiency dust removal and other flue gas treatment integrating R & D, engineering, and manufacturing, providing service for power, metallurgical and petrochemical industries, etc. The products have been installed in more than 1,000 projects, clients including China's Top 5 power generation groups (Huaneng, Guodian, Datang,Huadian, State Power Investment Corporation (SPIC)), Shanghai Baosteel, Sinopec Shanghai and so on. In addition, the FGD equipments and SCR catalyst have been exported to dozens of countries, such as Turkey,Russia, India, Malaysia, Vietnam, Philippines, Kyrgyzstan, Parkistan, Indonesia, Nigeria, Laos and so on.

We are expanding our business into global market with our rich experiences in China, and participating on global emission control projects to make the world a better place to live in.

Certifications

- National Torch Plan Key High-Tech Enterprise
- A National High-Tech Enterprise
- Famous Brand Product of Zhejiang Province
- Academician/Expert Workstation
- Provincial-Level Enterprise Technical Center in Zhejiang
- Enterprise Research Institute in Zhejiang Province
- A Member of China Association of Environmental Protection Industry
- A Director (organization) of the Council of China Association of Environmental Protection Industry
- A Member of China Association of Machinery Industry for Environmental Protection
- A Director of China Association of Machinery Industry for Environmental Protection
- High-Tech Enterprise R & D Center in Zhejiang Province

Qualifications

TUNA has been persisting in the development route of independent innovation and owns an integrated elite team covering R&D, design, engineering, manufacturing, construction, commissioning, operation and project management. With the reliable technology, perfect service, high level of project quality and practical and dedicated working style, TUNA had won good reputation in these industries involved.

Design Qualifications

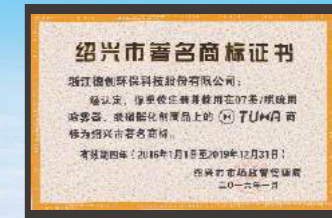
- Grade A special Qualification Certificate of Environmental Engineering
- Grade II Qualification Certificate of Contracting Environmental Projects
- Grade B Special Qualification of Environmental Engineering (Water Pollution Prevention and Treatment Project)

Quality Management System Certificates

- ISO 9001

EHS

- ISO 14000 Environmental Management
- Occupational Health and Safety Management System (OHSAS18001)



•TUNA had developed 100 new technologies with independent intellectual property right

•19 patents of invention

•81 patents of utility model

•Participating in drafting 6 national standards in environmental protection





Technology Categories



1. Flue Gas Desulfurization (FGD) Technology

- Wet Limestone (lime)-Gypsum Flue Gas Desulfurization (Wet-FGD) Technology
- CFB Semi-Dry Flue Gas Desulfurization



2. Denox Technology

- Selective Non-Catalytic Reduction Method (SNCR)
- Selective Catalytic Reduction Method (SCR)
- Low-NOx Combustion + SNCR or SCR



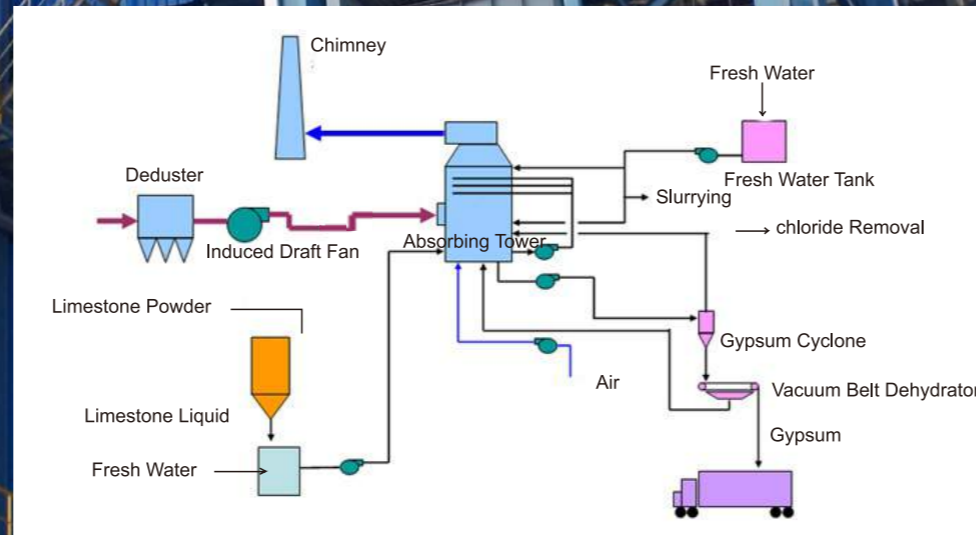
3. Electrostatic Precipitator Pechnology(ESP)

- Honeycomb-Tube Type Wet-esp
- Plate Type Wet-esp
- ESP
- DGGH



Still Expanding.....

Wet Limestone (lime)-Gypsum Flue Gas Desulfurization



Advantages

- ① Stable Operation, High Desulfurization Efficiency (above 99.5%).
- ② The Desulfurization Product (Gypsum with water content lower than 10%) is reusable.
- ③ It is applicable for Ultra-low Emission requirement.

Technical Characteristics

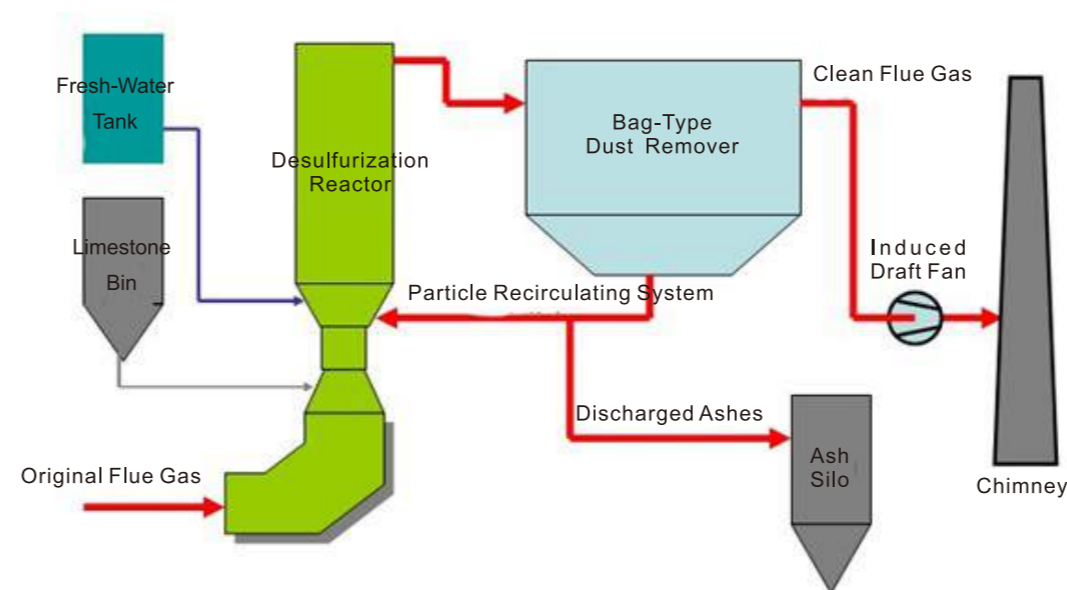
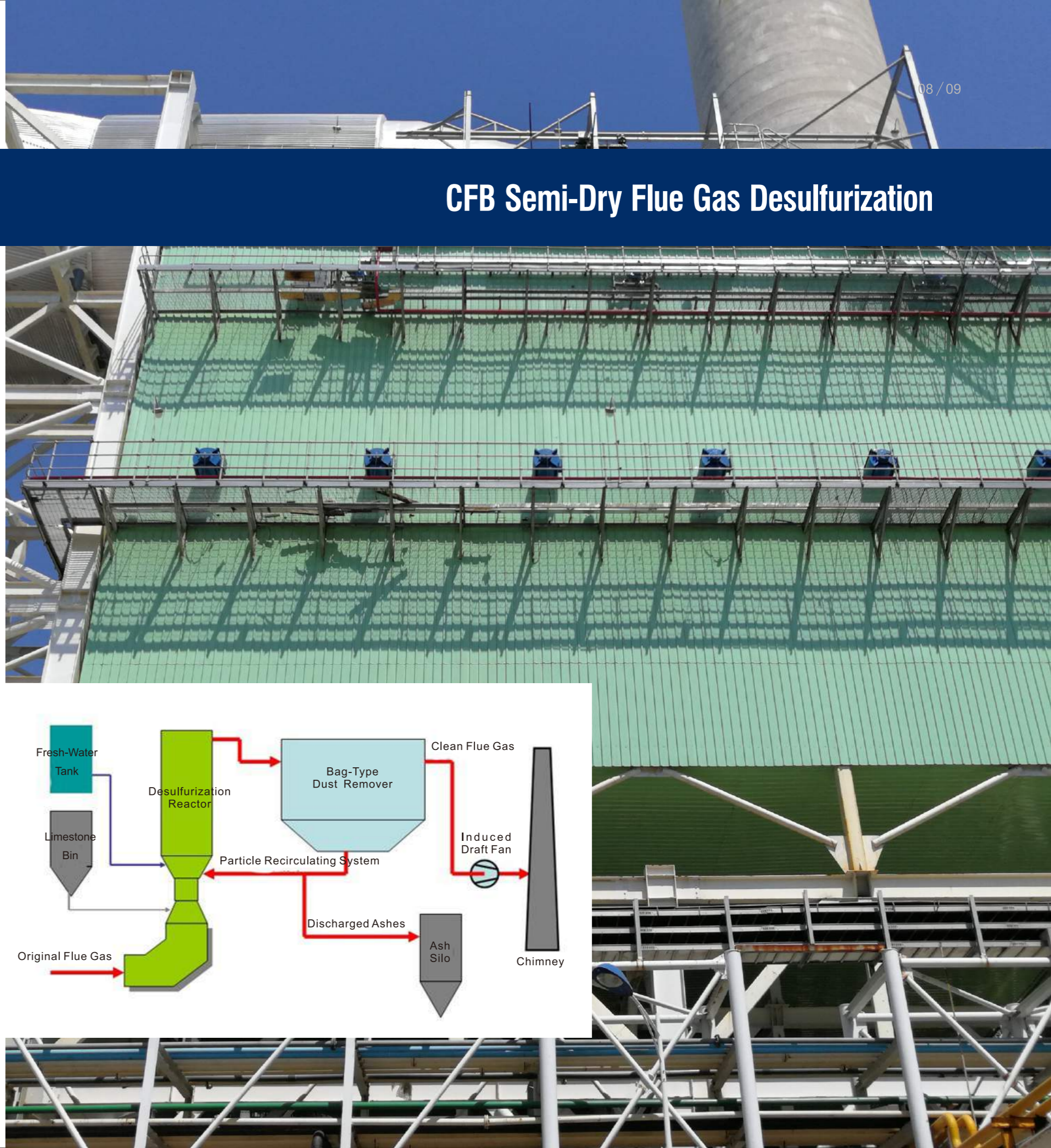
- High Desulfurization Efficiency average 95-99.5%.
- No Scale Formation, Block-free, Easy Maintenance.
- Strong adaptability for various coals with different sulfur contents.
- Sealing rings are reasonably arranged inside the absorber to prevent flue gas short circuit and make sure all flue gas completed washed by the slurry.
- As for the core technology for absorber detail arrangement design to guarantee efficiencies of desulfurization and dust removal.
- Reasonable nozzle coverage rate, both double way and single way nozzles are used for lower sprinkling layers, extended flue gas retention time in the absorber, fine atomized particle size, all these factors are in favor of collecting the pollutants in the absorber.
- Advanced CFD technology, improves flue gas uniform distribution to guarantee desulfurization efficiency.
- TUNA self-developed high-efficiency and ultra-clean demister(patented), the outlet liquid drop concentration can be effectively controlled within $20\text{mg}/\text{Nm}^3$.
- Absorber tray provided to promote gas/slurry contact, extend retention time, balance the flue gas distribution.
- TUNA provides both single absorber and dual tower arrangement solutions to guarantee high desulfurization efficiency in different projects especially for those with high sulfur content coal.

Advantages

Lime is used as the absorbent. It is applicable to flue gas cleaning for waste incineration boiler, sintering machine, coal-fired boiler and so on, with desulfurization efficiency around 90~95%. Small occupied area, simple system, low investment cost, multiple cleaning functions with desulfurization, removal of dust and other pollutants (chloride, heavy metal, dioxin substances), small water consumption and so on.

Technical Characteristics

- Extensive application fields, high-efficiency, synergistic treatment of multi-pollutants such as SO_x, NO_x, HCL, HF, heavy metal, dioxin substances, dust and so on.
- The reaction product is in dry state and can be easily treated and waste water discharge.
- Small occupation, small resistance, high automation, less investment and operation costs which are economic solution for long-term operation.
- Advanced fluidized bed reaction tower design, optimized desulfurization reaction environment temperature, humidity, concentration, flow field, gas/solid ratio and speedare in order to guarantee a best heat transfer and mass transfer effects.
- The absorbent is suspended and fluidized inside the absorber with continuously refreshed surface and high utilization rate of the desulfurizer so that consumption of lime is reduced.
- The temperature inside the tower is controlled through water sprinkling. In addition, the absorbent is humidified and activated again. Number of sprinkling layers is decided by the flue gas volume/temperature/moisture/content. Each water sprinkling layer is adjustable separately to assure uniform temperature field inside the absorber.
- The flue gas recirculating system is provided to effectively adapt to the boiler load change and assure the fine fluidized bed effect inside the absorber.



TUNA CORPORATION | Selective Catalytic Reduction (SCR)

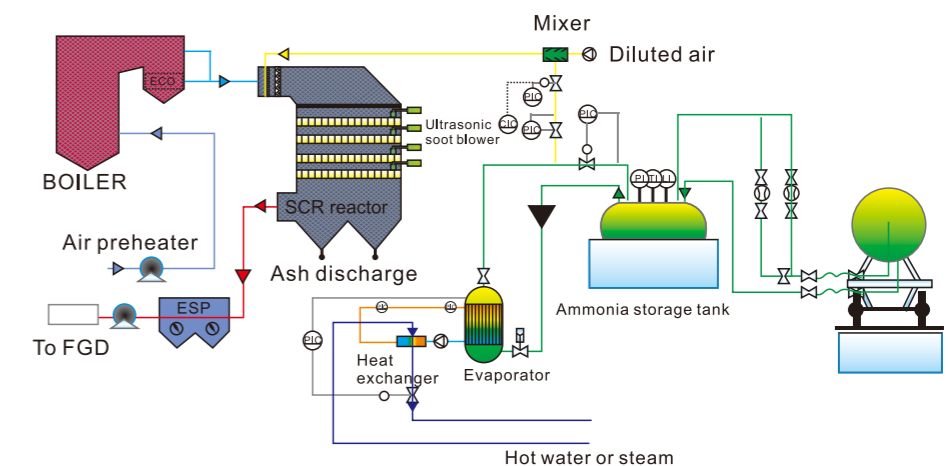


Advantages

Liquid nitrogen or urea is used as the reducing agent. Applicable for high NO_x concentration. The DeNO_x efficiency is usually at 85%-90%. The ammonia escape is normally lower than 3ppm.

Technical Characteristics

- Applicable to most of coal-fired units, gas turbine and HRSG.
- It has high reliability with mature technology which is easy for operation.
- Self developed SCR catalyst, strong database of the catalyst performance in various condition;
- Honeycomb type catalyst (developed with Japanese technology) and plate type catalyst (developed with German technology), optimized catalyst formula with low SO₂/SO₃ conversion rate to avoid heavy metal poisoning and reduce production of ammonium bisulfate;
- The fluidity of the alkaline metal can be diluted to avoid alkaline metal poisoning;
- Special design in catalyst pore structure to improve the arsenic-resistance.
- Harden treatment (hardening liquid immersing) at upper section of the catalyst, to effectively prevent wearing caused by the fly ash.

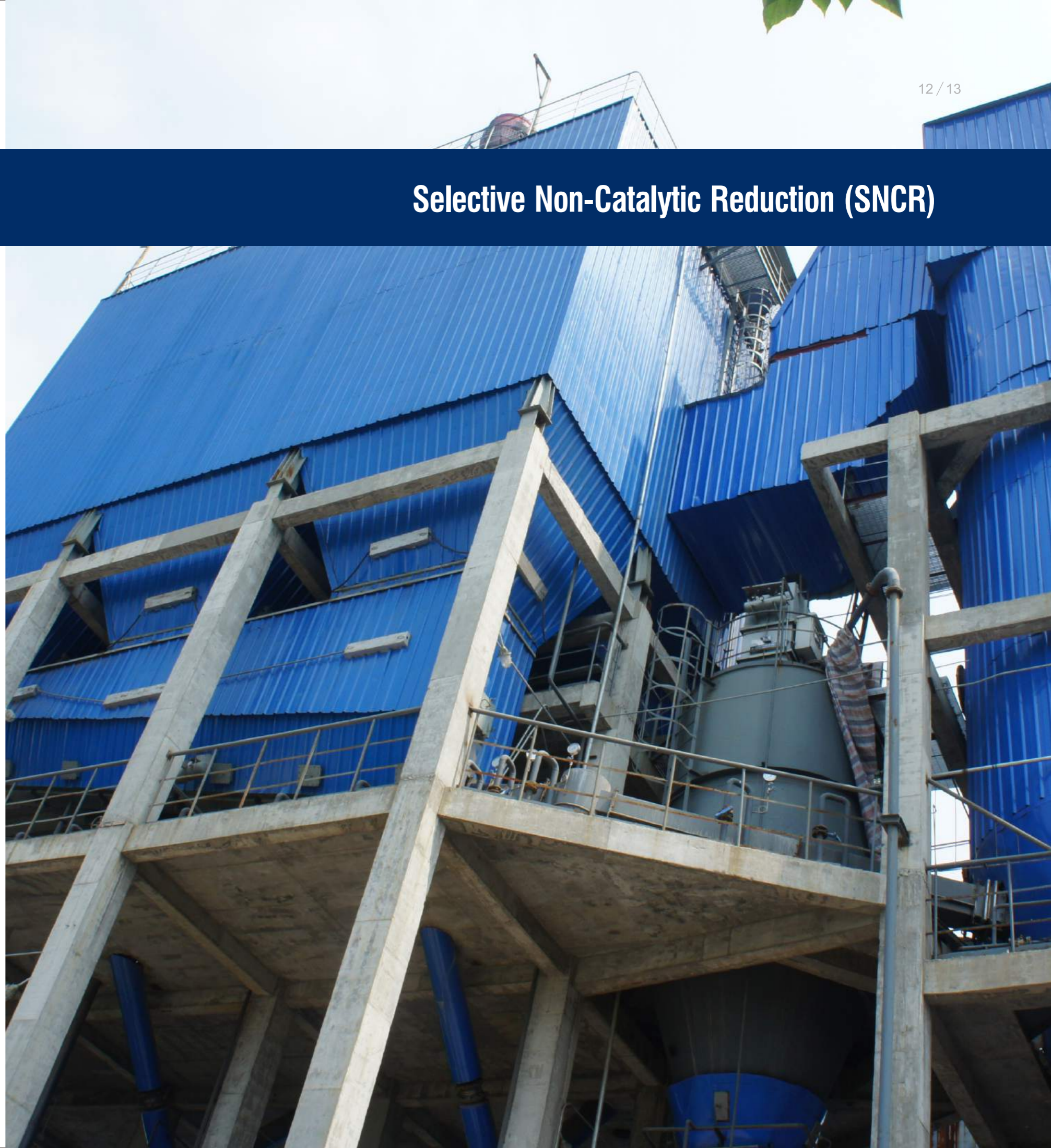
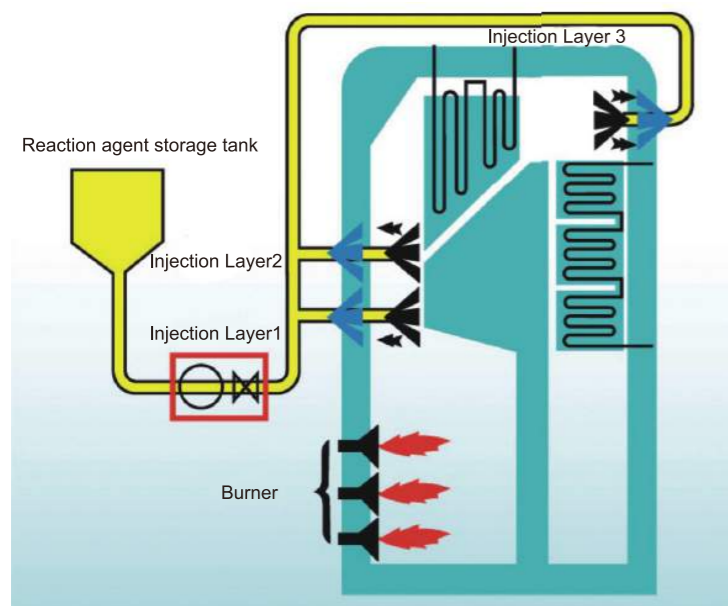


Advantages

Aqua ammonia is used as the reducing agent. It is applicable to the waste incineration boiler, smaller capacity unit and short construction period. Automatic operation of the DeNO_x system.

Technical Characteristics

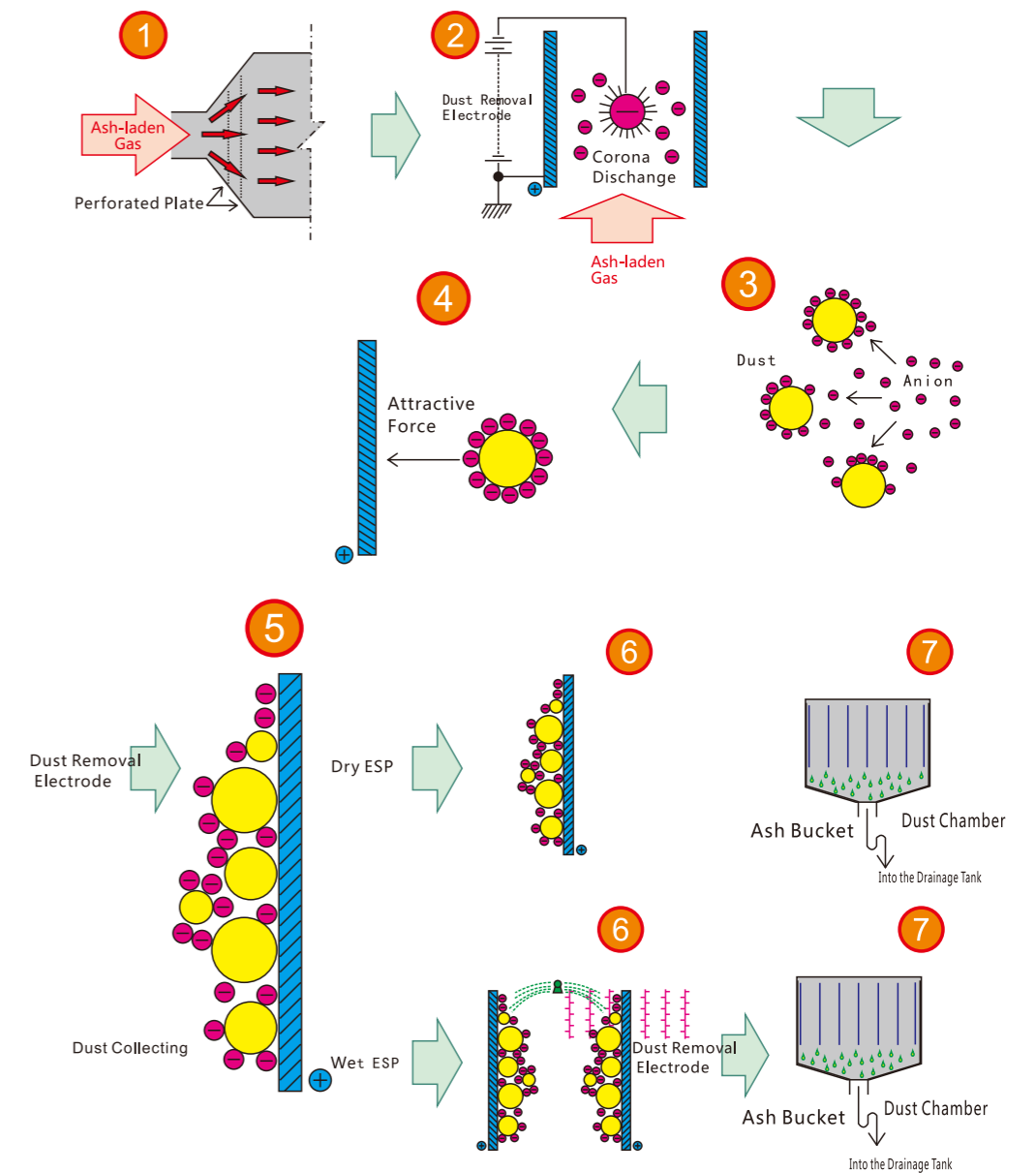
- The process technology application is mature and reliable.
- It is applicable to small unit, small investment and short construction period.
- One button operation, automatic controlled.
- Based on NO_x emission quantity and NH₃ escapement quantity, the system can automatically adjust the dosage quantity of the reducing agent.
- Advanced spray gun design and arrangement, precisely manufactured, excellent spraying performance which results high utilization rate of reducing agent.
- Modular design and small occupation.





Advantages

Resolve the gypsum rain and blue smoke problems that cannot be eliminated by wet FGD, mitigate corrosion against the downstream duct and chimney also remove multi pollutants. The dust emission concentration can be controlled to be lower than 2mg/Nm³.

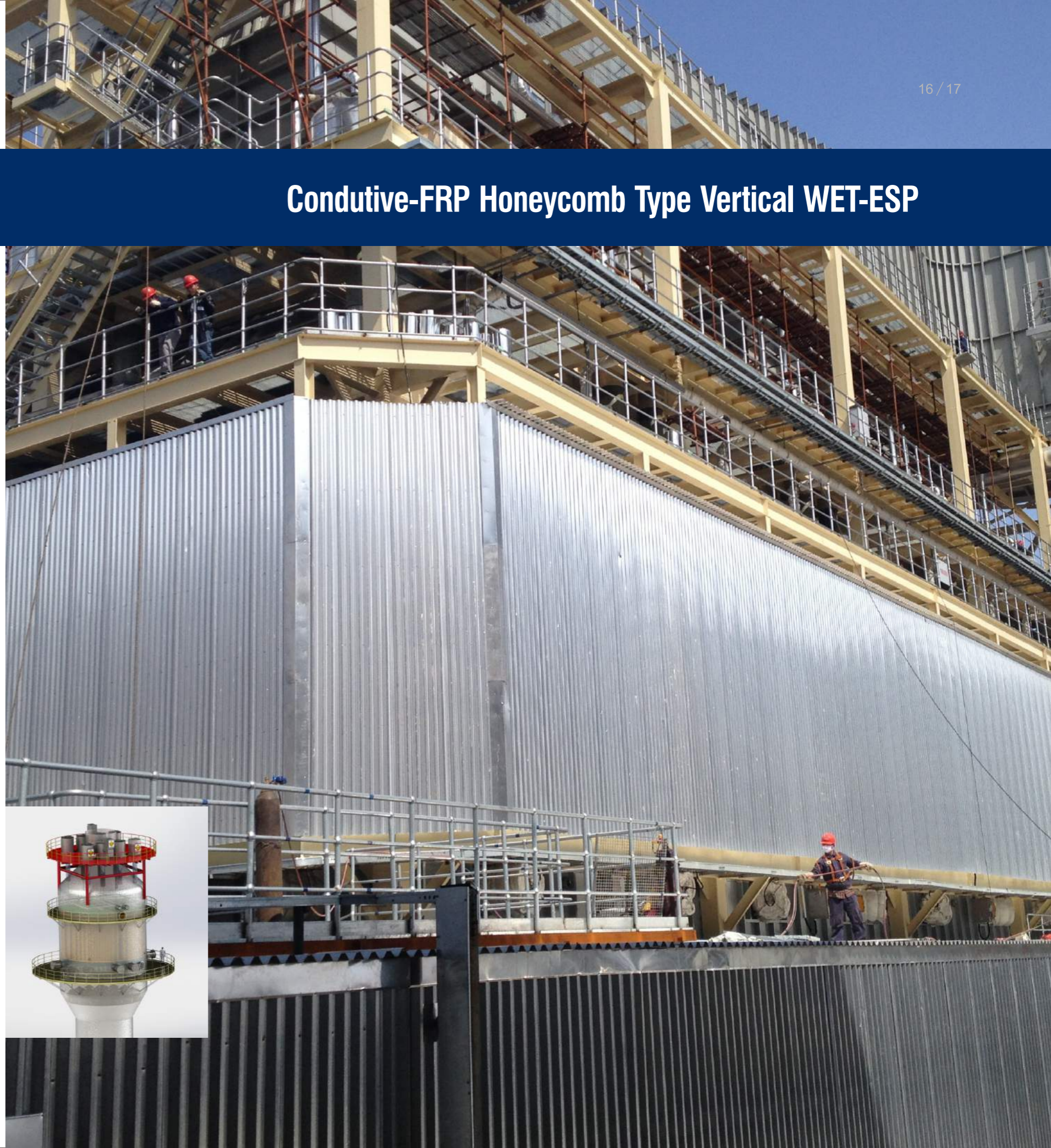


Main Composition

- ① Inlet Nozzle
- ② Gas Flow Uniform Distribution System
- ③ Collecting Electrode (CE) System
- ④ Discharging Electrode (DE) System
- ⑤ Spraying Eystem
- ⑥ Outlet Nozzle
- ⑦ HV Power Supply System
- ⑧ Casing
- ⑨ Stairs & Platform

Technical Characteristics

- The CE tube (dust collection electrode) is once formed through mechanical pulling and extrusion, the size precision is high, the internal surface is smooth, the material is CFRP, The corrosion-resistance is strong and the service life is more than 20 years.
- The collecting electrode module is fabricated in workshop, is hoisted and installed conveniently at the site and the construction period is saved.
- The collecting electrode module has fine conductivity, and the grounding resistance is smaller than 20Ω .
- The discharging electrode wire (discharge electrode) is made of specially designed rigid helical needled wire and has strong corona discharge capacity.
- The spraying system uses the special-purpose atomizing nozzles to achieve washing without dead zone.
- Intermittent washing is utilized for saving water.
- Its arrangement is flexible and can be arranged independently or arranged at the tower top.



TUNA CORPORATION | Electrode-Plate Type Horizontal WESP



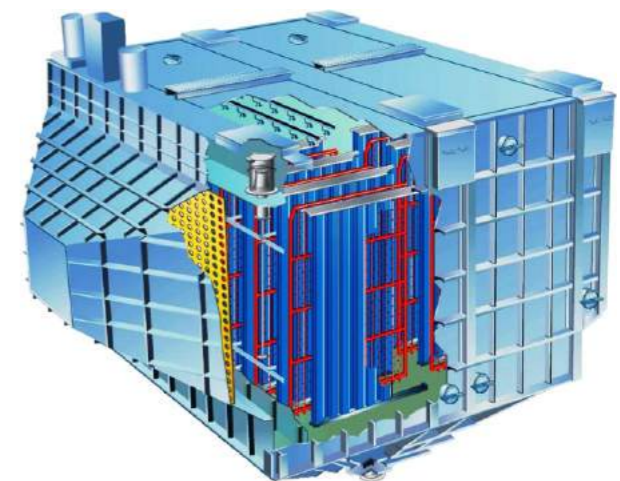
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Technical Characteristics

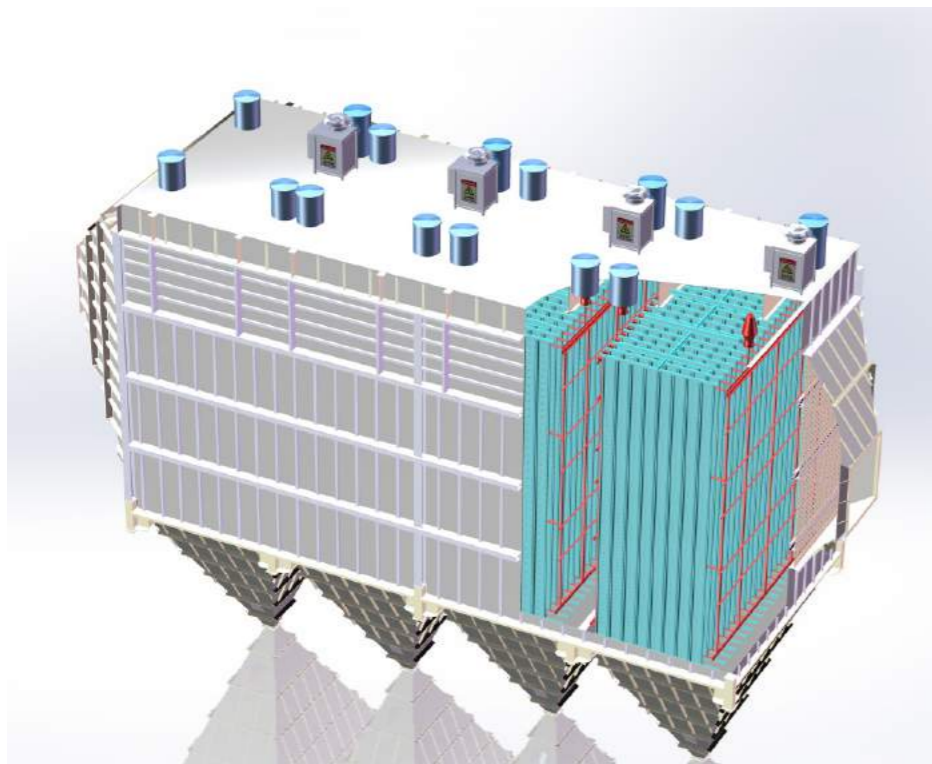
- The CE plate (dust collection electrode) adopts special plate type design which has fine rigidity and is good for uniform distribution of water film.
- The discharge electrode is made of specially designed rigid burred wire, cooperates with the anode plate to achieve uniform distribution of the electric field.
- The spraying system uses the special-purpose nozzles which is good for forming water film.
- The washing water is neutralized and filtered and then can be recycled.

fumée horizontal



Technical Characteristics

- The CE plate adopts the specially-designed plate type which is not easily deformed and has fine effect for vibrating and ash removal.
- The DE wire can be saw-teeth/barbed/needled wire based on the different smoke dust characteristics. The discharge inception voltage is low, corona current is large, mechanical strength is great and ash is easily removed.
- The resistance is low (only 150~300Pa), electric power consumption is low and operation cost is small.
- Dust removal efficiency is high and can reach more than 99.95%.



TUNA CORPORATION Hybrid ESP (ESP+ Bag Filter)

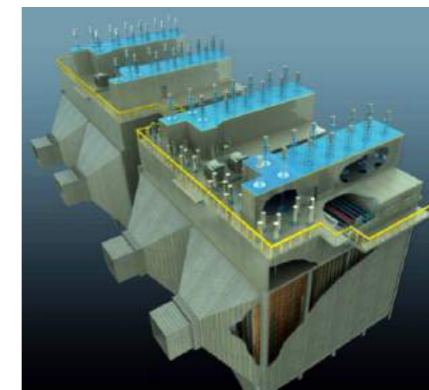


Operating Principle

Hybrid ESP consists of ESP at front fields and bag filter at the rear fields which is combined advantages of both dedusting methods.

Technical Characteristics

- High efficiency, low resistance at ESP zone and non-sensitive to coal types/dust properties, high collecting efficiency for fine dust (99.98%) with bag filter, easily guarantee outlet dust emission of $20\text{mg}/\text{Nm}^3$.
- Small load of dust at bag filter zone, small operating resistance ($<1200\text{Pa}$), long service life for bag filter (>5 years).
- Compact structure, smaller occupation, lower power consumption and less investment.
- New type and high-efficiency filtering bag to capture PM10 and PM2.5.



Solutions for Ultra-low Emission Control and Elimination of White Smoke at Chimney Outlet

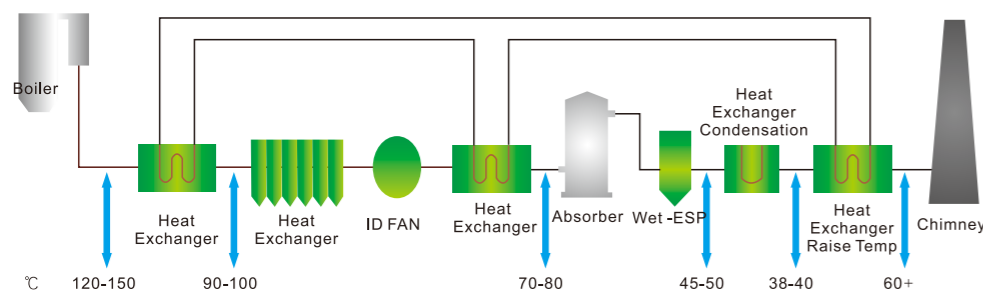
- Heat exchanger arranged before ESP to improve the ESP efficiency by reducing the flue gas temperature.
- Heat exchangers arranged before chimney for condensation and then to raise flue gas temperature for elimination of white smoke at the chimney outlet. The pollutant will be further reduced during condensation as well.

Types of Heat Exchanger

- Metal tubes
- Fluoroplastics

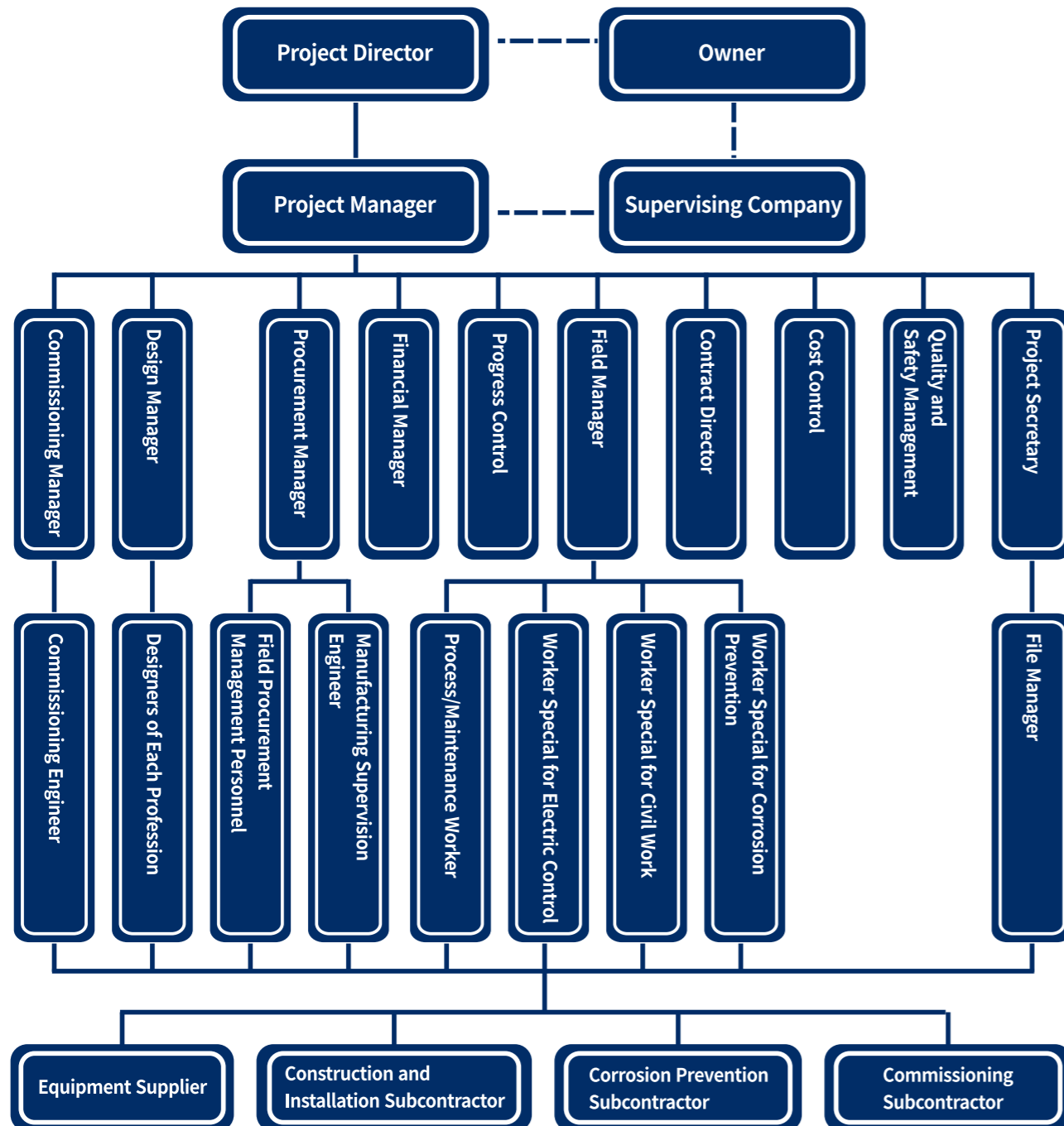
Measures for Safe and Reliable Operation

- Corrosion control: By selecting proper heat exchange pipe material and controlling the pipe wall temperature, the low temperature corrosion is effectively controlled.
- Blocking prevention: By increasing the pipe wall temperature, ABS cementing blocking is effectively controlled; the sound wave/steam soot blower is utilized for sootblowing periodically to effectively prevent that the heat exchange area is blocked by the ash.
- Preventing wearing: By analyzing the ash characteristics, the ash wearing index is calculated. The proper flue gas flow velocity is selected, the flow resistance is controlled, the impact equivalent of ash against the heat exchange pipe is reduced. In addition, the wearing-resistant pipe and wearing-resistant comb are provided at the heat exchange windward side to prevent that the ash wears out the heat exchange pipe.



Project Management

Project Management Organization



Project Management Categories

- Project Design Management
- Project Procurement Management
- Project Quality Management
- Occupational Health, Safety and Environmental Management
- Project Construction Technology Management
- Project Communication Management
- Project Risk Management

TUNA CORPORATION | **PRODUCT** Catalog | **Typical Cases**

Project Type: SCR DeNOx
 Hubei Energy Group Ezhou Power Gen. Co., Ltd.
 Capacity: 2×300MW
 Flue Gas Volume: 2×1027797 Nm³
 Inlet Concentration: NO₂≤1200 mg/Nm³
 Outlet Concentration: NO₂≤200 mg/Nm³
 Efficiency: 83.3%



Project Type: SCR DeNOx
 Ningbo Zhongjin Petrochemical Co., Ltd. Boiler
 Capacity: 3×310t/h
 Flue Gas Volume: 3×881770 Nm³
 Inlet Concentration: NO₂≤800 mg/Nm³
 Outlet Concentration: NO₂≤100 mg/Nm³
 Efficiency: 83.3%



Project Type: Wet ESP
 GUODIAN Jilin Jiangnan Thermoelectric Co., Ltd. Unit 1 & 2
 Capacity: 2×300MW
 Flue Gas Volume: 1200000 Nm³
 Inlet Concentration: Dust≤20 mg/Nm³
 Outlet Concentration: Dust≤4 mg/Nm³
 Efficiency: 80%



Project Type: Wet ESP
 Jiangsu Nanre Power Gen.Co., Ltd. Nanre
 Boiler 1 & 2
 Capacity: 2×350MW
 Flue Gas Volume: 1300000 Nm³
 Inlet Concentration: Dust≤35 mg/Nm³
 Outlet Concentration: Dust≤5 mg/Nm³
 Efficiency: 86%



Project Type: Wet FGD
 GUODIAN Feixian Power Gen. Co., Ltd. Unit 1 & 2
 Capacity: 2×650MW
 Flue Gas Volume: 2×2250000 Nm³
 Inlet Concentration: SO₂≤4500 mg/Nm³
 Outlet Concentration: SO₂≤35 mg/Nm³
 Efficiency: 99.23%



Project Type: Wet FGD
 Jingneng (Chifeng) Energy Development Co., Ltd. Boiler
 WCFB Flue Gas Desulfurization Project
 Capacity: 2×135MW
 Flue Gas Volume: 2×513590Nm³
 Inlet Concentration: SO₂≤6000 mg/Nm³
 Outlet Concentration: SO₂≤150 mg/Nm³
 Efficiency: 97.5%



Project Type: Wet FGD
 Desulfurization project of Jingtai Power Generation Co., Ltd.
 Capacity: 2×300MW
 Flue gas Volume: 2×1367500Nm³
 Inlet concentration:SO₂≤3750mg/Nm³
 Outlet concentration:SO₂≤200mg/Nm³
 Efficiency:95%



Project Type: Semi-dry FGD
 Desulfurization project of Jingfu Company
 Capacity: 1×130t/h
 Flue gas Volume: 1×185000Nm³/h
 Inlet concentration:SO₂≤500mg/Nm³
 Outlet concentration:SO₂≤100mg/Nm³
 Efficiency:80%



Project Installed Capacity

Project Type	Wet-ESP Project		FGD System Project		DeNOx System Project	
	Category	No. of Units	MW	No. of Units	MW	No. of Units
1000MW	9	9,000	-	-	-	-
600MW	18	11,140	4	2,500	3	1,800
300MW	41	12,930	7	2,250	4	1,320
<300MW	39	2,168	19	1,935	33	2,340
Total Installed Capacity	107 Units	35,238MW	30 Units	6,685MW	40 Units	5,460MW
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Cumulative Installed Capacity-Products

Products	Honeycomb Type SCR Catalyst		Plate Type SCR Catalyst		FGD Products	
	Category	No. of Units	MW	No. of Units	MW	No. of Units
1000MW	6	6,000	5	5,120	60	60,200
600MW	57	33,240	9	6,895	392	245,858
300MW	106	31,292	11	6,480	577	201,034
<300MW	80	7,158	18	2,043	2,031	100,000 +
Total Installed Capacity	249 Units	77,690MW	30 Units	6,685MW	3,060 Units	600,000MW +

Recent Reference-Products

No.	Project Name	Capacity	Product
1	Huadian Ningxia Ningwu Power Plant Unit 3&4	2×1060MW	Plate Type SCR Catalyst
2	Guangdong Huizhou Pinghai Power Plant Unit 1&2	2×1000MW	Plate Type SCR Catalyst
3	Huadian Zhouxian Power Plant	1×1000MW	Plate Type SCR Catalyst
4	Guodian Zhejiang Beilun No.3 Power Plant Unit 6&7	2×1000MW	Honeycomb Type SCR Catalyst
5	Zhejiang Zheneng Liheng Power Plant Unit 2	1×1000MW	Honeycomb Type SCR Catalyst
6	Huaneng Qinbei Power Plant Unit 5&6	2×1000MW	Honeycomb Type SCR Catalyst
7	Wanneng Tongling Power Plant	1×1000MW	Honeycomb Type SCR Catalyst
8	Xinjiang Nongliushi Coal-fire Power Plant	2×1100MW	FGD Slurry Piping
9	Huadian Laizhou Power Plant Ph-I	2×1000MW	FGD Slurry Piping
9	CHINA RES POWER Hezhou Power Plant Ph-I	2×1000MW	FGD Slurry Piping
10	Guodian Laizhou Power Plant PH-II	2×1000MW	Mist Eliminator
11	An'Hui Huadian Wuhu Power Plant	2×660MW	Mist Eliminator
12	Shenhua Fujian Luoyuan Power Plant	2×1000MW	Rubber Lined Pipes
13	Zheneng Taizhou Power Plant	2×1000MW	Vacuum Belt Dehydrator
14	Zheneng Jiahua Power Plant	2×1000MW	Damper