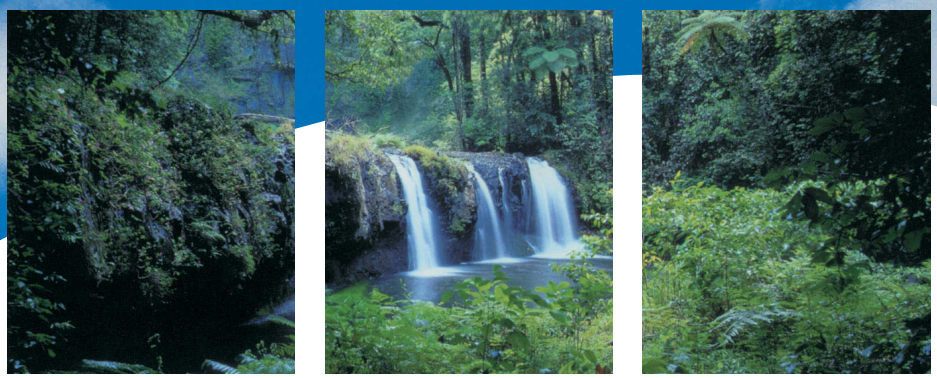


ECONOMIC IN ECOLOGY

Innovative environmental technologies

EWK UMWELTTECHNIK GMBH

System solutions for environmental protection

- Ecological
- Economical
- Law-conforming
- Non-polluting

Those are features required of an industrial production plant today.

The attempts of EWK Environmental Engineering (Zschocke Environmental Engineering until 1968) to construct flue gas purification plants, which would meet these requirements, go back more than a century.

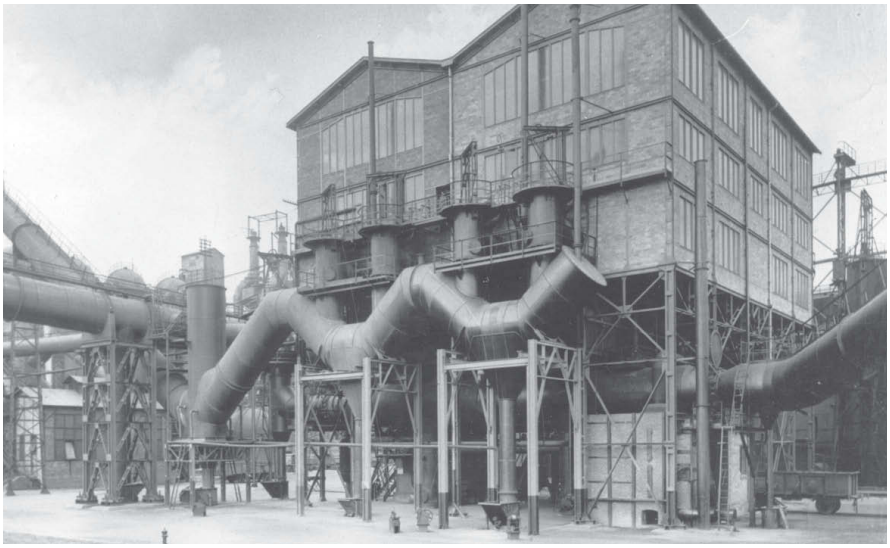
As early as 1914 Zschocke in Kaiserslautern began to develop electrostatic precipitators. The first large-size electrostatic precipitation system worldwide was completed in 1923.

As a competent provider of advanced filter systems for the purification of air, water and soil we are a reliable partner in all questions of environmental protection.

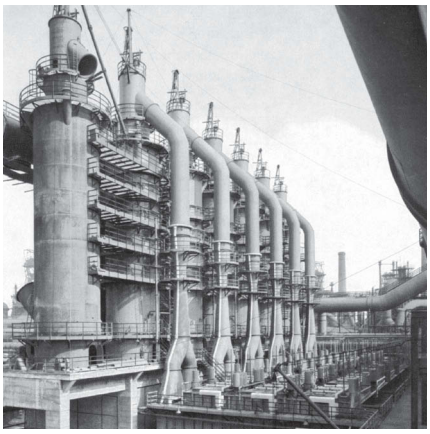
We will continue to maintain this standard in the future: Through persistent research based on decades of experience in the industry and a comprehensive specialized know-how.

1924 Dry electrostatic precipitator for blast furnace gas

Front: Fan cooler, capacity 200 m³/h
Rear: Countercurrent cooler, capacity 400 m³/h



1923 First large-size electrostatic precipitator for dust arresting in blast furnace gas



1958 Wet electrostatic precipitator for blast furnace gas

Research and development

Based on decades of experience in the fields of dry and wet electrostatic precipitators, wet absorbers, cyclone precipitators and fabric filters, EWK Umwelttechnik began several years ago to utilize its experience from individual industrial branches for new areas of application.
Since information on emissions is often unavailable either in sufficient quantity or quality, and since the economic efficiency of a purification system is of significance, various mobile trial plants are available for practice-related tests.

Before the respective uses the trial plants can be adapted to the individual requirement according to our experience and calculations based on the available knowledge about the waste gas composition. This permits testing of the envisaged large scale solution in practice. Optimization during the test performance can further increase the designed precipitation capacity in almost all processes.

Moreover, the use of optimized trial plants often demonstrates that excellent results can be achieved especially by combining various plant systems. Testing in the preliminary stage of a large scale plant, particularly in case of partially unknown or greatly varying emissions, results in optimum economic solutions.

Mobile trial wet absorber / wet electrostatic precipitation plant,
waste gas volume 2000-3000 m³/h.
This plant is equipped with complete EMSR technology and can be fitted with various wet absorbers.

Mobile trial scrubber,
waste gas volume 2000-3000 m³/h.
The system is set in a container frame and includes complete electronic instrumentation, control and regulating (EMSR) technology, dosing station and waste gas fan.

Index

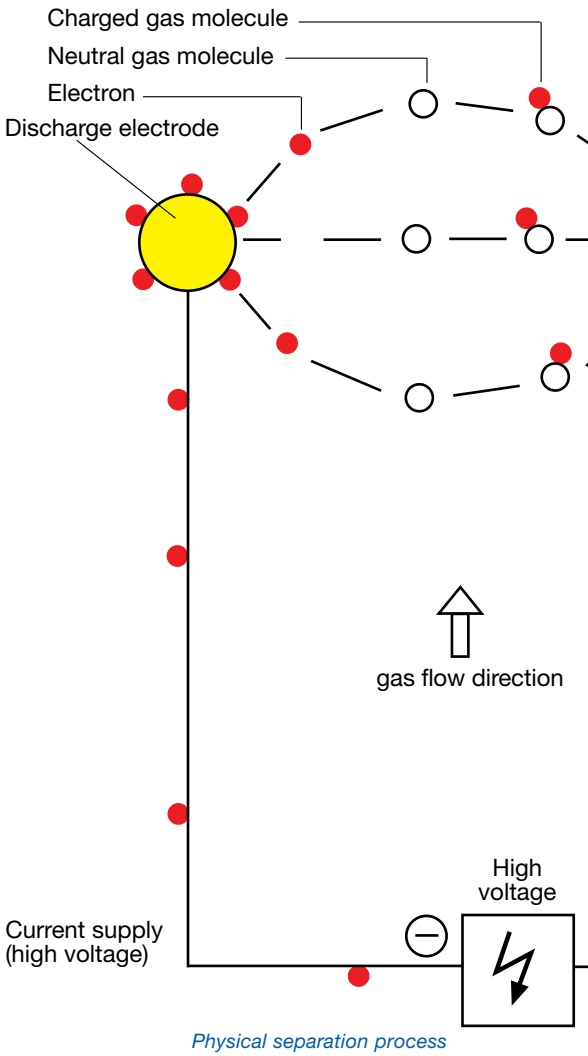
Mobile trail catalytic plant with catalytic soot filter and DeNO$_X$ catalyzer,
waste gas volume 500 Am³/h.
The trial plant can be equipped with up to 3 rows of DeNO$_X$ - or oxidizer elements.

Safe and economical dry dust collection

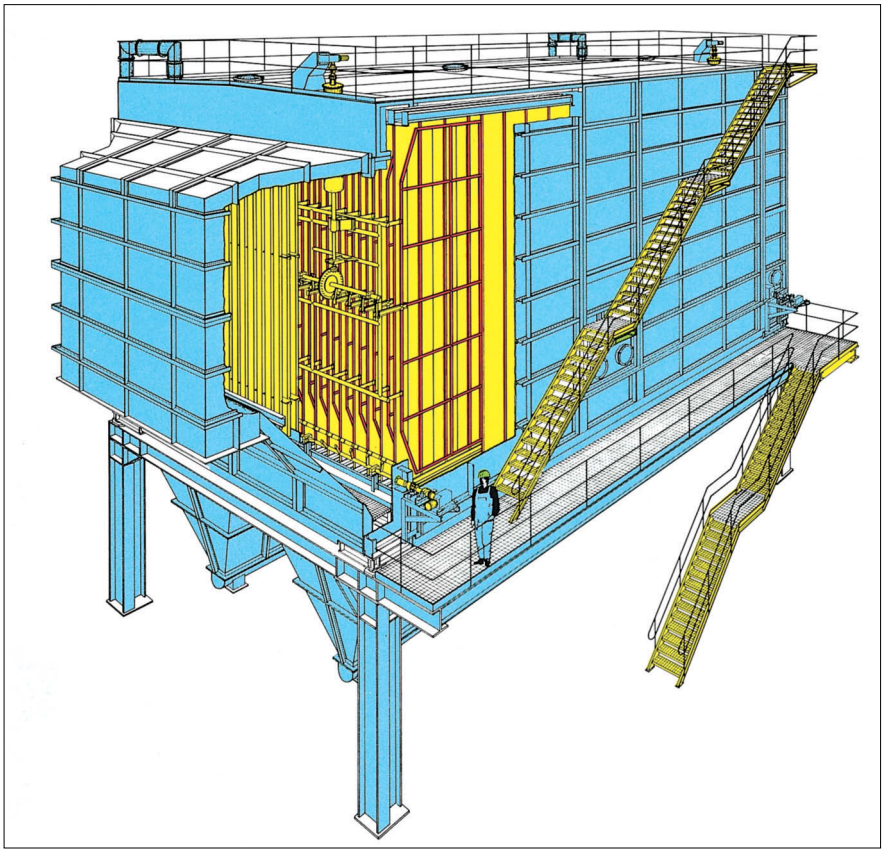
Dry electrostatic precipitators
Dry type electrostatic precipitators are today considered the most economical system for solving dust collecting problems, as any dry dust generated can be disposed of without any difficulty.

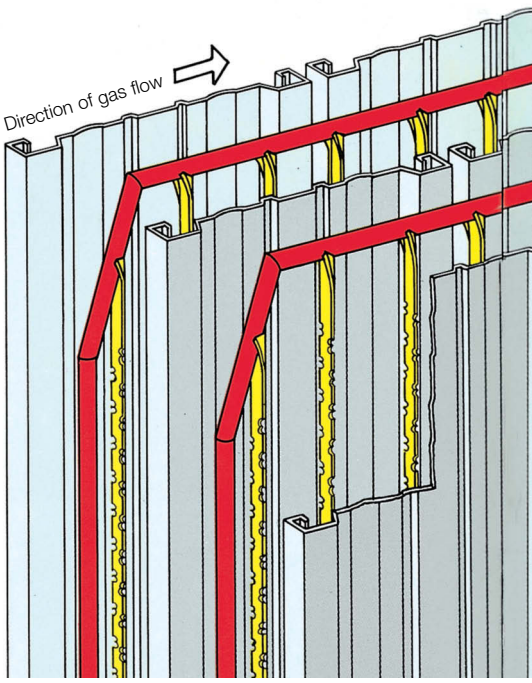
Proven technology in connection with high-grade materials ensures a long service life and minimal maintenance effort for EWK electrostatic precipitators.
We guarantee best quality and outstanding properties for every detail of our plants:

- the bicoronary band electrode
  – uniform corona formation over the entire length
  – welded into a tubular frame to provide safety against breakage
  – no deflection towards the precipitation electrode
- the collecting electrode
  – dust collection spaces at both ends
  – exact plate guidance
  – high stability
- the transverse separators
  – for additional electric and mechanical dust separation
- the rapping device
  – plate rapping by lifting and disengagement of the first plate
  – discharge frame rapping by drop hammers
  – all components enclosed in the filter housing, no openings in the filter wall, prevention of corrosion damage

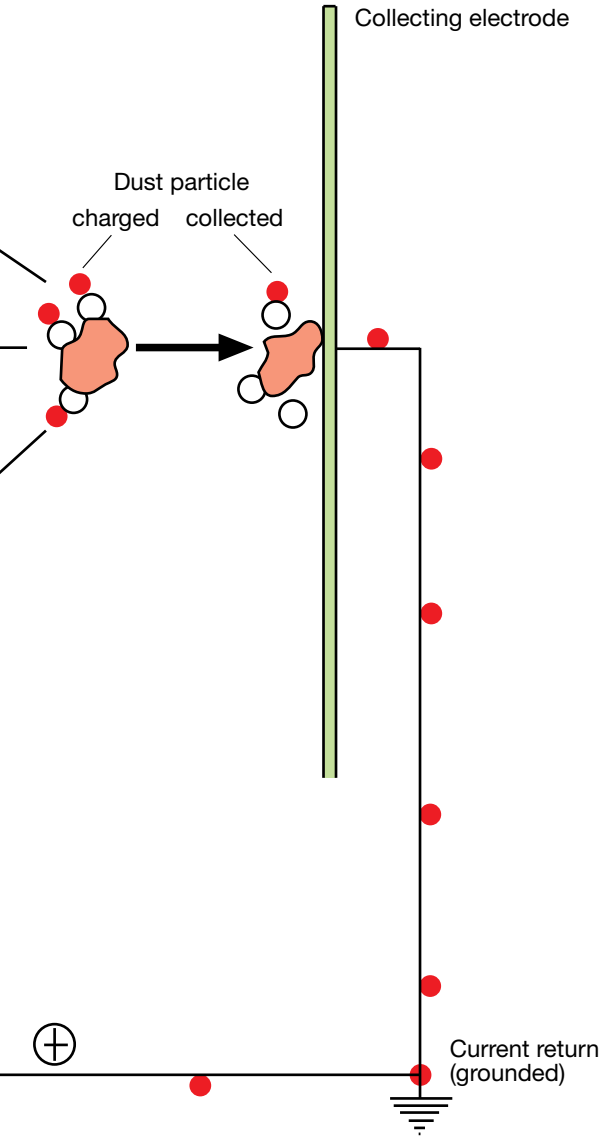


Physical separation process


Horizontal dry type electrostatic precipitator



BICORONA electrodes, collecting electrodes and transverse separator

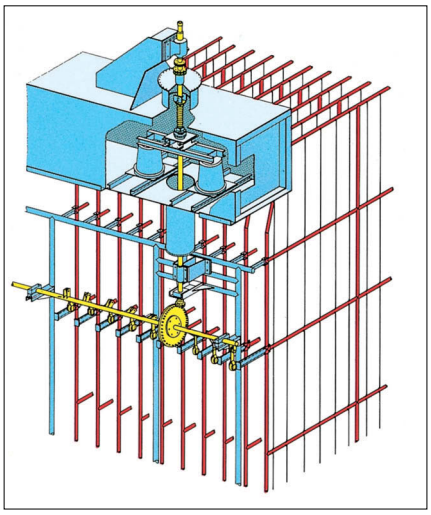


Applications:

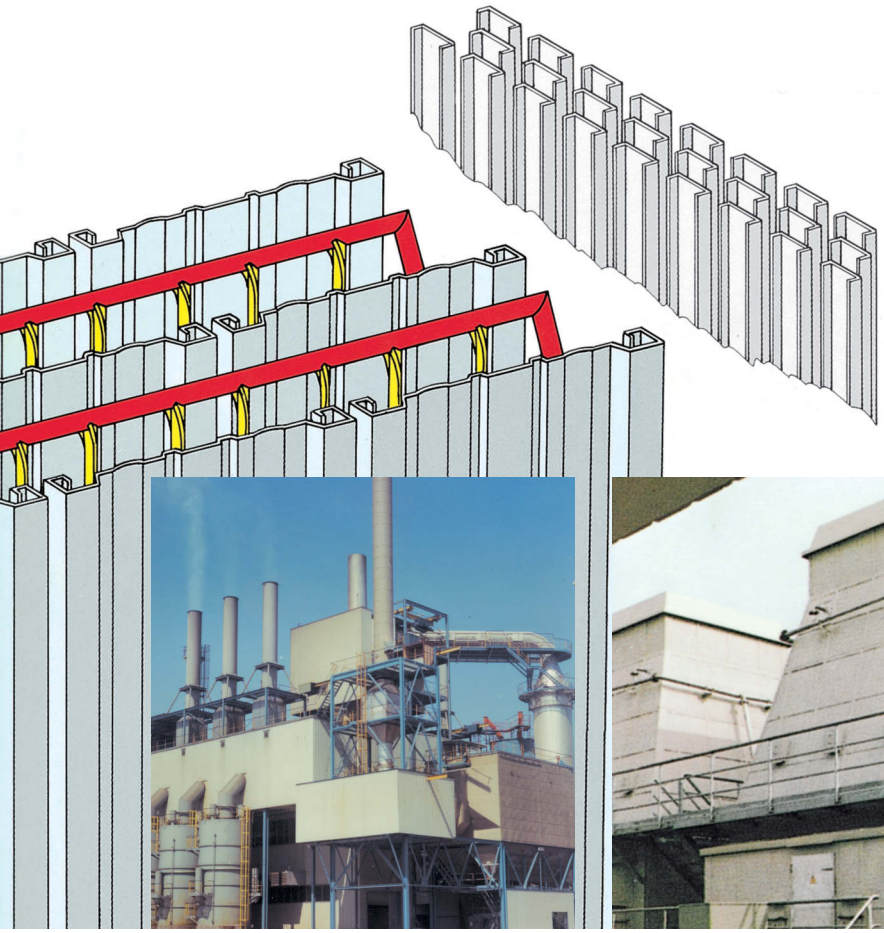
- Power station
- Wood and biomass combustion
- Waste and sludge combustion
- Glass smelting pots
- Coal and lignite drying systems
- Hot gas acid regeneration
- Cement, lime and gypsum industries
- Cupola furnaces
- Sintering plants and many more

Also in connection with noxious gas absorption.

Dust collecting of cupola furnace waste gases



Discharge electrode rapping feature



Glass smelting pot dust arresting

Smokestack heads of vertical vapor electrostatic precipitators downstream from lignite drying plant

Two-stage hot gas dry type electrostatic precipitator for glass smelting pot

High efficiency by wet cleaning

Wet electrostatic precipitator
Wet type electrostatic precipitators are used where aerosol-solid mixes have to be separated with high efficiency. Today wet type electrostatic precipitators with a high cost-benefit ratio are considered especially for separating:

- aerosols
- fine dusts
- blue haze
- paint mists
- resin vapors
- odours

Our plants are characterized by a number of outstanding properties:

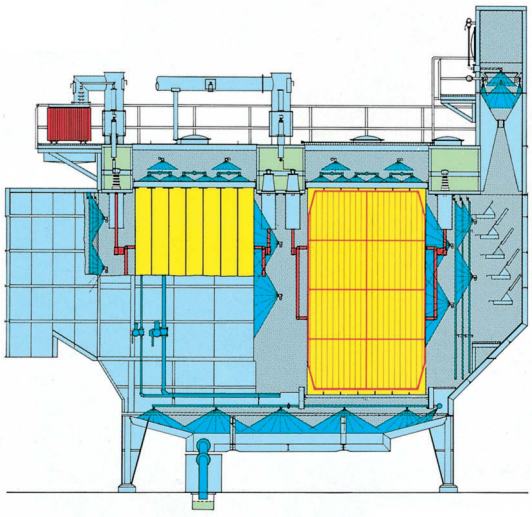
- high separation rate, clean gas solid content up to 0,05 mg/m³
- optimum spray water input for saturation of gas and complete wetting of the separation area
- effective interval flushing of the separator and precipitator bottom
- complete pumping system for circulating water and waste water
- minimum consumption of fresh water
- coating of internal walls and bottom for corrosion protection; discharge and collecting electrodes or entire system of stainless steel or FRP, if required.

Applications:

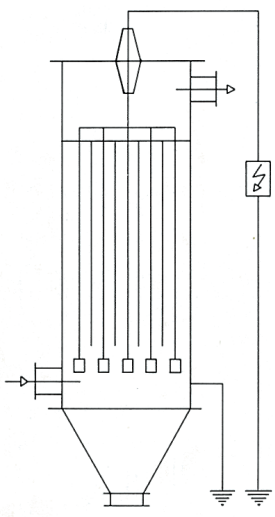
- Coking plants: coke oven process gas
- Mineral wool industry: forming plenum and curing oven waste gas
- Waste incineration: aerosol separation downstream from wet scrubber
- Plastic and textile industry: aerosol and oil mist separation
- Chipboard industry: dryer and press exhaust air
- Meat smoking plants: smoke-chambre exhaust
- Smith industry: graphite-oil mist from forging press
- Varnishing plants: particle, aerosols from wet cabin
- Liquid waste incineration: aerosol separation after wet scrubber

View into the separation area of a horizontal electrostatic precipitator

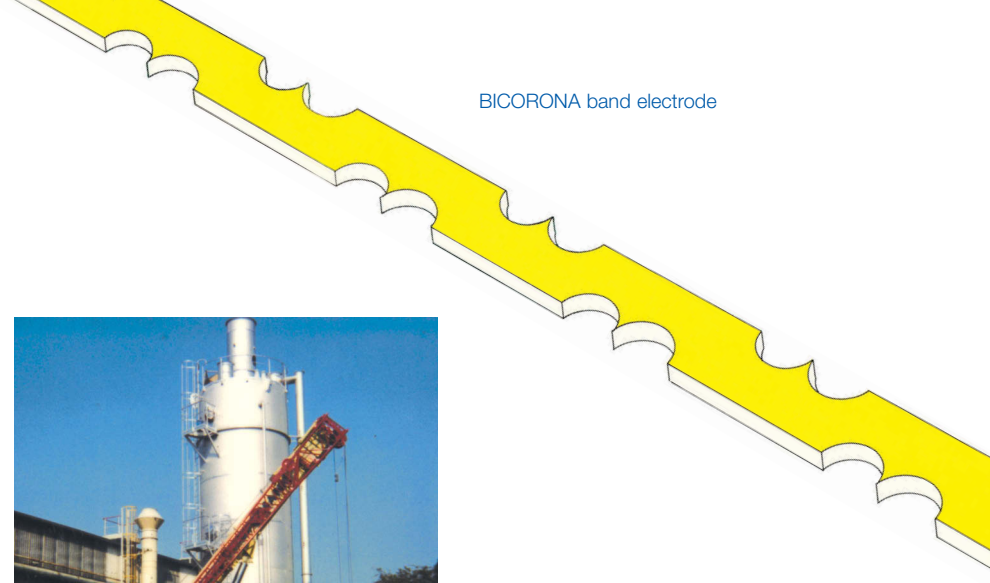
Horizontal electrostatic precipitator for curing oven and forming plenum waste gases each 100,000 Am³/h



Horizontal wet type electrostatic precipitator

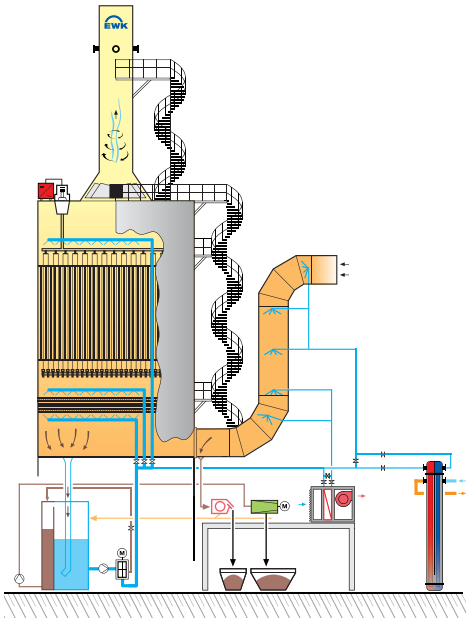


Vertical wet electrosatic precipitator

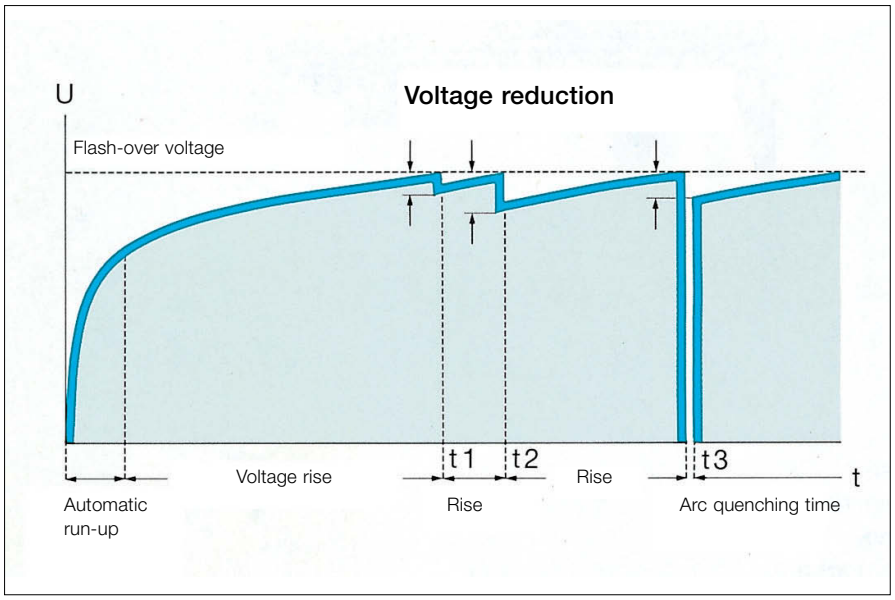


Vertical wet electrostatic precipitator for aerosol separation in the plastic industry

Vertical round type electrostatic precipitator for coke oven gas



Vertical wet electrostatic precipitator with closed absorbent cycle and heat recovery system



Typical control characteristics of a high voltage d.c. supply system

For the high-voltage supply of our electrostatic precipitators we use high voltage d.c. supply systems with electronic controllers and thyristor regulators.
Advantages: Short control periods, high efficiency, adaption to all service conditions, long service life.

Optimum solutions for individual dust collecting problems

Fabric type filters

Fabric type filters are an alternative to electrostatic dust-collecting. In many production areas, the manufacture of the products is connected with the development of environmentally hazardous materials and substances. Characteristics of such waste gases are components of SO_3, SO_2, HCl and HF generated singly or often in combination with low until very high fine dust content and toxic matter too.

We are able to develop the appropriate filter systems for the most varied areas of dry dust-arresting and material recovery. We can react individually to your dust-arresting problems with a variety of filter designs in different dimensions and various lengths and filter media. In many cases space and cost-saving filter cartridges can be used instead of elaborate filter bags.

Applications:

- Furnaces and incinerators
- Glass, ceramic, building materials industry
- Foundries and smelting plants
- Cement and lime industry
- Metal working industry
- Rubber and plastic industry
- Iron works and steel mills
- Pulp and paper industry
- Waste management
- Galvanic industry
- Wood industry
- Chemical/pharmaceutical industry

Cartridge filter for a sand blasting plant 40,000 m³/h

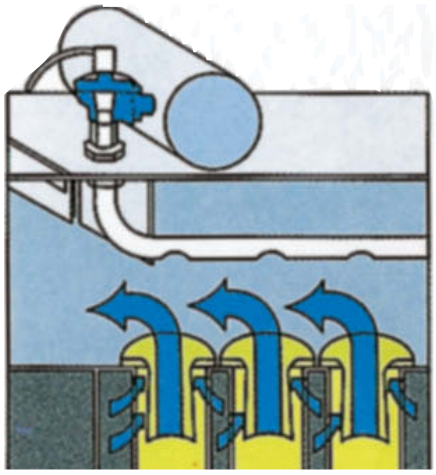
The EWK jet-pulse cleaning

It can be activated with the JP-tronic system either on time interval or on the differential pressure.Therefore a strong compressed-air impulse of 0,1-0,3 sek is injected into the filter cartridge / filter bag. The cluster injector is supporting the cleaning impulse. Through the puff up of the filter element with simultaneous air-counter-flow the dust cake is cleaned of efficiently.

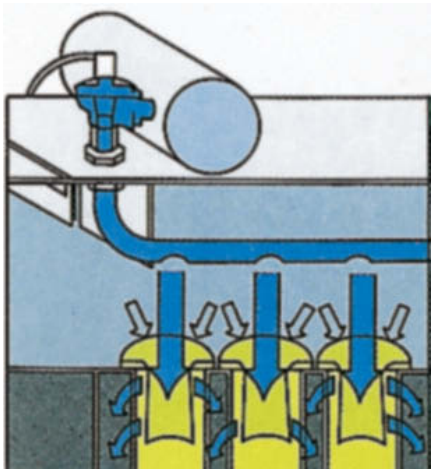
Advantages

- Cleaning cycle and length of jet impulse are adjustable in wide ranges
- Continous cleaning or cleaning depending on differential pressure is possible
- Cleaning on time interval if needed
- Low compressed air consumption
- Less wear

a) Filtering process
Systematic representation of the filtering and cleaning process. During the filtering phase, the dust particles are separated on the outside of the filter elements in which the flow runs from the outside to the inside.



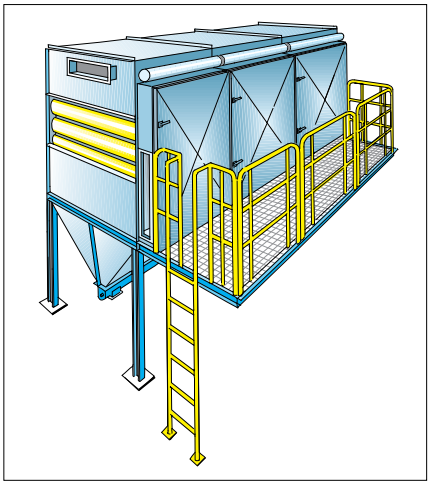
b) Bag cleaning
The filter elements are supplied with compressed air at supersonic speed by aid of cluster injectors. Additional secondary air returned from the clean air space provides for optimum flushing and cleaning of the filter elements. The filter elements can be reused for filtering after cleaning.



The round filter
with corresponding bursting discs is suitable mainly for applications with a increased risk of explosion.

The round design enables an economical construction with a high pressure resistance.

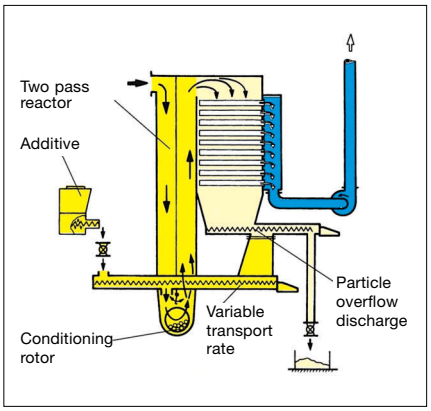
The oval bag filter
is a fabric filter with horizontal placed filter elements. It is suitable for offline cleaning as well as for online cleaning. Ideal for applications with limited space in height and area.



The in-line filter
is often designed as a chamber filter which is preferred for offline cleaning. Thereby the individual chambers are isolated from the gas stream by flaps during the cleaning cycle.

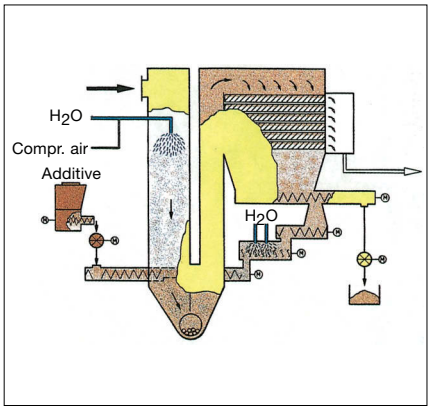
Dry sorption with the LÜHR conditioning rotor-recycle process
By admixture of additives like calcium-hydroxide $Ca(OH)_2$ and/or activated charcoal into the gas stream, gaseous emissions, for example HF, HCl, So_x, Hg as well as PCDD/PCDF can be bound to the adsorbing agent and then collected in the following bag filter. Thereby the conditioning rotor-recycle process has been proved as a reliable system with a high over-all efficiency.

Advantages
- The process allows operation with a high recycling rate of additives even if there are large amounts of problematic particles like $CaCl_2$ in the gas stream.
- The conditioning rotor prevents the clog up of the recycled material and ensures a homogenous mixing of additives in the gas stream.
- Reliable observance of the required emission limits in the clean gas also in continous operation is ensured.
- A high utilization coefficient of the additives reduces the running costs.



Dry sorption

Bag filter with dry sorption in a termal power plant with contaminated wood firing



Conditioned dry sorption

Environmental protection can also be conomical

Scrubber / heat recovery

Although scrubbers range among the simplest dust-arresters, they can be used in a multitude of applications. They do not only serve as dust removers, but are also used as gas coolers (quench), gas scrubbers for noxious gas removal, or for liquid input of absorbent substances for bonding noxious matter.

Because of today's high requirements in respect of the clean gas quality and/or of the overall-energy-concept, scrubbers are often combined with:

A. Wet electrostatic precipitators (WESP)

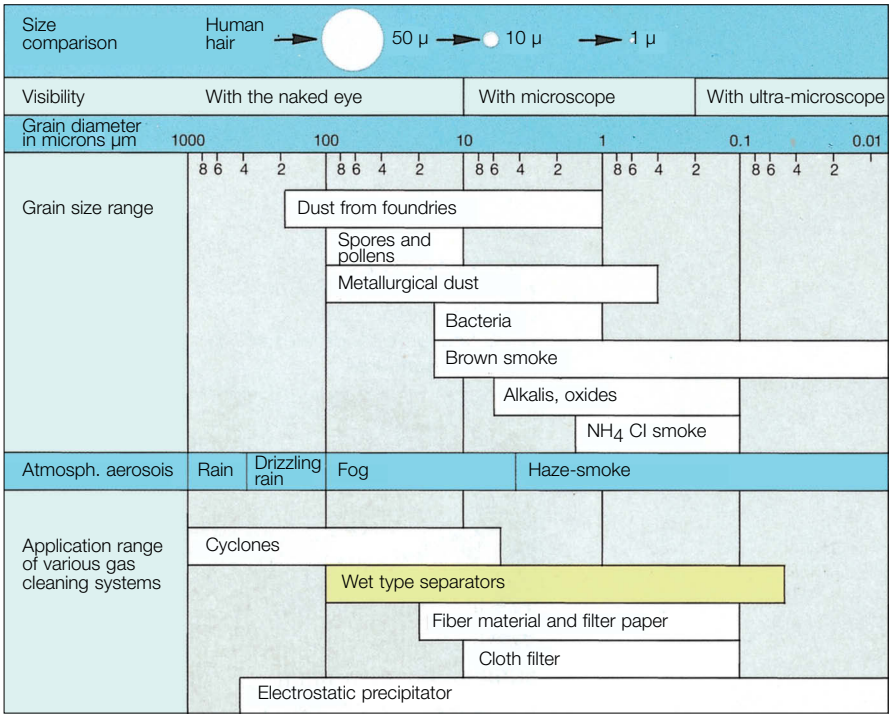
Thereby the scrubber serves as quench and pre-seperator for the WESP. With this system combination it is possible to obtain a high separation-efficiency of bigger then 99% even with a low pressure loss.

B. Heat recovery system

With integrated water/water or water/air heat-exchangers into the absorbent cycle of the scrubber it is possible to transfer large amounts of usable heat energy from the exhaust air into a water cycle or air stream. It is often possible to gain positive amortisation-calculations for the investment of a waste gas cleaning system.

The construction is always governed by their respective field of application. Possible examples are:

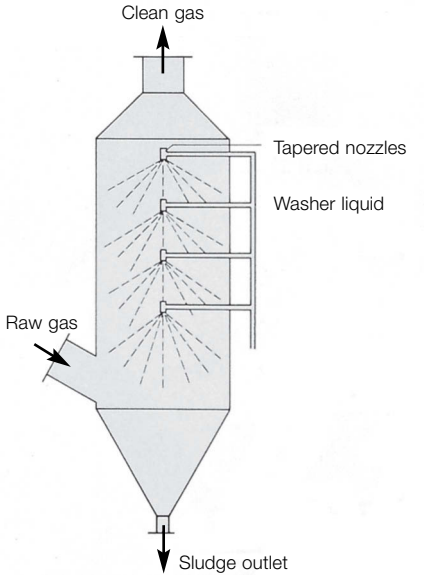
- Washer-coolers without internal installations
- Washer-towers with internal installations
- Venturi washers with free overflow
- Venturi washers with adjustable nozzle
- Venturi washers with adjustable throat
- Combinations of various design



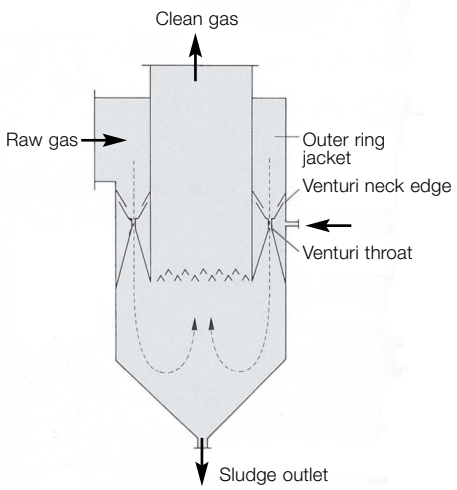
Possible uses of dust-arresters

Applications:

- Waste incineration
- Thermal residual waste utilization
- Chemical industry
- Wood panel industry
- Paint/textile industry
- Wet desulphurization plants
- Plastic processing industry
- Food industry
- District heating power plant



Washer cooler with central nozzles without internals

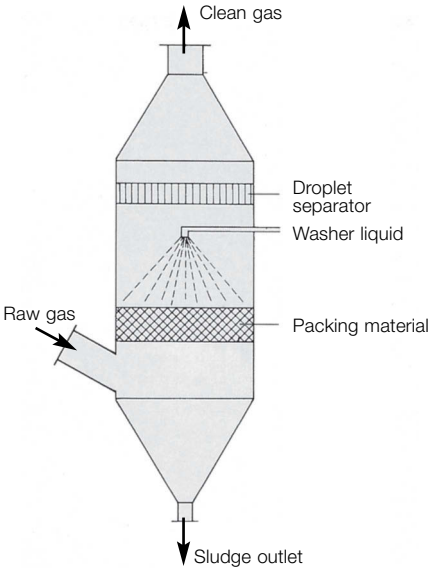


Venturi scrubber with free overflow, round construction

Flue gas desulphurization plant with spray tower, 25,000 m³/h, 200 °C

Clog-proof washer pack built as gas distributor in combination with a wet type electrostatic precipitator

Wet Electrostatic Precipitator (WESP) behind a wood-chip dryer for the pellet production with a heat recovery system to feed into the district heating network,
exhaust gas volume 78,000 Am³/h,
temperature 110 °C,
diameter 5,700 mm,
recovered heat energy 4-4.5 MW/h,
water outlet temperature 68 °C,
heat recovery rate 35-45%

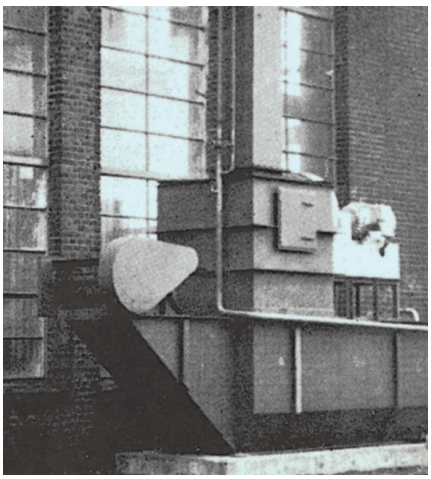


Washer tower with internals

Water/Water-heat exchanger

WESP behind a wood chip dryer,
volume 300,000 m³/h,
diameter 9,950 mm

Water/Air-heat exchanger for pre-heating the combustion air of a dryer,
air-volume 80,000 m³/h,
heat output 1,400 kW/h



Vario-Venturi scrubber with infinitely variable nozzle with fluid treatment for purification of exhaust gases from a non-ferrous smelting furnace

Catalytic technology for special solutions

Catalytic waste gas purification

Catalytic waste gas purification is one of the most important air purification technologies today.

The burning of biological fuels (wood, straw, biogas etc.) as well as of fossil fuels (oil, natural gas, heavy oil, coal) and industrial waste (solvent, sewage sludge, explosives, refuse and industrial residue combustion etc.) generates large amounts of the following substances even in the most advanced furnaces:

- Nitric oxide NO_X
- Carbon monoxide CO
- Hydrocarbon C_mH_n
- Dioxin/furan PCDD/PCDF

With the SCR catalyzer technology these air pollutants can be separated to a large degree and modified to N_2, CO_2 and H_2O.

The degree of efficiency amounts to:

- Nitric oxide 90-98%
- Carbon monoxide 92-98%
- Hydrocarbon 65-90%
- Dioxin/furan 80-95%

The catalyzers we use are designed for a long service life of 20,000-40,000 operating hours.
Used catalyzers are taken back for reprocessing or disposal.

Modular construction

The EWK reactors consist of modules set in stainless steel casings.

First stage

The NO_X conversion occurs in a reduction catalyzer. The active material is incorporated in ceramic honeycomb elements.
As reagent liquid urea solution or ammonia water is used as well as ammonia gas.

Second stage

The dioxin/furan conversion occurs in an oxidation catalyzer. The active material is incorporated in the ceramic element.

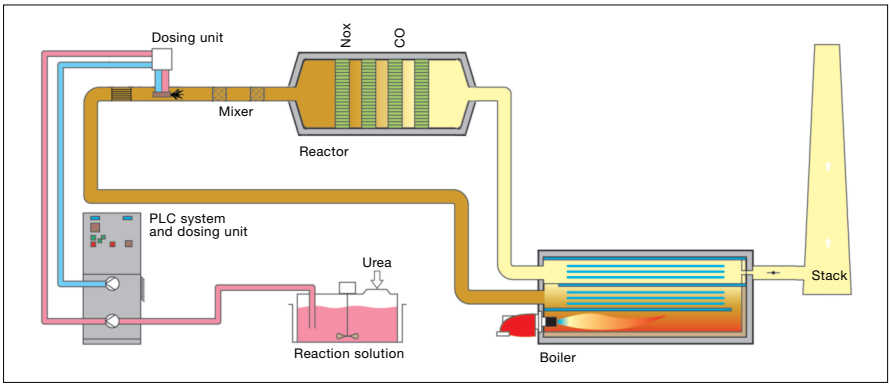
Third stage

The CO and C_mH_n conversion occurs in an oxidation catalyzer. The ceramic honeycomb element is coated with an active precious metal.

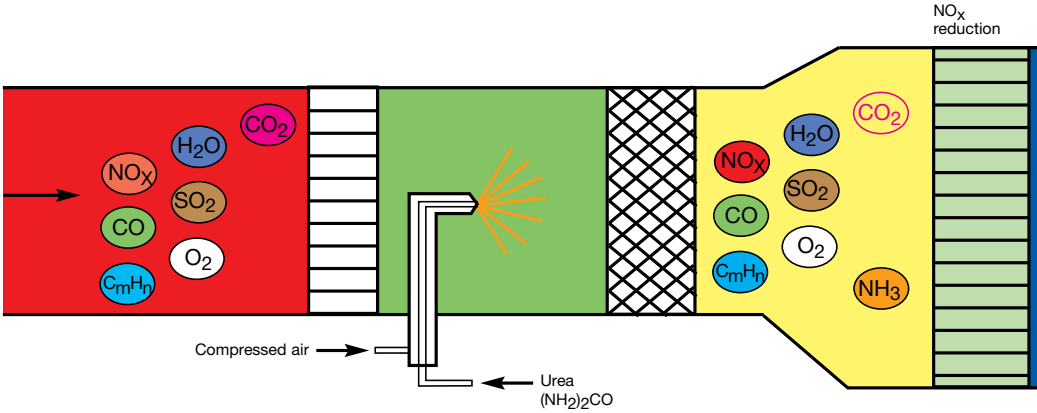
The individual stages are dimensioned according to the pollutant mix.
This allows an individual optimization of each plant to achieve the most economical cost-benefit ratio.

Applications:

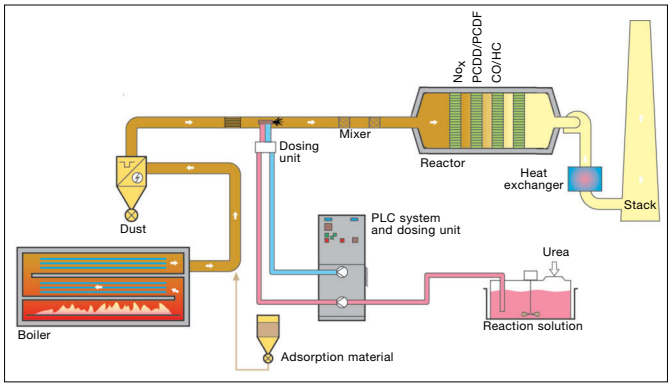
- Thermal power plants
- Waste incineration
- Acid pickling lines
- Waste wood incineration
- Explosives incineration
- Diesel engines
- Crematories
- Chemical/pharmaceutical industry
- Textile industry
- Thermal residual waste utilization
- Various process air purification systems
- Greenhouses



Catalytic waste gas purification for oil (heavy, extra light) or gas furnace

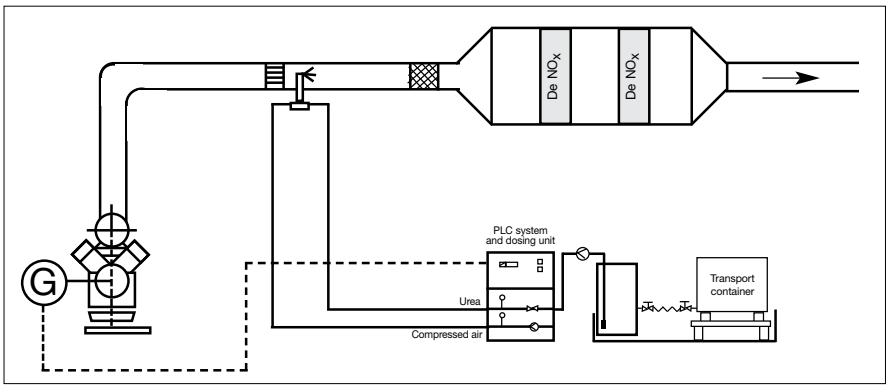


Reaction diagram



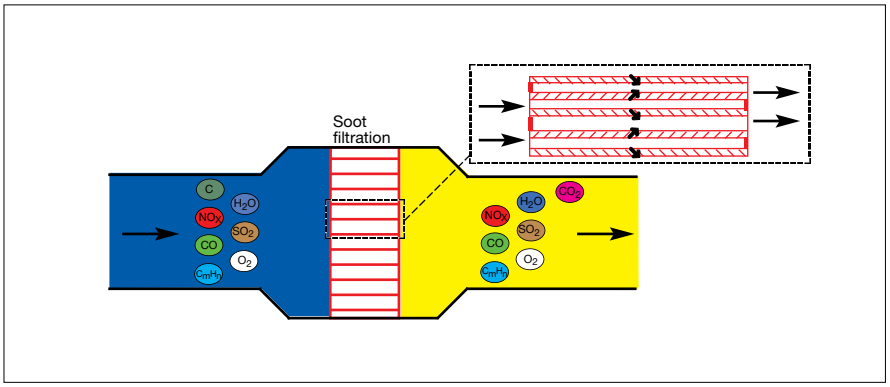
Catalytic waste gas purification for thermal residual waste utilization

DeNo$_X$ unit for 2 diesel engines, 21,000 m³/h



SCR catalytic converter for engines

DeNo$_X$ system for glass melting process, 21,000 m³/h



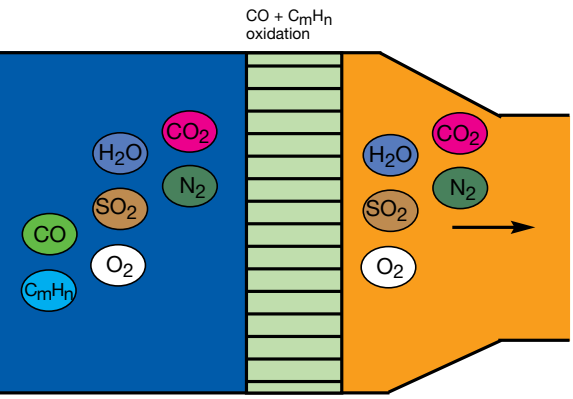
Reaction diagram of a fiber filter catalyzer

Fibre filter catalyzer

To precipitate the micro dust (soot) from combustion engines fiber cartridge filters are used.
Due to the catalytic coating of the fiber the soot is oxidized at temperatures of 360-480 °C.

Residual waste utilization

Residual waste utilization and process waste gases often generate pollutants such as SO_2, HCl, HF, Hg etc. At certain temperatures chlorine and hydrocarbon emissions lead to the formation of dioxin/furan. These can be converted to harmless gases by suitable catalyzers. The separation of SO_2, HCl, HF, Hg etc. can be performed by dry sorption with a downstream situated filter. This will protect the catalyzers from premature wear and guarantees compliance with the pollutant limits.



SCR catalyzer technology

is characterized by:

- Simple operation
- High operating safety
- Low maintenance effort
- Low operating costs
- Wide temperature range 180-550 °C, depending on pollutant
- High conversion rate of up to 98%
- No additional emissions
- Low ammonia slip
- Existing systems are easy to upgrade

Sensible use of water as a raw material

Water re-cooling systems

The plastic type small cooling tower series ZWK-W

The use of high-performance axial flow fans makes the small cooling towers of the ZWK-W series particularly efficient. They are used in the dry cleaning industry, for small air conditioning and refrigeration units and wherever small amounts of cooling water need to be cooled and the heat generated by industrial processes has to be discharged.
The main elements of the ZWK-W small cooling towers are made of glass fiber reinforced polyester and of PVC or PP.

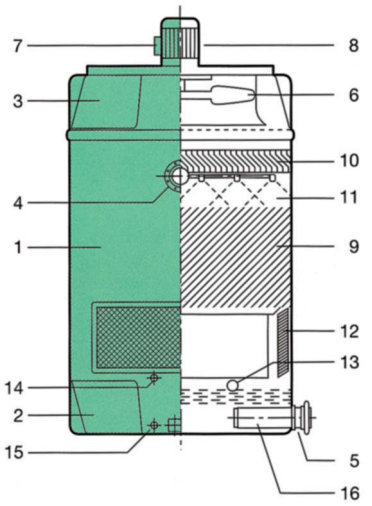
Operating mode of the ZWK-W cooling tower

In the cooling tower the warm water trickling down from nozzles is brought into close contact with the air of ambient temperature drawn in by the fan. The packing material of PVC or PP serves as a contact surface. Upon contact with the air some of the water trickling down evaporates and cools off. It is interesting to note that water can be cooled down below the ambient temperature.

The cooling depends primarily on the temperature and relative humidity of the ambient air.

Depending on the location, the warm water can be cooled down to approximately 22-24 °C.
The lower the desired water temperature, the larger the cooling tower will have to be.

Our economical, frequently proven design concept offers high performance and sturdy construction at considerable cost savings.



1 *Casing*
2 *Cold water tray*
3 *Fan casing*
4 *Warm water intake*
5 *Cold water outlet*
6 *Axial flow fan*
7 *Drive motor*
8 *Motor mounting*
9 *Tower packing*
10 *Mist collector*
11 *Spraying system*
12 *Air intake louver*
13 *Float valve*
14 *Overflow socket*
15 *Drain socket*
16 *Strainer basket*

Zschocke fan cooler, series ZWK-W 80 to 270, cooling capacity up to 0,843 MW/module. By connecting several modules the cooling capacity can be expanded as required.

System combinations

The increased legal and technical requirements on a waste gas cleaning system often lead to a system combination of different waste gas treatment steps. While a simple scrubber may have been sufficient formerly, a combination of multistage scrubber, wet ESP and waste water treatment with heat recovery system is often required today. In other cases multicyclones have to be replaced or complemented by dry sorption with bag filter and $DeNo_X$ units.

With the selection of the most suitable treatment system it is of great importance to find an optimum solution with respect to economical and ecological considerations. For budgetting the operation cost are often more important than the investment costs.

Two-stage WESP system behind forging press with integrated ultra-filtration for recyclable material

Waste gas cleaning system for 2 OSB-dryer System combination of quench,wet scrubber, dual wet electrostatic precipitator with stack up to 60 m

$DeNo_X$ catalytic system for glass smelter; 2 x 152,300 m³/h

Mineral coal heating plant, combined installation system comprising exhaust gas heat recovery, flue dust collection and wet desulphurization

2 lines with a two-stage WESP each with special FRP casing and high degree stainless steel internals behind liquid waste incineration, quench and scubber, volume each 37,000 Am³/h, efficiency > 99,5%

Wet electrostatic precipitator with biological water treatment system

Environmental protection is a tradition at EWK Environmental Engineering. Our plants, proven throughout the world in decades of operation, are the best evidence.

With this experience we develop and offer innovative technologies.

- Plant design
- Engineering
- Production
- Assembly
- Commissioning
- Maintenance/service

for:

- Electrostatic precipitators
- Fabric type filters
- Wet absorber/scrubbers
- Catalytic gas cleaning systems
- Heat recovery systems
- Water cooling towers
- System combinations

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