SUPPLIER OF EQUIPMENT
FOR ENVIRONMENTAL PROTECTION

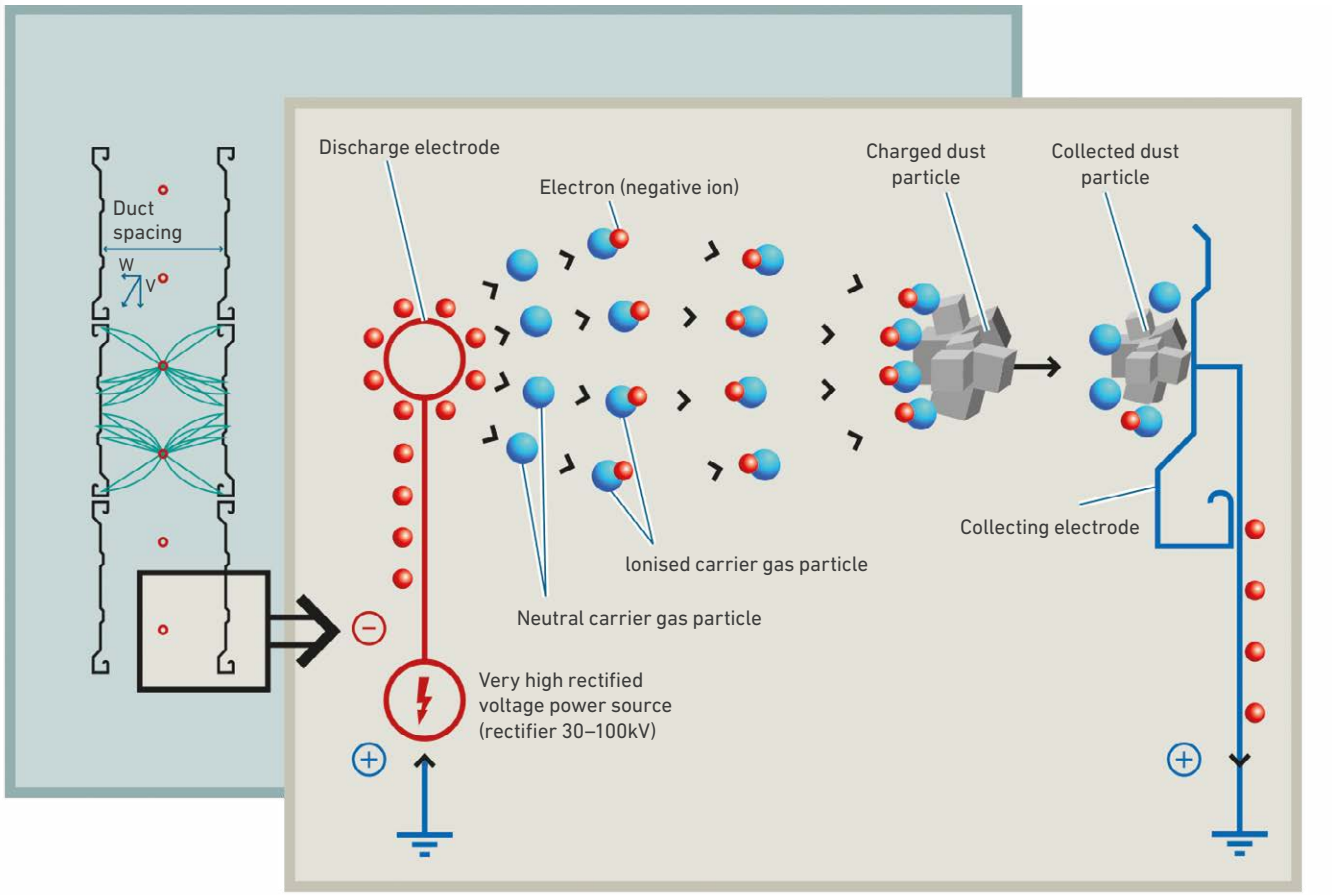
ELECTROSTATIC PRECIPITATORS

ZVVZ ENVEN ENGINEERING
Member of the ZVVZ GROUP

PRINCIPLE OF ELECTROSTATIC SEPARATION

ZVVZ-Enven Engineering, a.s. SUPPLIES DRY HORIZONTAL CHAMBER ELECTROSTATIC PRECIPITATORS (HEREINAFTER ELECTROSTATIC PRECIPITATORS) OF ITS OWN DESIGN UNDER THE EKO , EMO, EKF, EKG, EKH AND EKK BRAND NAMES.

PRINCIPLE OF ELECTROSTATIC PRECIPITATORS

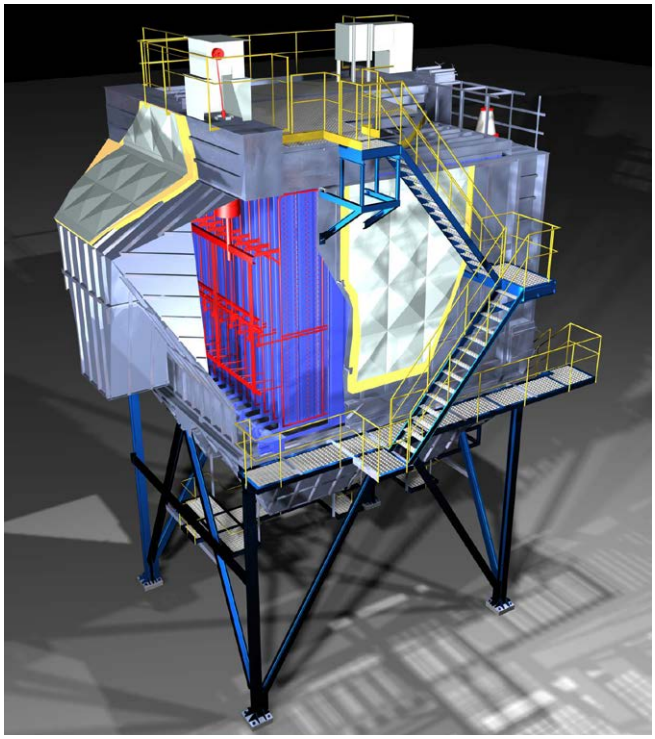


These electrostatic precipitators are highly effective and reliable devices for separating solid pollutants from waste and industrial gases, and their high separation efficiency guarantees low emission of pollutants into the environmental and fully meets the strictest environmental protection laws.

These devices are successfully implemented in power plants, heating plants, waste incineration plants, in the building industry during production of cement or lime, in the metallurgical industry, chemical industry and in other sectors that produce solid pollutants.

PRINCIPLE OF ELECTROSTATIC SEPARATION

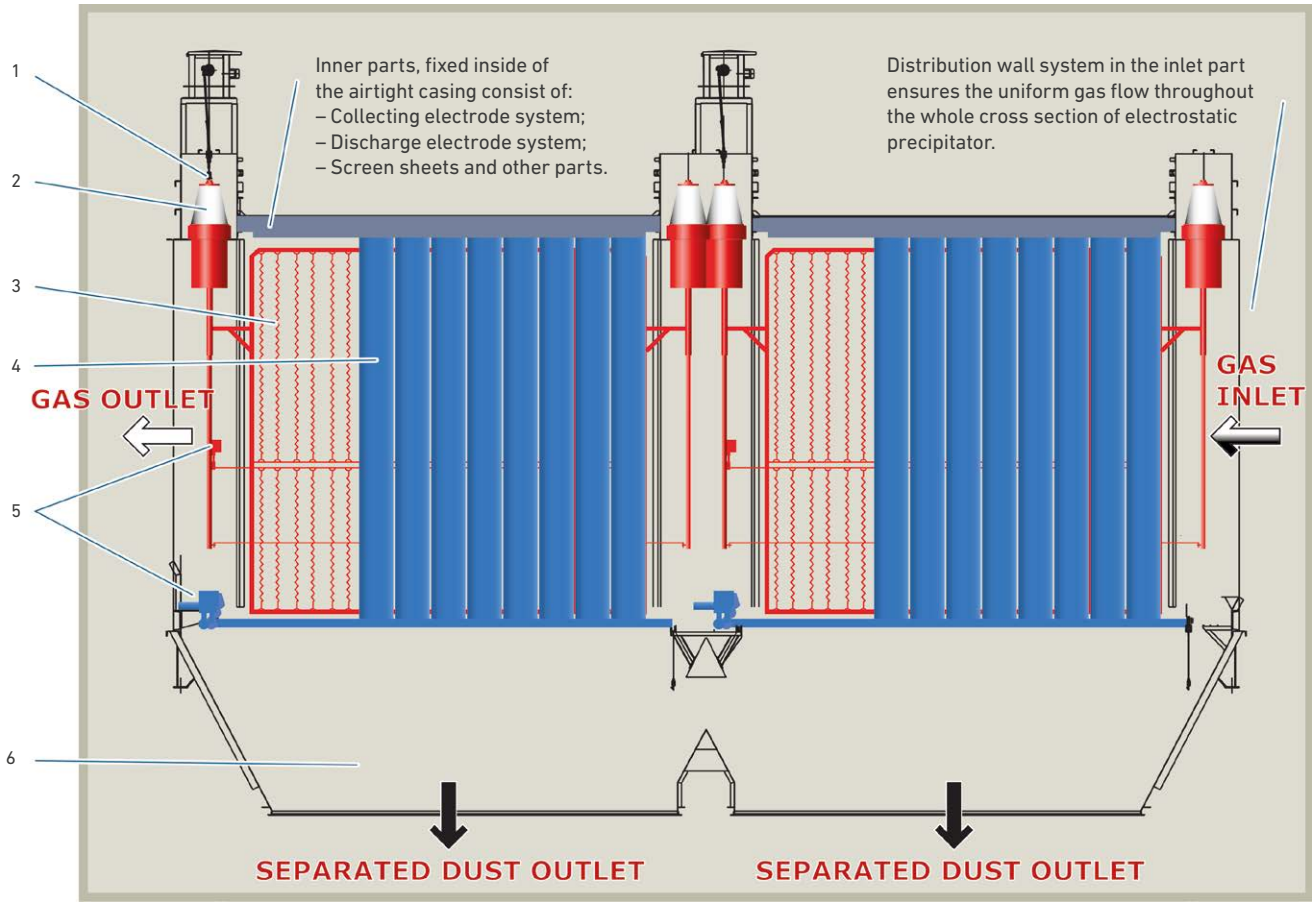
The principle of electrostatic separation is based on the



fact that flue gases containing solid pollutants (hereinafter SP or dust) flow through a inlet part into the active part of the electrostatic precipitator, which consist of a system of collecting electrodes and discharge electrodes. A non-homogenous electrical field is created between the earthed collecting electrodes and the powered discharge electrodes by supplying a very high, rectified voltage of negative potential. The intensity of this field creates a so-called corona discharge – radiation of a high number of free electrons into the flue gas. These free electrons bombard the solid dust particles in the gas, which causes these SP to be electrically charged. The effect of the high-strength electrical field attracts charged SP particles to the surface of the earthed collecting electrodes, where they collect. Mechanical rapping provides removal of this layer of SP. The cleaned gas leaves through the precipitator outlet part, duct and fan into stack and then into the environment or is directed away for further technological processing. To make the process more effective and to achieve greater efficiency of separation, the electrostatic precipitators are designed with multiple independent electrical fields, arranged in precipitator casing behind each other in series.

ELECTROSTATIC PRECIPITATOR DIAGRAM

1 Rectified very high voltage is supplied to the discharge electrodes through their suspension system
2 The discharge system in each electrical field is suspended on conical supporting insulators
3 The discharge electrodes are attached in solid tube frames
4 The collecting electrodes are cold-rolled profiles made from deep-drawn metal sheet
5 The rapping systems use hammers and bumpers to regenerate (clean) the discharge and collecting electrodes in fixed cycles
6 The separated dust slides into the hopper of the electrostatic precipitator due to the rapping



COMPACT ELECTROSTATIC PRECIPITATORS

EKO electrostatic precipitators of compact design are intended for separating solid particles from small sources of dust pollutants of flow-rate volumes from 3 000 to 40 000 m^3/h.

These are divided by design into several compact functional units, which are delivered to the construction site assembled. Their size is chosen depending on transportation possibilities. Workshop assembly of functional units assures the high-quality of delivery and reduced installation time at the construction site.

MODULE ELECTROSTATIC PRECIPITATORS

EMO electrostatic precipitators of module design are intended for separating solid particles from medium sources of dust pollutants of flow-rate volumes from 15 000 m^3/h to 120 000 m^3/h.

Their design is divided into smaller construction modules, which are transported to the construction site as assembly units and assembled to their final size on-site.

ELECTROSTATIC PRECIPITATORS MEDIUM AND LARGE SOURCES OF DUST POLLUTANTS

EKF, EKG , EKH and EKK electrostatic precipitators are supplied in a wide range of dimensions, which are always given as a combination of width, length and height of the active space of the electrostatic precipitator.

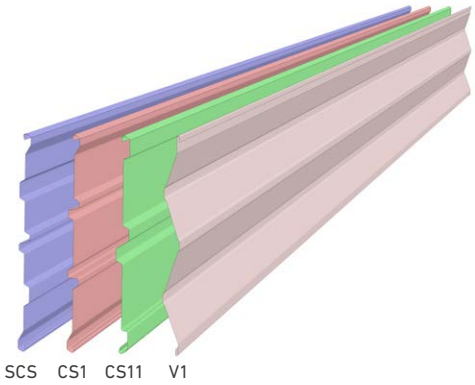
The internal, active parts of the electrostatic precipitators are designed so that they can be used for repairs and renovations of most available types of electrostatic precipitators.

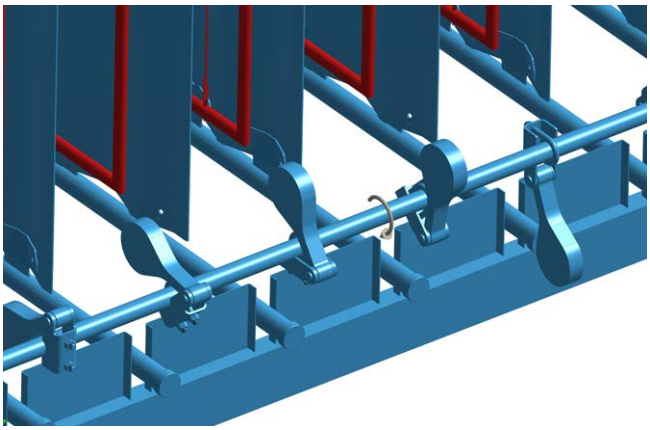
COLLECTING ELECTRODES

The collecting electrodes are designed so that they are sufficiently rigid and at the same time to utilize as much as possible the envelope curves of the effects of the corona discharges generated from the discharge electrodes. These electrodes are made by cold-rolling from deep-drawn metal sheet of a thickness of 1,25 mm to 1,5 mm.

TYPES OF PROFILES FOR THE COLLECTING ELECTRODES:

› V1 (width 640 mm – for EKH, EKK, EKG, EMO, EKO)
› CS11 (width 640 mm – for EKH, EKK)
› CS1 (width 640 mm – for EKG, EMO, EKO)
› SCS (width 640 mm – for EKF, EMO, EKO)

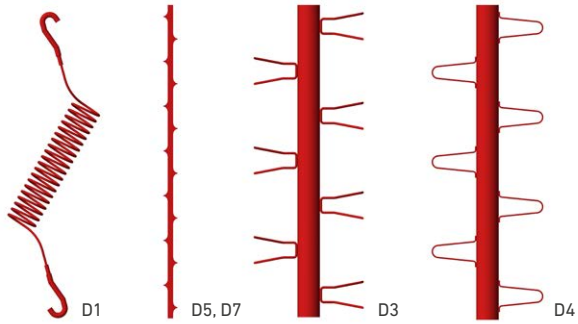




SUSPENSION AND RAPPING

The collecting electrodes are freely attached to suspended supports on pins. They are rigidly connected together in their bottom section in the rapping beams, by pre-tensioned joints. The lower rigid attachment and upper freely suspended attachment guarantees excellent transfer of energy from the rapping hammers to the entire row of collecting electrodes. Rapping is carried out systematically at regular intervals and assures removal of the collected dust from the electrodes into the hoppers.

DISCHARGE ELECTRODES



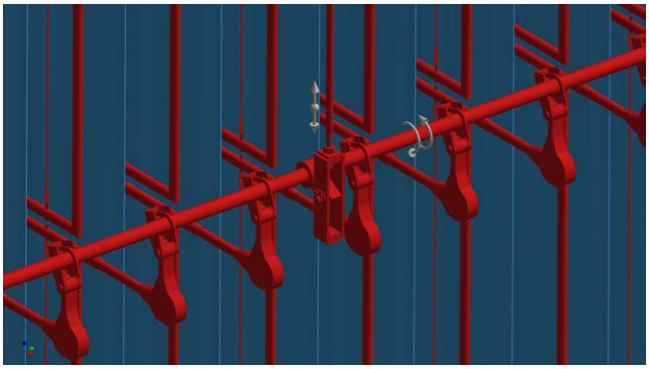
TYPES OF DISCHARGE ELECTRODES:

› D1 – spiral
› D5, D7 – pointed (ISODYN)
› D3 – rigid pointed
› D4 – rigid smooth

SUSPENSION AND RAPPING

The discharge electrodes are fixed in tube frames using pins or by welding. The discharge electrodes system of each field is electrically isolated from the earthed parts of the precipitator casing by porcelain conical insulators.

The individual frames for the discharge electrodes and the electrodes themselves are cleaned by mechanical rapping, which is caused by lifted hammers attached to a shaft. Rapping is carried out systematically at regular intervals.



SUMMARY OF TYPES AND IDENTIFICATION OF ELECTROSTATIC PRECIPITATORS

DIMENSIONAL SPECIFICATION	MARKING OF ELECTROSTATIC PRECIPITATOR	APPLICATION RANGE (volume, temperature, underpressure of gas)
2R = 0,25 m; 0,3 m 2 ≤ H ≤ 3 m	EKO S-PK-H-PS-2R/LS-V-TD1-TD2	3 000 to 40 000 m^3/h ≤ 300 °C (≤ 450 °C) ≤ 4,5 kPa
2R = 0,25 m; 0,3 m; 0,35 m 3,5 ≤ H ≤ 5,5 m	EMO S-PK-H-PS-2R/LS-V-TD1-TD2	15 000 to 120 000 m^3/h ≤ 300 °C (≤ 450 °C) ≤ 4,5 kPa
2R = 0,3 m 6 ≤ H ≤ 15 m	EKF S-PK-H-PP-PS-t-p-V (application exceptionally only for reconstructions)	40 000 to 1 800 000 m^3/h ≤ 300 °C ≤ 15 kPa
2R = 0,35 m 6 ≤ H ≤ 15 m	EKG S-PK-H-PP-PS-t-p-V	40 000 to 1 800 000 m^3/h ≤ 300 °C ≤ 15 kPa
2R = 0,5 m and combination 0,4 – 0,5 m 6 ≤ H ≤ 16,5 m	EKH S-PK-H-PS-LS-V-TD1-TD2	60 000 to 3 600 000 m^3/h ≤ 300 °C (≤ 450 °C) ≤ 15 kPa
2R = 0,4 m and combination 0,3 – 0,35 – 0,4 m 6 ≤ H ≤ 16,5 m	EKK S-PK-H-PS-LS-V-TD1-TD2	50 000 to 3 600 000 m^3/h ≤ 300 °C (≤ 450 °C) ≤ 15 kPa

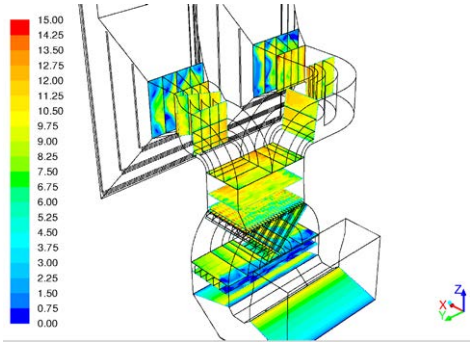
2R electrodes duct spacing (m)
S casing design (simple/double/triple)
H active height (m)
PK number of ducts per total width of the casing (pcs)
PS number of fields behind each other (pcs)
PP number of collecting electrodes behind each other in one field (pcs)
LS active length of one field (m)
t design temperature of the precipitator (°C)
p design underpressure of the precipitator (kPa)
V arrangement of the hoppers
TD1 type of inlet part
TD2 type of outlet part

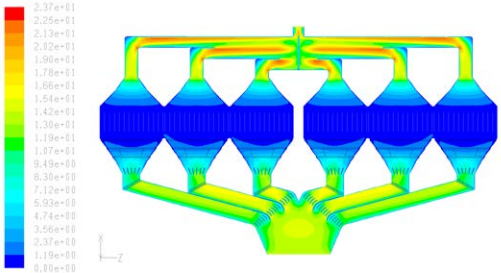
MODELLING THE FLOW OF GAS

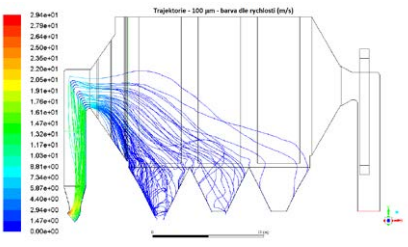
It is important to achieve the appropriate flow of gas and dust particles inside the electrostatic precipitator for its correct function. The results of mathematical modelling of the flow of gas (so-called CFD modelling) are utilised when designing the electrostatic precipitator and when planning the ducting routes.

USE OF GAS FLOW MODELLING

- Development and modification of air-handling systems
- Design and modification of ducting networks
- Resolution of issues arising during operation of the technological system
- Design of mixing chambers for gases at various temperatures and dust concentrations
- Multi-phase flow – with solid particles







POWER SUPPLY AND SYSTEM FOR CONTROLLING THE ELECTROSTATIC PRECIPITATORS

VERY HIGH RECTIFIED VOLTAGE POWER SOURCES

The electrostatic precipitators are powered by direct-current from very high rectified voltage power sources.

CHARACTERISTICS OF THE POWER SOURCES

- Single-phase silicon rectifiers with high-voltage transformer and metering circuits
- Single-phase silicon rectifiers with high-voltage transformer connected to a pulse generator and metering circuits
- Three-phase silicon rectifiers with high-voltage transformer with switched high-frequency converter and metering circuits

THE POWER SOURCE CONTROL SYSTEM ASSURES

Regulation of the power source

- Limitation of the maximum supply voltage
- Limitation of the maximum supply current
- Configuration of automatic regulation parameters
- Signalisation of a short-circuit in the electrostatic precipitator
- Suppression of the effects of a back corona in the electrostatic precipitator
- Semi-pulse power supply with optional number of periods
- Registration of the number of sparks
- Display of immediate volt-ampere characteristics

Complex control

- Operation of the electrical precipitator is monitored and complexly controlled by a multi-level micro-computer module system

Operational optimisation

- Achievement of minimum electricity consumption while adhering to the required emission limit or achievement of the lowest possible emission of dust particles

ADVANTAGES OF ELECTROSTATIC SEPARATION

- High functional and operating reliability
- Minimum requirements for operation and maintenance of the precipitator
- High separation effectiveness
- Low pressure drop of precipitator (max. 250 Pa)
- Separation at gas temperatures up to 300 °C as standard (up to 450 °C if special materials are used)
- Fully dry process
- Resistance to red-hot dust particles in the gas

APPLICATION OF ELECTROSTATIC PRECIPITATORS

For cleaning of waste industrial gases produced by the following sectors:

- Heat and electricity generation
  - incineration of coal and biomass
  - incineration of communal and industrial waste
  - incineration of liquid fuels
- Production of building materials, magnesite and shale
- Production of ferric metals and pigments
- Glass, chemical and paper industries

Czech
manufacturer

Worldwide
scope

More than
70 years
tradition

COMPLETE SUPPLIER PROGRAM

- Equipment for flue gas cleaning from solid and gaseous pollutants
- Equipment for pneumatic transport of bulk materials
- Equipment for air conditioning and ventilation of nuclear power plants
- Equipment for building air conditioning and ventilation of industrial buildings, mines, tunnels and subways

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