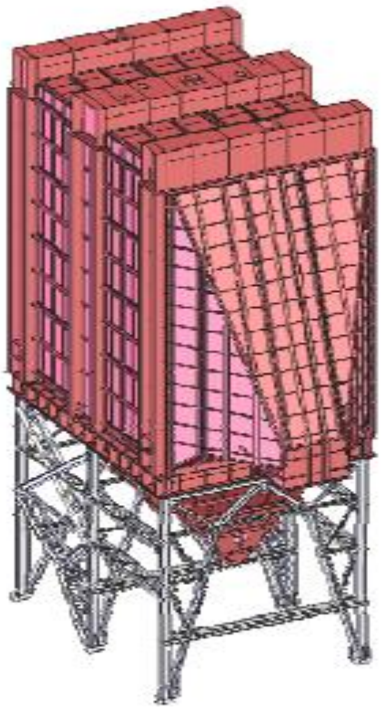
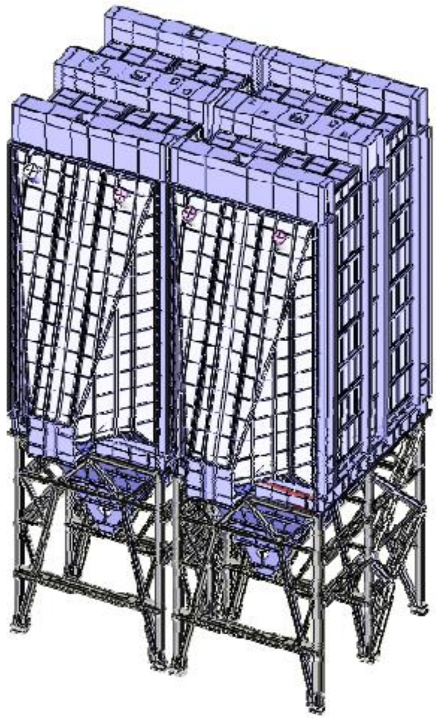
ELECTROSTATIC PRECIPITATORS





Description of Electrostatic Precipitator (ESP) structure.

Electrostatic precipitator is manufactured by "DEMZ-Engineering" Ltd for precipitating and extraction of flue gases dust content (Figure 1).

ESP can resist high temperatures, excessive and low pressure, wind and snow loads, earthquake affect, etc., depending on technological work regimes and environmental conditions.

ESP is equipped with pyramidal bunkers or with longitudinal shaped bunkers. In case of specific technological processes ESP can have flat bottom. Bunkers can be equipped with heating elements.

Figure 1

Due to high working temperatures ESP's body is installed on support system, equipped with roller bearings. This method minimizes load power that affects ESP's body and support system in conditions of repetitive heat expansion and compression.

ESP's body has a rectangular-cross section to which diffuser (gas inlet) and confusor (gas outlet) are adjacent. Bulks for collecting and ash disposal situated at the bottom of ESP's body. Inlet and outlet channels construction of which depends on performed technological processes and work shop arranging. Channels are equipped with gas distribution devices in order to provide equal distribution of the gas in transversal section of the ESP.

ESP's body, including bunkers, inlet/outlet channels (diffuser, confusor) is isolated with mineral wool that prevents condensation which causes corrosion and shortens work life of the equipment. Isolation also prevents uncontrollable heat expansion that causes dangerous service stress.

One or more electric fields are installed inside ESP's body. Each field can be separated into many electric independent areas- semi-fields. ESP's area has observation hatches located before the area, at the bottom and cover part of the ESP. One field contains grounding system of collecting electrodes and high voltage emitting electrodes. Both systems have separate rapping mechanisms.

Collecting electrode contains long collecting elements that are hanging on the girders and form rows. At the bottom and the top each row is connected to beams for suspension and rapping. Depending on the type of technological process spaces between electrodes can have different width.

Emitting electrode system is isolated from the other ESP elements. These isolators are placed in isolation boxes or inside girder beams. HV unit is connected to one suspension pipe of each field (semi-area).

Dust that is collected on collecting electrode is rapped by pendulous hammer that are installed on slowly rotating horizontal shaft. Pendulous hammers beat on rapping bar anvils.

Dust that is collected on emitting electrodes will also be shacked off with hammer that hit EE anvils.

Emitting and collecting electrodes are equipped with gears that are installed on the side and the top of the ESP.

Precipitated dust from ESP bunkers can be extracted with scraper transporter, helical conveyor, sluice, pneumatic or hydro extraction system. Choice will depend on the type of technological process and type of the bunker.

ESP is equipped with ladders and catwalks area for technical service procedures.

ESP's body.

Power construction of ESP`s body contains rows of portals. Each portal consists of girder beam and two columns (beams).

Construction of support casing's belt provides resistance to all loads from electric precipitator: ESP's load, wind and snow loads, dust loads in bunkers, excessive and low pressure, earthquake, etc.

ESP's body can have additional central support columns in case if it`s wide.

Observation hatches are located before and after fields and also on the roof.

Bunkers.

ESP can have one or more bunkers depending on width and length of it. Arrangement of bunkers provides load bearing capabilities for the exploitation.

Bottom part of the bunker has a service hatch.

Bunkers can have different wall angulations. Angulations are defined according to dust characteristics (Figure 2).

According to technological process of your company we can supply bottom parts of the bunkers with heating systems that can be regulated with thermal relay and will sustain required wall temperature.

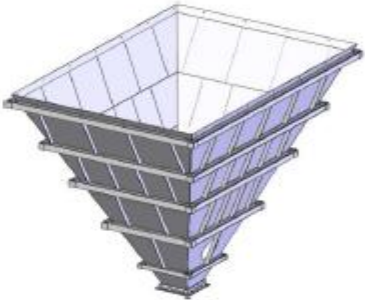


Figure 2

Dust extraction.

All the dust collected inside bunkers and will be removed with dust extraction system. Precipitated dust from ESP bunkers can be extracted with scraper transporter, helical conveyor, sluice, pneumatic or hydro extraction system. Hermetic properties of the bunker are provided by rotation, valve, louver or hydraulic gate. Equipment type can be chosen according to:

- Customer’s special requirements;
- Abrasiveness and viscidity of dust.

Gas distribution system.

Normally ESP is equipped with two gas distribution grids (Figure 3): one at the inlet, other at the outlet. Each grid contains row of vertical U-shaped profiles with special shaped apertures pierced in them. Guide fans are installed in between shapes. These fans can be relocated without instruments in order to provide optimal hydraulic resistance level of the entire grid or its part. This provides the best gas distribution along the ESP section.

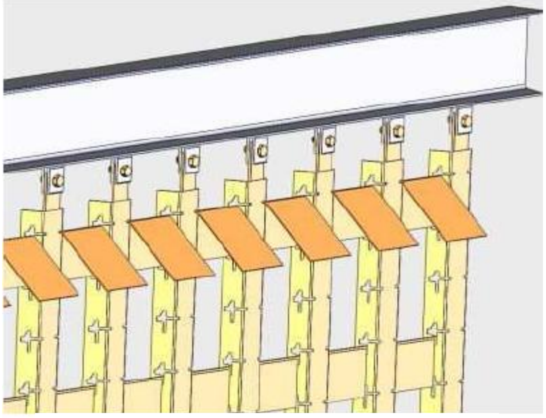


Figure 3

Dust collections system.

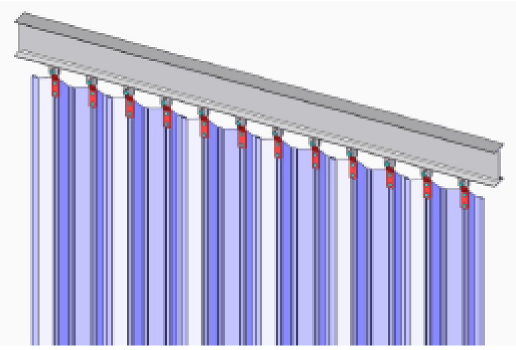


Figure 4

Collecting electrodes system (Figure 4) is equipped with long specially formed plates that are called collecting elements (CE). Plates form rows; each row contains 5-11 elements. Number of elements depends on the length of the field. Each element is fixed on the suspension beams, beams are installed between bottom parts of girders. At the bottom elements are connected into rows with guide beams, and that prevents their reciprocal shifting. The guide beam is a rapping beam for CE. CE profile is developed in such a way that can provide rigidness at minimal risk of spark rapture in order to develop required level of rapping acceleration.

Flexible sheets are installed between casing's wall and closest CE, before each field to prevent gas passing through without being filtered. CE are suspended with special fastening system and installed on the flat wall of rapping beam (Figure 5).

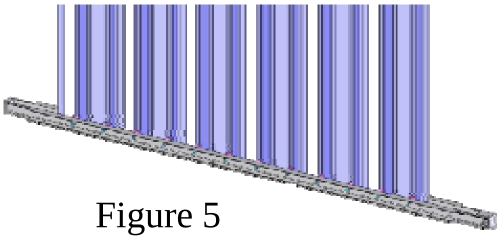


Figure 5

Hammers (Figure 6) hit the rapping beam's anvil what provides active energy transfer. The weight of the hammer depends on the height of CE and on the type of technological process.
The entire rapping mechanism provides maximal efficiency of CE rapping.
Pendulous hammers are installed on shafts, each hammer is turned on 30 degrees concerning previous hammer. Due to this method only few hammers can hit at the same time.
Rapping system work intervals are defined by control system.

Figure 6

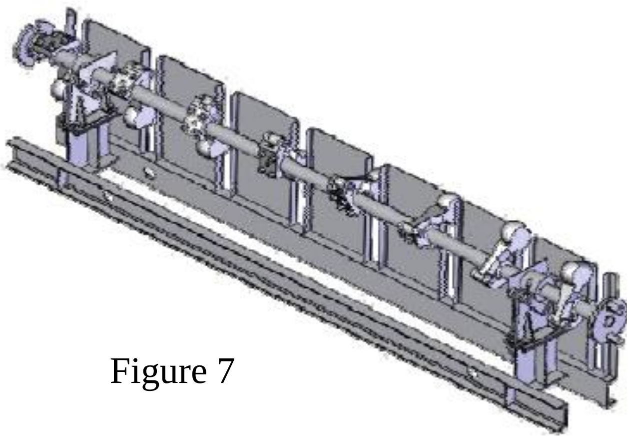


Figure 7

Shafts (Figure 7) equipped with required compensation sleeves and rotated in dust protected bearing.

Emitting electrodes system.

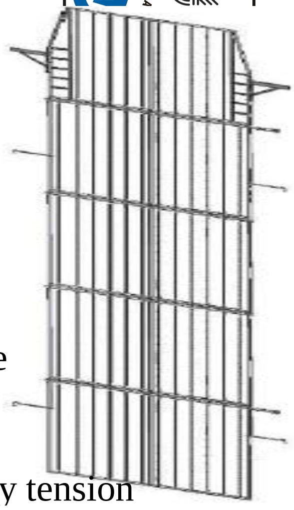


Figure 8

Each emitting electrode (EE) (Figure 8) hangs on two suspension frames. Each EE contains two or more tubular frames with emitting elements and it is installed in centers of passes between CE.

Emitting elements are V-shaped, with punched needles with sharp edges that improve gas flow ionization. The elements are attached to the frame from both sides with fastening joints. At the top and at the bottom part emitting electrode is attached to tubular frame with preliminary tension by special fastening joists. Fastening joists prevent additional tension after transportation and installation in the field.

Each EE is fastened to the girder beam on four separate support isolators.

Figure 9

Support isolators are installed on flanges with gaskets at the top and bottom ends, in order to compensate the difference of steel and isolation material expansion coefficient and prevent braking of the isolators. Support isolators have apertures in the top lid that allows cleaning the isolator inside without disassembling it.

Side forces do not effect isolators because of the movable joint between support isolator and emitting electrodes system.

All support isolators are installed in girder beams that have heat isolation, heating elements and temperature control system that eliminates appearance of condensation inside isolators. Due to specific technological process we can provide blow-down air system that prevents precipitation of electro-conductive dust on isolator.

Gearbox.

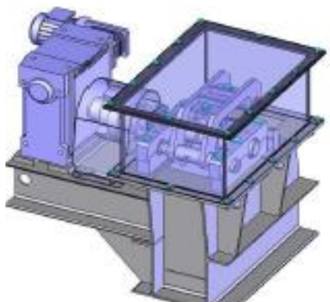


Figure 10

Hammer system shafts, that belong to CE (Figure 9), are operated by rapping gears (Figure 10), installed on the top of the ESP. Gear unit has sealing that prevents infiltration of the air into the ESP.

Rigid steel support system with sliding bearing.

ESP’s support system is a traditional rigid steel frame, which equipped with sliding bearing system that provides safe and controllable heat expansion of the ESP. Bering system minimizes load power that affects ESP’s casing and support system in heat expansion and compression continuous impact.

Each ESP's base, except fixed base, has a bearing. Bearings are orientated in radial direction from fixed base of the ESP, located near ESP center. Bearing are rated according to ESP proper weight, that includes bunkers filled up with dust and external loads. Bearings are provided according to the size of the ESP.

Isolation- external covering.

Main factor of workability and life duration of the ESP is an effective isolation system. In order to prevent condensation that leads to corrosion and to avoid uncontrolled heat expansion and deformation, entire surface of the ESP should be covered up neatly in mineral wool isolation. Thickness of the isolation is 50-200mm. Isolation is installed with corresponding steel sheet covering and heat expansion of the ESP. Rain drains, chute and water resistant and non-skid covering are applied in ESP construction. Alternatively, external sheathing of the sub-bunker space can be installed if there are special architectural requirements.

Description of electro-technical part.

The applied regulator can operate with any type of power supply equipment (ATF, ATPOM, OPMD, and OPMDA) and also with power supply units of foreign manufacture . In comparison with previous types of regulators (PRT, PVP, ARP-21, АРРКУ) ACSESP-01.00 (microprocessor automated control of HV unit with rapping system) has a modern element base and advanced software that allows to increase the ESP efficiency during any type of work mode (low current load, reverse corona, etc). The regulator operates directly in gearbox that also contains power thyristors and other types of switching devices. Connection to feedback system for current and voltage is similar to previous generations of regulators.

If requires, ACSESP-01.00 can be connected to general control system using central control computer panel. This will require serial interface RS-485 and special software (upper level).

Advantages of ACSESP-01.00 regulator.

Regulator optimizes work of each devise by choosing optimal value of corona current and voltage of electric ESP's field and as a result the ESP's efficiency increases. All characteristics (current, voltage, volt-ampere characteristics, etc.) are monitored and measured in real time mode.

ESP with reversed corona: ACSESP-01.00 regulator uses non-current regime with different width and defines an optimal current value for elimination of reversed corona.

During close-to-open-circuit regimes of ESP, regulator maintains maximal voltage in ESP's field that provides maximal efficiency of flue-gas purification. Reduced elementary base (due to microprocessor) increases durability and safety of equipment.
ACSESP-01.00 regulator control interface is simple and user-friendly.

Properties of equipment allow to upgrade and correct regulation and control algorithms, during installation of equipment and exploitation period. This device has improved spark-proofing algorithms, power and protection restoration: this ensures absence of prolonged and arch faults, forced restoration of load voltage, stable work of power supply equipment during low current loads, protection from half-wave regime.

Incorporated in ACSESP-01.00 regulator's software, algorithms analyze the impact of sparks frequency on integral voltage value inside ESP field that allows to keep ESP field at the maximum level and to increase the efficiency of flue-gas purification.

Precipitator automated control system

Precipitator automated control system comprises of (figure 11):

-switchgear of HV unit, collecting and emitting electrode rapping system, base insulator and bunkers' opening heating system.

-System of collection and processing information from the ESP fields and flue gases monitoring system

Collection and processing system is intended to transfer information on upper level control system, optimize the work of rapping mechanism and HV unit depending on dust content of flue gases.

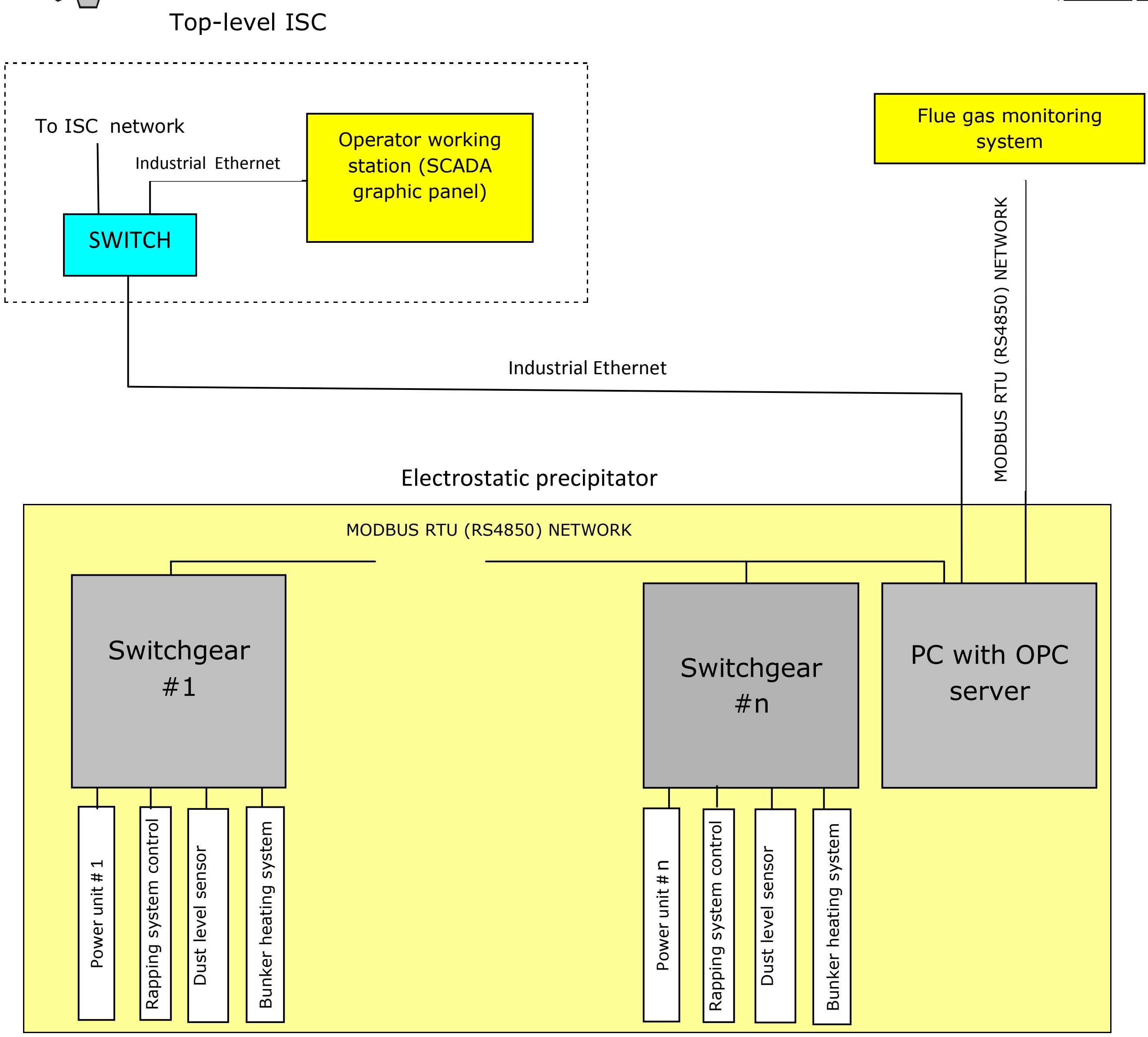


Figure 11

Switchgear holds control on HV unit of ESP field, collecting and emitting electrode rapping system, manages temperature and maintains insulator's heater and bunker's openings, monitors emergency level of ash in bin.

Switchgear of HV unit has the warning light for emergency for example calling lamp and control system with LCD display.

Switchgear components are at front switchgear space while at the same time thyristor's radiators are at the back switchgear space. Regulator ASUAP/V-M-01 is fixed in switchgear door. All auxiliary circuits are protected by disconnectors. All dangerous elements are protected from accidental contact (components are under protective cover)

If you are having interest to this information please do not hesitate to contact us: DEMZ-Engineering Limited, 20B Lenin Avenue, Zaporizhzhya 69063 Ukraine phone: +380 61 224 4207, fax: +380 61 224-4426, email: info@demz.org or visit our WEB page www.demz.org and you can have all information or send your request.