HEAT TECHNOLOGY

Finishing combustion equipment of the domed furnace

The combustion products created during the operation in the domed furnace are conducted into the system of gas purification. In case of emergency or when the temperature of the combustion products exceeds 360°C, the combustion products are conducted into the atmosphere through an emergency chimney with the use of an ejector with a ventilator. The combustion products are conducted by piping into a cooler located in front of the filter. The heat exchanger cools down the combustion products (by fresh air) or heats them up (by clean combustion products) in order to maintain the given constant temperature of combustion products at the filter input. Furthermore, combustion products are conducted by piping to the heat exchanger for preheating where the waste heat from the purified gas is used for preheating the combustion products. The preheating of combustion products minimizes the fuel consumption in the combustion chamber where the preheated gas is further heated to the required reaction temperature (820 - 860°C) by burning carbon monoxide and natural gas. The cleansed combustion products are cooled by fresh air at the output of the combustion chamber to the required temperature of the blast air of the domed furnace. The blast air is further distributed through an air duct and blowers into the fusing zone of the domed furnace.

The entire system is designed for automated control and cooperation with a visualisation system. All technologically important values (flows, temperatures, pressures) as well as alarms are displayed on the screen (Win CC). The system helps understand the process and simplifies the operation and maintenance.

Control system

The control system consists of the control panels of engines (MCC), production line control systems (PCC) and visualisation system.

MCC

All engines are supplied with feeding from motor panels, which control and ensure the operation of the engines directly through the soft starter or through frequency transformers. Each engine has an automatic circuit breaker for engine protection.

PCC

The technological control centre is equipped with several PLCs that are connected via a profibus. All devices are connected to the PCC panels.

Visualisation

The visualisation PCs are connected to PCCs via Ethernet. They include screens with technological information about:

- Raw material transport and feeding
- Domed furnace including the dome cooling system and siphon closures
- Drum with the fiberizing machine, swing conveyor and shaping conveyor
- Compression bench, toughening chamber, including heating and combustion
- Cold part of the line
- Finishing combustion equipment of the domed furnace
- Binding system

Mineral insulating material production lines

Manipulation with material, weighing

Raw material such as basalt, dolomite and coke is transferred by trucks or railway and stored in piles in an open-air warehouse. The transport from the piles to the receiving container is executed by loaders. The material is poured from the receiving container to the primary conveyor by the means of a vibrator. The primary conveyor transports the raw material into daily containers that are intended for 4 different elements (basalt, cinder, dolomite, coke) with the use of a distribution conveyor located in the upper part of the containers.

There are four weighing (feeding) systems under the containers that automatically fill up the domed furnace with the exact required volume of raw material. The weighed material is transferred to a conveyor and transported to a feeding conveyor that takes the material directly to the domed furnace.

Domed furnace

The material (stone with additives) is fused in the domed furnace with the use of coke. The domed furnace consists of a feeding, extracting and fusing zone. The upper part of the furnace consists of a receiving hopper fitted with a rotary feeding neck and gate with air-operated closing cone and feeding tube that distributes the material evenly. The minimal level of material in the feeding tube is monitored by a surface sensor. Combustion products are conducted away from the extracting zone.

The fusing zone consists of a conical, water-cooled casing. The bottom part widens for easier dumping of the furnace. There is a distributing air duct in the upper part of the fusing zone from which the preheated air is blown through blowers to the fusing zone. The molten mass flows from the furnace through a siphon and distribution channels to a fiberizing machine.

When the fiberizing process is interrupted, the molten mass is diverted through an emergency drain down below the domed furnace.

Fiberizing machine

The fiberizing machine transforms the molten mass into fibres and binding agents and oil are added. Each fiberizing wheel is driven by an independent engine with a frequency transformer for continuous regulation of revolutions.

Binding system

The elements necessary for the preparation of the binding agent, i.e. phenol resin, urea, silicone, ammoniac, anti-dust oil and water, are stored in different containers, batched and mixed according to the formula and distributed to the fiberizing machine.

Collection drum

The fibres from the fiberizing machine are collected in the collecting drum in a thin layer that is carried to the swing conveyor. There is an input chamber partially cooled by water in front of the rotary drum. The fibres are transported from the input chamber on the perforated surface of the drum casing with the use of rotation and suction air.

Swong conveyor

The swing conveyor receives the thin layer of the primary wool and layers it down on the shaping conveyor which creates the required height of the wool in front of the compression bench. It consists of two vertical conveyors; the wool layer is transferred between the conveyors to the shaping conveyor. Both conveyor belts hang on a joint pendulum frame.

Shaping conveyor

The thin primary layer arriving from the swing conveyor is laid down on the shaping conveyor. The thickness of the created wool block is determined by the speed of the production line.

The height of the shaping conveyor consisting of three parts can be adjusted in order to provide differently thick products. The conveyors are driven by engines with a speed-changing device.

There are weighing devices installed under the first conveyor that measure the specific weight of one square meter of the wool block for the correction of the speed of the line.

Compression bench

The machine compresses the non-toughened material to the determined thickness and length before the material enters the toughening furnace. The lengthwise compression improves the compression strength of the product by reorienting the fibres. This is achieved by the difference between the speed of feeding and extracting.

Toughening furnace

The material is transferred through the toughening furnace between the upper and lower conveyor with the use of lamellas. The chain wheels on the output side are driven by individual engines with speed regulators. Every conveyor has two pulling chains connecting both sides of the robust lamella. The upper conveyor is installed on a vertically moving frame; the bottom conveyor is installed on a fixed frame. The distance between the conveyors can be adjusted in order to obtain products of different thickness. The adjustment is executed by setscrews located on both sides of the chamber. All setscrews are adjusted by one engine through propeller shafts and worm wheels. The hot air for toughening carried from the combustion equipment is blown through the wool vertically. To prevent leakage of the hot air into the surroundings, the furnace is under-pressurized.

Finishing combustion system of the toughening chamber

Hot air is transferred to the toughening chamber to toughen the binding agent in the non-toughened wool. Emissions from the toughening chamber are purified in the combustion chamber and they are used for preheating the lamellas before discharge into the atmosphere. The hot air circulation system consists of 2 circulation ventilators, heating chamber and necessary piping. The combustion chamber and heating chamber are equipped with automation for regulation of the flame and temperature. In case of fire in the hot-air or combustion system, the fire extinguishing system is started manually.

Cooling zone

The hot toughened wool leaving the toughening chamber is cooled by air sucked through the material in the cooling zone.

The system consists of a ventilator, buffer, dry filter and piping connecting the cooling zone, ventilator and chimney. In case of fire in the hot-air or combustion system, the fire extinguishing system is started manually.

Cold end of the line

The entire equipment is used for cutting the toughened wool into the required length and width and to execute the required packing. The line is equipped with a wide saw and several engine-driven, side-adjustable, low-dust saws for cutting the wool block into the required width. The line is equipped with a transverse saw that works in the tact with the production line for cutting the wool block into the required length. All cutting modules of the wide and transverse saws work with rotary low-dust saws. The line is equipped with two saws, each on one side of the production line, that clean down the edges of the wool. The saw cleans the edge and the rotary knife processes the cuttings into granules at the same time. The cuttings are crushed in a granulator installed on the conveyor for the wool waste before they are placed on the collecting conveyor. The line is equipped with saws that cut the wool into two or three layers. The number depends on the required thickness of the layers for light material. The stacking device is used for collecting boards from the production line and stacking of a predetermined number of elements. The board elements are received in up to four rows (in relation to the setting of the saw). Each cycle of the board row speeds up after the cutting (superficial saw) and the boards are transported by a tilted conveyor to the stacking table where the predetermined number of elements is used for the creation of the required stacked parts. The packing and shrinking system is designed for repacking the created packs for rock wool boards and their shrinking in a heated tunnel (for shrinking foil).