

Technology portrait:

Doosan Lentjes Bubbling Bed Combustor

The bubbling bed combustor is the heart of every thermal treatment plant for processing sewage sludge for the recovery of the valuable material phosphorus. It has been tried and tested for decades and has been continuously further developed at Doosan Lentjes, so that the decisive criteria for economical plant operation such as high availability, energy self-sufficiency and durability are achieved.

In addition to changing properties with regard to ash and pollutant content, the special rheological properties of the fuel also require various measures to maintain autothermal combustion.

Today's high demands on ash quality, emissions and availability are met by the Doosan Lentjes adiabatic bubbling bed combustor with staged combustion thanks to the pronounced variability of air preheating and distribution. This makes it possible to stabilise the bed and freeboard temperatures without having to readjust the fuel moisture at short notice.

The task

Depending on the size of the combustion chamber, fuel is fed above the expanded bubbling bed via one or more rotary feeders (rotating 2-cell rotary valve with defined discharge parabola), which ensures even distribution over the bed surface.

The supply of combustion air to the Doosan Lentjes bubbling bed combustor is adjusted depending on the fuel and load and takes place both below the nozzle grade (primary air) and above the bubbling bed (secondary air). A minimum amount of primary air ensures that the bubbling bed is always fluidised. To maintain optimum fluidisation and combustion conditions, recirculated flue gas is added to the primary air if necessary. In conjunction with the air preheater integrated in the steam generator, the temperatures in the bubbling bed and the freeboard above it are adapted to the fuel characteristics. This creates the conditions for low primary emissions.

In the staged bubbling bed firing system of Doosan Lentjes, the excess oxygen is controlled exclusively by adjusting the secondary air volume, which prevents any undesirable influence on the fluidised bed.

The nozzle grade of the Doosan Lentjes bubbling bed combustor, which is supported by pillars and consists of easy-to-install prefabricated concrete parts, is low-wear and low-maintenance and is equipped with a standardised nozzle type. These can be easily replaced when worn thanks to a special tube-in-tube technology.

Optimised design

An optimised combustion system includes the design of the combustion chamber, the nozzle grade and the combustion air system in addition to the fuel feed that meets the requirements. Doosan Lentjes simulates the entire combustion process using CFD and optimises the combustion temperatures and residence time in the bubbling bed and freeboard. The air distribution and preheating around the nozzle grade and the secondary air zone are just as much a part of the simulation as the flue gas recirculation, if applicable.

By feeding the results back into the design of the combustion system, low primary emissions in the flue gas (CO, TOC, NO_x, N₂O) can be achieved through complete burnout of the gases and ashes. At the same time, very uniform temperature and pressure profiles are achieved in the bubbling bed, resulting in insensitive and low-wear operation.

DOOSAN Lentjes

The advantages of our Doosan Lentjes bubbling bed combustor at a glance:

- ▶ Thermal output of up to 32 MW per line
- ▶ High flexibility in fuel calorific value due to flue gas recirculation and integrated air preheater
- ▶ Low primary emissions in the flue gas (CO, TOC, NO_x, N₂O)
- ▶ Very good ash burnout
- ▶ No installations in the combustion chamber
- ▶ Guaranteed compliance with legal requirements for temperature and residence time

