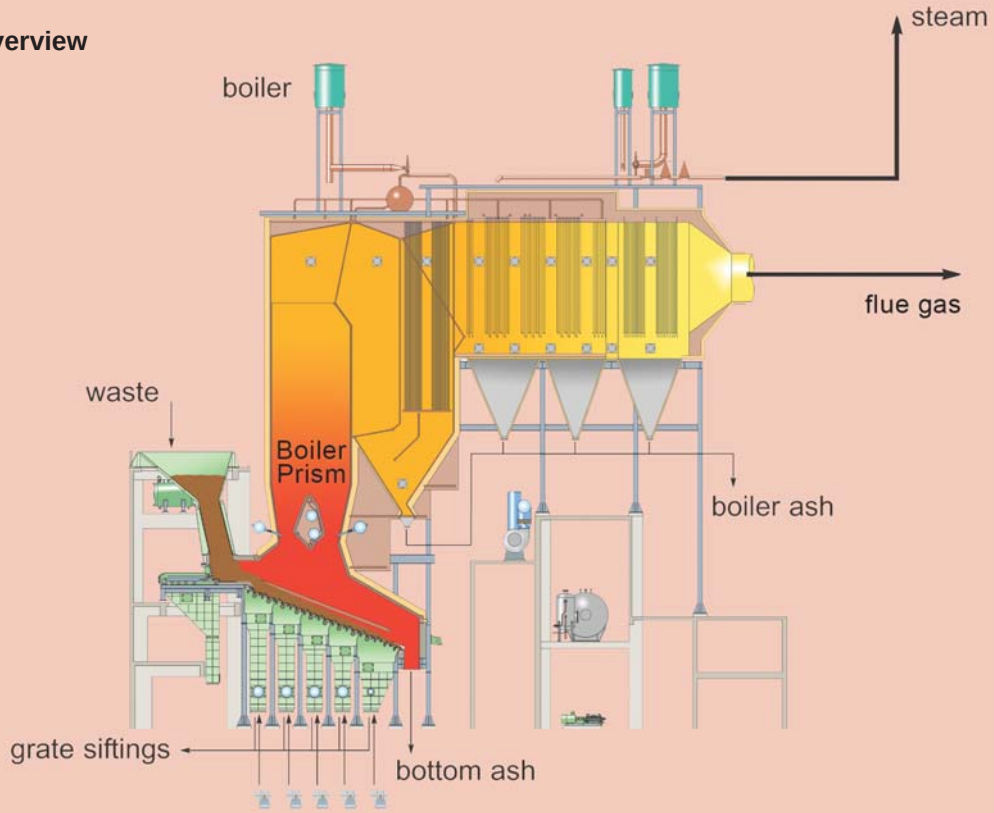
Waste-to-Energy

Keppel Seghers BOILER PRISM

Process Overview



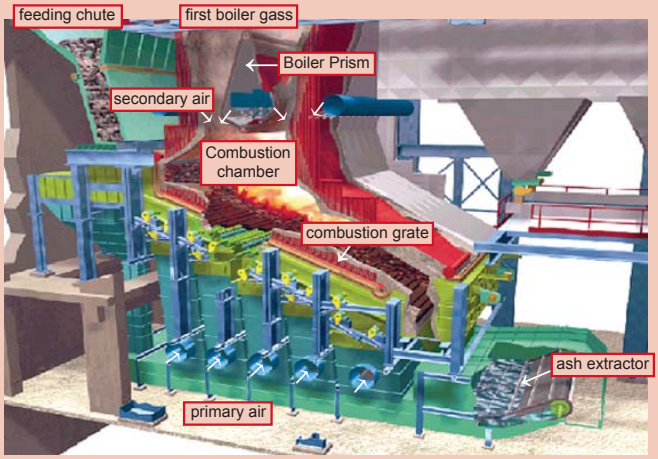
Waste incineration plants have evolved from pure incineration plants to state-of-the-art installations with minimal environmental impact. The interest is no longer exclusively on the thermal treatment of solid waste, but also the recovery of energy available in the waste.

In the energy recovery process, the steam boiler transfers heat present in the flue gas to the water/steam circuit. When leaving the furnace the flue gas flows through the empty passages of the boiler, releasing heat so that the temperature at the inlet of the convection section (final superheater) is less than 650°C. In the convection section, the flue gas further releases its heat such that its temperature at the outlet of the boiler is 200°C or less. Meanwhile, the water inside the boiler pipes is converted into superheated steam.

Principle

Flue gas from waste incineration contains very aggressive components. The combination of these pollutants and the temperature result in a high risk for corrosion. Therefore, one of the major problems with boilers of waste-to-energy plants is high-temperature corrosion.

Since its first installation in 1997, the Keppel Seghers Boiler Prism has proved to be an excellent primary measure against high-temperature corrosion in the empty boiler passages. The Boiler Prism is located at the transition of the combustion chamber to the first boiler passage and acts as a dynamic mixer due to the injection of secondary air. The device is water-cooled, refractory-lined and integrated with the natural circulation system of the boiler.



Application

The Keppel Seghers Boiler Prism is applied in medium to large waste-to-energy plants. The Boiler Prism can be installed in new plants and can also be retrofitted to existing plants.

The Boiler Prism divides the flue gas flow into two sections, into which secondary air is injected from four different locations.

Compared with a design without a Boiler Prism, this approach enables a more uniform injection of secondary air (ensuring high turbulence and optimal mixing) and superior process control.

Process Description

The Keppel Seghers Boiler Prism is an integrated boiler component positioned at the exit of the combustion chamber. It is prism-shaped and contains two internal collectors with nozzles for the injection of secondary combustion air. As such, it ensures a swift post-combustion of the flue gas along with an optimal flow-, temperature- and oxygen-distribution.

The improvements on the combustion and post-combustion process result in a much shorter and clearly defined burn-out of the flue gas just above the Boiler Prism. This achievement is based on following facts:

- Improvement of the flue gas mixing due to the reduction of the necessary penetration depth of the secondary air jet to nearly ¼ of the original furnace depth
- Injection through a large number of “smaller” nozzles with lower individual air flow, permitting a much quicker heating of the secondary air to the required reaction temperature for CO-oxidation (ca. 600°C)
- Creation of an optimal post-combustion reaction chamber with targeted oxygen supply in a highly turbulent stream

Just above the outlet of the two gas flow sections “A” and “B”, in the shape of a venturi, a flue gas temperature measurement gadget is installed to measure the actual temperature for each flow section. The purpose of this temperature measurement gadget is to maintain, through the combustion control system, almost the same flue gas temperature (ca. 1.000°C) in both sections by means of the variable secondary air flow.

Dust, trapped by the flue gas stream, causes erosion and pollution of the boiler walls and pipes, resulting in less efficient heat transfer. An efficient cleaning system is of great importance to guarantee a long operation time of the boiler. Typically, an operation time of 8000 hours without stoppage for manual cleaning can be guaranteed.

Features:

- Optimised injection of secondary air, resulting in a highly uniform distribution of the flue gas flow in terms of velocity, temperature and oxygen content
- Designed according to the customer's needs for heat recovery, using computational fluid dynamics (CFD)
- Unique and proprietary technology
- Proven primary measure against high-temperature boiler corrosion
- Leading to higher throughput and higher availability of the waste-to-energy plant, increased operation time between manual boiler cleanings and a lower reagent consumption of the SNCR system (if applicable)
- Also available as retrofit