Compact DeNOx

- **Technical paper**

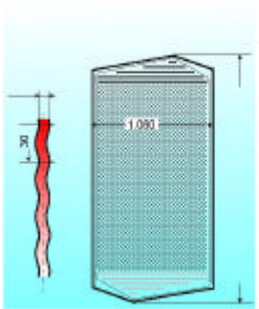
Abstract

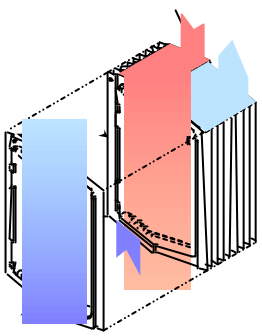
In order to comply with the limit values for nitric oxides, dioxines and furanes as stipulated in worldwide environmental standards (e.g.federal regulations governing immissions harmful to the environment), refuse incineration plants must be equipped with a nitric oxide reduction system. At existing plants available space frequently presents a problem. As a solution a space-saving Compact DeNOx system was developed.The system is built in close consultation with the industrial plant designer who is normally also responsible for determination of the process engineering. The system components and their function are described in this Technical paper.

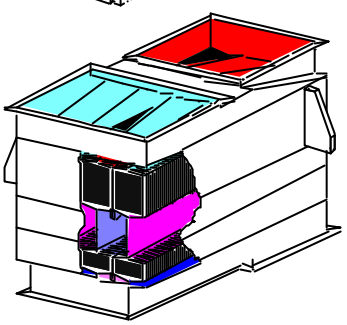
System / Process description

The Compact DeNOx system is normally installed downstream the desulfurisation process (FGD plant) in a so called Low Dust DeNOx process. Pollutants like NOx, dioxines and furanes are removed from the flue gas (clean gas) by the **S**elective **C**atalytic **R**eduction process (SCR). This process requires that the flue gases are heated to the appropriate reaction temperature of the catalyzer. The reaction temperature is between 170 °C and 320 °C depending on the flue gas composition and process. Normally the preheating of the flue gases is enhanced by a heat recovery system, with a terminal temperature difference between 18 and 35° C. Energy from external sources such as gas or steam is used for final heating to the reaction temperature.

In virtually every case, due to the pressure difference between the untreated and treated gas and the required high reaction level of pollutants, heat is recovered in gastight recuperative heat transfer systems utilizing the exhaust temperature of the calatalyst. In case of a Compact DeNOx system a fully welded plate type heat exhanger (REKUGAVO®) based on the counterflow principle is assembled with a similar size catalyzer to form a compact unit.







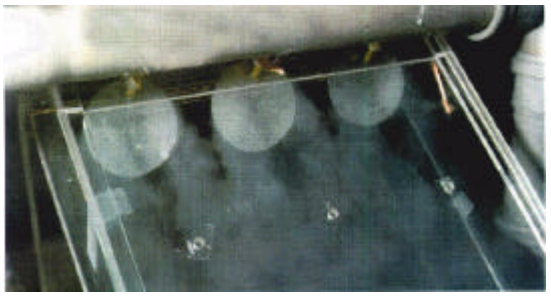
The REKUGAVO® is a one- or multi-stage counterflow plate recuperator. The heat transfer surfaces consist of shaped plates assembled to form modules. These modules are accommodated in standardized containers which can be combined to produce larger heat exchangers.

Standardization and automated manufacture produce short delivery times. Erection time is minimized by installing many small plate packs together in large construction modules. The system can also be delivered as small modules to suit limited site access.

The shaped plate surfaces produce a high specific surface density and ensure the maximum thermal efficiency with a compact construction. The vertical gas channels and the counterflow principle make it possible to achieve a uniform temperature pattern across the plate width and the plate outlet. This ensures a flat temperature profile across the plate. The two gases pass in counterflow to one another through the channels between the plates and are separated leakfree. Therefore the two gas flows do not mix, and no pollutants are transferred.

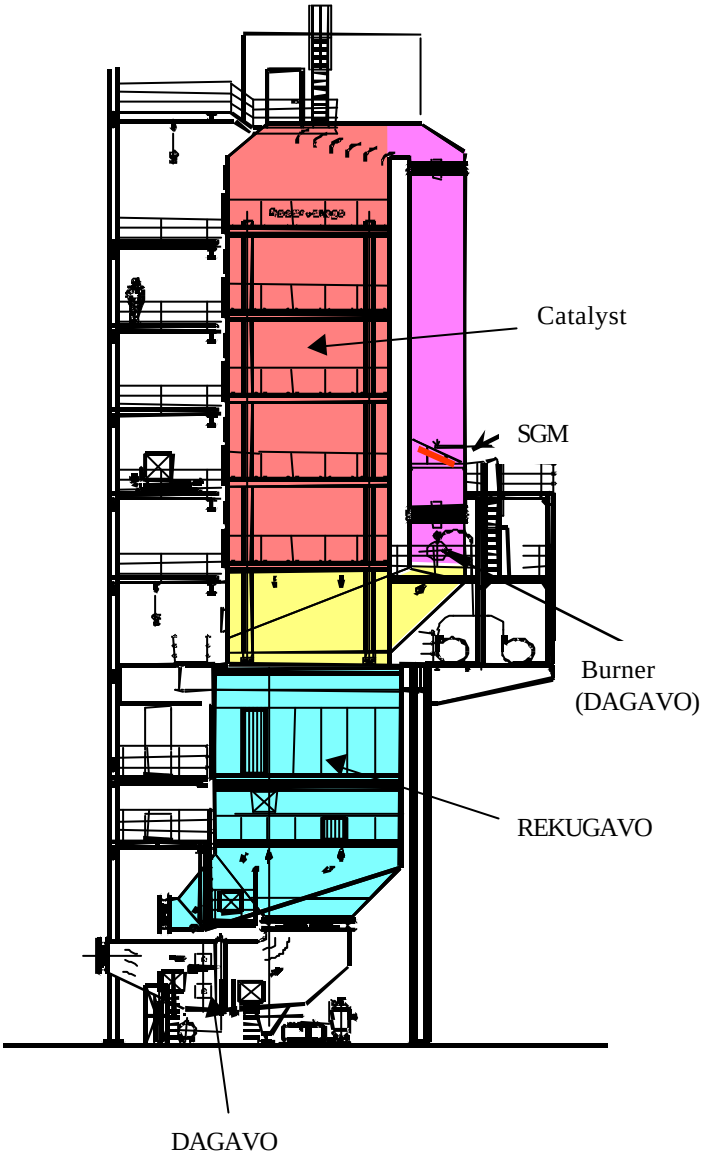
As far as the construction is concerned the heat exchanger is supended below the catalyzer casing. A system of guiding ductwork between the REKUGAVO outlet and the catalyzer inlet provides sufficient space for an auxiliary heating system, e.g. natural gas burner or steam heated gas heater (**DAGAVO**) and an ammonia dosing/mixing system. Ammonia solution is added as a reaction agent for the process of removing nitric oxides. The key component of an ammonia injection system is the

Static Gas Mixer (SGM)



The static mixer system is characterized by the fact that extensive steady state vortices are generated at the leading edges of circular, elliptical or delta shaped vortex-generating plates which are positioned with an angle of attack (a) to the flue gas flow.
The cross flow components of the vortex system force the ammonia with a different density, temperature and concentration to be virtually **ideally mixed** within a very **short distance** and at a **minimum pressure drop**.

Compact DeNOx



The five components (in gas flow direction)

- DAGAVO
- REKUGAVO
- Gas heater (Burner or DAGAVO)
- Static Gas Mixer
- Catalyst

and the connecting ductwork incl. the supporting structure form the so called Compact DeNOx.
The casing dimensions are determined in consultation with the industrial plant designer and the process engineer.
Balcke-Duerr Energietechnik, GmbH provides the heat exchanger, burner and gas mixer engineering, static and dynamic calculations and design data for the complete system, as well as the supply and assembly of all components.
This procedure minimizes the interfaces at which problems could occur.
Each system is designed to suit the technical requirements of the particular situation. In most cases the catalyzer is supported whereas the REKUGAVO is suspended. An opposite arrangement with suspended catalyzer is also possible. Corrosion resistant materials are used in the cold section. The heating surfaces are supplied as modules similar to the catalyzers. Dimensions, weights and erection procedures are also similar. All surfaces at the module inlet /outlet are accessible for inspection.This easy access means that any fouling can be washed off manually or, if required, with permanent cleaning systems online.