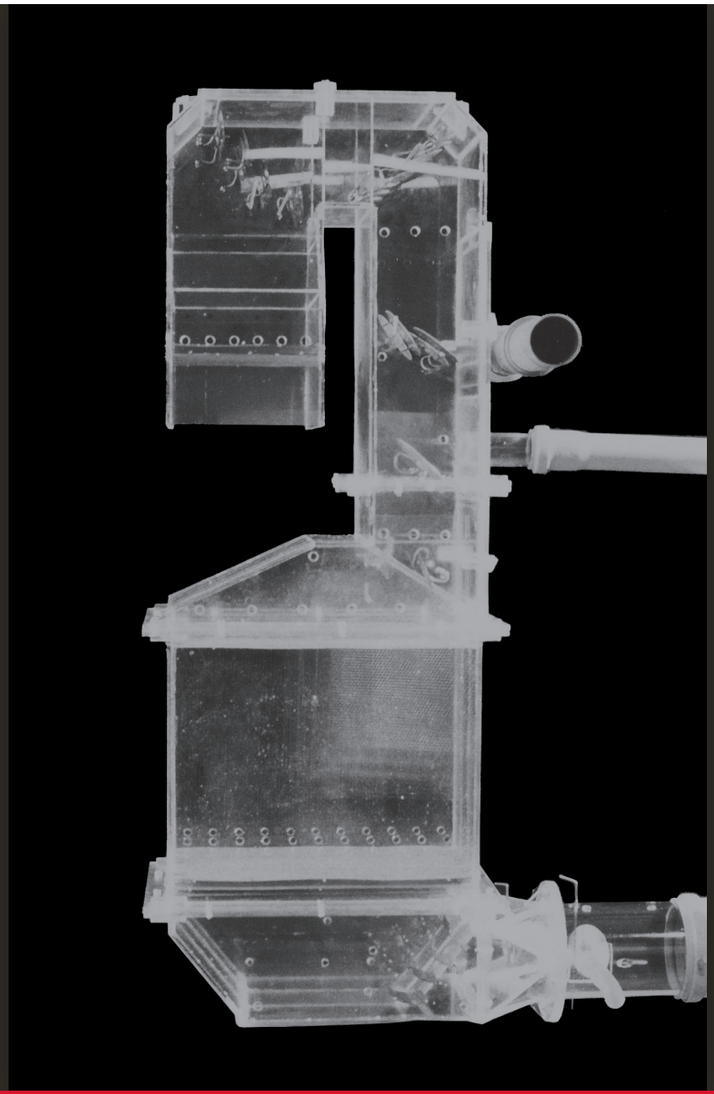


BD Heat Recovery Division, Inc.

7800 113th Street North
Seminole, Florida 33772

(727) 392-0492 • www.bdheat.com

BD Heat Recovery Division, Inc.

SCR & SCNR Systems

Compact DeNOx System

The Compact DeNOx is a Clean Side Selective Catalyst Reduction (SCR) system utilized for DeNOx applications that are installed downstream of other pollution control devices (baghouses, scrubbers, wet electrostatic precipitators etc) where the flue gas temperatures are below the normal levels for catalytic reaction.

In addition Compact DeNOx Systems have been designed to remove Dioxins and can be equipped with CO Oxidizing Catalysts.

Unique features of the Compact DeNox System

Energy Saving Counterflow Plate Type Heat Exchanger
Permits approach temperatures between the hot and cold gases of less than 50°F.

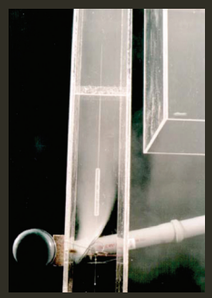
Direct Injection of Anhydrous, Aqueous Ammonia and Urea
Utilizing propriety Vortex Gas Mixers and Atomizing Nozzles eliminates the necessity of ammonia evaporators.

Limited Number of Injection Nozzles
With one injection nozzle per vortex gas mixer the number of nozzles required is extremely small permitting simple commissioning and maintenance of the system.

Air and Reaction Agent Flow can be Controlled to Individual Nozzles
Allows equal flows to be set to all nozzles increasing the system effectiveness and reducing slip.

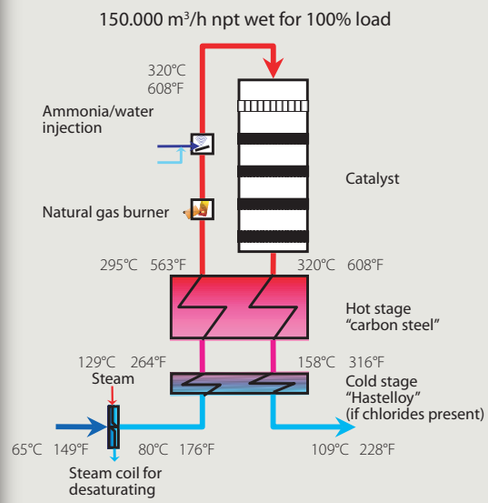
Scale Flow Modeling Optimizes Gas Flow, NOx, Temperature and Ammonia Distribution
Improving the catalyst effectiveness and reducing the Ammonia slip.

Reduced Plot Size
Innovative design and engineering accommodate the majority of the equipment in a patented tower arrangement reducing the amount of plant space required.



Production of an Actual Scale Model of the System permits the accurate placement of the Vortex Gas Mixers, which ensures the correct Flow Distribution of the Ammonia, NOx and Temperature. In addition the Scale Model demonstrates the System functionality prior to Manufacture.

Compact DeNOx System with Typical Operating Temperatures
(for Waste to Energy Plants)



Compact DeNOx Systems have been installed on Numerous Applications (a partial list is shown below):

- Coal Fired Boilers
- Waste To Energy Plants
- Wood Fired Boilers
- Hazardous Waste Incinerators
- VCM Incinerators
- LNG Vaporization Facilities

Non Selective Catalytic Reduction (SNCR) Systems

The features that make the Compact DeNOx System so successful can also be applied to any SNCR application.

The SNCR is a proven technology to convert NOx into N_2 and H_2O. It is a selective Reaction which means it does not react with the oxygen in the flue gas, but with the reagents itself.

The reagents are typically NH_3 (aqueous or gaseous) or Urea.

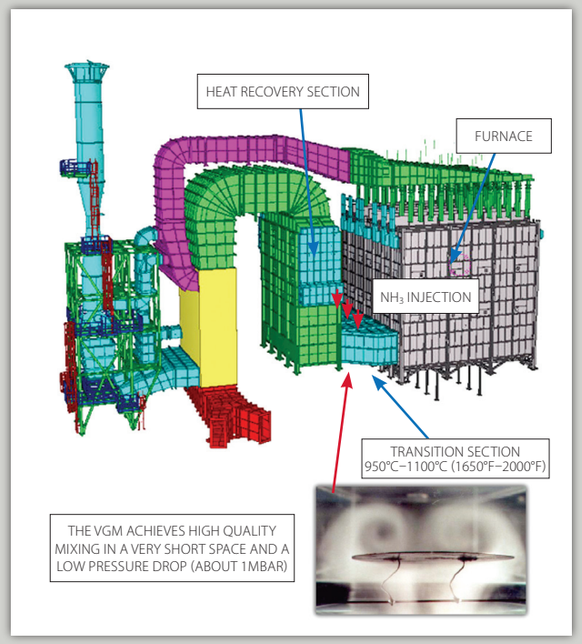
The SNCR can achieve surprisingly high reduction rate, providing the reagent and the flue gas are throughly mixed.

For multi-burner systems the SNCR is the most competitive NOx reducing retrofit technology compared to other solutions such as Low-Nox burners or tail-end SCR.

To avoid ammonia slip and achieve high reduction rates, it is essential to ensure complete mixing of the reagent (for example NH_3) with the flue gas.

The mixing typically will be required to occur over a short distance because space is usually restricted.

To avoid potential problems with the combustion fans (FD & ID) pressure drops for the SNCR system should be kept to a minimum.



Reaction temperature is higher than SCR sytems - ideally in the range of 900°C–1100°C (1650°F–2000°F).

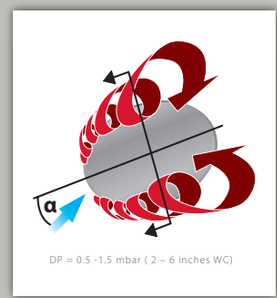
For furnace applications the injection of NH_3 can occur in the transition section, assuming the temperature is high enough.

The Vortex Gas Mixer

The Vortex Gas Mixer (VGM) relies on the physical phenomenon produced by a vortex at a sharp edge of a plate.

The counter flow rotating vortex produce an effect similar to a swirl or whirlpool.

The exact dimensions and position in the duct is established in a physical 3D model flow test.



A high mixing ratio of NH_3/NOx can be achieved within a very short space.

The ammonia slip is reduced to a minimum value.

Advantages

NOx Reduction with few components.

Easy technology.

Minimum ammonia slip, hence no risk of formation of ammonium bisulfate on downstream components.

No new space requirement.

Short installation time.

No operating costs (Except Reagent Cost).

Mixing is visualized in physical model testing prior to installation.