Sulzer Chemtech Ltd, a member of the Sulzer Corporation, with headquarters in Winterthur, Switzerland, is active in the field of process engineering and employs some 1200 persons worldwide. Sulzer Chemtech is represented in all important industrial countries and sets standards in the field of mass transfer with its advanced and economical solutions.

The activity program comprises:

- Process components such as trays, structured and random packings, internals for separation columns and reaction technology
- Engineering services for separation and reaction technology such as optimizing energy consumption, plant optimization studies, pre-engineering for governmental approval, basic engineering
- Separation and purification of organic chemicals by means of crystallization and membranes
- Mixing and reaction technology with static mixers

DeNOx Mixer

Sulzer Mixer-Injector for Selective Catalytic Reduction

Static Mixer in the SCR process

The Sulzer SMV Mixer in combination with the patented Sulzer Ammonia Injector represents a proven, highly efficient and reliable technology to distribute ammonia into flue gas in front of the SCR Reactor of coal or gas fired boiler applications. The simultaneous mixing of ammonia and \( \text{NO}_x \) as well as equalization of gas temperature gradients with the SMV Mixer creates almost ideal reaction condition in the catalyst bed. This is available for a minimum pressure drop of 1-2 mbar only, at no additional maintenance cost.

Advantages

- Improved \( \text{NO}_x \) distribution due to continuous mixing action, leading to even distribution of the reactants in front of the catalyst.
- Reduced temperature gradient in the flue gas provides equal reaction condition across the catalyst bed.
- Uniform \( \text{NH}_3/\text{NO}_x \) concentration helps to achieve a high \( \text{NO}_x \) reduction rate at minimum ammonia slip.
- Improved utilization leads to a longer life cycle of the catalyst.
- Low pressure drop in the flue gas compared to conventional injection grids (1-2 mbar, less than 1” WG).
- Virtually no maintenance required for trimming of the AIG.
- No evidence of corrosion or abrasion even for high temperature and high dust application so far.

Typical Layout for Coal Fired Boiler

1. SMV side-Mixer for \( \text{NH}_3 \) evaporation
2. Patented Sulzer Ammonia Injector, no trimming, no plugging, no maintenance
3. SMV Flue Gas Premixer for \( \text{NO}_x \) and Temperature Distribution
4. Main Mixer for Ammonia mixing
5. Even distribution of \( \text{NO}_x \), Ammonia, and Temperature at the catalyst face

Distributed by:

Sulzer Chemtech

Streak lines of ammonia injected in front of a SMV Mixer with extremely limited space available in front of the catalyst.
CFD for effective and optimum design

CFD represents an efficient and effective tool to optimize the design of the Mixer/Injector configuration as well as of the flow conditioning internals like guiding vanes. CFD helps a lot to design and optimize a test model configuration.

Model mixing

Model mixing is used to tune the Mixer/Injector configuration and the flow conditioning internals. Model mixing allows determining the basis for scale up and the guarantee values (typically NH3 homogeneity, pressure drop, etc.), as well as dust deposition behaviour.

Typical results

of a coal fired power plant after installation of an SCR reactor equipped with a Sulzer SMV Mixer/Injector.

<table>
<thead>
<tr>
<th>Process conditions after boiler</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flue gas norm = 1 800 000 Nm³/h</td>
</tr>
<tr>
<td>min = 1 600 000 Nm³/h</td>
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<tr>
<td>Ammonia / Flue gas = 1 : 2500</td>
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<td>NOx content = 900 mg/Nm³</td>
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<td>Flue gas temperature = 348°C</td>
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Reactors inlet after Sulzer SMV Mixer

Typically guaranteed by Sulzer

ΔT max deviation = +/- 1°C max

NH3 concentration 1σ = +/- 15%
max = +/- 20%

velocity distribution 1σ = +/- 15%
max = +/- 20%

Δp mixer < 1.1 mbar

Reactors outlet

Typically guaranteed by system or catalyst supplier

Ammonia slip < 1 ppm (vol)

NOx content < 190 mg/Nm³

Δp duct + mixer / injector + catalyst < 12 mbar

Installations

Sulzer has been designing and supplying SMV Mixers and Injectors for DeNOx application for more than 25 years. With more than fifty installed mixers running to full satisfaction of the users, Sulzer has proven to be a most reliable supplier of Static Mixing Technology in this segment.
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