

SCR De-NOx Scrubber

Selective Catalytic Reduction of NOx

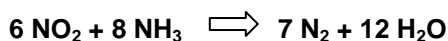
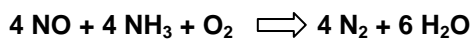
GAS CLEANING SYSTEMS DIVISION



Hamworthy Combustion SCR De-NOx Scrubbers are designed to effectively reduce NOx content in flue and exhaust gases from utility boiler and/or steam generators when other NOx prevention techniques (e.g. Low-NOx Burners, Air Staging, Over Fire Air, Flue Gas Recirculation) or Selective Non-Catalytic Reduction (SNCR) are not sufficient to meet the required NOx emission limits.

Through the selection of best-in-class high activity catalyst, the proper design of the SCR reactor casing and an accurate CFD modeling of the gas flow conditioning devices, Hamworthy Combustion SCR De-NOx Scrubbers ensure compliance with the most stringent Environmental Regulations (e.g. European Directive 2001/80/EC, US EPA Clean Air Act, Saudi Arabia RCER 2004, etc.).

The reducing agent – an ammonia source – is injected and intensely mixed with the flue gas. The mixture then passes through a series of catalyst layers where the nitrogen oxides are converted into nitrogen and water vapor through the following reactions:



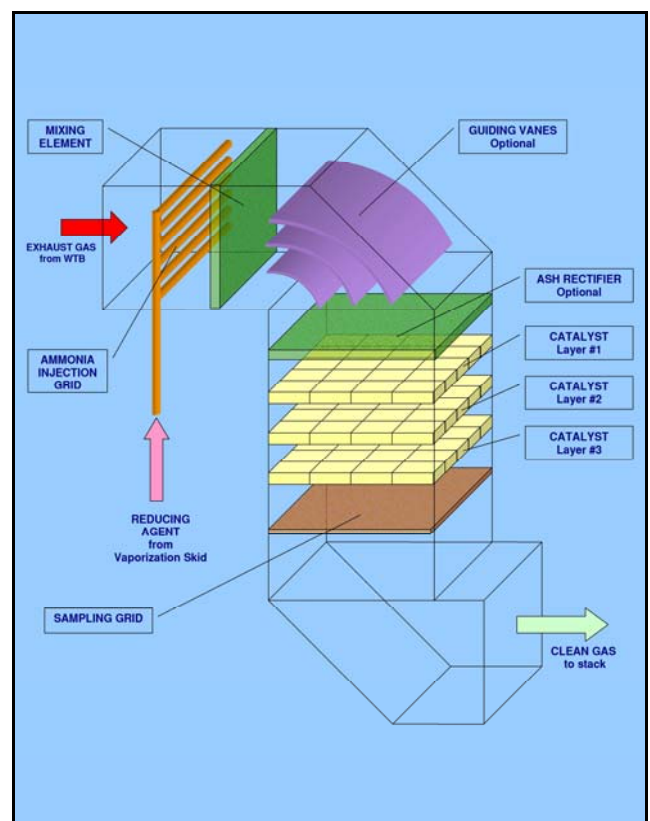
Design Characteristics

The reducing agent can be injected either in vapor phase by an Ammonia Injection Grid (AIG) assisted by an Ammonia Vaporization Skid, or in liquid phase by air assisted atomizing lances (Direct Injection). The NH₃/NOx ratio is carefully selected at design stage on the basis of the type of catalyst applied so to ensure high efficiency NOx reduction and very low NH₃ slip. During operation the NH₃/NOx ratio is continuously

adjusted by the dosing panel on the basis of the feedback signal from the NOx/O₂ analyzer at SCR outlet. The complete system is designed to be automatically controlled either by a local PLC or by implementing the logic in the plant DCS.

Catalysts are selected to ensure high-activity, low deactivation and negligible SO₂/SO₃ conversion rate to prevent or minimize Ammonium Bisulphate (ABS) formation and deposition. The catalysts can be plate type, corrugated type or honeycomb type depending on the dust load.

High-dust configurations are available for Fossil Fuel Fired Boilers where the SCR is installed after or in-between the economizer banks. Large pitch catalyst modules and sootblowers (sonic horn type or steam assisted type) are usually installed for maximum resistance against plugging.



Performance Features

The NOx reduction efficiency is typically 90%, but it can be designed to achieve 99%. The reducing agent is injected at a temperature of typically 320-420°C (610-790°F). The maximum allowable temperature of catalyst is typically 490°C (915°F). The ammonia slip is typically less than 5 ppm, but it can be less than 1 ppm. The SO₂/SO₃ conversion is typically less than 1%. Guaranteed catalyst life is typically 16,000 hours but SCR can be designed for 24,000 hours or more. Catalyst modules are designed for easy handling and quick installation. Catalyst with large pitch size and sootblowers are installed in high-dust applications and/or when superior resistance to plugging is required. The design of: AIG, SCR reactor, gas ducts and gas flow conditioning devices is verified by extensive application of CFD modeling. Ammonia vaporization skids, NOx/O₂ analyzer and dosing panel are designed for high reliability and can be CE marked and/or ATEX compliant upon request. Truck unloading stations, pumping stations and ammonia storage tanks can also be supplied.



Design Advantages

- Suitable for high-dust applications
- 90% and higher NOx reduction efficiency
- Low NH₃ split.
- Low SO₂/SO₃ conversion
- Low pressure drop.
- High resistance to plugging.
- High resistance to poisoning
- Controls by local PLC or plant DCS
- Complete Turnkey solutions

Specifications

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| Catalyst Type: | Plate, Corrugated and/or Honeycomb |
| Typical Operating Temperature | 320-420°C |
| Maximum Allowable Gas Temperature: | 490°C |
| Injection Method: | Ammonia Injection Grid or Direct Injection |
| Number or Catalyst Layers: | 2 minimum, 3 recommended |
| Ammonia Split | Down to less than 1 ppm |
| SO₂/SO₃ conversion rate: | Less than 1% |

Notes:

The Hamworthy Combustion SCR De-NOx Scrubber is individually designed for each installation. The catalyst life, minimum operating temperature and reducing agent consumption are related to the inlet gas properties.

Hamworthy Combustion Engineering Srl
Via A Gramsci, 11
20035 Lissone (MI) - Italy
Tel: +39 039 2434010
Fax: +39 039 2143 290
Email: info@hamworthy-combustion.it
Website: <http://www.hamworthy-combustion.com>

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Hamworthy Combustion Engineering Limited reserve the right to make changes and improvements which may necessitate alteration to the specification without prior notice

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COMBUSTION

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