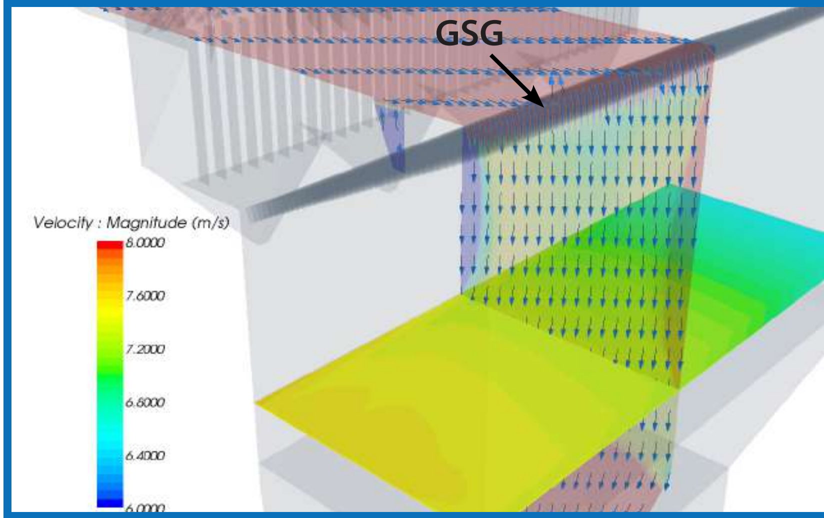
GSG™

Graduated Straightening Grid

Significantly improve SCR performance without increasing cost or complexity.

Fuel Tech's patent pending GSG™ Graduated Straightening Grid technology is a significant step forward in Selective Catalytic Reduction (SCR) process design.

Until now, improving the velocity distribution and flow direction into the face of the first catalyst layer the traditional solution has been to use many large turning vanes along with a straightening grid placed immediately above the catalyst. The turning vanes were tuned to achieve an even velocity distribution while the straightening grid below straightened the flow direction. This system requires exact spacing and angling of turning vanes during SCR construction to ensure required flow distributions are met. This traditional solution is also extremely sensitive to changes to the upstream flow distribution and any changes to the system require remodeling and retuning of the vanes to maintain the required distributions. After years of research and development using scale and computational modeling, the GSG has been thoroughly tested and successfully installed on a number of units.



Colored planes here depict velocity magnitude.

The GSG combines the turning vanes and straightening grid into a single sloped grid. The GSG has been shown to be an extremely robust flow corrective solution. It is much less sensitive to upstream flow distributions than traditional solutions which means that the catalyst and catalyst performance are protected even when the unit is not running at optimum design conditions (such as economizer bypass) or if boiler or ductwork changes are made in the future.

Finally the simple design of the GSG makes precise spacing and angling of turning vanes unnecessary. Fuel Tech's CFD modeling capabilities combined with our real world expertise provide the basis for all of our technologies and allow us to support guarantees on your system's performance. The GSG provides flow and velocity distribution towards the first layer of catalyst without turning vanes.

Prevent problems and downtime associated with:

- Dust accumulation
- Erosion
- Uneven catalyst face
- Shortened catalyst life
- Increased pressure loss

Traditional Turning Vane Velocity Distribution at Catalyst Face Statistics

- 62% of velocities within 10% of average
- 93.9% of velocities within 20% of average

GSG Velocity Distribution at Catalyst Face Statistics

- 95% of velocities within 10% of average
- 100% of velocities within 15% of average

Ammonia Injection Grid (AIG)

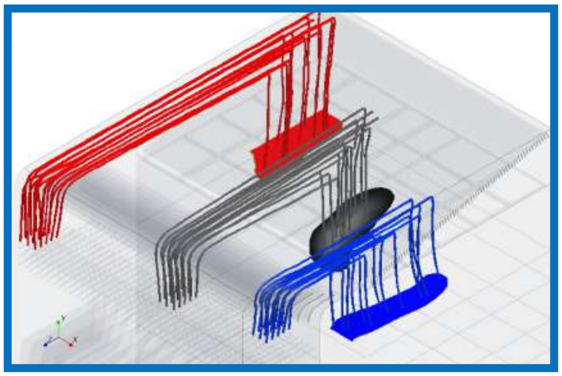
Field Installation of a multiple control zone, high performance AIG

- Experienced field personnel and training capabilities
- No horizontal vanes - often the root cause of ash fallout and pluggage issues on the catalyst
- Provides optimum delivery of NH_3 to treat NO_x

A well-designed ammonia injection grid is the backbone of an efficient SCR.

The ammonia injection grid (AIG) is an engineered matrix of piping and nozzles used with SCR systems. AIGs distribute vaporized ammonia just downstream of the static mixer. The AIG design and the distribution of ammonia-to-NO_X upstream of the catalyst are critical to SCR system performance. Each zone of the AIG is independent and controllable so that the grid can be properly tuned at startup and adjusted on a periodic basis as needed to accommodate changes in fuel and/or operating conditions. AIGs can be designed for either anhydrous or aqueous ammonia (NH_3) systems. Depending on the customer's objectives, AIGs can range in complexity from a single injection point to hundreds of injection points which are independent and controllable.

Fuel Tech will provide the design engineering and experimental modeling, and once we are satisfied with the performance, the design will be ready for fabrication. The design process will begin with critical information such as the flue gas flow rate, duct dimensions, and the required lb-NH_3 per hour flow rate. These process parameters will be used as input to the Computational Fluid Dynamics (CFD) model. The CFD model will be used in conjunction with the experimental (scale) model to finalize the design and ensure that the required NH_3:NO_X distribution will be achieved.



Ammonia Injection Grid Modeling: CFD model demonstrating 1- to 1 mapping of AIG control zones to their respective zones in the SCR

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