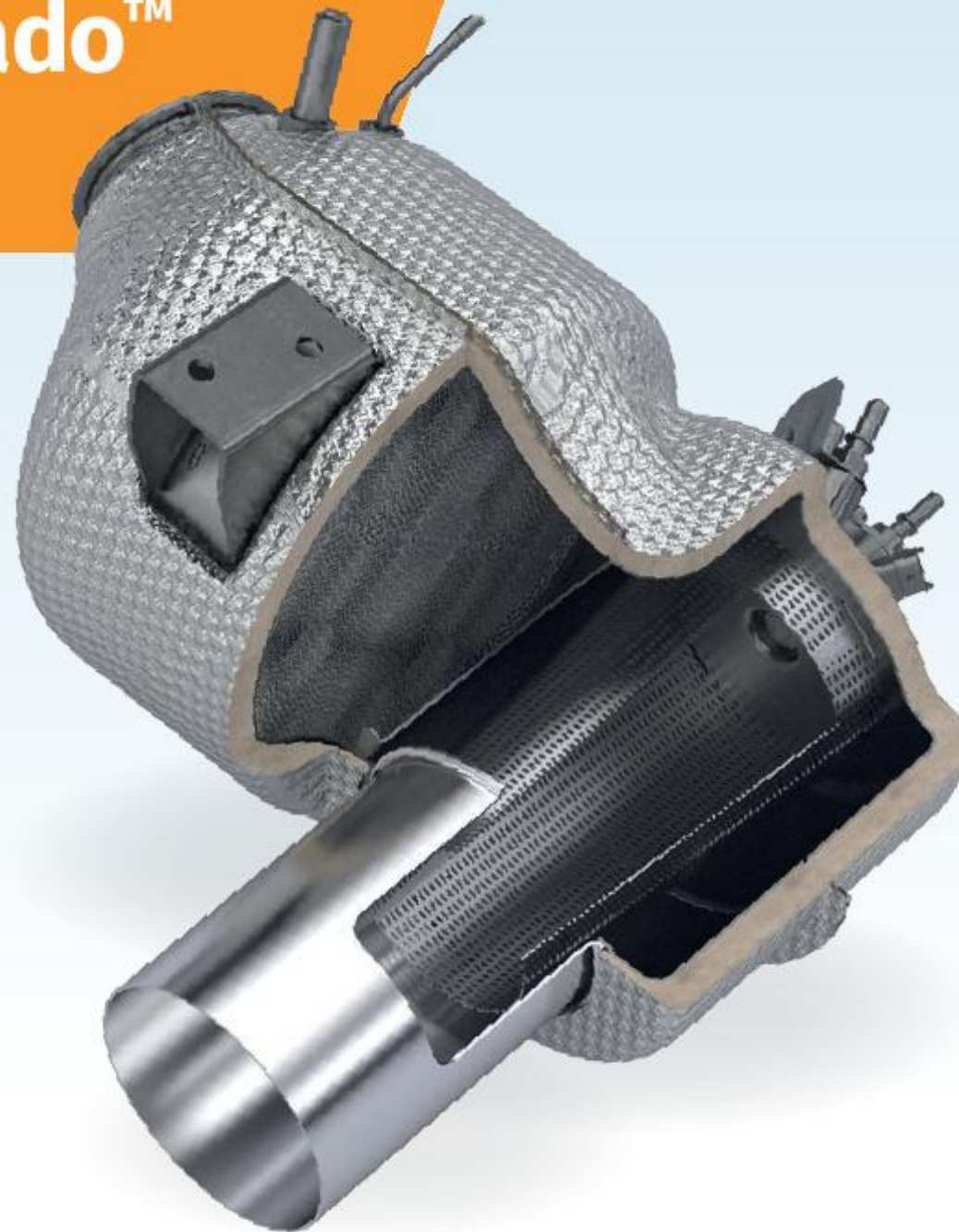


Proventia SuperTornado™

Urea Mixing Technology



Improved SCR performance with Proventia SuperTornado™ urea mixing technology

As emission standards are being tightened around the world, selective catalytic reduction (SCR) technology is increasingly being used in diesel engine applications for reducing emissions of nitrogen oxides (NO_x).

SCR technology uses ammonia in the form of a urea-water solution (known as AdBlue® in Europe) as reducing agent for the catalytic reactions. Particularly if an airless injector is used, the urea solution has a tendency to form deposits in the process of evaporation and decomposition into ammonia. To prevent the build-up of deposits and to obtain good uniformity at the catalyst cell, an efficient mixer is needed. Especially in

applications with limited space requirements or in real driving cycles that include slow driving with low loads, the high NO_x reduction targets of today's regulations cannot be reached without efficient urea mixing.

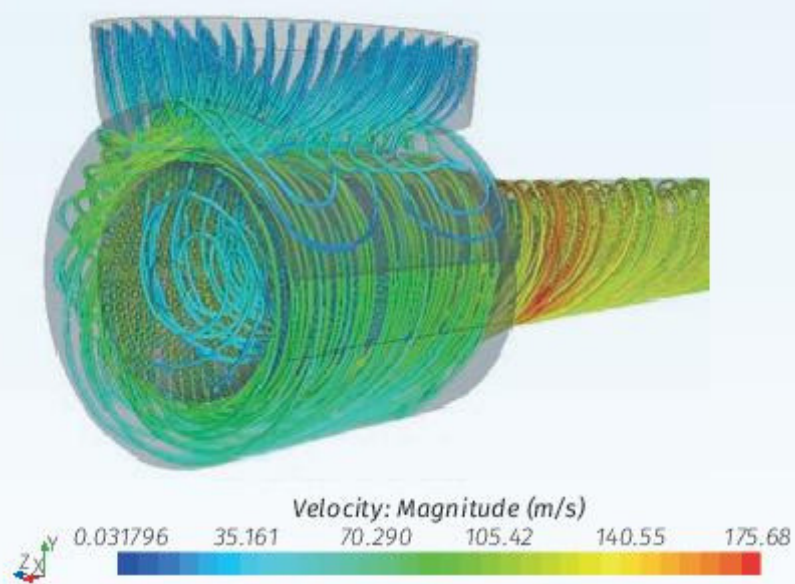
Proven performance even with short mixing lengths

As a rule, the longer the mixing length is, the easier it is to achieve optimal urea mixing. In diesel

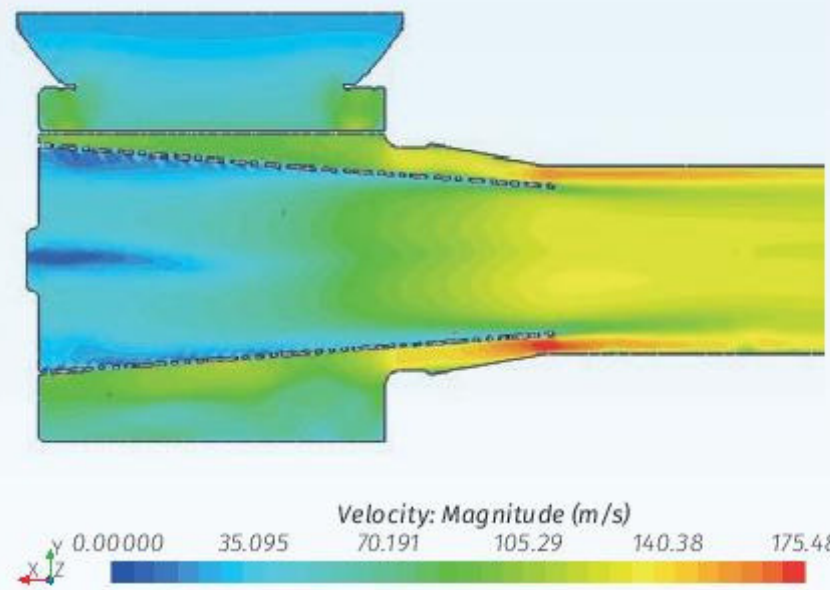
engines, especially in applications that require a compact design, there is no space available for longer pipelines.

The key to solving mixing problems is to have an effective urea mixer, such as Proventia SuperTornado™, which will allow injecting more urea solution at low temperatures and in minimal pipe lengths. Proventia SuperTornado™ mixer technology contributes to even ammonia (NH₃) distribution and improves overall SCR performance by inducing turbulence and enhancing urea/ammonia mixing within the exhaust gas.

Proventia SuperTornado™



Flow trajectories in SuperTornado™ mixing chamber.



Cross section view of velocity field in mixing chamber.

How does it work?

The Proventia SuperTornado™ urea mixer has two separate swirling concentric flows. Urea is injected into the centre flow, where the small droplets evaporate and bigger droplets travel further down the mixer to where the two flows meet.

When the droplets reach the stronger outer flow, the velocity difference between flow and droplet rises rapidly, resulting in a high evaporation rate. With SuperTornado™, evaporation and mixing is effective, leading to ammonia uniformity values

exceeding 0.99, allowing more precise amounts of urea to be injected into the exhaust gas – even at lower temperatures – which eventually results in increased NO_x reduction and the best possible use of SCR catalyst chemistry.

Benefits

The greatest benefit from the mixing technology is for SCR performance and NO_x reduction at low temperatures in real driving circumstances.

- Ensures optimal reaction with ammonia
- Allows increased urea solution injection even at low exhaust temperatures

- Allows shorter mixing pipes to be used
- Gives even NH₃ distribution
- **Required NO_x reductions also in real driving emission (RDE) tests**

Applicability of Proventia SuperTornado™ urea mixing technology

Proventia SuperTornado™ urea mixing technology is a flexible platform that can be used with various urea dosing systems to solve deposit problems and improve SCR performance in many applications with different engine sizes and in a variety of operating environments. Proventia SuperTornado™ enables compact EAT system design for applications that have limited space requirements. The system can be integrated with DPF substrates if the chosen emission strategy requires DPF.

Proventia provides support in engineering, testing and dosing strategy calibration.

