The Future Is Going to Be Increasingly Turbulent

Turbulence-generating catalytic converters for all modern powertrains

Emitec uses only metal catalytic converter substrates made from high-temperature steel foils, which offer great design freedom. One of the engineers’ first tasks at Emitec’s production site in Lohmar was the development of foil profiles that force the exhaust gas into turbulent flow. These turbulence-generating structures have long since become a popular choice. They now account for over 50% of Emitec’s deliveries and their share is steadily rising.

The reason for this is the unique performance of this type of catalytic converter. Special structures, such as LS (longitudinal structure), PE (perforated structure) or TS (transversal structure), break up the laminar flow of the exhaust gas to create turbulence inside the catalytic converter and so increase mass transfer. This makes it possible to build very small catalytic converters and more compact SCR systems, which ultimately reduce costs significantly. The turbulence-generating catalytic converters made by EMITEC Gesellschaft für Emissionstechnologie mbH from Lohmar near Cologne help reduce costs, cut exhaust gas emissions and minimise fuel consumption and hence CO$_2$ emissions.

In accordance with fluid dynamics, most catalytic converters will always produce laminar flow because their long, thin cell walls immediately rectify any turbulence that is present at the inlet. Because of this physical principle catalytic converters require long channels and large volumes to ensure complete mass transfer between the exhaust gas and the channel wall.

METALIT® catalytic converters with different turbulence-generating structures significantly improve mass transfer and catalytic efficiency by up to 30% depending on the application. Alternatively, catalytic converters can be made much smaller, which not only saves space and reduces pressure loss but also leads to a corresponding saving in the amount of expensive precious metals.
Perforated metal foils with a PE-Design® (PE = perforated) for petrol engines have proven to be particularly innovative and highly effective in many series production applications. In addition to turbulent flow conditions, the PE structure also allows gas and mass transfer between adjacent channels for the first time. In practice, this makes it possible to build smaller and more efficient catalytic converters with less pressure loss (= better engine performance) and lower CO₂ emissions. PE catalytic converters with very high cell densities up to 900 cpsi have already been developed and are used in a number of applications. The usual increase in pressure loss is offset by the higher cell density of the PE structures, which prevents loss of performance. The enormous benefits of PE catalysts have been recognised by the emerging car manufacturers in Russia and India, which have been using METALIT® catalytic converters with a PE structure in their series production for the last four years. The reasons for using catalytic converters with yet higher cell densities are even stricter future emission limits.

The V8 and V6 engines of the new Maserati Ghibli and the latest Maserati Quattroporte model will be fitted with one main catalytic converter per cylinder row. The sporty Bentley Continental GT with a 12-cylinder 6-litre twin-turbo engine has primary catalytic converters and underfloor catalytic converters with a PE structure. The cell density of the primary catalytic converters is 600 cpsi while that of the underfloor catalytic converters is 300 cpsi.

The number of diesel engines fitted with catalytic converters that contain turbulence-generating profiles is rising faster than average. Several car manufacturers have clearly decided to use this type of catalytic converter for their large-scale production in future. They are primarily used as oxidation catalytic converters (DOC) in front of the particulate filter where their compact size and high conversion rates are a key factor. The VW Group is already equipping all its 4-cylinder common rail engines with turbulence-generating DOCs and another German car manufacturer is about to start fitting these DOCs to their new V6 diesel engines. The future is going to be increasingly turbulent.

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Turbulence-generating PE, LS and TS metal profiles

LS-Design® used for the
4-cylinder engines of the VW Group