

Supporting Reduced Emissions

ACS Industries' L Seal technology designed to provide sealing, support for aftertreatment systems



ACS Industries has developed a variety of protective and support seals and exhaust joint seals for use on 2007 heavy-duty diesel engines. Among these is the L-Seal support system for diesel particulate filters, which is designed to create a cushion that not only accommodates the linear tolerance variations in the cone, shell and substrate, but is designed to deliver enough axial and radial support to support the entire system independently of other mounting elements.

As has been well documented, the upcoming 2007 EPA heavy-duty on-highway emissions standards will be the first regulations that require the use of exhaust aftertreatment systems, including diesel particulate filters and diesel oxidation catalysts. And with significantly greater reductions mandated for 2010, it seems likely that selective catalytic reduction (SCR) — already widely used in Europe — will also become part of the emissions aftertreatment mix in North America.

In the variety of DPF filters that have been developed, filter substrate materials such as cordierite, silicon carbide (SiC), knitted wire mesh and sintered metals have been selected, based on high filter efficiency, thermal shock resistance, low space requirements, low system mass and low thermal expansion coefficients.

A sometimes overlooked aspect of DPF design is the mounting system that holds the substrate in position within the DPF housing. In addition to conventional radial mounting, support rings, edge pins and cone modifica-

tions assist in retaining and providing axial support to the filter. But as Dr. Sivanandi Rajadurai (Raja), vice president of Exhaust Products for ACS Industries, explained, “these modifications tend to affect the linear tolerance of the system.”

ACS Industries, headquartered in Woonsocket, R.I., is a global supplier of engineered knitted wire mesh technologies, producing a broad range of knitted wire mesh filters, breathers, vibration isolators and liquid/gas separators for automotive, heavy-duty and industrial applications. The company also supplies a variety of protective and support seals and exhaust joint seals designed for use on 2007 heavy-duty diesel engines.

Among these is the L-Seal support system for DPFs, which is designed to create a cushion that not only accommodates the linear tolerance variations in the cone, shell and substrate, but also deliver more than enough axial and radial support to support the entire system independently of other mounting elements.

During operation, DPFs encounter

increased particulate loading and backpressure, which affects the axial force exerted on the substrate. Mounting systems must be able to handle these and other in-use forces stemming from thermal, mechanical and road-load conditions. Raja noted that, due to the larger size of the substrates typically used on heavy-duty engines, their higher bulk densities and higher thermal expansion coefficients, “conventional mounting systems often fail to provide sufficient mounting pressures to hold it in place.

“The L-Seal provides enough axial and radial compensating force so that either one or both can effectively hold the system,” Raja said. “It also offsets any mounting deterioration within the system due to normal wear and tear, expansion and weight loss from vibration and erosion, as axial support is independent of resonance frequency.”

Simple modifications to the L-Seal can be used to alter the axial and radial mounting forces, the company said. Even minor changes in wire configurations yield drastic changes in L-Seal functionality. Tweaking charac-

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teristics such as alloy or wire diameter can increase a seal's compression or heat tolerance.


"We custom-design L-Seals to fit our customers' particular applications," said Raja. "To change the mounting forces, we can manipulate variables such as the material used, its surface characteristics, heat treatment and wire geometry.

"For example, gas permeability of an ACS L-Seal can be modified by using half-flat/half-round wire to minimize the leak rate on the radial gap, or all-round wire to provide more gas penetration."

All DPF and SCR systems using ACS L-seal designs are validated to meet thermal, mechanical and road-load conditions of the vehicle. They must pass accelerated test conditions without field failure, which includes ambient and hot vibration, water quenches and oscillation load tests established to ensure safety and lifetime reliability.

"At ACS, our rigorous product development and validation process begins with input from our customers," Raja said. "Specifics such as vehicle information, engine characteristics, exhaust gas mass flow rate and thermal profiles are critical to these early stages.

"We then model the required axial and radial forces, compression behavior and spring-back curves and proceed to a soft-tool prototype which will be validated and verified before moving on to the final stage of hard-tool proving."

ACS, founded in 1939, manufactures its L-Seal technology at its Monterrey, Mexico, facilities. 

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