

Emissions requirements drive shift to thermoset truck parts

For components facing a long, hard existence in the engine compartments of heavy trucks, the material choice has often been some type of metal. But metal components can add a lot of weight to truck designs, which is a major concern at a time of rapidly rising fuel costs. What's more, metal components have a greater impact now that the U.S. **EPA** has introduced new restrictions on diesel-engine emissions.

Many designers of under-the-hood truck components are switching from metals to thermoset composite materials. Thermosets meet all the requirements of under-the-hood applications but are much lighter than metal alternatives, making it easier for designers to comply with the new emissions standards without adding weight. Thermosets can also handle the higher engine-compartment



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temperatures that result from compliance with the standards. And, as an added bonus, the materials provide excellent corrosion-resistance properties and slash the time and costs involved in manufac-

turing under-the-hood components.

Composite materials consist of glass-fiber reinforcement in a polymer resin. Two common thermosets are bulk molding compound (BMC) and sheet molding com-

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pound (SMC). SMC includes more reinforcement and longer glass fibers than BMC, so it provides higher mechanical strength than its thermoset counterpart. Suitable for the demanding service conditions in heavy trucks, SMC provides at least as much impact resistance as steel and up to four times as much as BMC.

In the heavy-truck industry, SMC provides strength and durability for under-the-hood components such as oil drain pans, heat and noise shields, and valve and timing chain covers. And it maintains excellent strength during prolonged exposure to high temperatures. This has become more important with the advent of more-stringent EPA diesel-engine emissions requirements, which make heavy-truck engines run at higher temperatures.

Truck designers also prefer SMC because it offers a higher strength-to-weight ratio than steel and most other metals. As a result, SMC components are typically 25-35% lighter than steel parts of equal strength. Because SMC is lighter

than metal alternatives, it offsets some of the additional engine weight introduced by the EPA emissions requirements, and therefore reduces the fuel consumption of heavy trucks. Class 8 trucks must now carry an additional 300-500 lb (136-227 kg) of emissions-reducing equipment to comply with new EPA standards.

Besides adding to vehicle weight, the new emissions equipment adds \$5000-7000 to the cost of a heavy truck. With designers looking to offset these higher costs, SMC is even more attractive when compared to metals, which have become much more expensive in recent years.

SMC lowers costs in other ways as well. In metal manufacturing, complex designs may require components consisting of multiple parts that are made separately and then assembled to create the final product. But by using SMC, manufacturers can mold many features into a component in a single step. This consolidation of multiple parts into one can significantly reduce manufacturing costs, as

well as shorten design and production time.

Manufacturing expenses are also lowered by the switch to composite tooling, which costs less than half as much as steel stamping tooling. Less-expensive tooling has a particularly significant impact on the overall cost of products made in low-volume processes, such as those typically used to manufacture under-the-hood truck components.

Parts have to meet a formidable list of requirements to assure their survival and success under the hoods of heavy trucks. Besides handling a combination of mechanical stresses, under-the-hood components must withstand exposure to harsh environments for projected truck lifetimes measured in decades rather than years.

Unlike metals, which are notoriously susceptible to corrosion, SMC will not rust or corrode when used in harsh environments. Without a protective coating of paint, thermoset material provides superior resistance to gasoline, motor oil, coolants, lubricants, automatic transmission fluid, cleaning agents, and water with a wide range of pH values. SMC also maintains its chemical resistance for the entire life span of the truck.

Another advantage of SMC is its ability to reduce engine noise. Tests show that the internal damping of the thermoset is 10 times that of steel and aluminum. Superior damping means that under-the-hood component designers who switch to SMC can expect 10-15% reductions in engine noise levels.

SMC is also dimensionally stable, which minimizes warping and thereby helps parts maintain flat mounting surfaces. This allows SMC components to provide better oil sealing, which helps allay warranty-related concerns of truck makers.

Featuring light weight and long-term resistance to high temperatures, SMC helps heavy-truck designers meet stringent new emissions requirements. SMC also provides superior physical properties and reduces manufacturing complexity and costs. Thus, SMC is an increasingly popular alternative to metals among those seeking to improve the design, manufacture, and performance of under-the-hood truck components.

Gary Littell, Applications Development Engineer at IDI Composites International, wrote this article for AEI.

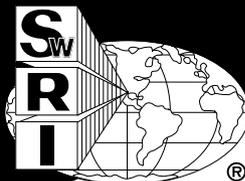
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