

# TRAILER BODY BUILDERS®

trailer-bodybuilders.com

Trailer/Body BUILDERS

BUILDERS®

A Prism Publication

## Structural metal bonding

*Specialty vehicle manufacturers are having success using structural adhesives to replace rivets and mechanical fasteners in truck body and trailer manufacturing*

ADVANCES IN STRUCTURAL adhesive technology have dramatically expanded the scope of potential metal-bonding applications, says Scott D Anderson, application engineer, Loctite Industrial Adhesives, Henkel Corp.

“In many industries, manufacturers of metal components are turning to structural adhesives to replace or augment rivets, bolts, welding, and other traditional fastening methods in their assembly processes,” he says. “Adhesives can improve product performance and aesthetics, reduce overall assembly time, and lower production costs.

“Until recently, most structural adhesives would lose strength over time on galvanized steel. New, patented adhesive technology provides long-term durability on galvanized substrates. Structural adhesives are also excellent alternatives for bond-



**THE DIFFERENCE:** Before switching to structural adhesives, beverage truck manufacturer Group Hesse would install a thin white plastic rail to hide and protect the rivets that attach the front and back truck walls. Using adhesives, the rail is no longer needed, resulting in a cleaner look.

ing metal-to-metal, metal-to-plastic, and metal-to-composites.”

He says that on specialty vehicles such as trailers and truck bodies, structural adhesives are being used to assemble frames, panels, booms,

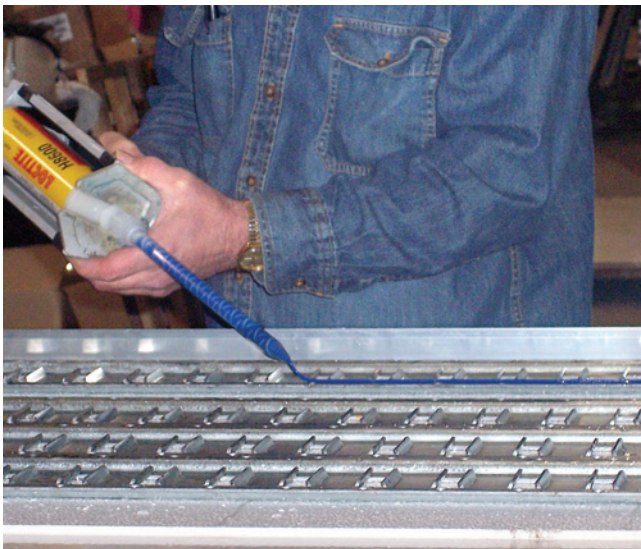
and cabs made of metal, plastic, and composites.

Anderson says structural adhesive systems have been formulated to bond trusses, joists, shear walls, headers, studs, and cantilevered

## Bonded bodies...



Galvanized steel e-tracks that run the length of a Mickey truck body are now attached to the fiberglass-reinforced plastic interior walls using adhesives to replace through-bolts.



Operator applies a two-part acrylic adhesive to a set of galvanized steel e-tracks for installation on the inside.

beams. Their use can reduce overall construction costs on the components by 60%, with the majority of savings found in assembly time.

### Limitations

He says there are three major methods of traditional metal-to-metal assembly, and they are used with varying degrees of effectiveness depending on the final application, end-use requirements, and environmental constraints such as weather, moisture, salt, or chemicals.

Thermal methods weld, braze, or solder two homogenous materials with similar melting points.

Mechanical fastening secures dissimilar substrates with bolts, screws, or rivets.

Chemical assembly bonds similar or dissimilar substrates using adhesives.

"The most important limitation of both thermal joining and mechanical fastening is cost," he says. "Thermal joining is an expensive process that requires specialized labor. Welded joints are often non-uniform and lack the clean aesthetics desired for high-end applications. Parts joined in this manner are very difficult to disassemble.

"Mechanical fastening is also an expensive process, requiring labor to drill holes and insert fasteners. The holes can create leak paths, a starting point for corrosion, and may detract from the visual aesthetics of the end product. As both fasteners and thermal joining concentrate stress at a single point, they may cause premature joint failure and have difficulty withstanding stresses caused by flex or vibration."

He says structural acrylic adhesives are two-part systems that fill large gaps, seal joints, join dissimilar materials, and provide a neat appearance. In addition, these materials deliver thermal and chemical resistance, and distribute stresses evenly across the entire bond joint. With stress spread across larger areas, the joint is stronger. On school buses, where safety is paramount, the steel will actually fracture and split before adhesive joints fail.

"By eliminating the stress concentrations produced by fasteners, thinner-gauge metals may often be used," he says. "Rubber-toughened structural acrylic formulations are an excellent choice for applications requiring excellent cold impact resistance, long-term fatigue resistance, and durability.

"These adhesives cure by mixing two separate parts: a resin and an activator. Once the two components are mixed, a room-temperature chemical reaction occurs, delivering a very strong bond to metals, plastics, and composites. These adhesives will not bond well to wood or rubber products."

### Corrosion reduced

Anderson says that by eliminating the holes made with mechanical fasteners, structural acrylics provide a better-looking end product and reduce corrosion. They require little surface preparation and can be formulated to deliver application-specific open times from minutes to hours.

The mix ratio for these adhesives is forgiving and allows some margin for error. Once mixed, the adhesive generates heat during the curing process. The effects of this heat can be minimized by controlling the amount of adhesive dispensed, the size of the assembly, and the substrates used. A large metal assembly, for instance, will dissipate heat faster than a small metal, plastic, or composite part.

He says that because most structural acrylics typically can't resist temperatures above 250° F, processing that involves elevated temperatures such as a paint bake cycle may present problems. However, a few structural acrylics can withstand temperatures up to 400° F for short periods of time, allowing for use in paint bake cycles without a significant loss in bond strength.

Structural acrylic adhesives require cure time up to 24 hours, he says. However, fixture time is much shorter, and many formulations allow handling of assemblies in just minutes. To keep production lines moving, mechanical fasteners are sometimes used to temporarily hold the assembly in place while the adhesive cures. These small fasteners are used only sparingly and do not require through-holes.

High-performance adhesive formulations are available to bond specific substrates such as aluminum, stainless steel, carbon steel, or galvanized materials. These adhesives also have more advanced toughening agents to improve impact and peel resistance.

"Specialty vehicle manufacturers are achieving great success using structural adhesives to replace rivets and mechanical fasteners in truck body and trailer manufacturing," Anderson says. "The improved product aesthetics that result from adhesive assembly can greatly enhance the value of the vehicle."

## Applications

Here are two examples of what Anderson is talking about:

- Group Hesse of Quebec, Canada, is the oldest beverage trailer and truck body manufacturer in North America. The company was using a riveting process to attach the exterior walls of the trailer to its aluminum frame. The three-step process required holes to be drilled into the wall panels for the rivets. Wall panels were then riveted in place, and a white plastic rail was installed around the edges of the front and back walls to cover the rivets. This plastic rail was designed to improve the appearance of the front and back walls that are used for advertising space.



**Structural acrylics provide a better-looking end product and reduce corrosion.**



**Without through-bolts, the truck body exterior is more visually appealing. The e-track bars are actually stronger as adhesives distribute stress over the entire bar rather than around individual fasteners.**

The plastic rails did not match the paint job and were easily damaged. The rivets caused the paint to peel and eventually rust and corrode in Canada's extreme weather conditions. Group Hesse was looking for a process that was simpler, less expensive, more attractive, and offered long-term performance.

In response, Henkel provided Loctite H8000 Speedbonder adhesive, a fast-fixturing structural acrylic that offers excellent impact and peel resistance on aluminum. The adhesive completely replaced the rivets on both the front and rear exterior walls, eliminating the plastic rails.

The adhesive was manually applied to the frame using a pneumatic cartridge dispenser. The flat painted panel was then clamped in position, excess adhesive was removed, and the assembly was allowed to cure for two hours. The assembly process was completed in just four hours—down from five hours, 15 minutes—and no additional reinforcements were required, according to Anderson.

Group Hesse tested a fleet of beverage trucks assembled using the structural acrylic adhesive for 18 months on Canadian roads. Tests found that the longevity and aesthetics of the painted graphics improved dramatically. By eliminating the rivets and the plastic rail, painted graphics could extend all the way across the panel. Corrosion that once started at the rivets was completely eliminated with the new assembly process.

Anderson says Group Hesse is now evaluating using Loctite H8000 Speedbonder to assemble the truck body's aluminum frame, to reduce difficult and expensive welding requirements. The adhesive is expected to increase the overall structural integrity of the assembly by evenly distributing joint stress.

"It is obvious to me that welds will be used less and less in our design, replaced by stronger, more efficient technologies," says Martin Barrette, chief engineer at

Group Hesse.

• Mickey Truck Bodies of High Point, North Carolina, a manufacturer of beverage delivery trucks and dry freight vans, is using adhesive to install galvanized steel e-track bars in van bodies.

In order to attach the e-track bars to the fiberglass-reinforced plastic interior walls, the company was using self-sealing through-bolts inserted every two feet for the length of the truck.

A structural acrylic formulated for long-term strength on galvanized steel replaced the through-bolts along the e-track and made the installation process a one-man job. First, adhesive is applied along the e-track bar. The bar is positioned to the wall and tacked in place using sheet metal screws that do not penetrate through the wall. The screws provide stability while the adhesive cures.

"The adhesive assembly process eliminated the need for one operator and still reduced installation time by 20%," Anderson says. "The company further reduced costs by eliminating expensive through-bolts. The look of the truck bodies is now more visually appealing, and the e-track bars are actually stronger as stress is spread over the entire bar rather than around individual fasteners." ■

**'Holes can create leak paths, a starting point for corrosion, and may detract from the visual aesthetics of the end product. As both fasteners and thermal joining concentrate stress at a single point, they may cause premature joint failure and have difficulty withstanding stresses caused by flex or vibration.'**

— *Scott D Anderson*

Reprinted with permission from the August 2006 issue of *Trailer/Body Builders*® ([www.trailer-bodybuilders.com](http://www.trailer-bodybuilders.com))  
Copyright 2006, Prism Business Media. All rights reserved.

TBB-58-RB



**Henkel Corporation**  
**Engineering Adhesives**  
**1001 Trout Brook Crossing**  
**Rocky Hill, CT 06067 U.S.A.**  
**[www.henkel.us](http://www.henkel.us)**  
**[www.loctite.com](http://www.loctite.com)**