



Smooth-sided Success with 3M™ VHB™ Tape

by Mark Berman, 3M

Successful trailer manufacturers have to be exceptionally good listeners. Their clientele are anything but shy when it comes to the quality of their trailers. Whether used to haul prized horses, tools and capital equipment, or extremely valuable “toys”, these customers often spend just as much time finding the perfect trailer as they do finding what rides inside. It needs to look good and they expect it to last. Customers have come to appreciate the smooth-sided look of trailers they see everywhere from racetracks to trade shows. They also recognize that new manufacturing techniques, in addition to looking great, can increase the resale value and longevity of the trailers they purchase.

Manufacturers who have listened closely to their customers have been using 3M™ VHB™ Tape in their smooth-sided trailer designs



3M continues to innovate within the 3M™ VHB™ Tape product line

for years. The rising popularity of smooth-sided trailers continues to increase the usage of these tapes throughout the industry. These same manufacturers have found that 3M™ VHB™ Tape can provide a number of important benefits beyond a smooth exterior surface. For example, 3M™ VHB™ Tape’s sealing properties create a trailer wall that is resistant to weather and moisture. 3M™ VHB™ Tape isolates materials to minimize bi-metallic corrosion on aluminum and steel interfaces. 3M™ VHB™ Tape’s acrylic foam core

also damps vibrations within the trailer walls, creating a smoother and quieter ride for the driver and cargo.

Unfortunately, some manufacturers have encountered side panel buckling or delamination issues on trailers that utilize acrylic foam tapes. These issues affect the appearance and are often triggered by prolonged sun exposure. Other possible causes for delamination include improper tape selection, improper surface preparation and poor application techniques. 3M recently discovered that engineering slight modifications into the design of the trailer can significantly reduce or eliminate delamination.

Why Delamination?

3M found that one potential source of delamination is caused by the combined use of mechanical fasteners and tapes to secure the exterior

walls of smooth-sided trailers to interior posts. In this design, tape is applied to bond the side panels to the interior posts and mechanical fasteners are placed a few inches apart along both the top and bottom of the wall extrusions. Through their research and discussion with customers, 3M engineers discovered that constraining the sidewall panel at the top and bottom of the interior post resulted in tremendous outward forces when the side panel expanded due to heat and sun exposure. These outward forces can be a reason for delaminations.

To explain, a typical trailer may consist of exterior walls made of aluminum panels that are mechanically fastened to steel posts along the top and bottom extrusions of the trailer. This results in a constrained sidewall. When exposed to heat (typically through extended periods in the sun), the temperature of the exterior aluminum skin on a dark-colored trailer can rise to nearly 200 degrees, causing the panel to expand 0.138 inches on a 96-inch panel. The interior steel post

is not directly exposed to the sun and has a lower thermal expansion rate than aluminum. The post temperature rises to approximately 100 degrees and expands minimally – about 0.018 inches on a 96-inch post. The difference in these expansion amounts causes the length of the panel to expand beyond the length of the post by 0.120 inches. When a panel is mechanically constrained by being fastened to the posts at the top and bottom, this expansion differential can cause the panel to buckle outward from the post. While acrylic foam tapes are typically able to withstand up to several times their thickness in expansion, that still may not be enough to withstand this amount of buckling due to panel thermal expansion. In fact, 3M’s preliminary investigations of other adhesive technologies, including polyurethane and structural adhesives, have shown similar delaminations on constrained designs.

Solution by Design

3M applauds one of its long-time customers, Cimarron



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Trailers, for developing a trailer design that takes advantage of the benefits of 3M™ VHB™ Tape and provides a solution to help prevent delamination. Cimarron Trailers is a manufacturer of high-quality, custom-built, all aluminum horse, stock and cargo trailers. Cimarron offers its entire line of Norstar horse trailers as smooth-skinned, and the company uses 3M™ VHB™ Tape exclusively to secure the side panels.

“When we designed the Norstar line of trailers, every component was designed from scratch with VHB Tape in mind,” said Cimarron president, Michael Terry, who wanted his trailers to have a clean, neat

appearance with no deviations.

Terry created an unconstrained smooth-sided design solution in which the exterior walls are attached to the posts using 3M™ VHB™ Tape, and the top and bottom of the panels are left to “float” in a notch-like component designed into the extrusions. This unconstrained design allows the panel to expand vertically when exposed to heat. The differential expansion of 0.120 inches experienced on a 96-inch unconstrained

panel to post application is within the design parameters of 3M™ VHB™ Tape. The same expansion of 0.120 inches on a constrained design that utilizes mechanical fasteners at the top and bottom extrusions could cause the exterior skin to buckle. 3M found that a design that leaves only one end of the panel to float – top or bottom – will also allow the panel to expand on an even plane, which helps to prevent delamination.

Proper craftsmanship and preparation in the

manufacturing process is key to realizing all the benefits 3M™ VHB™ Tape can provide. Much of the preparation depends on the materials being bonded together, but some factors that are crucial in the application of nearly any adhesive tape include:

- Use only an approved tape and surface preparation combination for the specific materials being bonded together. 3M conducts individual customer tests to help a customer optimize the surface preparation for the customer’s substrates and 3M™ VHB™ Tape selection.
- Typical surface preparations can include abrading, priming, cleaning or a combination of the listed. Good tape roll down pressure is always required.
- 3M continues to innovate within the 3M™ VHB™ Tape product line with technologies designed to improve adhesion while reducing the number of surface



Cimarron Trailers’ Transtar model also uses 3M™VHB™ Tape to achieve the smooth-sided appearance

preparation steps required.

- 3M has developed a procedure manual for substrate preparation and assembly of panel bonding applications. These visual, step-by-step procedures assist customers in training production staff and controlling their manufacturing processes.

- Ensure that the manufacturing facility and all materials meet the required minimum temperature for a given adhesive and surface preparation.

Cimarron Trailers credits much of the success of their Norstar smooth-sided trailers to the correct application of 3M™ VHB™ Tape with emphasis placed on craftsmanship in the manufacturing process.

“I’ve used a number of different fastener products in the 29 years I’ve been in the trailer business,” said Terry. “I use VHB Tape for several reasons, but mainly because it’s reliable – the foam core doesn’t fail down the center,



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the adhesive is fast – and because of the technical support that 3M offers.”

3M has assisted Cimarron Trailers with a number of design solutions in its long relationship with the premium trailer manufacturer and offers in-depth technical assistance to help all of its customers set up the most stream-lined manufacturing process possible. In fact, 3M recently added a Trailer Market Specialist to further assist manufacturers and share industry best practices in panel bonding.

For more information, call 3M’s Trailer Market Specialist, Charlie Toney, at (800) 643-2954.

Mark Berman is an Application Development Specialist for 3M. He has more than 30 years of experience in the development, manufacturing and application of a variety of 3M technologies. Over the last five years, he has worked directly with 3M customers on many projects and product solutions. He holds a Master's degree in electrical engineering from the University of Minnesota.