3M

VHB™ Tape
Cold Temperature Performance

Technical Bulletin **January, 2002**

Cold Temperature Performance of 3M™ VHB™ Tapes

This bulletin summarizes the typical low temperature performance of the 3M™ VHB™ family of tapes. The performance of both VHB Foam Tapes and Adhesive Transfer Tapes is profiled over a broad temperature range.

The VHB tapes are thermoplastic in nature, becoming softer as temperature increases and firmer as temperature decreases. As the adhesive and core materials become firmer, the performance generally increases measured by the standard test methods described in the VHB tape product information page. This performance increase is demonstrated graphically in Figure 1. This graph shows the breakaway force and peel measured to break a VHB Tape 9473 bond as a function of temperature. The graph in Figure 2 shows the dynamic normal tensile strength of VHB Tape 4945 as a function of temperature. All products in the VHB Tape family would be expected to follow this same pattern under the same conditions.

The exception to this performance-temperature relationship is at very low temperatures when high impact stress along with high frequencies are encountered. The acrylic polymer from which VHB Tapes are made goes through its glass transition temperature at approximately -40°F (-40°C). At low temperatures, when the adhesive and foam core are firm or glassy, the ability to absorb impact energy is reduced. This type of shocky behavior is demonstrated by the lower performance of VHB Tape 9473 as noted at -65°F (-54°C) in Figure 1. The potential for shock failure is dependent on the temperature, the frequency of the impact stress and the material to which the adhesive is bonded.

With the number of variables involved, the potential for cold shock cannot be accurately described or tested on laboratory sized specimens. Although it is not generally seen to be a limiting factor in many actual applications, small laboratory samples can be made to exhibit brittle behavior at extremely cold temperatures. In full scale applications, the frequency distribution and energy concentration would generally be expected to be within the limits of VHB tape capability. For this reason, it is suggested that small scale tests not be solely relied upon to draw conclusions about this performance characteristic. While we do not see low temperatures to be a limiting factor in many actual applications, we suggest that a thorough evaluation be conducted by the user at actual use conditions on applications where high impact stress is expected at low temperatures.

In one example of a cold temperature application, exterior stainless steel anti-chaffing strips on a commercial aircraft are bonded to the wing flaps with VHB Tape 9473 and are routinely subjected to temperatures from -65°F (-54°C) to more than 150°F (66°C) several times each day, as well as the typical vibration and environment which the outside of a passenger jet encounters. This application has been in use since 1984 and continues to be utilized on new models of the aircraft. While 3M does not recommend use of VHB tapes in exceedingly cold temperatures, one can see by the above application that with the user's proper evaluation and design even these harsh environments can be tolerated under certain circumstances as determined to the user's satisfaction.

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T-Peel vs. Temperature Tape
F-9473PC Adhesion to Aluminum

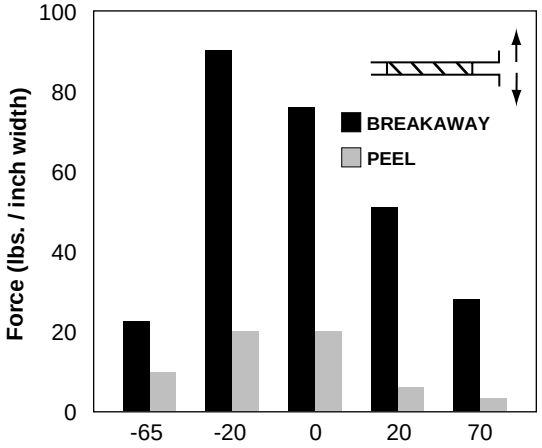

Figure 1

Dynamic Normal Tensile vs. Temperature
Tape 4945 to Aluminum Blocks

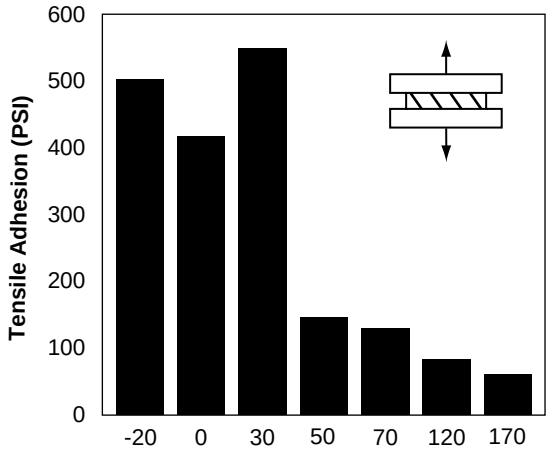

Figure 2

For Additional Information

To request additional product information or to arrange for sales assistance, call toll free 1-800-362-3550 or visit www.3M.com/adhesives. Address correspondence to: 3M Engineered Adhesives Division, 3M Center, Building 220-7E-01, St. Paul, MN 55144-1000. Our fax number is 651-733-9175. In Canada, phone: 1-800-364-3577. In Puerto Rico, phone: 1-787-750-3000. In Mexico, phone: 52-70-04-00.

Important Notice

User is responsible for determining whether the 3M product is fit for a particular purpose and suitable for user's method of application. Please remember that many factors can affect the use and performance of a 3M product in a particular application. The materials to be bonded with the product, the surface preparation of those materials, the product selected for use, the conditions in which the product is used, and the time and environmental conditions in which the product is expected to perform are among the many factors that can affect the use and performance of a 3M product. Given the variety of factors that can affect the use and performance of a 3M product, some of which are uniquely within the user's knowledge and control, it is essential that the user evaluate the 3M product to determine whether it is fit for a particular purpose and suitable for the user's method of application.

Warranty

3M warrants for 24 months from the date of manufacture, that 3M™ VHB™ Tape will be free of defects in material and manufacture. 3M MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. This Limited Warranty does not cover damage resulting from the use or inability to use 3M™ VHB™ Tape due to misuse, workmanship in application, or application or storage not in accordance with 3M recommended procedures.

Limitation of Remedies and Liability

If the 3M™ VHB™ Tape is proved to be defective within the warranty period stated above. THE EXCLUSIVE REMEDY, AT 3M'S OPTION, SHALL BE TO REFUND THE PURCHASE PRICE OF OR TO REPAIR OR REPLACE THE DEFECTIVE 3M™ VHB™ TAPE. 3M shall not otherwise be liable for loss or damages, whether direct, indirect, special, incidental, or consequential, regardless of the legal theory asserted, including negligence, warranty, or strict liability.

ISO 9002

This Engineered Adhesives Division product was manufactured under a 3M quality system registered to ISO 9002 standards.

3M

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