



Obtaining optimum performance with 3M™ VHB™ Tapes

Technical Bulletin

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Introduction

3M VHB Tapes utilize a variety of specific foam, adhesive, color and release liner types to provide each product/family with specific features. These features can include adhesion to specific or a broad range of materials, conformability, high tensile strength, high shear and peel adhesion and resistance to plasticizer migration. All 3M VHB Tapes have excellent durability and excellent solvent and moisture resistance.

Note: All 3M VHB Tapes should be thoroughly evaluated by the user under actual use conditions with intended substrates to determine whether a specific tape is fit for a particular purpose and suitable .

Adhesive Types

Multi-Purpose Acrylic: This adhesive bonds to a wide range of materials including metals, glass, and high and medium surface energy plastics and paints. This unique adhesive also has the ability to resist migration of plasticizers in vinyl substrates.

Modified Acrylic: This adhesive bonds to medium low surface energy paints and plastics, including many powder coated paints in addition to the substrates listed with the multi-purpose acrylic adhesive (except plasticized vinyl).

General Purpose Acrylic: This adhesive bonds to most higher surface energy substrates including metal, glass and high surface energy plastics.

Low Temperature Applicable Acrylic: This adhesive can make bonds down to 0°C, compared to 10°C for most acrylic adhesives. This adhesive system bonds to most high surface energy substrates including metal, glass and high surface energy plastics.

Foam Types

Conformable: This foam provides high strength with the capability of conforming to the irregularities of rigid substrates, even when there might be slight mismatch.

Very Conformable: This foam provides the highest level of conformability while maintaining high internal strength.

Firm: This foam provides the highest level of foam strength in the 3M VHB Tapes family.

Clear: Not technically a foam; this solid acrylic material provides excellent clarity.

VHB Tape Number	Adhesive Type	Foam Type	Thickness	Colour
4941	Multipurpose Acrylic	Conformable	1.1	Grey
4956		Conformable	1.6	
4991		Conformable	2.3	
4945		Firm	1.1	White
4905	General Purpose Acrylic	Clear	0.5	Clear
4910		Clear	1.0	
4929		Firm	0.64	Black
4949		Firm	1.10	
4930		Firm	0.64	
4950		Firm	1.1	White
4951	Low Temperature applicable acrylic	Firm	1.1	White
5652	Modified Acrylic	Very Conformable	1.1	Dark Grey / Black

Design and Tape Selection Considerations

Choose the right tape for the substrate

Adhesives must flow onto the substrate surfaces in order to achieve intimate contact area and allow the molecular force of attraction to develop. The degree of flow of the adhesive on the substrate is largely determined by the surface energy of the substrate. Refer to 3M VHB Tape Technical Data for more detail.

Use the right amount of tape

As a general rule, for static loads, approximately 55sqcm or tape per kg of static weight to be supported in order to prevent excessive creep. For dynamic loads, the dynamic performance characteristics provided on page 4 of the *VHB Tapes Technical Datasheet* should be useful, factoring in the appropriate safety factors.

Allow for thermal expansion/contraction

3M VHB Tapes can perform well in applications where two bonded surfaces may expand and contract differentially. Assuming good adhesion to the substrates, the tapes can typically tolerate differential movement in the shear plane up to 3 times their thickness.

Bond Flexibility

While an advantage for many applications where allowing differential movement is a benefit, the tape bonds are typically more flexible than alternate bonding methods. Suitable design modifications or periodic use of rigid fasteners or adhesives may be needed if additional stiffness is required.

Severe Cold Temperature

Applications which require performance at severe cold temperatures must be thoroughly evaluated by the user if the intended use will subject the tape product to high impact stresses.

Application Techniques

Cleaning

Most substrates are best prepared by cleaning with a 3M HiPA Clean 300 or 50:50 mixture of isopropyl alcohol (IPA) and water prior to applying 3M VHB Tapes.

Exceptions to the general procedure that may require additional surface preparation include:

- Heavy Oils: A degreaser or solvent-based cleaner such as 3m 700 cleaner may be required to remove heavy oil or grease from a surface and should be followed by cleaning with IPA/water.
- Abrasion: Abrading a surface, followed by cleaning with IPA/water, can remove heavy dirt or oxidation and can increase surface area to improve adhesion.
- Adhesion Promoters: Priming a surface can significantly improve initial and ultimate adhesion to some materials such as plastics and paints.
- Porous surfaces: Most porous and fibered materials such as wood, particleboard, concrete, etc. need to be sealed to provide a unified surface.
- Unique Materials: Special surface preparation may be needed for glass and glass-like materials, copper and copper containing metals, and plastics or rubber that contain components that migrate (e.g. plasticisers).

Refer to 3M Technical Bulletin "*Surface Preparation for 3M VHB Tape Applications*" for additional details and suggestions.

Pressure

Bond strength is dependent upon the amount of adhesive-to-surface contact developed. Firm application pressure develops better adhesive contact and helps improve bond strength. Typically, good surface contact can be attained by applying enough pressure to insure that the tape experiences approximately 15 psi (100 kPa) pressure. Either roller or platen pressure can be used. Note that rigid surfaces may require 2 or 3 times that much pressure to make the tape experience 15 psi.

Temperature

Ideal application temperature range is 21°C to 38°C. Pressure sensitive adhesives use viscous flow to achieve substrate contact area. Minimum suggested application temperature is 15°C for most VHB Tapes, 0°C for VHB 4951. To obtain good performance with all 3M VHB Tapes, it is important to ensure that the surfaces are dry and free of condensed moisture.

Time

After application, the bond strength will increase as Bond Typical Build vs. Time the adhesive flows onto the surface. At room temperature approximately 50% of ultimate bond strength will be achieved after 20 minutes, 90% after 24 hours and 100% after 72 hours.

Special Cases

Plasticised Vinyl – Plasticizers compounded in soft vinyl can migrate into adhesives and significantly change their performance characteristics. 3M VHB Tapes 4941 and 4945 families have very good plasticizer resistance and adhesion to many vinyl formulations. Because of the wide variation in vinyl formulations, however, evaluation by the user must be conducted with the specific vinyl used to ensure that performance will be satisfactory over time. Problems related to plasticizer migration can often be predicted by accelerated aging of assembled parts at 66°C for one week).