TBP Converting, Inc.
3M 4991 PDS

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3M™ VHB™ Tape 4991

Product Description

3M™ VHB™ Tape 4991 is a 0.090 inch (2.3 mm) thick gray double coated acrylic foam tape with PE film liner. The multi-purpose acrylic adhesive on both sides bonds to a broad range of high and medium surface energy substrates including metals, glass and a wide variety of paints and plastics as well as plasticized vinyl. The conformable foam provides good contact between substrates even when they are slightly mismatched. 3M™ VHB™ Tape 4991 is part of the 4941 tape family. Each product in this family has multi-purpose acrylic adhesive and conformable foam but varies in thickness, color and liner type.

Product Features

- Fast and easy-to-use permanent bonding method provides high strength and long-term durability
- Virtually invisible fastening keeps surfaces smooth
- Can replace mechanical fasteners (rivets, welds, screws) or liquid adhesives
- Gray, 0.090 in (2.3 mm), multi-purpose adhesive and conformable acrylic foam core offers a good balance of strength and conformability
- Eliminate drilling, grinding, refinishing, screwing, welding and associated clean-up
- Creates a permanent seal against water, moisture and more
- Pressure sensitive adhesive bonds on contact to provide immediate handling strength
- Allows the use of thinner, lighter weight and dissimilar materials
- UL GREENGUARD and UL GREENGUARD Gold Certified, contributing to LEED Credit

Technical Information Note

The following technical information and data should be considered representative or typical only and should not be used for specification purposes.

Typical Physical Properties

Property	Values	
Color	Gray	
Tape Thickness	2.3 mm	0.09 in
Thickness Tolerance	±10 %	
Adhesive Type	Multi-Purpose Acrylic	
Foam Type	Conformable Acrylic Foam	
Density	720 kg/m³	45 lb/ft³
Liner	PE Film	
Liner Thickness	0.13 mm	0.005 in
Liner Color	Red (printed)	

Typical Performance Characteristics

Property	Values		Method	Dwell/Cure Time	Test Condition	Substrate	Notes
90° Peel Adhesion	39 N/cm	22 lb/in	ASTM D3330	72 hr @ Room Temperature	Room Temperature	Stainless Steel	Jaw speed 12 in/min (304.8 mm/min). Average force to remove is measured.
Normal Tensile	480 kPa	70 lb/in²	ASTM D897	72 hr @ Room Temperature	Room Temperature	Aluminum	1 in² (6.45 cm²), Jaw Speed 2 in/min (50.8 mm/min). Peak force to separate is measured.
Dynamic Overlap Shear	450 kPa	65 lb/in²	ASTM D1002	72 hr @ Room Temperature	Room Temperature	Stainless Steel	1 in² (6.45 cm²), Jaw speed 0.5 in/min (12.7 mm/min). Peak force to separate is measured.
Short Term Temperature Tolerance	121 °C	250 °F					No change in room temperature dynamic shear properties following 4 hours conditioning at indicated temperature with 100 g/static load. (Represents minutes, hours in a process type temperature exposure).
Long Term Temperature Tolerance	93 °C	200 °F					Maximum temperature where tape supports at least 250 g load per 0.5 in² in static shear for 10,000 minutes. (Represents continuous exposure for days or weeks).

Typical Performance Characteristics (continued)

Static Shear	Test Condition
1000 g	Room Temperature
500 g	66°C (150°F)
500 g	93°C (200°F)

Property: Static Shear
Method: ASTM D3654
Substrate: Stainless Steel
notes: Tested at various temperatures and gram loadings. 0.5 in² (3.23 cm²). Will hold listed weight for 10,000 minutes (approximately 7 days).

Available Sizes

Property	Values	
Standard Length	32.9 m	36 yd
Minimum Available Width	6.4 mm	0.25 in
Maximum Available Width	1219 mm	48 in
Normal Slitting Tolerance	±0.79 mm	±1/32 in
Core Size (ID)	76.2 mm	3 in

Available Sizes:

Available Sizes

Tape Thickness inches (mm)	Standard Length yards (meters)	Minimum Width inches (mm)	Maximum Width inches (mm)	Maximum Roll Length: Width 1/4"up to 3/8" (6.4mm up to 9.5mm) yards (meters)	Maximum Roll Length: Width >3/8" up to 1/2" (>9.5mm up to 12.7mm) yards (meters)	Maximum Roll Length: Width 1/2" and wider (12.7mm and wider) yards (meters)
< 0.015 (0.4)	72 (65.8)	0.5 (13)	46 (1168)	N/A N/A	N/A N/A	See Note Below
0.015/0.016 (0.4)	72 (65.8)	0.25 (6)	48* (1219)	144 (131.7)	175 (160.0)	360 (329.2)
0.025 (0.6)	72 (65.8)	0.25 (6)	48* (1219)	72 (65.8)	108 (98.8)	175 (160.0)
0.032 (0.8)	72 (65.8)	0.25 (6)	48 (1219)	72 (65.8)	108 (98.8)	175 (160.0)
0.040 (1.0)	36 (32.9)	0.25 (6)	48 (1219)	72 (65.8)	108 (98.8)	144 (131.7)
0.045 (1.1)	36 (32.9)	0.25 (6)	48 (1219)	72 (65.8)	108 (98.8)	144 (131.7)
0.062 (1.6)	36 (32.9)	0.25 (6)	46 (1168)	72 (65.8)	72 (65.8)	108 (98.8)
0.090 (2.3)	36 (32.9)	0.25 (6)	46 (1168)	36 (32.9)	36 (32.9)	72 (65.8)

*Exception – 5915 (P) max. width 46 inches (1168 mm); 5925 (P) max. width 47 inches (1194 mm).
Note: 5952 family tapes thinner than 0.015 in (0.4 mm) have max. length 360 yd (329.2 m) for widths 1 in (25 mm) to 8 in (203 mm) and 180 yd (164.6 m) for all other widths.

Special Considerations

Plasticized Vinyl – Plasticizers compounded in soft vinyl can migrate into adhesives and significantly change their performance characteristics. 3M™ VHB™ Tapes 4941 family has 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 150°F (66°C) for one week).

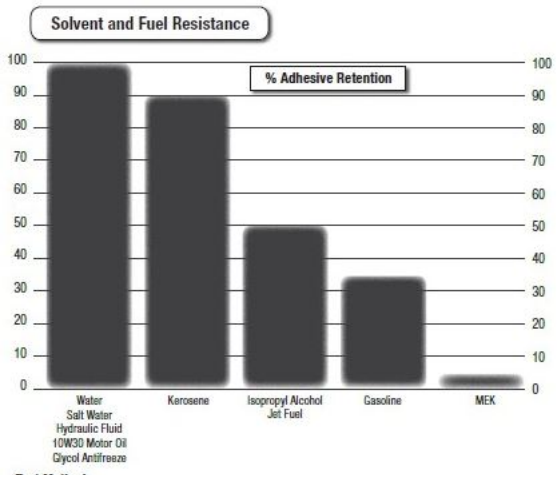
UL746C Listings

3M™ VHB™ Tapes
UL746C Listings - File MH 17478
Category QOQW2 Component - Polymeric Adhesive Systems, Electrical Equipment

3M™ VHB™ Tapes/ Product Families	Substrates	Temperature Rating Minimum	Maximum
4919F, 4926, 4936, 4936F, 4941, 4941F, 4947F, 4956, 4956F, 4979F	Ceramic	-35°C	110°C
	Aluminum, Galvanized Steel, Stainless Steel, Enameled Steel, Nickel Coated ABS, Glass (with or without Silane Coating) PVC, Glass/Epoxy, PBT, Polycarbonate, Acrylic/Polyurethane Paint, Polyester Paint	-35°C	90°C
	ABS	-35°C	75°C
4991	Polycarbonate, Aluminum, Acrylic/ Polyurethane Paint, Polyester Paint	-35°	90°C
5915, 5915P, 5915WF 5925, 5925P, 5925WF, 5930, 5030P, 5930WF, 5952, 5952P, 5952WF, 5962, 5962P, 5962WF	Polycarbonate, Primer 94 Coated Polycarbonate, Aluminum, Acrylic/ Polyurethane Paint, Galvanized Steel, Polyester Paint, Epoxy Paint, Silane Coated Glass, Uncoated Glass, Stainless Steel, Enameled Steel, Glass Epoxy, Polybutylene Terephthalate, Nylon, Polyphenelene Ether (PPE), Acrylic	-35°C	90°C
	Rigid PVC, ABS	-35°C	75°C
5952, 5952P, 5952WF	Cellulose Acetate Butyrate	-35°C	90°C
RP16	Aluminum, Silane Coated Glass	-35°C	90°C
	PVC, ABS	-35°C	75°C
RP16, RP25, RP32, RP45, RP62	Galvanized Steel, Enameled Steel, Nylon, Polycarbonate, Glass Epoxy, Phenolic, PPE/PS Blend, PBT, Epoxy Paint, Polyester Paint, Adhesion Promoter 111 Coated Epoxy Paint, Promoter 111 Coated Polyester Paint, Acrylic Urethane Paint, Epoxy/ Polyester Paint	-35°C	90°C
RP62	Stainless Steel, Glass, Acrylic	-35°C	90°C
	PVC, ABS	-35°C	75°C

A current list can be found at www.ul.com (select certifications, search file MH17478)

Solvent and Fuel Resistance



Additional Typical Performance Characteristics

Property	Values	Method	Test Condition
Water Vapor Transmission Rate	See 3M™ VHB™ Tape 4941 g/m²/24 hr	ASTM F1249	@ 38°C/100% RH
Shear Modulus	See 3M™ VHB™ Tape 4941 Pa		
Poisson's Ratio	See 3M™ VHB™ Tape 4941		
Coefficient of Thermal Expansion	See 3M™ VHB™ Tape 4941 m/m/°C		

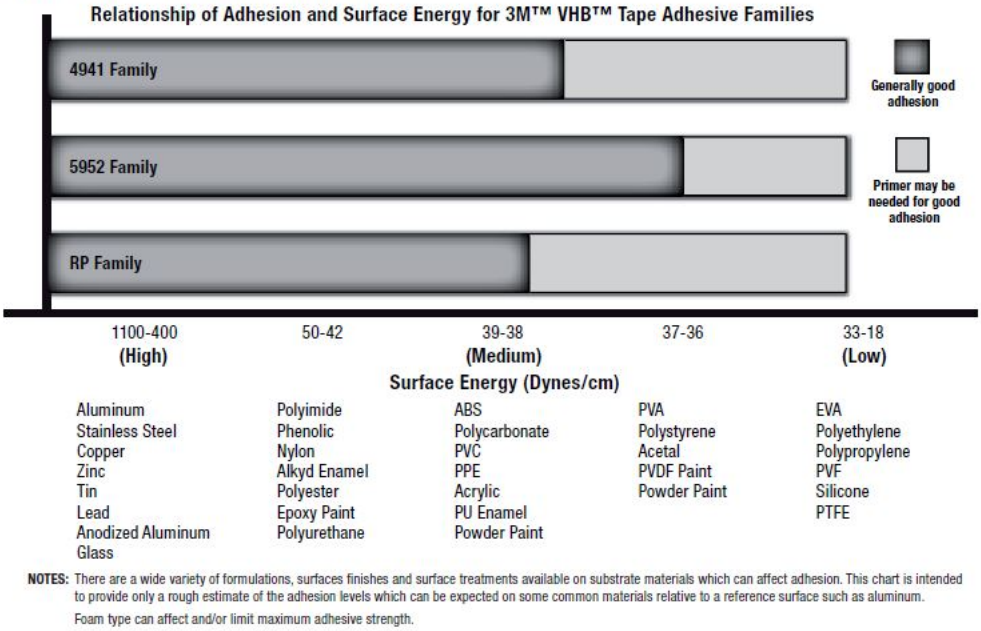
Electrical and Thermal Properties

Property	Values	Method	Test Condition
Dielectric Constant	See 3M™ VHB™ Tape 4941	ASTM D150	1 KHz, Room Temperature
Dielectric Constant	See 3M™ VHB™ Tape 4941	ASTM D150	1MHz, Room Temperature
Dissipation Factor	See 3M™ VHB™ Tape 4941	ASTM D150	1 KHz, Room Temperature
Dissipation Factor	See 3M™ VHB™ Tape 4941	ASTM D150	1MHz, Room Temperature
Dielectric Strength	See 3M™ VHB™ Tape 4941 V/µm	ASTM D140	
Thermal Conductivity (k value)	See 3M™ VHB™ Tape 4941 W/m/K		
Volume Resistivity	See 3M™ VHB™ Tape 4941 Ω-cm	ASTM D257	Room Temperature
Surface Resistivity	See 3M™ VHB™ Tape 4941 Ω/sq	ASTM D257	Room Temperature

Design Considerations

Adhesion to the substrate is important in achieving bonding success. 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. 3M™ VHB™ 4941 family tapes bond well to high (HSE) and medium (MSE) surface energy materials. The image below shows typical materials in these categories.
Achieving good contact is also important. The necessary thickness of tape depends on the rigidity of substrates and their flatness irregularity. While the 3M™ VHB™ Tapes will conform to a certain amount of irregularity, they will not flow to fill gaps between the materials. For bonding rigid materials with normal flatness, consider use of tapes with thickness of 45 mils (1.1 mm) or greater. As the substrate flexibility increases thinner tapes can be considered.
Using the right amount of tape is important to handle the expected stresses. Because 3M™ VHB™ Tapes are viscoelastic by nature their strength and stiffness is a function of the rate at which they are stressed. They behave stronger with relatively faster rate of stress load (dynamic stresses) and will tend to show creep behavior with stress load acting over a long period of time (static stresses). As a general rule, for static loads, approximately four square inches of tape should be used for each pound (57 cm² of tape per kg) of weight to be supported in order to prevent excessive creep. For dynamic loads a useful design factor is 12 lb/in2 (85 kPa) for most dynamic stresses in general applications.
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 alternative bonding methods. Suitable design modifications or periodic use of rigid fasteners or adhesives may be needed if additional stiffness is required.
Performance in Severe Cold Temperature can be challenging. 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. A technical bulletin “3M™ VHB™ Tape Cold Temperature Performance” (70-0707-3991-0) is available for additional information.

This illustration demonstrates the effect of surface energy on adhesive interfacial contact. High surface energy materials draw the adhesive closer for high bond strength.



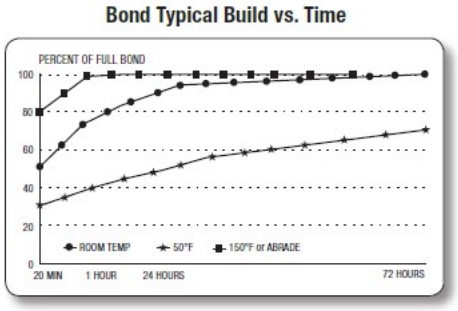
NOTES: There are a wide variety of formulations, surfaces finishes and surface treatments available on substrate materials which can affect adhesion. This chart is intended to provide only a rough estimate of the adhesion levels which can be expected on some common materials relative to a reference surface such as aluminum.

Foam type can affect and/or limit maximum adhesive strength.

Handling/Application Information

Application Techniques

Clean: Most substrates are best prepared by cleaning with a 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 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 many 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. plasticizers).
Refer to 3M Technical Bulletin “Surface Preparation for 3M™ VHB™ Tape Applications” for additional details and suggestions. (70-0704-8701-5)
*Note: These cleaner solutions contain greater than 250 g/l of volatile organic compounds (VOC). Please consult your local Air Quality Regulations to be sure the cleaner is compliant. When using solvents, be sure to follow the manufacturer’s precautions and directions for use when handling such materials.
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 70°F to 100°F (21°C to 38°C). Pressure sensitive adhesives use viscous flow to achieve substrate contact area. Minimum suggested application temperature for the 3M™ VHB™ Tape 4941 family is 60°F (15°C). Minimum application temperature does vary by 3M™ VHB™ tape family and ranges from 32°F to 60°F (0°C to 15°C)
Note: Initial tape application to surfaces at temperatures below these suggested minimums is not recommended because the adhesive becomes too firm to adhere readily. However, once properly applied, low temperature holding is generally satisfactory. 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 the adhesive flows onto the surface (also referred to as “wet out”). At room temperature approximately 50% of ultimate bond strength will be achieved after 20 minutes, 90% after 24 hours and 100% after 72 hours. This flow is faster at higher temperatures and slower at lower temperatures. Ultimate bond strength can be achieved more quickly (and in some cases bond strength can be increased) by exposure of the bond to elevated temperatures (e.g. 150°F [66°C] for 1 hour). This can provide better adhesive wetout onto the substrates. Abrasion of the surfaces or the use of primers/ adhesion promoters can also have the effect of increasing bond strength and achieving ultimate bond strength more quickly.



Storage and Shelf Life

All 3M™ VHB™ Tapes have a shelf life of 24 months from date of manufacture when stored at 40°F to 100°F (4°C to 38°C) and 0-95% relative humidity. The optimum storage conditions are 72°F (22°C) and 50% relative humidity.
Performance of tapes is not projected to change even after shelf life expires; however, 3M does suggest that 3M™ VHB™ Tapes are used prior to the shelf life date whenever possible.
The manufacturing date is available on all 3M™ VHB™ Tapes as the lot number, typically marked on the core or on a label on the outer roll lap. The lot number, typically a 4 digit code, is a Julian date (Y D D D). The first digit refers to the year of manufacture, the last 3 digits refer to the days after January 1. Example: A lot number of 7266 (or 17266) would translate to a date of manufacture of Sept. 23 (266th day of year) in 2017.

Industry Specifications

UL 746C (File MH 17478)
UL GREENGUARD and UL GREENGUARD Gold Certified, contributing to LEED Credit

Trademarks

3M and VHB are trademarks of 3M Company.

References

Safety Data Sheet (SDS)

https://www.3m.com/3M/en_US/company-us/SDS-search/results/?gsaAction=msdsSRA&msdsLocale=en_US&co=ptn&q=4991

Family Group

	4919F	4936	4936F	4941	4941F	4926	4956	4956F	4979F	4991	4991B
Color	Black	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Black	Gray	Black
Tape Thickness (mm)	0.6	0.6	0.6	1.1	1.1	0.4	1.6	1.6	1.6	2.3	2.3
Adhesive Type	Multi-Purpose Acrylic	Multi-Purpose Acrylic	Multi-Purpose Acrylic	Multi-Purpose Acrylic	Multi-Purpose Acrylic	Multi-Purpose Acrylic	Multi-Purpose Acrylic	Multi-Purpose Acrylic	Multi-Purpose Acrylic	Multi-Purpose Acrylic	Multi-Purpose Acrylic
Foam Type	Conformable Acrylic Foam	Conformable Acrylic Foam	Conformable Acrylic Foam	Conformable Acrylic Foam	Conformable Acrylic Foam	Conformable Acrylic Foam	Conformable Acrylic Foam	Conformable Acrylic Foam	Conformable Acrylic Foam	Conformable Acrylic Foam	Conformable Acrylic Foam
Liner	PE Film	DK Paper	PE Film	DK Paper	PE Film	DK Paper	DK Film	PE Film	PE Film	PE Film	PE Film
Liner Thickness (mm)	0.13	0.08	0.13	0.08	0.13	0.08	0.08	0.13	0.13	0.13	0.13
Liner Color	Red (printed)	White (printed)	Red (printed)	White (printed)	Red	White (printed)	White (printed)	Red (printed)	Red (printed)	Red (printed)	Red (printed)

ISO Statement

This Industrial Adhesives and Tapes Division product was manufactured under a 3M quality system registered to ISO 9001 standards.

Technical Information

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