English
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Technical Data Sheet

3M™ VHB™ Tape 4991

Product Description

Finite Element Analysis (FEA) data is available for this product at: **3m.com/FEA**

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 asPlasticized 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	Additional Information
Adhesive Type	Multi-Purpose Acrylic	
Foam Type	Conformable Acrylic Foam	
Color	Gray	
Liner Color	Red (printed)	View
Test Name: Primary		
Liner	PE Film	

Liner Thickness	0.13 mm	

Total Tape Thickness (mil)	90 mil	View
Test Method: ASTM D3652		

Total Tape Thickness (mm)	2.3 mm	View
Test Method: ASTM D3652		

Total Tape Thickness	0.09 in	View
Test Method: ASTM D3652		

Liner Thickness	5 mil	

Liner Thickness	0.005 in	

Thickness Tolerance	±10 %	

Density	720 kg/m³	View
Test Method: ASTM D3574 Notes: Foam with adhesive		

Density	45 lb/ft³	

Typical Performance Characteristics

Property	Values	Additional Information
90° Peel Adhesion	22 lb/in	View
Test Method: ASTM D3330 Dwell/Cure Time: 24.0 Dwell Time Units: hr Temp C: 23C Temp F: 72F Environmental Condition: 50%RH Backing: 5 mil Aluminum Foil Notes: 12 in/min (300 mm/min)		
90° Peel Adhesion	39 N/cm	View
Test Method: ASTM D3330		

Dwell/Cure Time: 72.0
Dwell Time Units: hr
Temp C: 70C
Temp F: 158F
Environmental Condition: 50%RH
Substrate: Stainless Steel
Backing: 2 mil Aluminum Foil

Notes: 12 in/min (300 mm/min)

Normal Tensile	480 kPa	View

Test Method: ASTM D897

Dwell/Cure Time: 72.0
Dwell Time Units: hr
Temp C: 23C
Temp F: 73F
Substrate: Aluminum

Notes: 1 in.² (6.45 cm²), Jaw Speed 2 in./min. (50 mm/min.)

Normal Tensile	70 lb/in²	View

Test Method: ASTM D897

Dwell/Cure Time: 72.0
Dwell Time Units: hr
Temp C: 23C
Temp F: 73F
Substrate: Aluminum

Notes: 1 in.² (6.45 cm²), Jaw Speed 2 in./min. (50 mm/min.)

Overlap Shear Strength	450 kPa	View

Test Method: ASTM D1002

Notes: 1 in² (6.45 cm²), Jaw Speed 0.5 in/min (12.7 mm/min)

Overlap Shear Strength	65 lb/in²	View

Test Method: ASTM D1002

Notes: 1 in² (6.45 cm²), Jaw Speed 0.5 in/min (12.7 mm/min)

Short Term Temperature Resistance	121 °C	View

Notes: No change in room temperature dynamic shear properties following 4 hour conditioning at indicated temperature with 100 g/static load. (Represents minutes, hour in a process type temperature exposure).

Short Term Temperature Resistance	250 °F	View

Notes: No change in room temperature dynamic shear properties following 4 hour conditioning at indicated temperature with 100 g/static load. (Represents minutes, hour in a process type temperature exposure).

Long Term Temp C	93 °C	View

Notes: 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 day or weeks).

Long Term Temp F	200 °F	View

Notes: 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 day or weeks).

Minimum Application Temperature	15 °C
Minimum Application Temperature	60 °F

Static Shear	1000 g	View

Test Method: ASTM D3654

Temp C: 23C
Temp F: 73F
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 day).

Static Shear	500 g	View

Test Method: ASTM D3654

Temp C: 66C
Temp F: 150F
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 day).

Static Shear	500 g	View

Test Method: ASTM D3654

Temp C: 93C
Temp F: 200F
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 day).

Available Sizes

Property	Values	Additional Information
Standard Roll Length	32.9 m	
Standard Roll Length	36 yd	
Minimum Available Width	6.4 mm	
Minimum Available Width	0.25 in	
Maximum Available Width	1219 mm	
Maximum Available Width	48 in	

Normal Slitting Tolerance	±0.79 mm
Normal Slitting Tolerance	±1/32 in
Core Size (ID)	76.2 mm
Core Size (ID)	3 in

Available Sizes

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).

UL 746C Listings

Solvent and Fuel Resistance

Additional Performance Characteristics

Property	Values	Additional Information
Water Vapor Transmission	See 3M™ VHB™ Tape 4941 g/m²/24 hr	View
Test Method: ASTM F1249 Temp C: 38C Environmental Condition: 100%RH		
Shear Modulus	See 3M™ VHB™ Tape 4941 Pa	
Coefficient of Thermal Expansion	See 3M™ VHB™ Tape 4941 m/m/°C	

Electrical and Thermal Properties

Property	Values	Additional Information
Dielectric Constant 1KHz	See 3M™ VHB™ Tape 4941	View
Test Method: ASTM D150 Temp C: 23C Temp F: 72F		

Test Condition: 1 KHz

Dielectric Constant 1MHz	See 3M™ VHB™ Tape 4941	View

Test Method: ASTM D150

Temp C: 23C
Temp F: 72F
Test Condition: 1MHz

Dissipation Factor 1KHz	See 3M™ VHB™ Tape 4941	View

Test Method: ASTM D150

Temp C: 23C
Temp F: 72F
Test Condition: 1 KHz

Dissipation Factor 1MHz	See 3M™ VHB™ Tape 4941	View

Test Method: ASTM D150

Temp C: 23C
Temp F: 72F
Test Condition: 1MHz

Dielectric Strength	See 3M™ VHB™ Tape 4941 V/µm	View

Test Method: ASTM D140

Thermal Conductivity	See 3M™ VHB™ Tape 4941 W/m/K

Volume Resistivity	See 3M™ VHB™ Tape 4941 Ω-cm	View

Test Method: ASTM D257

Temp C: 23C
Temp F: 73F

Surface Resistivity	See 3M™ VHB™ Tape 4941 Ω	View

Test Method: ASTM D257

Test Condition: 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 cm^2 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.

Converting

In addition to standard and custom roll sizes available from 3M through the distribution network, 3M™ VHB™ Tapes are also available in limitless shapes and sizes through the 3M Converter network. For additional information, contact 3M Converter Markets at 1-800-223-7427 or on the web at www.3M.com/converter.

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
UL 879 (File E65361)
EN 45545 test report for details (ISO 5659-2, ISO 9239-1, ISO 5660-1, ISO 5658-2)

Automotive Disclaimer

Select Automotive Applications: This product is an industrial product and has not been designed or tested for use in certain automotive applications, such as automotive electric powertrain battery or high voltage applications, which may require the product to be manufactured in a IATF certified facility, meet a Ppk of 1.33 for all properties, undergo an automotive production part approval process (PPAP), or fully adhere to automotive design or quality system requirements (e.g., IATF 16949 or VDA 6.3). Customer assumes all responsibility and risk if customer chooses to use this product in these applications.

Bottom Matter

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Trademarks

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.

References

Property	Values
3m.com Product Page	https://www.3m.com/3M/en_US/p/d/b40072036/
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

ISO Statement

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

Information

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