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August, 2018

3M™ VHB™ Tape - Specialty Tape 4611

Product Description



3M™ VHB™ Tape 4611 is a 0.045 inch (1.1 mm) thick dark gray double coated acrylic foam tape with PE film liner. The general purpose acrylic adhesive on both sides bonds to a broad range of high surface energy substrates including metals, glass and easier to bond paints and plastics. The firm foam provides high foam strength and has high temperature resistance. 3M™ VHB™ Tape 4611 is part of the 4611 tape family. Each product in this family has general purpose acrylic adhesive but varies in thickness.

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
- Dark gray, 0.045 in (1.1 mm), general purpose adhesive with firm foam has added feature of high temperature resistance
- 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

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		Method	Notes	Test Name
Color	Dark Gray				
Thickness Tolerance	±10 %				
Adhesive Type	General Purpose Acrylic				
Foam Type	Firm Acrylic				
Density	840 kg/m³	52 lb/ft³	ASTM D3574	Foam with adhesive	
Liner	PE Film				
Liner Color	Red				Primary
Liner Thickness	0.13 mm	0.005 in			

Total Tape Thickness		
1.1 mm	45 mil	0.045 in

Property: Total Tape Thickness
Method: ASTM D3652

Typical Performance Characteristics

Property	Values		Method	Dwell/Cure Time	Dwell Time Units	Temp C	Temp F	Environmental Condition	Backing	Notes	Substrate
90° Peel Adhesion	18 lb/in		ASTM D3330	24	hr	23C	72F	50%RH	5 mil Aluminum Foil	12 in/min (300 mm/min)	
90° Peel Adhesion	32 N/cm		ASTM D3330						2 mil Aluminum Foil	12 in/min (300 mm/min)	
Normal Tensile	620 kPa	90 lb/in²	ASTM D897	72	hr	23C	73F			1 in.² (6.45 cm²), Jaw Speed 2 in./min. (50 mm/min.)	Aluminum

Table continued on next page

Typical Performance Characteristics (continued)

Property	Values		Method	Dwell/Cure Time	Dwell Time Units	Temp C	Temp F	Environmental Condition	Backing	Notes	Substrate
Overlap Shear Strength	450 kPa	65 lb/in²	ASTM D1002							1 in² (6.45 cm²), Jaw Speed 0.5 in/min (12.7 mm/min)	
Short Term Temperature Resistance	232 °C	450 °F								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 Temperature Resistance	149 °C	300 °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 day or weeks).	
Static Shear 121C Stainless Steel	750 g		ASTM D3654			121C	250F			Tested at various temperatures and gram loadings. 0.5 in² (3.23 cm²). Will hold listed weight for 10,000 minutes (approximately 7 day).	Stainless Steel
Static Shear 177C Stainless Steel	750 g		ASTM D3654			177C	350F			Tested at various temperatures and gram loadings. 0.5 in² (3.23 cm²). Will hold listed weight for 10,000 minutes (approximately 7 day).	Stainless Steel

Static Shear	Temp C	Temp F
1500 g	23C	73F
750 g	66C	150F
750 g	93C	200F

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 day).

3M™ VHB™ Tape - Specialty Tape 4611

Available Sizes

Property	Values		Test Name
Standard Roll 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	76.2 mm	3 in	ID

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)
0.010 (0.25)	72 (65.8)	0.25 (6)	48 (1219)	72 (65.8)	144 (131.7)	360 (329.2)
0.015 (0.4)	72 (65.8)	0.25 (6)	48 (1219)	144 (131.7)	175 (160.0)	360 (329.2)
0.020 (0.5)	72 (65.8)	0.25 (6)	48 (1219)	72 (65.8)	108 (98.8)	175 (160.0)
0.025 (0.6)	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)
0.080 (2.3)	36 (32.9)	0.25 (6)	46 (1168)	36 (32.9)	36 (32.9)	72 (65.8)
0120 (3.0) (4959)	36 (32.9)	0.5 (13)	46 (1168)	N/A N/A	N/A N/A	36 (32.9)
0120 (3.0) (4959F)	36 (32.9)	0.25 (6)	46 (1168)	36 (32.9)	36 (32.9)	36 (32.9)

UL746C Listings

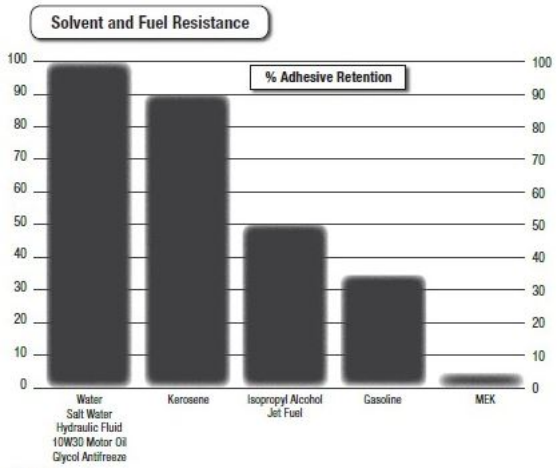
3M™ VHB™ Tapes
UL746C Listings - File MH 17478
Category QOQW2 Component - Polymeric Adhesive Systems, Electrical Equipment

3M™ VHB™ Tapes/ Product Families	Substrates	Temperature Rating Minimum	Temperature Rating Maximum
4914, 4920, 4930, 4950	Aluminum, Galvanized Steel, Enameled Steel, Stainless Steel, Ceramic, Glass/Epoxy	-35°C	110°C
	PBT	-35°C	90°C
	ABS, Polycarbonate, Rigid PVC	-35°C	75°C
4920, 4930, 4950,	Acrylic	-35°C	90°C
4955, 4959, 4959F	Glass / Galvanized Steel*, Glass / Glass*, Galvanized Steel / Aluminum*, Aluminum / Aluminum*	-35°C	120°C
4945	Phenolic, Aluminum, Galvanized Steel, Alkyd Enamel, Enameled Steel	-35°C	110°C
	ABS, Polycarbonate, Polyamide, Stainless Steel, Acrylic/Polyurethane Paint, Polyester Paint	-35°C	90°C
	Unplasticized PVC	-35°C	75°C
4905, 4910	Polycarbonate, Aluminum, Acrylic/Polyurethane Paint	-35°C	90°C
4611, 4646, 4655	Stainless Steel, Aluminum, Galvanized Steel, Glass, Glass/Epoxy, Phenolic	-35°C	110°C
	Nylon, Polycarbonate	-35°C	90°C
	ABS, Rigid PVC	-35°C	75°C

*Substrates can be used with or without primer/s/Coating. 3M Silane Coating, 3M Adhesion Promoter 4298UV and 3M Tape Primer 94 are used with glass substrate. 3M Primer AP111, 3M Adhesion Promoter 4298UV and 3M Tape Primer 94 are used with aluminum and galvanized steel substrates.

Solvent and Fuel Resistance

Solvent Resistance:



Test Method

- Tape between stainless steel and aluminum foil
- 72 hours dwell at room temperature
- Solvent immersion for 72 hours
- Test within 45 minutes after removing from solvent
- 90° peel angle
- 12 in/min rate of peel
- Peel adhesion compared to control

Note: Continuous submersion in chemical solutions is not recommended. The above information is presented to show that occasional chemical contact should not be detrimental to tape performance in most applications in ordinary use.

Additional Performance Characteristics

Property	Values	
Shear Modulus	6 × 10^5 Pa	
Poisson's Ratio	0.49	
Coefficient of Thermal Expansion	180 × 10^-6 m/m/°C	100 × 10^-6 in/in/°F

Electrical and Thermal Properties

Property	Values		Method	Temp C	Temp F	Test Condition
Dielectric Constant 1KHz	2.8		ASTM D150	23C	72F	1 KHz
Dielectric Constant 1MHz	2.43		ASTM D150	23C	72F	1MHz
Dissipation Factor 1KHz	0.013		ASTM D150	23C	72F	1 KHz
Dissipation Factor 1MHz	0.0564		ASTM D150	23C	72F	1MHz

Table continued on next page

Electrical and Thermal Properties (continued)

Property	Values		Method	Temp C	Temp F	Test Condition
Dielectric Strength	13 V/µm	330 V/mil	ASTM D140			
Thermal Conductivity	0.11 W/m/K	0.8 (btu-in)/(h-ft²-°F)				
Volume Resistivity	1.4 × 10^15 Ω-cm		ASTM D257	23C	73F	
Surface Resistivity	>10^16 Ω		ASTM D257			Room Temperature

Design Considerations

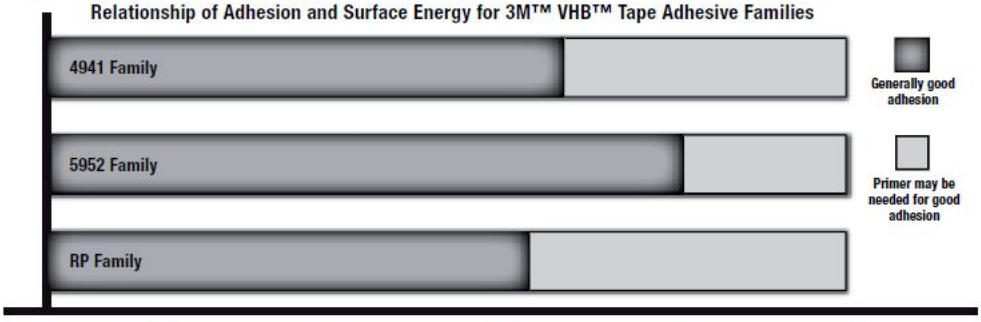
Adhesion to the substrate is important in achieving bonding success. Adhesives must flow onto the substrate surfaces in order to achieve intimate contact area and allow the molecular force of attraction to develop. The degree of flow of the adhesive on the substrate is largely determined by the surface energy of the substrate. 3M™ VHB™ 4611 family tapes bond well to high (HSE) 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.

Design Considerations (continued)



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

Relationship of Adhesion and Surface Energy for 3M™ VHB™ Tape Adhesive Families



1100-400 (High)	50-42	39-38 (Medium)	37-36	33-18 (Low)
Surface Energy (Dynes/cm)				
Aluminum	Polyimide	ABS	PVA	EVA
Stainless Steel	Phenolic	Polycarbonate	Polystyrene	Polyethylene
Copper	Nylon	PVC	Acetal	Polypropylene
Zinc	Alkyd Enamel	PPE	PVDF Paint	PVF
Tin	Polyester	Acrylic	Powder Paint	Silicone
Lead	Epoxy Paint	PU Enamel		PTFE
Anodized Aluminum	Polyurethane	Powder Paint		
Glass				

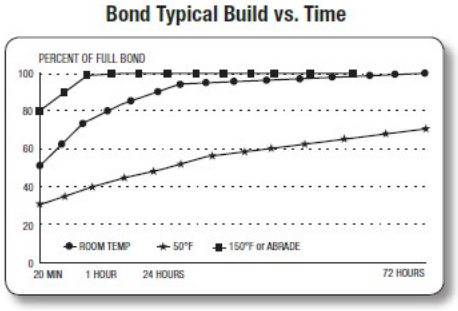
NOTES: There are a wide variety of formulations, surfaces finishes and surface treatments available on substrate materials which can affect adhesion. This chart is intended to provide only a rough estimate of the adhesion levels which can be expected on some common materials relative to a reference surface 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 4611 family is 50°F (10°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.



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™ Tape cores as the lot number. 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 9266 would translate to a date of manufacture of Sept. 22 (266th day of year) in 2009. On most products this is found as the 4 digits after the “9” following the product number. For tapes printed continuously around the core (e.g. 3M™ VHB™ Tape 5952 family) the lot number typically will be the string of 4 digits preceding the product number.

Industry Specifications

UL 746C (File MH 17478)

Trademarks

3M and VHB are trademarks of 3M Company

References

Property	Values
3m.com Product Page	https://www.3m.com/3M/en_US/company-us/all-3m-products/~/3M-VHB-Tape-4611?N=5002385+3293242238&rt=rud
Safety Data Sheet (SDS)	https://www.3m.com/3M/en_US/company-us/SDS-search/results/?gsaAction=msdsSRA&msdsLocale=en_US&co=ptn&q=4611

Family Group

	4611	4646	4655
Liner Color Test Name: Primary	Red	Red	Red
Color	Dark Gray	Dark Gray	Dark Gray
Total Tape Thickness (mm)	1.1	0.6	1.6
Adhesive Type	General Purpose Acrylic	General Purpose Acrylic	General Purpose Acrylic
Foam Type	Firm Acrylic	Firm Acrylic	Firm Acrylic
Liner	PE Film	PE Film	PE Film
Liner Thickness (mm)	0.13	0.13	0.13

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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