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Argent

Technical Data Sheet

3M™ VHB™ Tape - Specialty Tape 4646

Product Description

3M™ VHB™ Tape 4646 is a 0.025 inch (0.6 mm) thick dark gray double-sided 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 4646 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, 0.025 in (0.6 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

Attribute Name	Test Method	Value
Color		Dark Gray
Adhesive Type		General Purpose Acrylic
Foam Type		Firm Acrylic
Density	ASTM D3574	840 kg/m³ (52 lb/ft³) [1]
Total Tape Thickness	ASTM D3652	0.6 mm (25 mil) (0.025 in)
Thickness Tolerance		±15 %

[1] Foam with adhesive

Attribute Name	Value
Liner	PE Film
Primary Liner Color	Red
Liner Thickness	0.13 mm (0.005 in)

Typical Performance Characteristics

Temperature: 22 °C (72 °F)
Dwell Time: 72 h

Attribute Name	Test Method	Substrate	Backing	Value
90° Peel Adhesion	ASTM D3330	Stainless Steel	5 mil Aluminum Foil	26 N/cm (15 lb/in) [1]
Normal Tensile	ASTM D897	Aluminum		690 kPa (100 lb/in²) [2]
Overlap Shear Strength	ASTM D1002	Stainless Steel		550 kPa (80 lb/in²) [3]

[1] 12 in/min (300 mm/min)

[2] 1 in.² (6.45 cm²), Jaw Speed 2 in./min. (50 mm/min.)

[3] 1 in² (6.45 cm²), Jaw Speed 0.5 in/min (12.7 mm/min)

Static Shear

Substrate: Stainless Steel
Test Method: ASTM D3654

Temperature	Value
22 °C (72 °F)	1,500 g [1]
66 °C (150 °F)	500 g [1]
93 °C (200 °F)	500 g [1]
121 °C (250 °F)	500 g [1]
177 °C (350 °F)	500 g [1]

[1] Tested at various temperatures and gram loadings. 0.5 in² (3.23 cm²). Will hold listed weight for 10,000 minutes (approximately 7 day).

Attribute Name	Value
Short Term Temperature Resistance	232 °C (450 °F) [1]
Long Term Temperature Resistance	149 °C (300 °F) [2]

[1] 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).

[2] 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).

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.

Handling/Application Information

Application Techniques

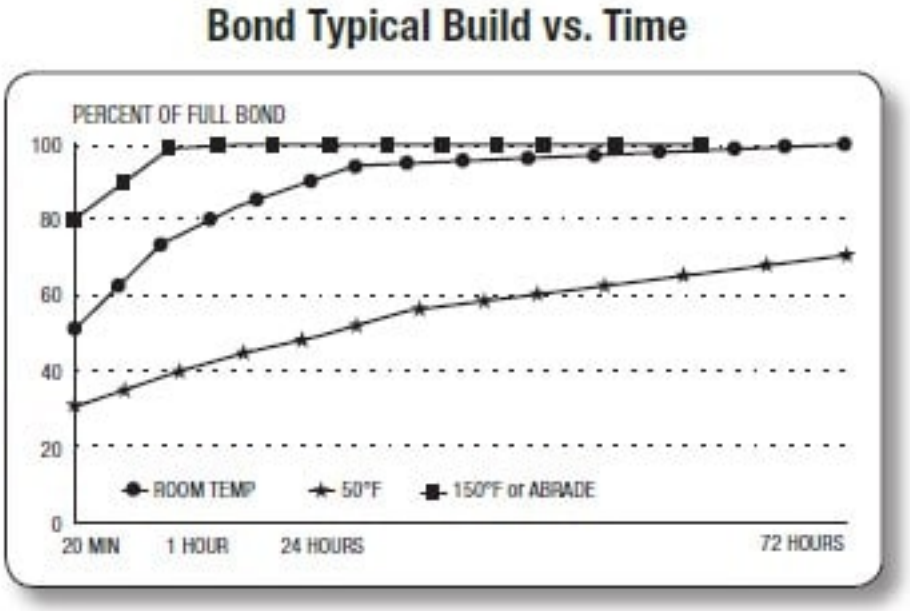
Clean: Most substrates are best prepared by cleaning with a 50:50 mixture of isopropyl alcohol (IPA*) and water prior to applying 3M™ VHB™ Tapes.
Exceptions to the general procedure that may require additional surface preparation include:
• Heavy Oils: A degreaser or solvent-based cleaner may be required 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.



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 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.

Industry Specifications

UL 746C (File MH 17478)
UL 879 (File E65361)

UL 746C Listings

3M™ VHB™ Tapes
UL746C Listings - File MH 17478
Category QQQW2 Component - Polymeric Adhesive Systems, Electrical Equipment

3M™ VHB™ Tapes/ Product Families	Substrates	Temperature Rating Minimum	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.

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

Available Sizes

Attribute Name	Value
Core Size (ID)	76.2 mm (3 in)
Maximum Available Width	1219 mm (48 in)
Minimum Available Width	6.4 mm (0.25 in)
Normal Slitting Tolerance	±0.79 mm (±1/32 in)
Standard Roll Length	65.8 m (72 yd)

Available Sizes - Detailed

Available Sizes				Maximum Roll Length		
Tape Thickness inches (mm)	Standard Length yards (meters)	Minimum Width inches (mm)	Maximum Width inches (mm)	Width 1/4"up to 3/8" (6.4mm up to 9.5mm) yards (meters)	Width >3/8" up to 1/2" (>9.5mm up to 12.7mm) yards (meters)	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)

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.

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ISO Statement

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

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