3M
VHB™ Tape Specialty Tapes

Technical Data **October 2014**

Product Description:
3M™ VHB™ Tapes provide the convenience and simplicity of a tape fastener and are ideal for use in many interior and exterior bonding applications. In many situations, they can replace rivets, spot welds, liquid adhesives and other permanent fasteners.

These 3M™ VHB™ Tapes are made with acrylic foam which is viscoelastic in nature. This gives the foam energy absorbing and stress relaxing properties which provides these tapes with their unique characteristics. The acrylic chemistry provides outstanding durability performance.

These 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, resistance to plasticizer migration, and UL746C recognition. All 3M™ VHB™ Tapes have excellent durability and excellent solvent and moisture resistance.

The tapes included in this data page have unique performance features that are not typically required in most common applications. Please refer to "3M™ VHB™ Tapes" technical data sheet for applications that do not require the special features incorporated in these specialty tapes.

3M™ VHB™ Tape Products

4950 Family

This family has general purpose adhesive on both sides of firm type foam. This family is typically used on metal, glass and high surface energy plastic substrates. Available in white and black.

Tape Number	Color	Thickness in (mm)
4914	White	0.010 (0.25)
4920	White	0.015 (0.4)
4929	Black	0.025 (0.6)
4930(F)	White	0.025 (0.6)
4949	Black	0.045 (1.1)
4950	White	0.045 (1.1)
4955	White	0.080 (2.0)
4959(F)	White	0.120 (3.0)

4945 Family

This family has multi-purpose adhesive on both sides of firm foam.

Tape Number	Color	Thickness in (mm)
4945	White	0.045 (1.1)
4946	White	0.045 (1.1)

4910 Family

This family of clear tapes is excellent for applications where clear or colorless is desired. The general purpose adhesive on both sides is suitable for high surface energy substrates.

Tape Number	Color	Thickness in (mm)
4905	Clear	0.020 (0.5)
4910	Clear	0.040 (1.0)

4951 Family

This family of tapes is based around the low temperature appliable acrylic adhesive system, utilized on both firm and conformable foam types. These products are suitable for high surface energy substrates. Available in white (firm foam) and gray (conformable foam).

Tape Number	Color	Thickness in (mm)
4951	White	0.045 (1.1)
4943F	Gray	0.045 (1.1)
4957F	Gray	0.062 (1.6)

4952 Family

This family utilizes the low surface energy adhesive on a firm foam.

Tape Number	Color	Thickness in (mm)
4932	White	0.025 (0.6)
4952	White	0.045 (1.1)

4611 Family

This family has a general purpose adhesive on both sides of firm foam. This family of tapes is typically used on metal substrates, and has the added feature of high temperature resistance, making it often suitable for bonding prior to high temperature paint processing.

Tape Number	Color	Thickness in (mm)
4611	Dark Gray	0.045 (1.1)
4646	Dark Gray	0.025 (0.6)
4655	Dark Gray	0.062 (1.6)

4622 Family

This family has general purpose adhesive on the face side (the side that typically would be bonded first) and multi-purpose adhesive on the liner side (the side exposed when the release liner is removed) of a conformable foam. Available in white.

Tape Number	Color	Thickness in (mm)
4618	White	0.025 (0.6)
4622	White	0.045 (1.1)
4624	White	0.062 (1.6)

(P) or (F) after the product number designate that both a paper and film liner product version are available. [e.g. 4930 (paper liner) and 4930F (film liner). See page 2 for specific details.

Typical Physical Properties

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

3M™ VHB™ Tapes				Adhesive and Foam			Release Liner		
Family	Number	Color	Tape Thickness Inches (mm) Tolerance	Adhesive Type	Foam Type	Density lb/ft³ (kg/m³)	Type	Thickness Inches (mm)	Color
4950	4914	White	0.010 (0.25) ± 15%	Gen Purp	Firm	50 (800)	DK Paper	0.003 (0.08)	White (printed)
	4920	White	0.015 (0.4) ± 15%	Gen Purp	Firm	50 (800)	DK Paper	0.003 (0.08)	White (printed)
	4929	Black	0.025 (0.6) ± 15%	Gen Purp	Firm	50 (800)	Polyester	0.002 (0.05)	Clear
	4930	White	0.025 (0.6) ± 15%	Gen Purp	Firm	50 (800)	DK Paper	0.003 (0.08)	White (printed)
	4930F	White	0.025 (0.6) ± 15%	Gen Purp	Firm	50 (800)	PE Film	0.005 (0.13)	Red
	4949	Black	0.045 (1.1) ± 10%	Gen Purp	Firm	50 (800)	Polyester	0.002 (0.05)	Clear
	4950	White	0.045 (1.1) ± 10%	Gen Purp	Firm	50 (800)	DK Paper	0.003 (0.08)	White (printed)
	4955	White	0.080 (2.0) ± 10%	Gen Purp	Firm	50 (800)	Polyester	0.002 (0.05)	Clear
	4959	White	0.120 (3.0) ± 10%	Gen Purp	Firm	50 (800)	Polyester	0.002 (0.05)	Clear
	4959F	White	0.120 (3.0) ± 10%	Gen Purp	Firm	50 (800)	PE Film	0.005 (0.13)	Red
4945	4945	White	0.045 (1.1) ± 10%	Multi-Purp	Firm	50 (800)	DK Paper	0.003 (0.08)	White (printed)
	4946	White	0.045 (1.1) ± 10%	Multi-Purp	Firm	50 (800)	PE Film	0.005 (0.13)	Clear
4910	4905	Clear	0.020 (0.5) ± 15%	Gen Purp	Sollid	60 (960)	PE Film	0.005 (0.13)	Red (printed)
	4910	Clear	0.040 (1.0) ± 10%	Gen Purp	Sollid	60 (960)	PE Film	0.005 (0.13)	Red (printed)
4951	4951	White	0.045 (1.1) ± 10%	Low Temp Appl	Firm	50 (800)	Polyester	0.002 (0.05)	Clear
	4943F	Gray	0.045 (1.1) ± 10%	Low Temp Appl	Conform	45 (720)	Polyester	0.002 (0.05)	Clear
	4957F	Gray	0.062 (1.6) ± 10%	Low Temp Appl	Conform	45 (720)	Polyester	0.002 (0.05)	Clear
4952	4932	White	0.025 (0.6) ± 15%	LSE	Firm	50 (800)	DK Paper	0.003 (0.08)	White (printed)
	4952	White	0.045 (1.1) ± 10%	LSE	Firm	50 (800)	DK Paper	0.003 (0.08)	White (printed)
4611	4611	Dk Gray	0.045 (1.1) ± 10%	Gen Purp	Firm	52 (840)	PE Film	0.005 (0.13)	Red
	4646	Dk Gray	0.025 (0.6) ± 15%	Gen Purp	Firm	52 (840)	PE Film	0.005 (0.13)	Red
	4655	Dk Gray	0.062 (1.6) ± 10%	Gen Purp	Firm	52 (840)	PE Film	0.005 (0.13)	Red
4622	4618	White	0.025 (0.6) ± 15%	Gen/Multi Purp	Conform	45 (720)	PE Film	0.004 (0.10)	Green
	4622	White	0.045 (1.1) ± 10%	Gen/Multi Purp	Conform	45 (720)	PE Film	0.004 (0.10)	Green
	4624	White	0.062 (1.6) ± 10%	Gen/Multi Purp	Conform	45 (720)	PE Film	0.004 (0.10)	Green

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)	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)

Slitting Tolerance

Standard slitting tolerance ± 1/32 inch (± 0.031 inch, ± 0.79 mm).

Precision slitting with slitting tolerance of ± 1/64 inch (± 0.016 in., ± 0.41 mm) is available on select products with minimum order of full web increments.

Core Size

All products are provided on a 3 inch ID Core (76.2 mm)

Converted Parts

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.

Shelf Life

All 3M™ VHB™ Tapes have a shelf life of 24 months from date of shipment 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.

Special Cases:

Plasticized Vinyl – Plasticizers compounded in soft vinyl can migrate into adhesives and significantly change their performance characteristics. 3M™ VHB™ Tapes 4945 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).

Typical Performance Characteristics

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

3M™ VHB™ Tapes				Dynamic Adhesion Performance		
Family	Product Number	Color	Thickness Inches	90° Peel Adhesion lb/in N/cm	Normal Tensile lb/in² kPa	Dynamic Overlap Shear lb/in² kPa
4950	4914	White	0.010	13 (23)	130 (900)	130 (900)
	4920	White	0.015	15 (26)	160 (1100)	100 (690)
	4929	Black	0.025	20 (35)	160 (1100)	100 (690)
	4930(F)	White	0.025	20 (35)	160 (1100)	100 (690)
	4949	Black	0.045	25 (44)	140 (970)	80 (550)
	4950	White	0.045	25 (44)	140 (970)	80 (550)
	4955	White	0.080	20 (35)	95 (660)	70 (480)
	4959(F)	White	0.062	20 (35)	75 (520)	55 (380)
4945	4945	White	0.045	25 (44)	140 (970)	80 (550)
	4946	White	0.045	25 (44)	140 (970)	80 (550)
4910	4905	Clear	0.020	12 (21)	100 (690)	70 (480)
	4910	Clear	0.040	15 (26)	100 (690)	70 (480)
4951	4951	White	0.045	18 (32)	110 (760)	80 (550)
	4943F	Gray	0.045	20 (35)	85 (590)	70 (480)
	4957F	Gray	0.062	20 (35)	75 (520)	70 (480)
4952	4932	White	0.045	20 (35)	100 (690)	100 (690)
	4952	White	0.045	25 (44)	80 (550)	80 (550)
4611	4611	Dk Gray	0.045	18 (32)	90 (620)	65 (450)
	4646	Dk Gray	0.025	15 (26)	100 (690)	80 (550)
	4655	Dk Gray	0.062	18 (32)	80 (550)	60 (410)
4622	4916	White	0.025	17 (30)	85 (590)	80 (550)
	4622	White	0.045	20 (35)	70 (480)	65 (450)
	4624	White	0.062	20 (35)	55 (380)	60 (410)

90° Peel Adhesion - Based on ASTM D3330 -To stainless steel, room temperature, jaw speed 12 in/min (304.8 mm/min). Average force to remove is measured. 72 hour dwell.

Normal Tensile (T-Block Tensile) - ASTM D-897 - To aluminum, room temperature, 1 in² (6.45 cm²), jaw speed 2 in/min (50.8 mm/min) Peak force to separate is measured. 72 hour dwell.

Dynamic Overlap Shear - ASTM D-1002 - To stainless steel, room temperature, 1 in² (6.45 cm²), jaw speed 0.5 in/min (12.7 mm/min) Peak force to separate is measured. 72 hour dwell.

Typical Performance Characteristics

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

3M™ VHB™ Tapes				Static Shear					Temperature Tolerance	
Family	Product Number	Color	Thickness Inches	72°F (22°C)	150°F (66°C)	200°F (93°C)	250°F (121°C)	350°F (177°C)	Short Term (Minutes, Hours) °F (°C)	Long Term (Days, Weeks) °F (°C)
4950	4914	White	0.010	1500	500	500			300 (149)	200 (93)
	4920	White	0.015	1500	500	500			300 (149)	200 (93)
	4929	Black	0.025	1500	500	500			300 (149)	200 (93)
	4930(F)	White	0.025	1500	500	500			300 (149)	200 (93)
	4949	Black	0.045	1500	500	500			300 (149)	200 (93)
	4950	White	0.045	1500	500	500			300 (149)	200 (93)
	4955	White	0.080	1500	1000	750	750	750	400 (204)	300 (149)
	4959(F)	White	0.120	1500	1000	750	750	750	400 (204)	300 (149)
4945	4945	White	0.045	1500	500	500			300 (149)	200 (93)
	4946	White	0.045	1500	500	500			300 (149)	200 (93)
4910	4905	Clear	0.020	1000	500	500			300 (149)	200 (93)
	4910	Clear	0.040	1000	500	500			300 (149)	200 (93)
4951	4951	White	0.045	1250	500	500			300 (149)	200 (93)
	4943F	Gray	0.045	1000	500	500			300 (149)	200 (93)
	4957F	Gray	0.062	1000	500	500			300 (149)	200 (93)
4952	4932	White	0.025	1500	500				200 (93)	160 (71)
	4952	White	0.045	1500	500				200 (93)	160 (71)
4611	4611	Dk Gray	0.045	1500	750	750	750	750	450 (232)	300 (149)
	4646	Dk Gray	0.025	1500	750	750	750	750	450 (232)	300 (149)
	4655	Dk Gray	0.062	1500	750	750	750	750	450 (232)	300 (149)
4622	4616	White	0.025	1000	250	250			250 (121)	200 (93)
	4622	White	0.045	1000	250	250			250 (121)	200 (93)
	4624	White	0.062	1000	250	250			250 (121)	200 (93)

Static Shear - ASTM D3654 - To stainless steel, tested at various temperatures and gram loadings. 0.5 in^2 (3.23 cm^2). Will hold listed weight for 10,000 minutes (approximately 7 days). Conversion: 1500 g/0.5 in^2 equals 6.6 lb/in^2; 500 g/0.5 in^2 = 2.2 lb/in^2.

Short Term Temperature Tolerance - 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 - Maximum temperature where tape supports at least 250 g load per 0.5 in^2 in static shear for 10,000 minutes. (Represents continuous exposure for days or weeks).

Additional Typical Performance Characteristics

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

	3M™ VHB™ Tape 4950	4910	4611	Units	Test Standard
Dielectric Constant	2.28 1.99	3.21 2.68	2.80 2.43	at 1 kHz at 1MHz	ASTM D150 ASTM D150
Dissipation Factor	0.0227 0.0370	0.0214 0.0595	0.0130 0.0564	at 1 kHz at 1MHz	ASTM D150 ASTM D150
Dielectric Breakdown Strength	18 (460)	25 (630)	13 (330)	V/µm (V/mil)	ASTM D140
Thermal Conductivity (k value)	0.09 (0.6)	0.16 (1.1)	0.11 (0.8)	W/mK (BTU•in/hr•ft²•°F)	
Volume Resisitivity	1.5×10^{15}	3.1×10^{15}	1.4×10^{15}	Ω-cm	ASTM D257
Surface Resisitivity	$>10^{16}$	$>10^{16}$	$>10^{16}$	Ω/sq	ASTM D257
Water Vapor Transmission Rate	14.0			g/m²•day	ASTM F1249 at 38°C/1000% RH
Thermal Properties of Modeling					
Thermal Coefficient of Expansion		180 (100)		10^{-6} m/m/°C (10^{-6} in/in/°F)	
Shear Modulus (at 25°C, 1 Hz)		6×10^5		Pa	
Poisson's Ratio		0.49			

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
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

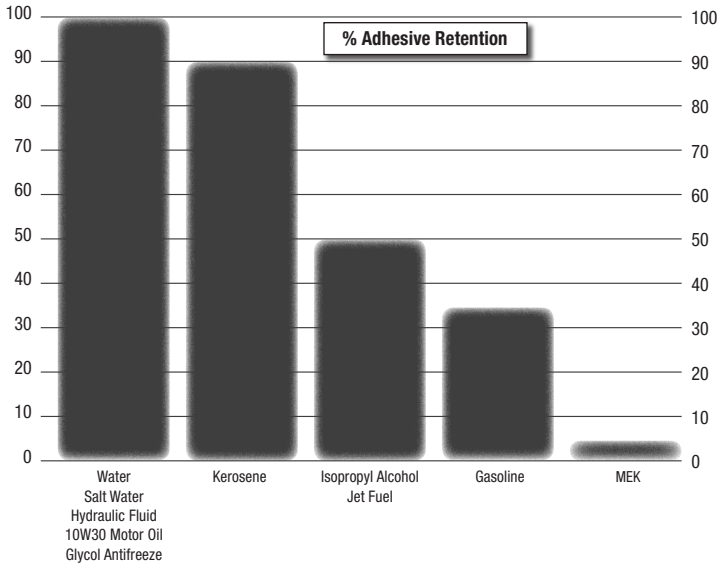
*Substrates can be used with or without primer(s)/Coating. 3M Silane Coating, 3M Adhesion Promoter 4298UV and 3M Tape Primer 94 are used with glass substrate. 3M Primer AP111, 3M Adhesion Promoter 4298UV and 3M Tape Primer 94 are used with aluminum and galvanized steel substrates.

Outgassing

3M™ VHB™ Tapes	% TML	%VCM	%WVR
4930	0.77	0.01	0.21
4932	2.41	0.66	0.23
4945	1.24	0.01	0.19

TML - Total Mass Loss
VCM - Volatile Condensible Materials
WVR - Water Vapor Regained
NASA Reference Publication, "Outgassing Data for Selecting Spacecraft Materials", (11/18/2004)
Available online at http://outgassing.nasa.gov

Solvent and Fuel 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

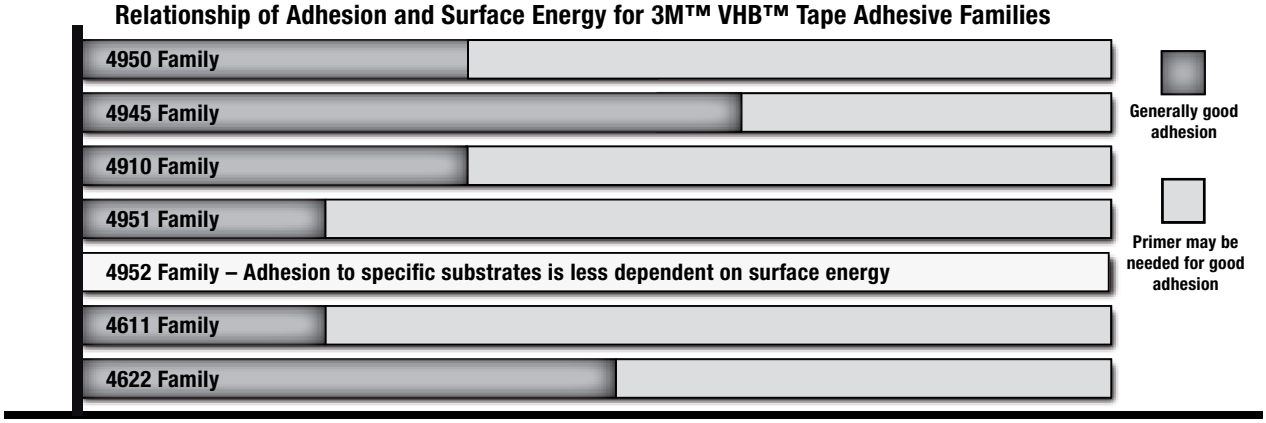
Note: Continuous submersion in chemical solutions is not recommended. The above information is presented to show that occasional chemical contact should not be detrimental to tape performance in most applications in ordinary use.

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.

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



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.

► **Use the right tape thickness:** 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.

► **Use the right amount of tape:** 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 of weight to be supported in order to prevent excessive creep. For **dynamic loads,** the dynamic performance characteristics provided on page 4 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 alternative 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. A technical bulletin "3M™ VHB™ Tape Cold Temperature Performance" (70-0707-3991-0) is available for additional 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. Abrasion is not suggested with 3M™ VHB™ Tapes 4932 and 4952.
- **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 temperatures:

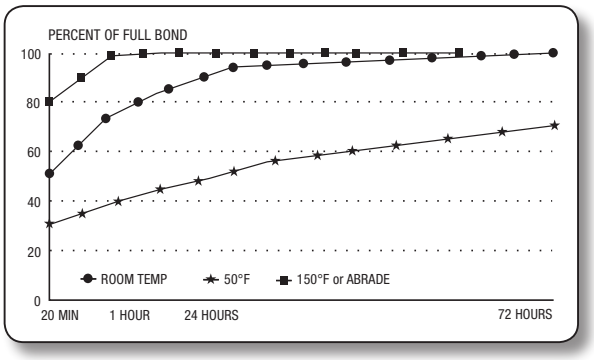
- 50°F (10°C): 3M™ VHB™ Tapes 4950, 4910, 4952, 4611, 4622 families.
- 60°F (15°C): 3M™ VHB™ Tape 4945 family.
- 32°F (0°C): 3M™ VHB™ Tape 4951 family.

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.

Bond Typical Build vs. Time



Technical Information

The technical information, recommendations and other statements contained in this document are based upon tests or experience that 3M believes are reliable, but the accuracy or completeness of such information is not guaranteed.

Product Use

Many factors beyond 3M's control and uniquely within user's knowledge and control can affect the use and performance of a 3M product in a particular application. Given the variety of factors that can affect the use and performance of a 3M product, user is solely responsible for evaluating the 3M product and determining whether it is fit for a particular purpose and suitable for user's method of application.

Limitied Remedy

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Limitation of Remedies and Liability

If the 3M™ VHB™ Tape is proved to be defective within the warranty period stated above. THE EXCLUSIVE REMEDY, AT 3M'S OPTION, SHALL BE TO REFUND THE PURCHASE PRICE OF OR TO REPAIR OR REPLACE THE DEFECTIVE 3M™ VHB™ TAPE. 3M shall not otherwise be liable for loss or damages, whether direct, indirect, special, incidental, or consequential, regardless of the legal theory asserted, including negligence, warranty, or strict liability.

ISO 9001

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

3M

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