



# VHB™ Tapes

## 3M™ VHB™ Tapes Product Information

July 2013

**Product Description** 3M™ VHB™ Tapes are a family of double-sided foam tapes made from high performance acrylic adhesives. These tapes are able to form bonds of exceptional strength and have greater durability and elasticity than conventional double-sided foam tapes. The VHB Tape product range includes tapes with different core constructions and a variety of adhesives. All 3M VHB Tapes use closed cell technology, and provide outstanding environmental resistance and durability. The superior performance of 3M VHB Tapes means they can often be used to replace mechanical fasteners for joining a wide range of materials.

**How 3M VHB Tapes Work** The exceptional performance of these tapes comes from the properties of the acrylic core. The core has the dual properties of behaving like a very viscous liquid and an elastic solid. This property is known as viscoelasticity. The “visco” properties allow the adhesive to flow into the microscopic irregularities of the surface to form very strong bonds. The elastic properties allow these tapes to absorb dynamic loads, accommodate differential expansion between surfaces and help distribute loads over the greatest possible area. The elastic properties are maintained between -40°C and 90°C.

**The Benefits of Using VHB Tapes**

- No holes to drill, no riveting, no liquid adhesives to cure, no weld distortion, no clean up.
- Prevents corrosion by separating dissimilar metals.
- Is invisible and eliminates unsightly rivets, spot welds, screw-heads or nuts and bolts.
- Meets a wide range of holding requirements for tough applications involving glass, metals, woods, composites and many plastics.
- Damps vibration and reduces noise.
- Resists solvents and salt water. Seals and bonds even in extreme environments.
- Can compensate for thermal expansion and contraction of bonded parts.
- Distributes stress. Excellent for thin materials.
- Fast, clean and simple to apply. Reduces assembly costs.

**Durability** Acrylic is a very durable chemistry with excellent long term aging resistance. 3M VHB Tape has been used in many long term and demanding applications in varied industries such as construction, signage and transportation. There are examples of successful applications of VHB Tapes dating back to 1980. Locally, VHB Tape was used in 1987 on the exterior cladding panels of the 227 building in Newmarket, Auckland. Durability is dependent on specific application and working conditions, and further detailed information is available in the *3M VHB Tape Durability Technical Bulletin*.

**Outdoor Weathering** The performance of VHB Tapes is not significantly affected by exposure to sunlight and harsh environments. Outdoor weathering decks in Florida (hot and moist, high UV), and Arizona (hot with high UV) and other locations around the world are used to collect data on the long term performance of these tapes. These harsh tests typically show 100% bond strength retention after 2-5 years.

**Fatigue and Vibration Resistance** An example of VHB Tape durability has been generated on the Bendix Automotive Proving Ground in Indiana, USA. A full size semi-truck with a sleeper cab was constructed with all exterior panels and doors taped to an underlying frame with 4950 VHB Tape. After approximately 500,000km on the harsh durability track the VHB Tape bonds remained completely intact. This is particularly impressive as some of the mechanically joined and welded parts failed and required repairs during the test program.

**Solvent and Moisture Resistance** Testing has revealed no apparent degradation of any VHB Tape when exposed to splash testing of most common solvents, including water, petrol, white spirits, motor oil, ammonia cleaner, acetone, methyl ethyl ketone (MEK) and isopropyl alcohol. 3M VHB Tape acts as a seal against moisture and helps to prevent galvanic corrosion between dissimilar metals. Although laboratory tests have shown no degradation after 10 years submersion in salt water, VHB Tapes are not recommended for applications involving continuous submersion.

**Shelf Life** When stored in the original cartons in cool dry conditions (ideal 20°C, 50% relative humidity) the shelf life is 24 months from date of manufacture.

## 3M™ VHB™ Tape Product Selection

### Step 1: Special Feature or General Purpose Product?

**Special Feature** products have special performance characteristics. Products are available for:

- Situations where high dynamic stresses are involved
- Applications to paints and plastics including plasticized vinyl
- Situations that require a transparent tape
- When the tape is applied between 0°C and 10°C
- Components that are bonded before powder coating or need to withstand higher temperatures

**General Purpose** products are ideal for many interior and exterior industrial applications. These tapes have softer cores and are especially suited for textured surfaces or where sealing is required.

The table on the next page describes the properties of the available VHB Tapes.

### Step 2: What are the surfaces to be bonded?

- **All VHB Tapes** provide good adhesion to most **metals, glass and high surface energy plastics.\***
- For higher performance on **paints and plastics\*\*** use **4941, 4991, 5925, 5952, 5962 or 4945**. The liner side of **4618, 4622 and 4624** has good adhesion to **paints and plastics**.
- Use **General Purpose VHB Tapes** or **4941 or 4991** when the surface is **textured** to get a more complete bond or when **sealing** the joint is a critical requirement.
- On **flexible vinyls** use only plasticizer resistant **4941, 4945 or 4991** (Note: the **liner side** of **4618, 4622 and 4624** is also plasticizer resistant).

\* High surface energy plastics include acrylic, ABS, polycarbonate, PVC, polyester, Polyamide, Polyimide, Phenolic, Noryl.

\*\* Low surface energy plastics include PVA, EVA, polystyrene, acetal and some paints. They may require priming with 3M Tape Primer 94. Very low surface energy plastics such as polypropylene, polyethylene and EPDM are difficult surfaces to stick to. Primer 94 may improve the performance on these surfaces.

See also the **Surface Preparation Suggestions** on the back page

### Step 3: How thick does the tape have to be?

- The tape thickness required depends on the mismatch between the surfaces to be joined. The more closely the two surfaces fit together the thinner the tape can be. As a general rule the tape can accommodate up to 50% of its thickness in mismatch (i.e. the tape should be at least twice as thick as the mismatch). **If in doubt, use a thicker tape** to ensure a significant area of the tape forms a bond.
- When bonding sheets or large pieces, the thickness of the material should not be more than twice the tape thickness, e.g. 1.1mm thick tape is commonly used to bond sheets up to 2.2mm thick.
- Thermal expansion and contraction or movement in the joint should not exceed three times the tape thickness. As a general rule, a 2.4m length of plastic can be bonded to metal using a 1.1mm thick tape.

### Step 4: How much tape to use?

- In shear (e.g. holding a sign or panel to a wall) the suggested amount of tape to hold up 1 kg is about 55cm<sup>2</sup> or for:

Standard Tape Widths	Tape Length
12.7 mm wide	430 mm
19.0 mm wide	290 mm
25.4 mm wide	215 mm

These amounts of tape include a significant factor of safety to allow for the different properties of the tapes in the VHB Tape range. These amounts can be reduced by up to 50% depending on the tape type, if customer evaluation gives satisfactory results.

### Step 5: What is the application temperature?

The desirable tape application temperature range is 20°C - 40°C. There are VHB Tapes with special properties that allow **low temperature application**.

The **minimum** suggested surface temperatures for tape application are:

16°C: 4936, 4941, 4945, 4991

10°C: 4611, 4618, 4622, 4624, 4905, 4910, 4915, 4918, 4930, 4950, 4959, 5925, 5952, 5962, 9473

0°C: 4951, 4957 (on high surface energy substrates only)

**Once properly applied, low temperature holding is generally satisfactory down to -40°C.**

**Always test and evaluate the suitability of the chosen VHB Tape for your application.**

# 3M™ VHB™ Tapes Product Range

	Adhesive type	Product Number	Tape Thickness	Colour	Temperature Resistance		Relative Adhesion		Liner Type	Application Ideas	
					Minutes Hours	Days Weeks	HSE Material	LSE Material			
General Purpose VHB Tapes	Modified adhesive on both sides of a soft foam	5925	0.64mm	Black adhesive, grey core	149 °C	121°C	High	Medium	Red Film	Excellent adhesion to the widest variety of surfaces, including most powder coated paints and plastics.	
		5952	1.1mm	Black adhesive, grey core	149 °C	121°C	High	Medium	Red Film		
		5962	1.55mm	Black adhesive, grey core	149 °C	121°C	High	Medium	Red Film		
	Firm adhesive on one side and a soft adhesive on the other side of a medium foam	4618	0.64mm	White	121°C	93°C	High	Low	Green Film	Good adhesion to a wide range of surfaces.	
		4622	1.1mm	White	121°C	93°C	High	Low	Green Film		
		4624	1.55mm	White	121°C	93°C	High	Low	Green Film		
Special Feature VHB Tapes	Firm adhesive on both sides of a firm foam	4930	0.64mm	White	149°C	93°C	High	Low	Paper	Use with metals where high dynamic stresses are involved.	
		4950	1.1mm	White	149°C	93°C	High	Low	Paper		
		4959	3.0mm	White	204°C	149°C	High	Low	Clear Film		
	Soft adhesive on both sides of a firm foam	4945	1.1mm	White	149°C	93°C	High	Low	Paper	Use with metals and HSE plastics where high dynamic stresses are involved.	
		Soft adhesive on both sides of a medium foam	4936	0.64mm	Grey	149°C	93°C	High	Medium	Paper	Excellent adhesion to a wide range of materials including plasticised vinyl.
			4941	1.1mm	Grey	149°C	93°C	High	Medium	Paper	
	4991		2.3mm	Grey	121°C	93°C	High	Medium	Red Film		
	Clear firm adhesive	4905	0.5mm	Clear	149°C	93°C	High	Low	Red Film	For high surface energy materials where a clear adhesive is required.	
		4910	1.0mm	Clear	149°C	93°C	High	Low	Red Film		
		4915	1.5mm	Clear	149°C	93°C	High	Low	Red Film		
4918		2.0mm	Clear	149°C	93°C	High	Low	Red Film			
Low temperature adhesive on both sides of a firm foam	4951	1.1mm	White	149°C	93°C	High	Low	Clear Film	For HSE substrates where tape is applied at temperatures down to 0 °C.		
	4957	1.55mm	Grey	149°C	93°C	High	Low	Clear Film			
High temperature firm foam adhesive	4611	1.1mm	Dark grey	232°C	149°C	High	Low	Red Film	High temperature resistance. Can be used on metals prior to powder coating.		
High temperature firm adhesive transfer tape	9473	0.25mm	Clear	260°C	149°C	High	Low	Paper	High temperature resistance. Thin laminating adhesive.		

# 3M™ VHB™ Tapes Product Performance Guide

## General Purpose VHB Tapes

Tape #	4618	4622	4624	5925	5952	5962
Peel Adhesion N/100mm	300	350	350	300	350	350
Normal Tensile kPa	580	480	380	620	620	620
Dynamic Shear kPa	550	445	410	620	550	550
Static Shear g	22°C	1000	1000	1000	1000	1000
	66°C	250	250	250	500	500
	93°C	250	250	250	500	500
	121°C				250	250

## Special Feature VHB Tapes

Tape #	4611	4905	4910	4915	4918	4930	4941	4945	4950	4951	4957	4959	4991	9473
Peel Adhesion N/100mm	315	210	260	260	260	350	350	440	440	315	350	350	350	160
Normal Tensile kPa	590	690	690	690	690	1100	585	970	970	760	515	520	480	690
Dynamic Shear kPa	445	480	480			690	480	550	550	550	480	380	450	550
Static Shear g	22°C	1500	1000	1000	1000	1500	1000	1500	1500	1250	1000	1500	1000	1000
	66°C	750	500	500	500	500	500	500	1000	500	500	1000	500	1000
	93°C	750	500	500	500	500	500	500	500	500	500	750	500	1000
	121°C	750										750		1000
	149°C	750										750		1000
	177°C	750										750		

## Test Methods

90° Peel Adhesion: Stainless Steel, 72 hours dwell, Peel speed 305mm/min  
 Normal tensile: Stainless Steel, 6.45cm<sup>2</sup>, 72 hours dwell, Jaw speed 50mm/min  
 Dynamic Shear: Stainless Steel, 6.45cm<sup>2</sup>, 72 hours dwell, Jaw speed 12.7mm/min  
 Static Shear: Weight (grams) that 3.23cm<sup>2</sup>, will hold 10,000 minutes (7 days) at stated temperature

# 3M™ VHB™ Tapes Product Application

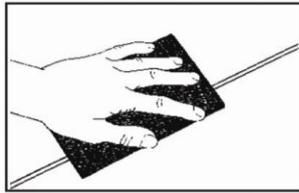
## Introduction

Refer to the **Surface Preparation Suggestions** below, or to the *Surface Preparation for 3M VHB Tape Applications Technical Bulletin*.

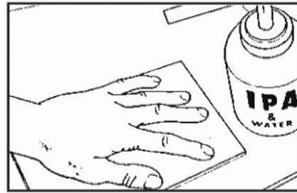
- Most substrates common to VHB Tape applications are best prepared by wiping (in one direction) with a 50:50 mixture of isopropyl alcohol (IPA) and water.
- Where heavy oils or greases are present there may be a need to first cut the oil with a “degreasing” solvent, e.g. 3M Citrus Cleaner or white spirits, but this should always be followed with IPA/water cleaning to remove any residue.
- Abrasion or scuffing\* of the surface will in many instances enhance adhesion by increasing the surface area available for bonding. Scuffing must be followed by cleaning with IPA/water mixture.
- The surface must be dry.  
A good way to assess cleanliness is that a surface prepared for VHB Tape application should be as clean as one being prepared for painting.

## Making the Bond

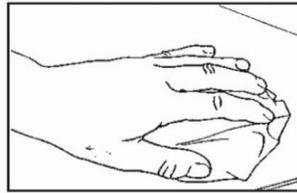
Apply the tape to one surface leaving the liner in place. Apply pressure using a Scotch™ brand PA-1 applicator or a roller. This ensures contact and removes air bubbles. Remove the liner, fit the two surfaces together carefully, and using a suitable roller apply sufficient pressure to ensure the tape experiences 1 kg/cm<sup>2</sup> (100 kPa) pressure.



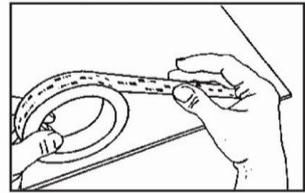
**Step A:** Some surfaces may need to be abraded using a 3M™ Scotch-Brite™ Abrasive Pad prior to cleaning.



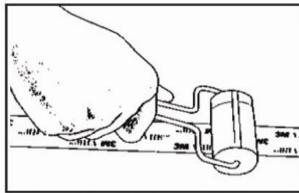
**Step B:** Solvent Wipe  
Note: Be sure to carefully read and follow solvent manufacturer's directions for use and precautions.



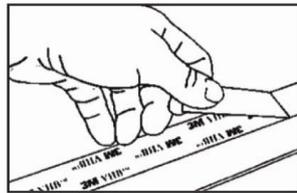
**Step C:** Wipe dry.



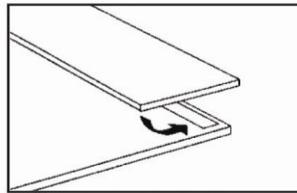
**Step D:** Position tape. Handle tape by edges only.



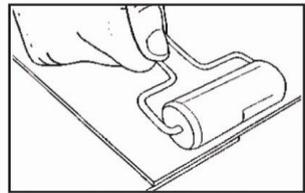
**Step E:** Squeegee onto surface.



**Step F:** Remove liner.



**Step G:** Position materials to be bonded.



**Step H:** Roll finished joint firmly.

## Time/Temperature

**Bond strengths at the minimum application temperature will be achieved as follows:**

20 minutes	50%	24 hours	90%
1 hour	75%	3 days	100%

Assemblies can be handled within 10 minutes but bonds should not be stressed before 72 hours

## Surface Preparation Suggestions for Specific Materials

Surface	Surface Preparation Suggestions
Metals	Scuff if oxidized. For copper or brass apply lacquer or varnish to prevent further oxidation
Aluminium, anodized	Clean only
Some plastics & paints	Scuff, particularly on paints and hard plastics
Plasticised vinyl	Evaluate plasticizer resistant tapes or prime with VHB Tape Primer 9639
Wood, concrete, brick	Seal surface with paint, varnish or thin coat of neoprene contact adhesive
Glass/ceramic surfaces	Use Silane Glass Treatment AP115 in high moisture or humidity environments
Low surface energy plastics	Prime with Primer 94 and evaluate suitability of VHB tape
High Surface energy plastics with mould release	Clean with MEK or acetone (ensure solvents do not affect the plastic), then scuff, IPA/water wipe
Fibreglass: Gelcoat	Clean with 3M General Purpose Adhesive Cleaner to remove mould release, scuff
Non Gelcoat	Sand smooth, prime with thin coat of neoprene contact adhesive or gelcoat
*Scuffing By hand:	Use Scotch-Brite™ 7447 Hand Pads
By Machine (Grinder):	Use Scotch-Brite™ Roloc™ Surface Conditioning Discs, medium or fine