



VHB™ Tapes

Product Description

VHB™ Tapes are a family of double-sided tapes made from high performance acrylic adhesive, providing excellent long-term durability and holding power. The VHB Tape product range includes tapes with different core constructions and a variety of adhesives. All 3M VHB Tapes are 100% closed cell, giving outstanding environmental resistance.

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 epoxies to cure, no weld distortion, no clean up.
- Prevents corrosion by separating dissimilar metals.
- Is invisible and eliminates unsightly rivets, spot welds, screwheads 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 ageing 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 on the exterior cladding panels of the 277 building in Newmarket, in Auckland in 1987. 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 to 5 years.

Fatigue and Vibration Resistance

An example of VHB Tape durability has been generated on the Bendix Automotive Proving Ground in Indiana. 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 500,000 simulated kilometres 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 products when exposed to splash testing of most common solvents, including petrol, white spirits, motor oil, ammonia cleaner, acetone, methyl ethyl ketone (MEK), JP-4 jet fuel.
- resistance to moisture (continuous submersion in liquids is not recommended)**

*Splash testing cycle - 20 seconds submersion, 20 seconds air dry. 3 cycles.

**Note: it is important to consider the potential for corrosion of the surfaces involved, and any subsequent weakening of bond, particularly in a saline environment

3M VHB Tapes Product Selection

The following factors should be considered when selecting which VHB tape to use. Choose from the Product Range table on the following page.

Step 1: General Purpose, High Performance or Special Feature Product?

General Purpose products are ideal for many interior and exterior industrial applications. Their performance is significantly higher than urethane and other foam tapes. They have conformable cores and are especially suited for textured surfaces or applications where sealing is required.

High Performance products have higher core strength than general purpose products and should be selected for more demanding applications involving dynamic (moving) loads. Significant vibration and movement can be absorbed by the foam core.

Special Feature products have special performance characteristics, as detailed in the Product Range table.

There are products suitable for:

- Cold temperature application
- Bonding components before powder coating
- Application to paints and plastics, including plasticised vinyl
- Applications requiring sealing (conformable products)

Step 2: 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 (ie 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. Eg 1.1 mm thick tape is commonly used to bond sheets up to 2.2 mm thick

• Thermal expansion and contraction or movement in the joint should not exceed three times the tape thickness. As a general rule, a 2.4 m length of plastic can be bonded to metal using a 1.1 mm thick tape.

Step 3: What are the surfaces to be bonded?

- See **Product Range** table for VHB Tape selection
- **All VHB Tapes** provide good adhesion to most **metal and high surface energy plastics***
- For higher performance on **paints and plastics**** use **4945, 4941, 4947 or 4991**. The **liner side** of **4618, 4622 and 4624** has good adhesion to **paints and plastics**.
- Use **conformable or General Purpose VHB Tapes** 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, 4947 or 4991**. (Note: the **liner side** of **4618, 4622 and 4624** is plasticizer resistant)

*High surface energy plastics include acrylic (Perspex), ABS, polycarbonate (Lexan), PVC, polyester (Mylar), polyamide (Nylon), polyimide (Kapton), 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 4: Is the colour important?

See the **Product Range** table for options.

Step 5: What is the application temperature?

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

The **minimum** suggested surface temperatures are:

16°C: 4945, 4941, 4947, 4991

10°C: 4905, 4910, 4618, 4622, 4624, 9473, 4930, 4950, 4959, 4611

0°C: 4951, 4957

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

Step 6: How much tape to use?

In shear (eg holding a sign or panel to a wall) the **suggested** amount of tape to hold up 1 kg is:

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

More or less tape may be required, depending on the tape type and the particular application.

Step 7: What is the working temperature range?

The temperature tolerance and shear load is detailed on the next page.

Products 9473, 4611 and 4959 can be used for high temperature processing such as powder coating.

Step 8: Will there be exposure to chemicals?

VHB Tapes are resistant to many common solvents. See front page for resistance details.

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

3M VHB Tapes Product Range

Product Types

Thickness (mm)	General Purpose	High Performance	Special Feature
0.25		9473 Translucent	
0.5	4905* Clear		
0.65	4618* White	4930 White	
1.0	4910* Clear		
1.1	4622* White	4945 White For plastics/paints Plasticizer resistant 4950 White For metals	4941 Grey For plastics/paints Conformable Plasticizer resistant 4951* White For cold temperature application 4947* Black For plastics/paints Conformable Plasticizer resistant 4611* Grey For powdercoating processes
1.6	4624* White		4957* Grey For cold temperature application Conformable
2.3			4991* Grey For plastics/paints Conformable Plasticizer resistant
3.0		4959* White	

Product Selection Ideas

General Purpose

- Truck roof bows
- Backlit translucent signs
- Bond and seal lens over LCD
- Stainless steel table tops to metal tables
- Bond decorative metal trim in exterior applications

High Performance

- Truck bodies
- Traffic and overhead motorway signs
- Security devices onto computer monitors
- Attach stiffeners to exterior architectural panels

Special Feature

- Truck body building and metal fabrication at low temperatures
- Powder-coated aluminium colonial bars on windows (interior and exterior)
- Bonding components prior to powder coating

Items in bold are the most commonly used products

*Film liner

3M VHB Tapes Product Performance

	General Purpose					High Performance					Special Feature					
	4905	4910	4618	4622	4624	9473	4930	4945	4950	4959	4941	4947	4951	4611	4957	4991
Peel Adhesion To stainless steel N/100 mm Room temperature 305 mm/min jaw speed	210	260	300	350	350	160	350	440	440	350	350	350	315	320	350	350
Normal Tensile Aluminium/Aluminium kPa Room temperature 50 mm/min jaw speed	690	690	580	480	380	690	1100	970	970	520	585	585	760	590	515	415
Static Shear and Temperature Tolerance Weight(g) held for 22°C 10,000 minutes 66°C Stainless steel to 93°C Stainless steel 121°C 322mm ² 149°C 177°C	1000	1000	1000	1000	1000	1500	1000	1500	1500	1500	1000	1000	1250	1500	1000	1000
	500	500	250	250	250	1000	500	500	500	1000	500	500	500	750	500	500
	500	500				1000	500	500	500	750	500	500	500	750		500
						1000				750				750		
						1000				750						
						500				750						
Dynamic Shear Stainless steel/Stainless steel kPa Room temperature 12.7 mm/min jaw speed	480	480	580	445	410	550	690	550	550	380	480	480	550	445	415	450
Temperature Tolerance Short Term °C No change in room temperature dynamic shear properties following 4 hour conditioning at indicated temperature with 100g static load 322mm ²	149	149	121	121	121	260	149	149	149	204	149	149	149	230	149	121
Temperature Tolerance Long Term °C Maximum temperature where tape supports 250g in static shear for 10,000 minutes 322mm ²	93	93	93	93	93	149	93	93	93	149	93	93	93	149	93	93

The values in this table are typical values and should not be used for specification purposes

Shelf Life: 12 months from date of despatch from 3M New Zealand when stored in the original cartons in cool (less than 21°C), dry conditions

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*.

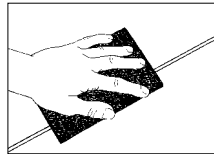
- Most substrates common to VHB Tape applications are best prepared by wiping (in one direction) with a 50:50 mixture of isopropyl alcohol (IPA) and water.
- Where heavy oils or greases are present there may be a need to first cut the oil with a “degreasing” solvent, but this should always be followed with an 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.

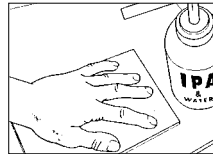
Making the bond

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.

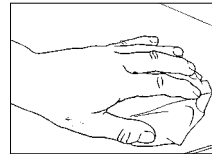
Remove the liner, fit the two surfaces together carefully, and using a suitable roller apply sufficient pressure to ensure the tape experiences 1 kg/cm² (100 kPa) pressure.



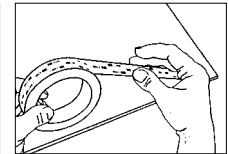
Step A: Some surfaces may need to be abraded using a 3M™ Scotch-Brite™ Abrasive Pad prior to cleaning.



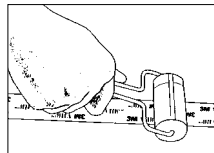
Step B: Solvent Wipe
Note: Be sure to carefully read and follow solvent manufacturer's directions for use and precautions.



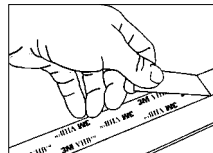
Step C: Wipe dry.



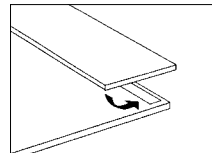
Step D: Position tape. Handle tape by edges only.



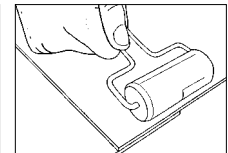
Step E: Squeegee onto surface.



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 h.

In some cases bond strength can be increased and ultimate bond strength can be achieved more quickly by exposure of the bond to elevated temperatures eg 66°C for 1 hour.

3M VHB Tapes Surface Preparation Suggestions for Specific Materials

Surface

Metals
Brass, copper
Aluminium, mill finished
Aluminium, anodized
Some plastics and paints
Plasticized vinyls

Wood, concrete, brick
Glass/ceramic surfaces

Low surface energy plastics
High surface energy plastics
with mould release agents
Fibreglass

Surface Preparation Suggestions

Scuff if oxidized
After cleaning the metal apply acrylic lacquer to prevent further oxidation
If oxidized, scuff immediately prior to bonding
Clean only
Scuff, particularly on paints and hard plastics
Evaluate 4941, 4945, 4947, 4991 plasticizer resistant tapes and/or prime with VHB Tape Primer 9639
Fully paint, or prime with a very thin coat of neoprene contact adhesive to seal the surface
Silane based coupling agent should be used in high moisture or high humidity environments (see *3M VHB Tape Glass Bonding - VHB Tape and Silane Coupling Agents Technical Bulletin*)
Prime with Tape Primer 94 and evaluate suitability of VHB Tape
Solvent wipe with MEK or acetone (check that these solvents do not affect the plastic) (Then scuff, IPA/water wipe as usual)
Gelcoat: Solvent wipe with 3M Automotive General Purpose Adhesive Cleaner to remove mould release wax if necessary, scuff
Non gelcoat: Grind to give smooth surface, prime with very thin coat of neoprene contact adhesive or gelcoat
Scuffing is best done with Scotch-Brite™ products
By hand: Use Scotch-Brite General Purpose Hand Pads no. 7447 (Maroon)
By machine: Use Scotch-Brite Roloc Surface Conditioning Discs - Medium or Fine grade

*Scuffing

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