



VHB™ Tapes

Design Guide for Architectural Metal Panels



Build fast to last

3M™ VHB™ Tapes...



Beauty, not the tape, is in the eye of the beholder

- Virtually invisible fastening helps keep surfaces smooth and clean to enhance design and appearance
- Use a wider variety of materials more readily for high impact visual combinations

Withstands wind, heat, cold, sway, and vibration

- Bond with high holding strength to replace screws, rivets, welds, and silicones for static and dynamic loads
- Elastic properties absorb shock and flexing for reliability against wind, vibration, and thermal expansion/contraction
- Fill irregularities and gaps between surfaces to help keep out dirt, water, and cleaning chemicals

Bonds panel to aluminum frame

For more than 20 years, engineers worldwide have been specifying 3M™ VHB™ Tapes to permanently bond and seal many surfaces for all the reasons shown here. And in commercial construction from Brazil to the United States, to

Switzerland, as well as here in Australia, applications for these double-sided acrylic foam tapes have continued to expand indoors and outdoors for panel to frame bonding and stiffener attachment.

• Cladding

• Column cover

• Curtain wall panels

• Ceiling



Simply clean...

3

Bonds aluminum stiffener to ACM panel



Adhesive applies easily to save time, money, and labour

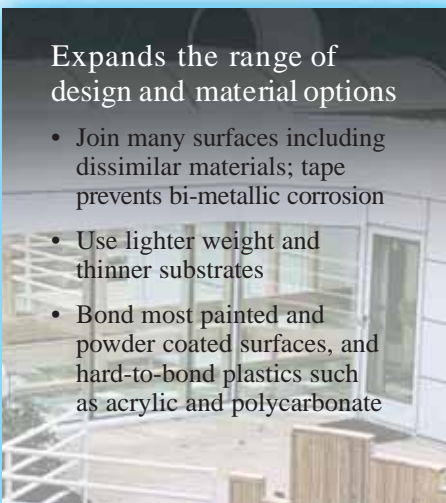
- PSA (pressure sensitive adhesive) bonds on contact with no drying time or fixturing
- Save processing steps such as drilling, screwing, welding, clean-up, and refinishing
- Easy-to-use; bond metal, glass, and most plastics with minimal surface preparation



and apply 3M™ VHB™ Tape

Expands the range of design and material options

- Join many surfaces including dissimilar materials; tape prevents bi-metallic corrosion
- Use lighter weight and thinner substrates
- Bond most painted and powder coated surfaces, and hard-to-bond plastics such as acrylic and polycarbonate



Manual Inline Tape Applicator

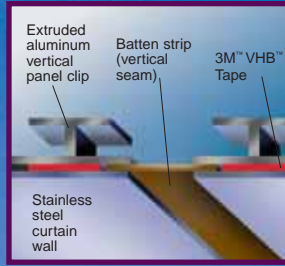
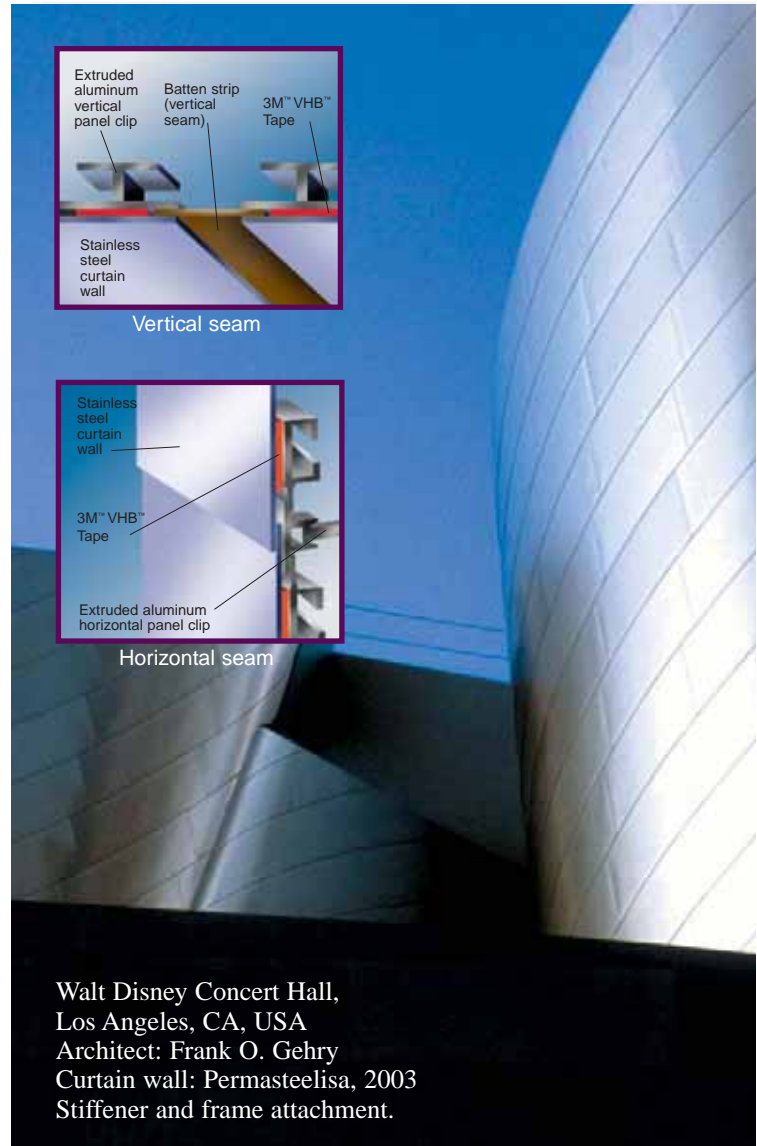
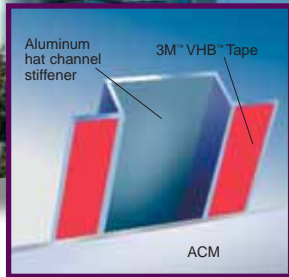
- Reduce labour time by up to 50%
- Applies VHB tape precisely & consistently in the desired area.
- Ensures correct pressure to the VHB Tape



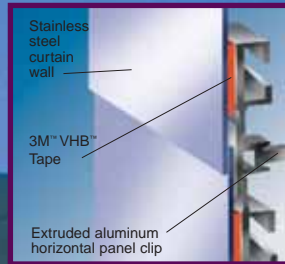
systems • Canopies • Decorative metal and trim • And more...



Plaza Centenário,
Sao Paulo, Brazil
Architect: Carlos Bratke, 1995
Aluminum stiffeners bonded
to ACM panels.



Vertical seam



Horizontal seam

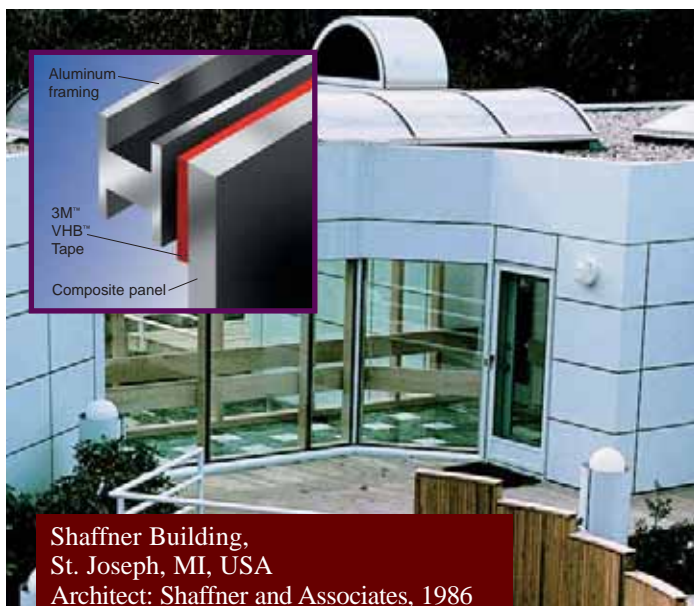
Walt Disney Concert Hall,
Los Angeles, CA, USA
Architect: Frank O. Gehry
Curtain wall: Permasteelisa, 2003
Stiffener and frame attachment.



CSIRO Energy Centre,
Newcastle, NSW, Australia
Architect: Cox Richardson Architects, 2003
Aluminum panels bonded to frame.



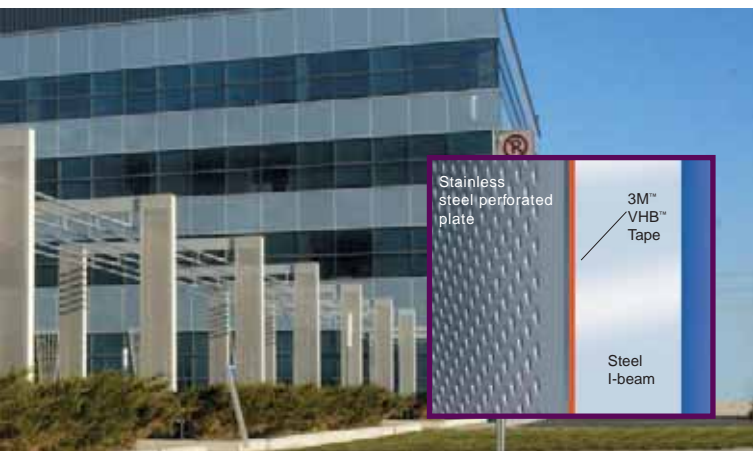
Toronto Bell Building,
Toronto, ONT, Canada
2000
Perforated stainless steel
plate bonded to I-beam.



Shaffner Building,
St. Joseph, MI, USA
Architect: Shaffner and Associates, 1986
Aluminum composite panels
bonded to aluminum framework.



Brindabella Precinct
Daryl Jackson Alastair Swayn Pty Ltd,
2004
Aluminium composite panels
bonded to top hat sections.



Stainless
steel perforated
plate

3M™
VHB™
Tape

Steel
I-beam

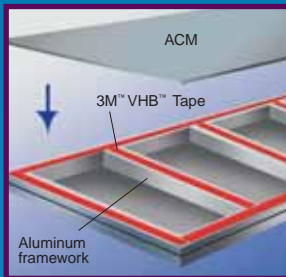


Dearborn Center, Chicago, IL, USA
Fabricator: Copper Sales Una-Clad, 2003
Stiffeners bonded to exterior metal trim cladding.

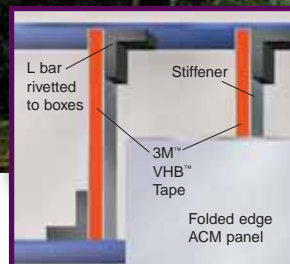
Sydney Entertainment Centre,
Sydney, Australia 2000
Refurbishment exterior
cladding.



Burj Al Arab Hotel,
Dubai, UAE
Architect: W.S. Atkins and Partners, 1999
Aluminum composite panels
bonded to framework to resist
high wind loads.

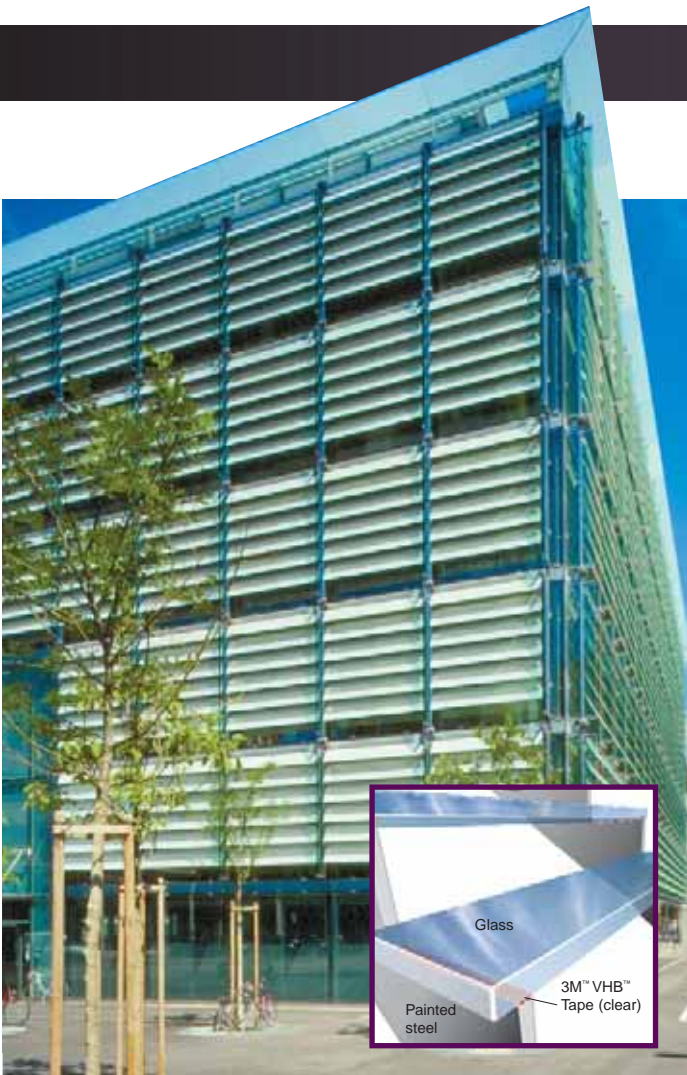


Adelaide Convention Centre, South Australia
Architect: Woods Bagot with
Skidmore, Owings & Merrill, 2001
Aluminum composite panel bonded
to galvanized frame.



Jurong West Telephone Exchange, Singapore
ACM panels attached to stiffeners.

Applies easily



Tamedia Building,
Zurich, Switzerland
Facade design: Soder AG, 2001
Glass steps bonded to
varnished steel frame.



ABC Ultimo Centre,
Sydney, Australia 2003
Architects: Cox Richardson Architects
Composite panels to metal frame.

to permanently bond many materials flat or curved

BankBoston,
Sao Paulo, Brazil
Architect: Skidmore, Owings &
Merrill and Julio Neves
partnership, 2002
Stainless steel panels
bonded to aluminum tray frame.



Canberra International Sports Centre
Canberra, Australia
Architects: Peter Hunt Architects, 2004
Builder: Sports Centre Australia (Konstantinou Group)
Composite panels to gal top-hats.



Samsung Medical Center,
Seoul, South Korea
Architect: Samoo Architects
and Engineers, 1995
Aluminum stiffeners
bonded to aluminum panels.

3M VHB™ Performance Tests

Structural Performance Tests

Architectural metal panels assembled using 3M™ VHB™ Tapes were given structural performance tests at Construction Research Laboratory (Miami, FL). Each panel measured 1525 mm x 2440 mm and was built with a perimeter frame and three stiffeners attached to the aluminum or ACM sheet using only VHB tape. The tests were performed according to ASTM E330 “Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference”. The panels survived pressures up to 4.3 kPa in both directions, which corresponds to a sustained wind speed of 305 km/h. The VHB tapes demonstrated excellent performance, even after the panels and stiffeners themselves had shown permanent deformation in these simulated high winds.

A duplicate set of panels constructed using VHB tapes was subjected to non-ambient temperature structural performance tests. The panels were subjected to positive and negative pressures up to 2.9 kPa at cold -29°C, ambient 32°C, and hot 66°C outside air test temperatures, which were the most extreme temperatures obtainable in this specific test configuration. Subsequent inspection showed VHB tapes withstood these wind pressures at the temperature extremes, and provided excellent performance despite the panels and stiffeners exerting high stresses on the tapes at all three test temperatures.

Aluminum panels of another design were bonded with VHB tape and tested in accordance with AS 2047 “Windows in Buildings” by the CSIRO Division of Building, Construction and Engineering (Australia). The panels were subjected to differential pressures up to 7.0 kPa with no signs of failure. This pressure represents a wind speed of approximately 390 km/h.

Cyclone Impact and Pressure Cycling Tests

Architectural metal panels assembled with VHB tapes were subjected to impact and pressure cycling tests to determine their ability to survive a hurricane or other high wind event. This testing was also performed at Construction Research Laboratory (Miami, FL). The impact test was performed in accordance with ASTM E1996 “Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Windborne Debris in Hurricanes”, using the most severe wind zone classification for non-essential buildings. The impacts resulted in heavy damage to the panels, frame, and stiffeners, but the VHB tapes held fast and even expanded to maintain contact with both dented surfaces.

The same panels were then given the pressure cycling sequence specified by Dade County Specification PA-203 using the test method provided in ASTM E1886 “Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Storm Shutters Impacted by Missiles and Exposed to Cyclic Pressure Differentials”. This resulted in a total of 1,342 pressure cycles (in the positive and negative wind directions) on the panels using a building design pressure of 1.9 kPa. Visual inspection after the test indicated the VHB tapes had maintained full contact to all stiffeners with no loss of adhesion. The pressure cycling sequence was then repeated using a building design pressure of 2.9 kPa for an additional 1,342 cycles. Two VHB tapes maintained complete adhesive contact with the stiffeners after this additional pressure cycling, indicating excellent performance throughout the cyclone-related tests.

Fire Tests

A different VHB tape bonded in a similar construction was tested to AS 1530 III

“Early Fire Hazard Properties of Materials” by the CSR Concord Research & Development Centre (Australia). This testing yielded the following fire rating indices:

Ignitability	= 0
Spread of Flame	= 0
Heat Evolved	= 0
Smoke Developed	= 0

Weathering Resistance

Numerous accelerated aging tests have also been performed which subject a bond made with VHB tape to heat, humidity, and concentrated UV light exposure to simulate outdoor weather conditions. For example, tests have demonstrated that VHB tape bond strength, as performed in a dynamic overlap shear test, typically maintains its original performance even after 7000 hours of exposure to these harsh conditions, at which point the tests were discontinued.

Chemical Resistance

Test results show no effect on VHB tape bond performance after splashes or incidental contact with a wide variety of solvents (such as fuels, alcohols, adhesive removers, weak acids, and weak bases).

Sealing

3M™ VHB™ Tapes can provide an excellent seal against moisture. They also form an excellent barrier to prevent galvanic corrosion between dissimilar metals. Test results indicated that, with proper tape application and perhaps a small amount of silicone sealant over the tape seams, that VHB tape can provide an excellent seal against water penetration.

3M VHB™ Design Considerations

will handle greater mismatch and differential thermal expansion between surfaces, and provide better contact and sealing.

Important Note

The details about each architectural metal panel application (such as panel design, materials, surface preparation, selected VHB tape, and building-specific requirements) can affect the use and performance of a VHB tape. Therefore, VHB tapes should be thoroughly evaluated by the user under actual use conditions with intended substrates to determine whether a specific VHB tape is fit for a particular purpose and suitable for user's method of application, especially if expected use involves extreme environmental conditions.

Warranty

VHB tapes can provide the strength and durability needed in the assembly of architectural metal panels. For qualifying applications, 3M may provide an application warranty to provide you and your customers with even more confidence that VHB tapes can deliver higher performance and long-term reliability. Contact your local 3M representatives for details on an application warranty.

Static Loads					
As a general rule 1 kg per 55 sq cm should be used to support static tensile or shear dead loads.					
Metres of tape required : Tape width (mm)					
Dead Weight (kg)	9	12	15	18	24
10	6.1	4.6	3.7	3.1	2.3
11	6.7	5.0	4.0	3.4	2.5
12	7.3	5.5	4.4	3.7	2.8
13	7.9	6.0	4.8	4.0	3.0
14	8.6	6.4	5.1	4.3	3.2
15	9.2	6.9	5.5	4.6	3.4
16	9.8	7.3	5.9	4.9	3.7
17	10.7	7.8	6.2	5.2	3.9
18	11.0	8.3	6.6	5.5	4.1
19	11.6	8.7	7.0	5.8	4.4

While this guideline includes some safety factors, a different amount of VHB tape may be required depending on the particular application.

Dynamic Loads–The Trapezoid Rule is commonly used to calculate the minimum width of VHB tape required for frame attachment to withstand the dynamic forces which may be experienced by an architectural metal panel: Dynamic tensile and shear strength tests have shown the minimum material design stress for VHB tapes to be approximately 138 kPa over the temperature range from -20°C to 80°C. An appropriate safety factor should be included in the panel design.

two bonded surfaces experience contraction and expansion relative to each other. VHB tapes can typically tolerate differential shear movement up to 3 times their original thickness. Since bonds made with VHB tapes will be more flexible than other joining methods, suitable design modifications may be needed to achieve required stiffness.

Tape Thickness–The optimal thickness of VHB tape for a particular application depends on the size, rigidity, and flatness of the substrates, as well as the amount of application pressure applied to mate the surfaces together. In general, thicker tapes

Thermal Expansion/Contraction–VHB tapes perform well in applications where the

3M™ VHB™ Tapes for Architectural Metal Panels

Product Numbers	Tape Thickness	Description	Adhesive Type	Temperature		Solvent Resistance	Liner Type	Relative		Application Ideas
				Short	Long			HSE	LSE	
VHB 4991 VHB 4941	2.3 mm 1.1 mm	Dark grey, closed cell acrylic foam carrier. Conformable. Good adhesion to many to painted surfaces* Plasticizer resistant	Acrylic	121°C	93°C	High	Film	High	Med	Bond and seal perimeter frame to metal sheet and Aluminium Composite Material (ACM). Attachment of stiffener to panels.
VHB 4951	1.1 mm	White, closed cell acrylic foam carrier	Acrylic	121°C	93°C	High	Film	High	Low	Can be applied as low as 0°C.
4612 ATF	1.2 mm	Acrylic foam tape	Acrylic	121°C	93°C	Med	Film	High	Low	Bonding joint backing plates or on non critical structural applications.

Note: This technical information should be considered representative or typical only and should not be for specification purposes. Relative Adhesion: HSE–High Surface Energy LSE– Low Surface Energy Temperature: Short–minutes to hours. Long–continues Surface Preparation: Consult 3M on the correct preparation for the intended materials. *Primers may be used to increase the surface energy of LSE materials. Consult 3M technical representative.

Technical Information

Additional Information

Beyond bonding with 3M™ VHB™ Tape, 3M industrial technologies can help you finish, mask, and protect the surfaces of architectural metal panels.



3M Abrasive Systems:

From a wide selection of 3M non-woven abrasive products you can find wheels and discs to quickly deburr, blend and finish any metal. Special construction runs cool and long for cost-effectiveness.



3M™ Protective Films:

To protect metal surfaces during processing, shipping and installation, these polyethylene films offer combinations of adhesive sticking power and removability for the demands of various conditions.



3M™ Masking Tapes:

With this extensive line you have choices in holding power, paint edge sharpness, temperature resistance, and clean removal to meet the productivity and quality requirements of any painting method.



3M™ Reclosable Fasteners:

3M reclosable fasteners systems invisibly attach access doors and panels where frequent access is required without the need for unsightly mechanical fasteners. Various combinations of the mushroom heads engage together providing an industrial high strength bond.



3M™ Adhesive Cleaner 700 & 300:

Versatile and convenient general-purpose cleaners. Ideal for cleaning surface prior to bonding with adhesives and adhesive tapes. Also useful for cleaning up adhesive residue.

For Additional Information: To request additional product information or to arrange for sales assistance, call toll free 136 136. Address correspondence to 3M Industrial Adhesives and Tapes Division, Pymble, NSW 2073 Australia.

Limited Product Warranty: 3M warrants for 24 months from the date of manufacture, that 3M™ VHB™ Tape will be free of defects in material and manufacture. 3M MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. This warranty does not cover damage resulting from the use or inability to use 3M VHB Tape due to misuse, workmanship in application, or application or storage not in accordance with 3M recommended procedures. Important Notice: User is responsible for determining whether the 3M product is fit for a particular purpose and suitable for user's method of application. Please remember that many factors can affect the use and performance of a 3M product in a particular application. The materials to be bonded with the product, the surface preparation of these materials, the product selected for use, the conditions in which the product is used, and the time and environmental conditions in which the product is expected to perform are among the many factors that can affect the use and performance of a 3M product. Given the variety of factors that can affect the use and performance of a 3M product, some of which are uniquely within the user's knowledge and control, it is essential that the user evaluate the 3M product to determine whether it is fit for a particular purpose and suitable for the user's method of application.

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.



3M Australia Pty Ltd.
950 Pacific Highway Pymble NSW 2073