

# 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

Property	Values	Additional Information
Adhesive Type	General Purpose Acrylic	
Foam Type	Firm Acrylic	
Liner	PE Film	
Liner Thickness	0.13 mm	
Color	Dark Gray	
Liner Color	Red	View 
Test Name: Primary		

Total Tape Thickness (mil)	25 mil	View 
Test Method: ASTM D3652		
Total Tape Thickness (mm)	0.6 mm	View 
Test Method: ASTM D3652		
Total Tape Thickness	0.025 in	View 
Test Method: ASTM D3652		
Thickness Tolerance	±15 %	
Density	840 kg/m <sup>3</sup>	View 
Test Method: ASTM D3574		
Notes: Foam with adhesive		
Density	52 lb/ft <sup>3</sup>	
Liner Thickness	0.005 in	

### Typical Performance Characteristics

Property	Values	Additional Information
90° Peel Adhesion	15 lb/in	View 
Test Method: ASTM D3330		
Dwell/Cure Time: 24.0		
Dwell Time Units: hr		
Temp C: 23C		
Temp F: 72F		
Environmental Condition: 50%RH		
Substrate: Stainless Steel		
Backing: 5 mil Aluminum Foil		
Notes: 12 in/min (300 mm/min)		
90° Peel Adhesion	26 N/cm	View 
Test Method: ASTM D3330		
Dwell/Cure Time: 72.0		
Dwell Time Units: hr		
Temp C: 23C		
Temp F: 72F		
Environmental Condition: 50%RH		
Substrate: Stainless Steel		
Backing: 2 mil Aluminum Foil		
Notes: 12 in/min (300 mm/min)		

Normal Tensile

690 kPa

View 


Test Method: ASTM D897

Dwell/Cure Time: 72.0  
Dwell Time Units: hr  
Temp C: 23C  
Temp F: 73F  
Substrate: Aluminum

Notes: 1 in.<sup>2</sup> (6.45 cm<sup>2</sup>), Jaw Speed 2 in./min. (50 mm/min.)

Normal Tensile

100 lb/in<sup>2</sup>

View 

Test Method: ASTM D897

Dwell/Cure Time: 72.0  
Dwell Time Units: hr  
Temp C: 23C  
Temp F: 73F  
Substrate: Aluminum

Notes: 1 in.<sup>2</sup> (6.45 cm<sup>2</sup>), Jaw Speed 2 in./min. (50 mm/min.)

Overlap Shear Strength

550 kPa

View 

Test Method: ASTM D1002

Notes: 1 in.<sup>2</sup> (6.45 cm<sup>2</sup>), Jaw Speed 0.5 in/min (12.7 mm/min)

Overlap Shear Strength

80 lb/in<sup>2</sup>

View 

Test Method: ASTM D1002

Notes: 1 in.<sup>2</sup> (6.45 cm<sup>2</sup>), Jaw Speed 0.5 in/min (12.7 mm/min)

Short Term Temperature Resistance

232 °C

View 

Notes: 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).

Short Term Temperature Resistance

450 °F

View 

Notes: 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).

Long Term Temp C


149 °C

View 

Notes: Maximum temperature where tape supports at least 250 g load per 0.5 in<sup>2</sup> in static shear for 10,000 minutes. (Represents continuous exposure for day or weeks).

Long Term Temp F

300 °F

View 

Notes: Maximum temperature where tape supports at least 250 g load per 0.5 in<sup>2</sup> in static shear for 10,000 minutes. (Represents continuous exposure for day or weeks).

Static Shear

1500 g

View 

Test Method: ASTM D3654

Temp C: 23C  
Temp F: 73F  
Substrate: Stainless Steel

Notes: Tested at various temperatures and gram loadings. 0.5 in.<sup>2</sup> (3.23 cm<sup>2</sup>). Will hold listed weight for 10,000 minutes (approximately 7 day).

Static Shear 500 g

[View](#) 

Test Method: ASTM D3654

Temp C: 66C  
Temp F: 150F  
Substrate: Stainless Steel

Notes: Tested at various temperatures and gram loadings. 0.5 in<sup>2</sup> (3.23 cm<sup>2</sup>). Will hold listed weight for 10,000 minutes (approximately 7 day).

Static Shear 500 g

[View](#) 

Test Method: ASTM D3654

Temp C: 93C  
Temp F: 200F  
Substrate: Stainless Steel

Notes: Tested at various temperatures and gram loadings. 0.5 in<sup>2</sup> (3.23 cm<sup>2</sup>). Will hold listed weight for 10,000 minutes (approximately 7 day).

Static Shear 121C Stainless Steel 500 g

[View](#) 

Test Method: ASTM D3654

Temp C: 121C  
Temp F: 250F  
Substrate: Stainless Steel

Notes: Tested at various temperatures and gram loadings. 0.5 in<sup>2</sup> (3.23 cm<sup>2</sup>). Will hold listed weight for 10,000 minutes (approximately 7 day).

Static Shear 177C Stainless Steel 500 g

[View](#) 

Test Method: ASTM D3654

Temp C: 177C  
Temp F: 350F  
Substrate: Stainless Steel

Notes: Tested at various temperatures and gram loadings. 0.5 in<sup>2</sup> (3.23 cm<sup>2</sup>). Will hold listed weight for 10,000 minutes (approximately 7 day).

## Available Sizes

Property	Values	Additional Information
Standard Roll Length	65.8 m	
Standard Roll Length	72 yd	
Minimum Available Width	6.4 mm	
Minimum Available Width	0.25 in	
Maximum Available Width	1219 mm	
Maximum Available Width	48 in	

Normal Slitting Tolerance ±0.79 mm

Normal Slitting Tolerance ±1/32 in

Core Size (ID) 76.2 mm

Core Size (ID) 3 in

Available Sizes




## UL 746C Listings

## Solvent and Fuel Resistance

## Additional Performance Characteristics

Property	Values	Additional Information
Shear Modulus	6 x 10 <sup>5</sup> Pa	
Poisson's Ratio	See 3M™ VHB™ Tape 4611	
Coefficient of Thermal Expansion	See 3M™ VHB™ Tape 4611 m/m/°C	

## Electrical and Thermal Properties

Property	Values	Additional Information
Dielectric Constant 1KHz	See 3M™ VHB™ Tape 4611	View 
Test Method: ASTM D150 Temp C: 23C Temp F: 72F Test Condition: 1 KHz		
Dielectric Constant 1MHz	See 3M™ VHB™ Tape 4611	View 
Test Method: ASTM D150 Temp C: 23C Temp F: 72F Test Condition: 1MHz		
Dissipation Factor 1KHz	See 3M™ VHB™ Tape 4611	View 

Test Method: ASTM D150

Temp C: 23C

Temp F: 72F

Test Condition: 1 KHz

Dissipation Factor 1MHz

See 3M™ VHB™ Tape 4611

View 

Test Method: ASTM D150

Temp C: 23C

Temp F: 72F

Test Condition: 1MHz

Dielectric Strength

See 3M™ VHB™ Tape 4611 V/μm

View 

Test Method: ASTM D140

Thermal Conductivity

See 3M™ VHB™ Tape 4611 W/m/K

Volume Resistivity

See 3M™ VHB™ Tape 4611 Ω-cm

View 

Test Method: ASTM D257

Temp C: 23C

Temp F: 73F

Surface Resistivity

See 3M™ VHB™ Tape 4611 Ω

View 

Test Method: ASTM D257

Test Condition: Room Temperature

## 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<sup>2</sup> 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/in<sup>2</sup> (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.

## 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](http://www.3M.com/converter).

## 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

## Industry Specifications

---

UL 746C (File MH 17478)

UL 879 (File E65361)

## Automotive Disclaimer

---

Automotive Applications: This product is an industrial product and has not been designed or tested for use in certain automotive applications, including, but not limited to, automotive electric powertrain battery or high voltage applications. This product does not fully adhere to typical automotive design or quality system requirements, such as IATF 16949 or VDA 6.3. This product may not be manufactured in an IATF certified facility and may not meet a Ppk of 1.33 for all properties. The product may not undergo an automotive production part approval process (PPAP). Customer is solely responsible for evaluating the product and determining whether it is appropriate and suitable for customer's automotive application and for conducting incoming inspections before use of the product. Failure to do so may result in injury, death, and/or harm to property. No written or verbal statement, report, data or recommendation by 3M related to automotive use of the product shall have any force or effect unless in an agreement signed by the Technical Director of 3M's Automotive Division. Customer assumes all responsibility and risk if customer chooses to use this product in an automotive electric powertrain battery or high voltage application, and 3M will not be liable for any loss or damage arising from or related to the 3M product or customer's use of the product, whether direct, indirect, special, incidental, or consequential (including, but not limited to, lost profits or business opportunity or recall costs), regardless of the legal or equitable theory asserted, including, but not limited to, warranty, contract, negligence, or strict liability. In no event shall 3M be liable for any damages in excess of the purchase price paid for the product.

NOTWITHSTANDING ANY OTHER STATEMENT TO THE CONTRARY, 3M MAKES NO REPRESENTATIONS, WARRANTIES OR CONDITIONS WHATSOEVER, EXPRESS OR IMPLIED, REGARDING THE PRODUCT IF USED IN AN AUTOMOTIVE ELECTRIC POWERTRAIN BATTERY OR HIGH VOLTAGE APPLICATION, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTY ON PERFORMANCE, LONGEVITY, SUITABILITY, COMPATIBILITY, OR INTEROPERABILITY, OR ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR ARISING OUT OF A COURSE OF DEALING, CUSTOM, OR USAGE OF TRADE.

## Bottom Matter

---

3M

Industrial Adhesives and Tapes Division

3M Center, Building 225-3S-06

St. Paul, MN 55144-1000

800-362-3550 • 877-369-2923 (Fax)

www.3M.com

## Trademarks

---

3M and VHB are trademarks of 3M Company

## 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.

## References

Property	Values
3m.com Product Page	<a href="https://www.3m.com/3M/en_US/p/d/b40065659/">https://www.3m.com/3M/en_US/p/d/b40065659/</a>
Safety Data Sheet SDS	<a href="https://www.3m.com/3M/en_US/category_US/SDS-sheets/4646">https://www.3m.com/3M/en_US/category_US/SDS-sheets/4646</a>

## Family Group

Link Tags:

- [4611](#)
- [4646](#)
- [4655](#)

Products	Adhesive Type	Foam Type	Liner Thickness	Color	Liner Color	Total Tape Thickness (mm)
4646	General Purpose Acrylic	Firm Acrylic	0.13 mm	Dark Gray	Red	0.6 mm
4655	General Purpose Acrylic	Firm Acrylic	N/A	Dark Gray	Red	N/A
4611	General Purpose Acrylic	Firm Acrylic	0.13 mm	N/A	Red	N/A

## ISO Statement

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

## Information

**Technical Information:** The technical information, guidance, and other statements contained in this document or otherwise provided by 3M are based upon records, tests, or experience that 3M believes to be reliable, but the accuracy, completeness, and representative nature of such information is not guaranteed. Such information is intended for people with knowledge and technical skills sufficient to assess and apply their own informed judgment to the information. No license under any 3M or third party intellectual property rights is granted or implied with this information.

**Product Selection and 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. As a result, customer is solely responsible for evaluating the product and determining whether it is appropriate and suitable for customer’s application, including conducting a workplace hazard assessment and reviewing all applicable regulations and standards (e.g., OSHA, ANSI, etc.). Failure to properly evaluate, select, and use a 3M product and appropriate safety products, or to meet all applicable safety regulations, may result in injury, sickness, death, and/or harm to property.

**Warranty, Limited Remedy, and Disclaimer:** 3M warrants for 24 months from the date of 3M manufacture that 3M™ VHB™ Tape will be free of defects in material and



manufacture. 3M MAKES NO OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR ARISING OUT OF A COURSE OF DEALING, CUSTOM, OR USAGE OF TRADE. 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 (except to the extent 3M approves and issues a specific application warranty, for which the customer must apply, receive 3M approval, and meet all applicable warranty and process requirements, the additional details, terms, and conditions of which are available from 3M). If a 3M product does not conform to this warranty, then the sole and exclusive remedy is, at 3M's option, replacement of the 3M product or refund of the purchase price.

**Limitation of Liability:** Except for the limited remedy stated above, and except to the extent prohibited by law, 3M will not be liable for any loss or damage arising from or related to the 3M product, whether direct, indirect, special, incidental, or consequential (including, but not limited to, lost profits or business opportunity), regardless of the legal or equitable theory asserted, including, but not limited to, warranty, contract, negligence, or strict liability.

**Disclaimer:** 3M industrial and occupational products are intended, labeled, and packaged for sale to trained industrial and occupational customers for workplace use. Unless specifically stated otherwise on the applicable product packaging or literature, these products are not intended, labeled, or packaged for sale to or use by consumers (e.g., for home, personal, primary or secondary school, recreational/sporting, or other uses not described in the applicable product packaging or literature), and must be selected and used in compliance with applicable health and safety regulations and standards (e.g., U.S. OSHA, ANSI), as well as all product literature, user instructions, warnings, and limitations, and the user must take any action required under any recall, field action or other product use notice. Misuse of 3M industrial and occupational products may result in injury, sickness, or death. For help with product selection and use, consult your on-site safety professional, industrial hygienist, or other subject matter expert. For additional product information, visit [www.3M.com](http://www.3M.com).