

Surface Preparation for 3M™ VHB™ Tape Applications

Technical Bulletin

April, 2007

Summary

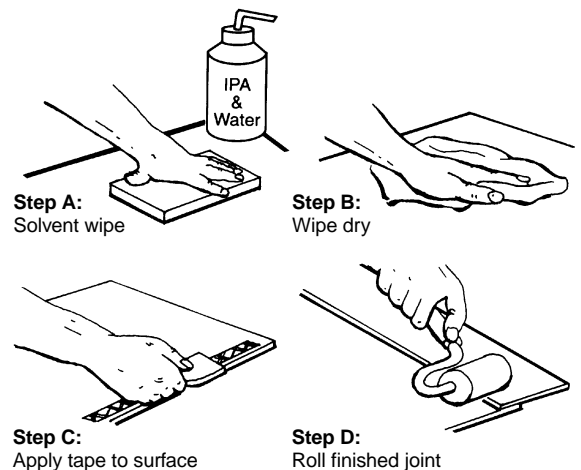
Most substrates are best prepared by cleaning with a 50:50 mixture of isopropyl alcohol (IPA) and water* prior to applying 3M™ VHB™ Tapes.

Exceptions to this general procedure that may require additional surface preparation include:

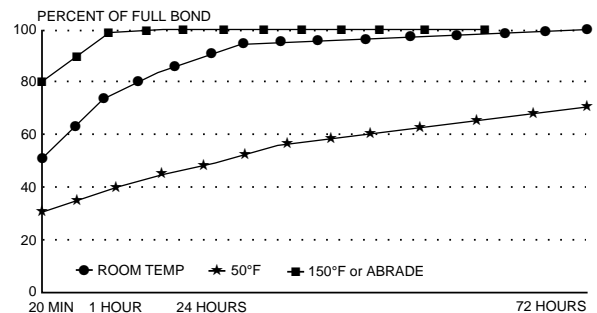
- **Heavy Oils:** A degreaser or solvent-based cleaner may be required to remove heavy oil or grease from a surface and should be followed by cleaning with IPA/water.
- **Abrasion:** Abrading a surface, followed by cleaning with IPA/water, can remove heavy dirt or oxidation and can increase surface area 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 fibred 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).

General Procedure

- To obtain optimum adhesion, the bonding surfaces must be well unified, clean and dry. Typical surface cleaning solvents are IPA/water mixture (rubbing alcohol) or heptane.* (Steps A and B)
- 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. (Steps C and D)
Generally, this means that the tape should experience at least 15 psi (100 kPa) in roll down or platen pressure. (Sources- page #4)
- After application, the bond strength will increase as the adhesive flows onto the surface. At room temperature, approximately 50% of the ultimate strength will be achieved after 20 minutes, 90% after 24 hours and 100% after 72 hours. 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 (e.g. 150°F [66°C] for 1 hour).



Typical Bond Build Over Time



*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.

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Heavy Oils On surfaces with a light oily film, or other light contamination, the 50:50 IPA/water solution is usually adequate. Where heavy oils or grease are present, a “degreasing” solvent such as 3M™ Prep Solvent 70, 3M™ Citrus Base Cleaner, mineral spirits, naphtha or similar solvents are suggested to cut the oil. This should always be followed with an IPA/water cleaning to help ensure that any residue or film is removed.*

Abrasion Abrading a surface can serve several functions:

- Remove heavy levels of dirt or oxide from metals or paints (e.g. galvanized steel).
- Create additional surface area that can increase adhesion.
- Smooth a surface to obtain more flatness, allowing improved contact area.

Abrasion often helps adhesion to paints and plastics. When abrading, it is important for tapes to have a finely abraded surface. Very small scratches in the surface, generated with circular motion rather than straight-line motion, are most desirable. A surface with many micro-scratches in it can have up to 40% additional available surface area, translating to higher ultimate strength and greater initial adhesion. Scotch-Brite® Hand Pads (such as 7447 Maroon or Heavy Duty Green) are good for achieving the right level of abrasion. Tools such as a power palm sander will assist on large jobs. Avoid grinding a surface with coarse abrasive materials, since they may create too rough of a texture for the adhesive to adequately flow into the surface. Always clean the surface with the IPA/water solution or additional methods previously described, and be certain that all loose particles are removed prior to bonding.

Exceptions to these abrading guidelines are 3M™ VHB™ Tapes 4932 and 4952, as they typically perform best on smooth glossy surfaces and abrasion may reduce the bond strength.

Adhesion Promoters Priming a surface can significantly improve initial and ultimate adhesion to many materials such as plastics and paints because of their low surface energy or the additives they may contain. A primer creates a new surface for 3M™ VHB™ Tape to adhere to and can also create a layer that may impede the migration of additives that may be present in a material. It is important for the user to determine the suitability of the 3M™ VHB™ Tape, the adhesion promoter and the application process.

Porous Surfaces Rough, porous or fibered materials such as wood, particleboard, cement, etc., have an open surface and require sealing to provide a unified surface for tape bonding. Common sealing materials would include paint, varnish or other hard surface coatings. Fast drying 3M™ Rubber and Vinyl Spray 80 can also be used to unify the surface and improve the tape bond.

Unique Surfaces Glass, stone, ceramic or other siliceous materials are hydrophilic (water-loving) by nature. Normally, the hydrophilic nature makes pressure sensitive adhesive bond durability susceptible to change under high humidity or exposure to moisture. In basic terms, water vapor can undercut the tape bond and interfere with the normal adhesion forces. Silane coupling agents, added to the IPA/water cleaning solution, can help reduce the “water-loving” tendency of these surfaces and enhance the tape bond in high moisture environments.

Copper, brass, and bronze are prone to oxidation even after the 3M™ VHB™ Tape is applied. To prevent a weakening of the bond, a lacquer or varnish should be applied to these surfaces. Be sure to test the tape bond to the sealer on a metal surface to verify good adhesion.

Flexible PVC (vinyl) contains plasticizers that can migrate into the tape and affect adhesion. There are several 3M™ VHB™ Tapes that are formulated to be resistant to plasticizer migration, or 3M™ Scotch-Grip™ Plastic Adhesive 2262, thinned, can serve as a barrier to migration. Rubber materials (e.g. EPDM, neoprene) can have low surface energy and may also contain plasticizers and oils. These require the use of an adhesion promoter for stable bond strength. Test for compatibility with flexible PVC and rubber materials by aging bonded samples for a week at 150°F (66°C) and check for softening of the adhesive, discoloration or reduction in bond strength.

***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.

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Suggested Primers The table below offers suggested primers and alternative methods that commonly require primers, adhesion promoters or other surface treatments for successful use with 3M™ VHB™ Tapes. This list is not intended to be fully comprehensive but may be useful for many applications. It is very important for the user to determine the suitability of the 3M™ VHB™ Tape, primer and application process and compliance with local Air Quality Regulations.

Surface	Concern	Suggested Primer	Alternatives
Steel or Aluminum	Surface must be clean	None suggested	Abrasion may clean surface, 3M™ Adhesion Promoter 111 for increased adhesion.
Copper, Brass, Bronze	Oxidation after bonding	Lacquer or varnish ^(b)	Architectural grade coatings
Concrete, Brick	Non-unified or rough surface, moisture	3M™ Rubber and Vinyl Spray 80	Concrete sealer, paint
Glass, Stone, Ceramic Tile	High humidity, moisture	3M™ Silane Glass Treatment AP 115 or similar silane coupling agent in IPA/water mixture ^(b)	3M™ Primer 94
Wood (soft, hard particle board, etc.)	Weak fiber layer on surface (e.g., low surface strength)	3M™ Rubber and Vinyl Spray 80, 3M™ Fastbond™ 30 Contact Adhesive	Urethane paint, varnish
Plastics: Polyolefin	Low adhesion	3M™ Primer 94 (additional surface preparation may be required)	Flame treatment, Corona treatment
Non-olefin	Additives, low adhesion	3M™ Primer 94, 3M™ Scotch-Grip™ Plastic Adhesive 2262 ^(a)	Abrade or 3M™ VHB™ Tapes 4932/4952/5925/5952/5962
Polyurethane (Molded or Rubber)	Mold release, low adhesion	3M™ Adhesion Promoter N-200J, 3M™ Scotch-Grip™ Plastic Adhesive 1099	Abrade and prime
Rubber: Neoprene, Santoprene	Migrating oils	3M™ Primer 94, 3M™ Scotch-Grip™ Plastic Adhesive 1099	3M™ Weather Strip Tapes
EPDM	Low adhesion	3M™ Primer 94	3M™ Weather Strip Tapes
Paints	Low adhesion	3M™ Adhesion Promoter 111	Abrade or 3M™ VHB™ Tapes 4932/4952/5925/5952/5962, or 3M™ Primer 94, 3M™ Scotch-Grip™ Plastic Adhesive 2262 ^(a) , 3M™ Adhesion Promoter N-200J
Coil Coated Aluminum	Low adhesion	3M™ Adhesion Promoter 111	Abrade or 3M™ VHB™ Tapes 4932/4952/5925/5952/5962, or 3M™ Primer 94, 3M™ Scotch-Grip™ Plastic Adhesive 2262 ^(a) , 3M™ Adhesion Promoter N-200J
Flexible PVC (Vinyl)	Plasticizer migration	3M™ Scotch-Grip Plastic Adhesive 2262 ^(a) , 3M™ Rubber and Vinyl Spray 80	3M™ VHB™ Tapes 4945 and 4941 (test for migration)

Note: These primers contain greater than 250 g/l of volatile organic compounds (VOC). Please contact your local Air Quality Regulations to be sure these primers are compliant.

^(a)3M™ Scotch-Grip™ Plastic Adhesive 2262 contains 196 g/l VOC.

^(b)See supplier information.

Primer Source and Description

- **3M™ Primer 94, 3M™ Adhesion Promoter 111 and 3M™ Silane Glass Treatment AP 115** are available through distributors that carry 3M™ VHB™ Tapes.
- **3M™ Scotch-Grip™ Plastic Adhesive 2262** must be thinned in acetone or MEK* in a 1:5 or 1:10 ratio (e.g., 1 part Scotch-Grip plastic adhesive 2262 to 5 parts acetone or MEK). The product is available premixed in either acetone or MEK from: PRC DeSoto at (317) 290-1600. 3M™ Scotch-Grip™ Plastic Adhesive 2262T, thinned in 10:1 MEK solution or 3M™ Scotch-Grip™ Plastic Adhesive 2262TA, thinned in 10:1 acetone solution.* When diluted in acetone at this ratio, this material contains 196 g/l VOC.*
- **Diluted 3M™ Scotch-Grip™ Plastic Adhesive 1099** must be thinned in acetone* in a 1:3 ratio (e.g., 1 part Scotch-Grip plastic adhesive 1099 to 3 parts acetone). This thinned material contains zero VOC's when diluted in these ratios.
- **3M™ Adhesion Promoter N-200J** is available from PRC DeSoto at (317) 290-1600.
- **Silane Coupling Agent** is also available premixed in a 91:9 IPA/water solution or as a concentrate. A 0.5 wt. % level of silane* adhesion promoter diluted in a 91:9 IPA/water cleaning solution has been found to be sufficient.

Suggested Sources for Silane Coupling Agents:

Custom-Pak Products, Inc. (262) 251-6180 available premixed in IPA/water
Lancaster Synthesis, Inc. (603) 889-3306 available 100% concentrated

***Note:** Be sure to read and follow silane and solvent manufacturer's precautions and directions for use for proper handling and storage information.

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Run an Evaluation

Because 3M cannot anticipate all of the different possible surfaces and contaminants that may exist, it is imperative that the user conduct an evaluation to determine the suitability of 3M™ VHB™ Tapes, surface preparations procedures, and any other processes that may have an influence on the tape or the bonded parts. Likewise, where there are any changes in plastic or paint formulation, or suppliers of these materials, it is advisable to run evaluations to ensure that the change has not influenced the compatibility of the surface with 3M™ VHB™ Tapes.

Sources

Hand held J-Roller:
Rockler Woodworking and Hardware
Phone: (800) 279-4441 Specify #39463
www.rockler.com

Product Use

All statements, technical information and recommendations contained in this document are based upon tests or experience that 3M believes are reliable. However, many factors beyond 3M's control can affect the use and performance of a 3M product in a particular application, including the conditions under which the product is used and the time and environmental conditions in which the product is expected to perform. Since these factors 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.

Limited 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 limited 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.

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 9001:2000

This Industrial Adhesives and Tapes Division product was manufactured under a 3M quality system registered to ISO 9001:2000 standards.



Industrial Business Industrial Adhesives and Tapes Division

3M Center, Building 21-1W-10, 900 Bush Avenue
St. Paul, MN 55144-1000
800-362-3550 • 877-369-2923 (fax)
www.3M.com/industrial



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