



Panel Bonding Procedure using 3M™ VHB™ Tape

Technical Bulletin

July, 2008

Introduction

Since 1980, manufacturers of commercial vehicles have been using 3M™ VHB™ Tapes to attach sidewall panels to the framework of commercial vehicles such as trailers, truck bodies, ambulances, fire trucks, busses, and rail cars. The purpose of this technical bulletin is to assist with developing a standardized process to assemble smooth sided trailers or truck bodies with 3M™ VHB™ Tape.

I. Key Factors For Successful Application

- Determine suitability of these tapes for your particular application.
- Use only an approved tape and surface preparation combination for the specific materials to be bonded together. Contact your local 3M specialist for assistance and possible tape adhesion strength testing.
- Design framework and trim pieces such that panels are not constrained, but rather are allowed to freely expand and contract with temperature differences. See 3M technical bulletin “Design Considerations for Smooth Sided Trailers.” Visit www.3M.com/vhb.
- Always clean surface properly. Apply tape as soon as possible after cleaning to avoid contaminants.
- If abrading surfaces is required to increase tape adhesion levels or adhesion build rate, abrade only with a fine abrasive that is not coarser than 3M™ Scotch-Brite™ Hand Pad 7447 or 180x grit sandpaper.
- Use an adequate amount of tape.
- Ensure that all materials meet the required minimum tape application temperature of 60°F (15°C) for 3M™ VHB™ Commercial Vehicle Tapes CV45F and CV62F.
- Allow taped trailer or truck bodies to dwell for a minimum of 4 hours at 60°F (15°C) or higher before exposure to colder temperatures.
- Roll down tape firmly both after tape application and then again after parts are bonded together.

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II. Materials Required

A. *Tape*

1. Select appropriate 3M™ VHB™ Tape for specific materials and paint used.

3M™ VHB™ Tape	Tape Thickness	Tape Color	Tape Release Liner	Application
CV45F	.045"	Gray	Red polyethylene film	Panel-to-panel at the overlap seams
CV62F	.062"	Gray	Red polyethylene film with white printing	Panels to posts

2. Use at least 1" wide tape if posts are 16" on centers.
3. Use .062" thick tape for panel-to-post tape and 0.45" thick tape for panel-to-panel tape at the overlap seam.
4. Use adequate tape coverage and proper tape application techniques.

B. *Posts*

1. Steel –
 - a. Abrade down to bare metal to remove rust. (Use 3M™ Clean & Strip XT Disc listed below).
 - b. Abrade to remove all loose paint.
 - c. Fine abrade painted steel posts.
 - d. Always clean after abrading.
 - e. If approved by testing, painted post may be coated with 3M™ Adhesion Promoter 111 as an alternative to fine abrading.
2. Bare aluminum –
 - a. Abrade, if necessary, to remove oxidation. (Use 3M™ Scotch-Brite™ Hand Pad 7447 listed below.)
 - b. Always clean after abrading.
 - c. If aluminum is not oxidized, clean with 50:50 mixture of isopropyl alcohol and water.
3. Galvanized or galvanealed steel –
 - a. If necessary, pre-clean properly with a detergent to remove oils commonly used in roll forming and punching operations.
 - b. Final clean with 50:50 mixture of isopropyl alcohol and water.

C. *Panels*

1. Painted color exterior side – Test specific panel paint to ensure suitability of a particular tape and surface preparation combination for that paint. If paint changes, retesting of tape and surface preparation combination may be necessary. The four options for surface preparation are typically:
 - a. Clean only
 - b. Fine abrading with Scotch-Brite hand pad 7447 followed by good cleaning
 - c. Good cleaning followed by application of 3M™ Adhesion Promoter 111; or
 - d. Combination of fine abrading, good cleaning, and 3M adhesion promoter 111. This combination will often accelerate adhesion build rate in cooler weather.
2. Clear interior side – Test specific panel washcoat to ensure suitability of a particular tape and surface preparation combination for that paint. If paint changes, retesting of tape and surface preparation combination may be necessary. The four options for surface preparation are typically:
 - a. Clean only
 - b. Fine abrading with Scotch-Brite hand pad 7447 followed by good cleaning
 - c. Good cleaning followed by application of 3M adhesion promoter 111; or
 - d. Combination of fine abrading, good cleaning, and 3M adhesion promoter 111. This combination will often accelerate adhesion build rate in cooler weather.

***Note:** When using solvents, extinguish all ignition sources, including pilot lights, and follow the manufacturer's precautions and directions for use.

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II. Materials Required (continued)

D. *Equipment required*

1. Surface abrading equipment.
 - a. Right angle post grinder for 4-1/2" diameter discs; used to prepare rusty or poorly painted posts.
 - b. 3M™ Abrasive Disc Backup Pad; 3M P/N 60-9801-0501-3; UPC #00-05111-56573-5.
 - c. 3M™ TN Quick-change Clean and Strip XT disc; 4-1/2" diameter; 3M P/N 61-5001-8756-4; UPC #00-48011-33194-2; used to remove rust and prepare posts for cleaning and taping. If the 3M clean and strip XT disc is not used for rust and/or paint removal, then final abrading should be done with 180x grit abrasive or finer. Tape adhesion levels will drop with medium or coarse abrasives.
 - d. Electric, palm held, finishing sander; used for abrading panel backside with 3M™ Scotch-Brite™ Hand Pad 7447.
 - e. Optional, hand held, "L" shaped, custom abrading block with 7/8" wide Scotch-Brite hand pad 7447; used for abrading overlap seam area when panels are abraded on workbench. Available from B&L Fabricating (651-484-8225).
 - f. Optional hand held, "U" shaped, custom abrading block with 7/8" wide Scotch-Brite hand pad 7447; used for abrading overlap seam area when panels are abraded after hung on trailer truck body. Available from B&L Fabricating (651-484-8225).
 - g. Scotch-Brite hand pad 7447; 6" x 9"; 3M P/N 61-5001-2323-9; UPC #048011-04029-5.
 2. Surface cleaning supplies.
 - a. Mixture of 50:50 isopropyl alcohol and water. Most rubbing alcohol is a 70:30 mixture of isopropyl alcohol and water. However, the 50:50 mixture is preferred since it will allow slightly more time, before drying, to wipe away dirt and other foreign debris. Many "dollar" stores sell rubbing alcohol that is already a 50:50 mixture of isopropyl alcohol and water.
 - b. Spray bottle for mist spraying of IPA and water mixture. Spray the surface to be cleaned and not the cleaning wipe. This will provide better dirt and debris removal.
 - c. Disposable cleaning wipes.
 - d. Degreaser; used if surfaces have oil or grease. After pre-cleaning with an appropriate degreaser, final clean with a 50:50 mixture of isopropyl alcohol* and water.
 3. Adhesion promoter application (if required).
 - a. 3M™ Adhesion Promoter 111
 - 1) Available in 250ml bottle; 3M P/N 70-0064-0398-7; UPC 00-048011-58147-7.
 - 2) Available in 1 gallon container; 3M P/N 70-0064-0673-3; UPC 00-048011-58526-0.
- *Note:** When using solvents, extinguish all ignition sources, including pilot lights, and follow the manufacturer's precautions and directions for use.

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II. Materials Required (continued)

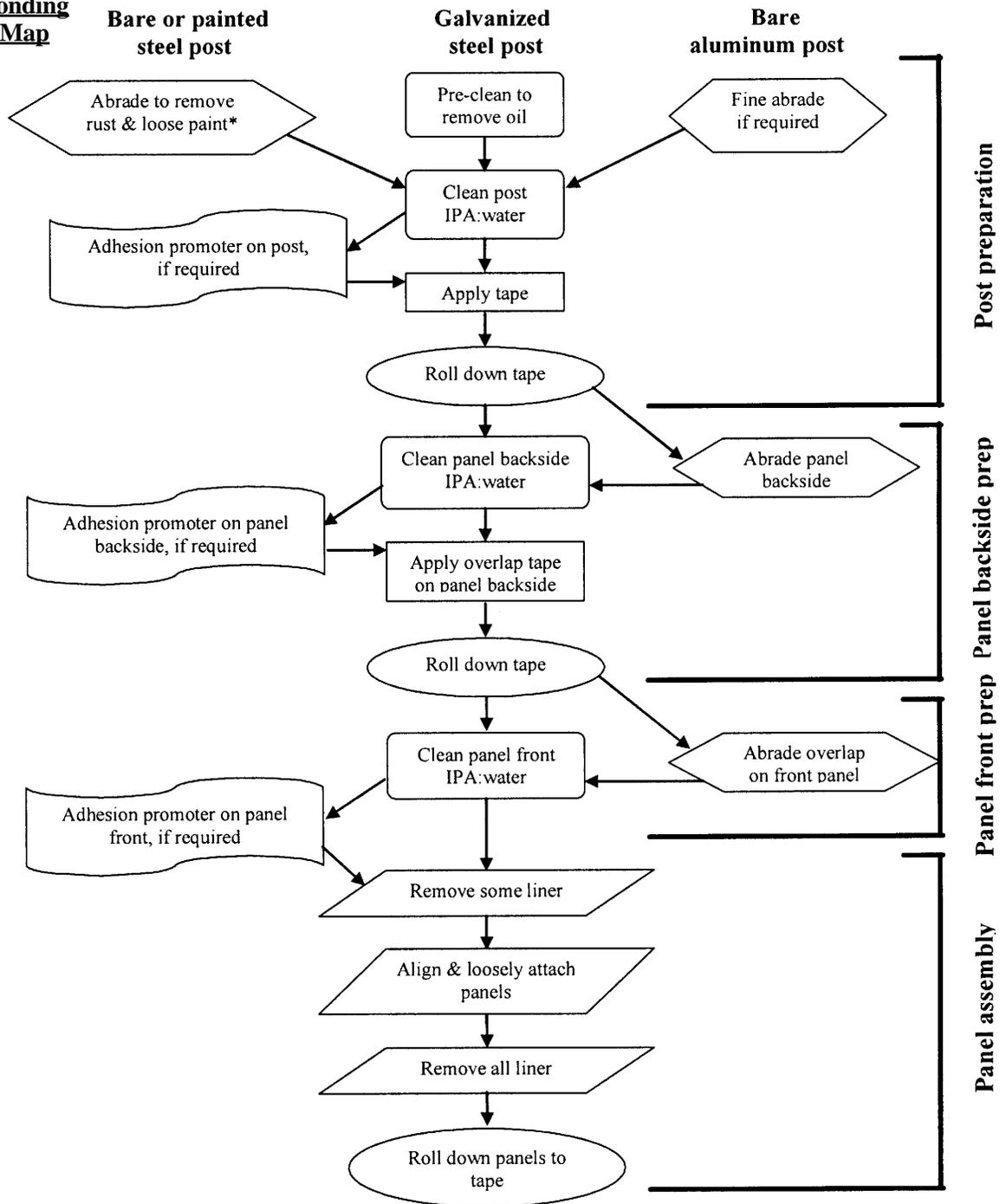
D. *Equipment required* (continued)

4. Tape application and liner removal equipment.
 - a. Utility knife or scissors; used to cut the tape.
 - b. Two handed tape roller available from Rockler Woodworking and Hardware, 1-800-279-4441, specify #39463 Pressure J-Roller.
 - c. Optional dual wheel roller available from B&L Fabricating (651-484-8225) to use instead of pressure J-roller. The rubber coated rollers can roll down two posts spaced up to 16" apart at the same time. On 49" wide panels, this large rolling pin is especially helpful for rolling down the panels at the two center posts on each panel.
 - d. Optional caulk line or laser light to assist with tape attachment location when either abrading panels or rolling down the panel onto the taped posts. Also may be useful, with the "floating panel" design, to position panels so that a 1/4" gap exists between panel and nearest constraint at both the top and bottom of the panel.
 - e. Optional 8" file cleaner brush to assist liner removal; e.g. Nicholson (Cooper Tools) #21455. This very stiff wire brush is normally used to clean metal files but works good to catch and lift corner of liner on tape; readily available from hardware and/or tool stores.
5. Panel removal equipment (if needed for repairs).
 - a. 3M™ SMART Tool (Side Molding and Emblem Removal Tool) P/N 08978; stock #60-9800-2172-3; UPC #0-00-51135-08978-1; six per case.
 - b. Air chisel.
 - c. Razor blade scraper.
 - d. 3M™ Scotch-Brite™ Bristle Disc; stock #61-5001-3901; UPC #048011-24241-5; 4.5" diameter; green; grade 50; used to remove tape residue on posts and backside of panels to be reused; 5 per box; 2 boxes per case.
 - e. Right angle grinder for 4-1/2" diameter bristle discs.
 - f. 3M™ Stripe Off Wheel with hardware; P/N 07498; stock #61-5001-3873-2; UPC #5-00-51131-07498-4; used to remove tape residue on painted panel surface without damaging the painted surface; five per case; subsequent purchase may be P/N 07499 without mandrel for securing in electric drill.
 - g. Electric drill; used with stripe off wheel.
 - h. See 3M technical bulletins Removal of 3M™ VHB™ Tape Bonded Panels From Trailers and Truck Bodies or 3M™ VHB™ Tape Replacement Systems or visit www.3M.com/vhb.

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III. Panel Bonding Process Map



Paint types vary considerably. Testing may be required to determine best surface preparation for a given paint type. Depending on materials to be bonded, the four possible surface preparations are:
 1) Clean only; or 2) Fine abrade & clean; or 3) Clean & adhesion promoter; or 4) Fine abrade & clean & adhesion promoter.

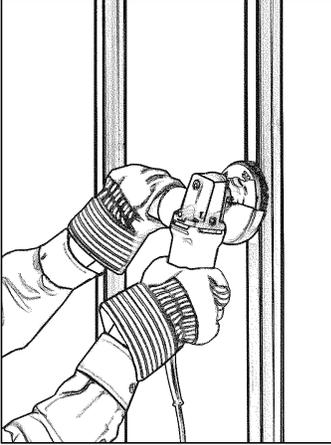
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IV. Panel Bonding Procedure

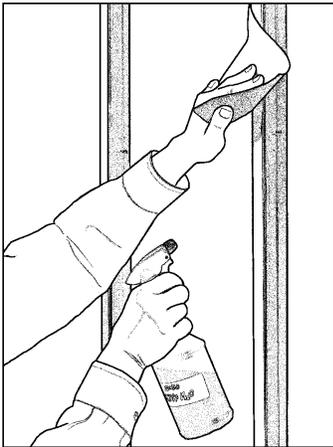
A. *Post preparation*

1. Abrade post with 3M™ TN Quick-change Clean and Strip XT Disc.



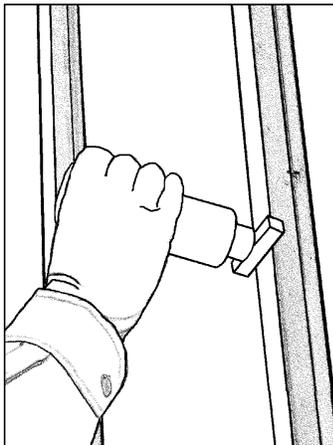
- a. Pre-clean posts, if oily, with 3M™ Prep Solvent 70, or MEK solvent, or other degreaser*.
- b. Abrade steel post to remove all rust and any loosely adhered paint. If the 3M clean and strip XT disc is not used for rust and/or paint removal, then final abrading should be done with 180x grit abrasive or finer. The final post surface must be relatively smooth with only fine abrasive scratches equivalent to 180x grit abrasive scratches or finer. Coarse abrasion decreases adhesive strength since the tape adhesive cannot flow into the deeper scratches.

2. Spray post with 50:50 IPA:water mixture and wipe clean.



- a. Clean posts after any pre-cleaning, after abrading, or before the use of an adhesion promoter, with 50:50 isopropyl alcohol* and water mixture.
- b. Spray posts, not cleaning towel, with 50:50 mixture of IPA and water mixture.
- c. Wipe the 50:50 IPA and water mixture off with a clean disposal towel until a thoroughly cleaned and dried surface is attained.
- d. Do not use 100% IPA, acetone, denatured alcohol, lacquer thinner, or mineral spirits. These cleaning liquids either evaporate too quickly or leave a residue that reduces adhesion.

3. Apply 3M™ Adhesion Promoter 111 to posts (as required).



- a. Apply 3M adhesion promoter 111*, if required, with a felt applicator dauber or clean, saturated cloth, paper towel, cotton pad or brush that is not affected by the isopropyl alcohol in the adhesion promoter. Use only a very light coating. Wipe away excessive adhesion promoter.
- b. Allow 3M adhesion promoter 111 solvents to dry or “flash off” (typically 2-3 minutes) prior to tape application.
- c. Prolong life of the felt applicator dauber by cleaning and storing in an airtight container or plastic bag.
- d. Replace cap on 3M adhesion promoter 111 bottle and minimize exposure to humid environments.

***Note:** When using solvents, extinguish all ignition sources, including pilot lights, and follow the manufacturer’s precautions and directions for use.

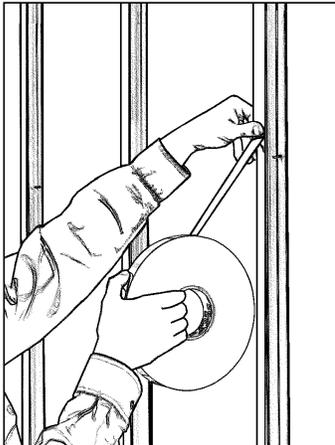
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Panel Bonding Procedure using 3M™ VHB™ Tape

IV. Panel Bonding Procedure (continued)

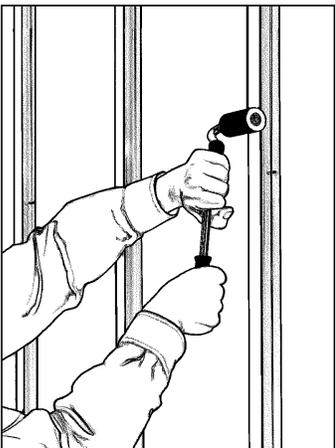
A. Post preparation (continued)

4. Apply 3M™ VHB™ Commercial Vehicle Tape CV62F to posts.



- a. Apply tape in a straight line. Initially, use only light hand pressure and gentle pulling of the tape to minimize air entrapment and stretching of the tape.
- b. Work carefully from one end to the other to avoid any air bubbles.

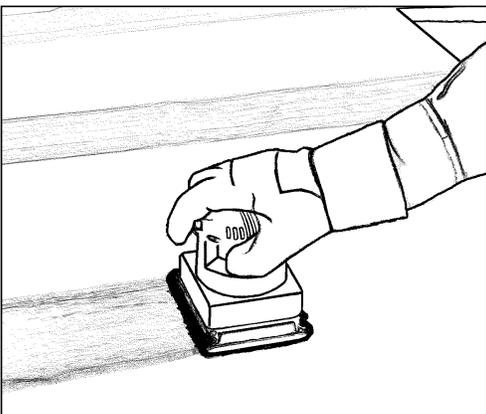
5. Roll down 3M™ VHB™ Commercial Vehicle Tape CV62F with J-roller.



- a. Use a “two handed pressure roller” to ensure adequate adhesive “wet out”. Alternatively, a dual roller may be used. A dual roller may also be helpful to maintain proper roller alignment and also roll down the panel over two posts simultaneously.
- b. With the small pressure roller, use at least 15 psi (pounds per square inch) or 15 pounds of roller force. Double that if rolling down tape on two posts at one time.

B. Panel backside preparation

1. Abrade panel with 3M™ Scotch-Brite™ Hand Pad 7447.



- a. Snap caulk lines or otherwise mark where panels will meet the posts.
- b. Use an electric, palm held, finishing sander (sometimes called a jitterbug sander) with Scotch-Brite hand pad 7447, to abrade the areas where the backside of the panel will meet the posts.
- c. Do not use an abrasive more coarse than this Scotch-Brite hand pad 7447 or 180x grit abrasive sheets. Coarse abrading actually decreases tape adhesive contact area and reduces overall adhesive strength. Good cleaning is always required after abrading.

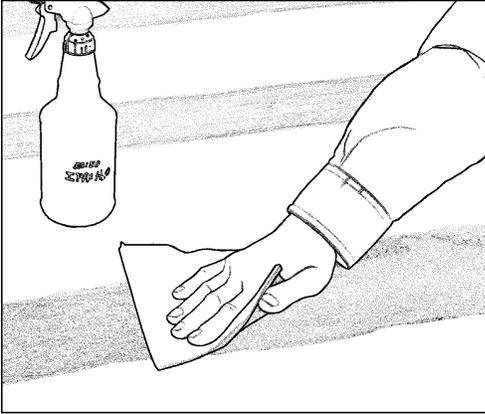
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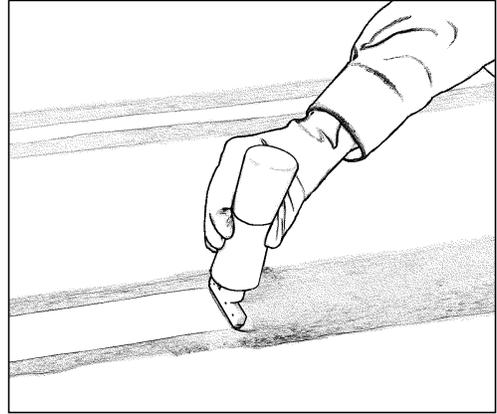
IV. Panel Bonding Procedure (continued)

B. Panel backside preparation (continued)

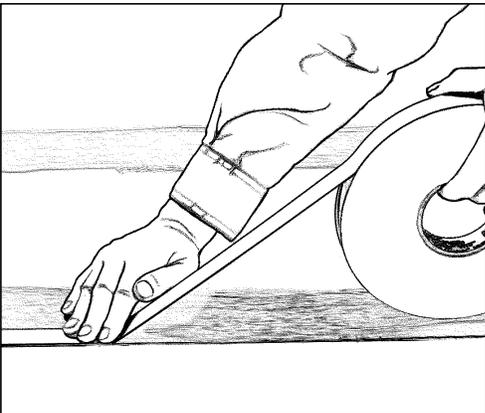
2. Spray panel with 50:50 IPA*:water and wipe clean.



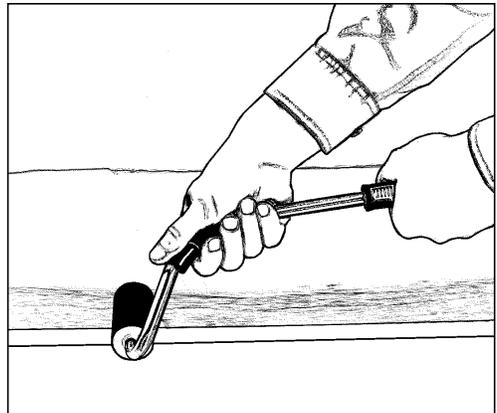
3. Alternatively or additionally, apply 3M™ Adhesion Promoter 111.



4. Apply 3M™ VHB™ Commercial Vehicle Tape CV45F for overlap seam.



5. Roll down 3M™ VHB™ Commercial Vehicle Tape CV45F with J-roller.



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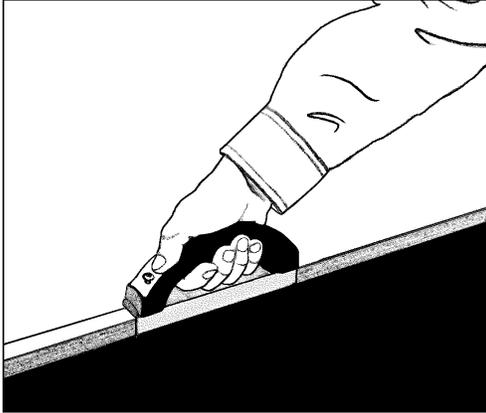
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IV. Panel Bonding Procedure (continued)

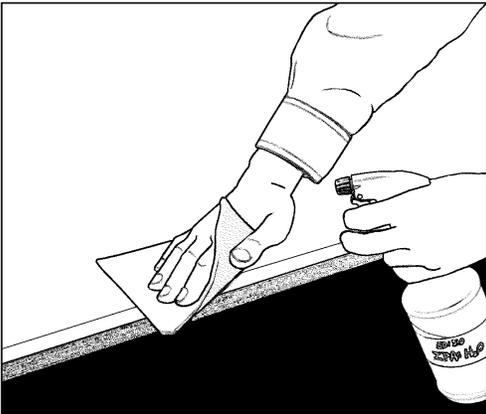
C. *Panel front preparation – if panel is on a table. (An alternative is to hang the top of the panels and then abrade underneath the overlap seam. See next section.)*

1. Abrade overlap with 3M™ Scotch-Brite™ Hand Pad 7447.

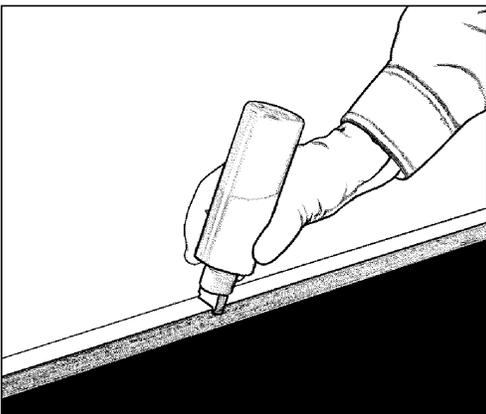


- a. Abrade the area on the front, exterior, painted surface of the panel only where the overlap seam tape will be bonded.
- b. Abrade to scuff or dull the glossy paint surface.
- c. Use sanding block with edge guide, masking tape, duct tape, or existing protective film to protect the painted surface of the panel.
- d. Understand that this is perhaps the most critical step to ensure a good overlap seam bond.

2. Spray overlap with 50:50 IPA*:water and wipe clean.



3. Alternatively or additionally, apply 3M™ Adhesion Promoter 111.



- a. Use a 7/8" wide felt applicator dauber with an edge guide to apply 3M adhesion promoter 111*, if required.
- b. Use caution so that no 3M adhesion promoter 111 contacts the exterior, painted surface that will be seen.

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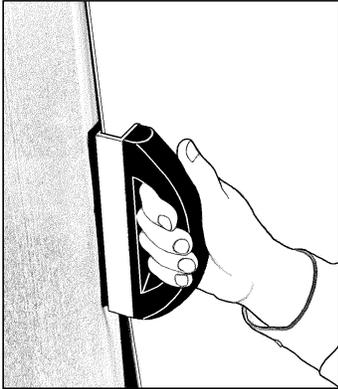
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IV. Panel Bonding Procedure (continued)

D. *Panel front preparation – if panel is already hanging. (This is an alternative to previous section when overlap seam abrading is done prior to hanging the panel.)*

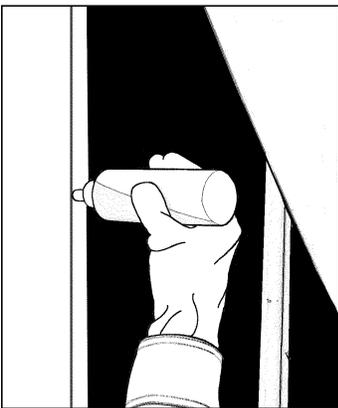
1. Abrade overlap with 3M™ Scotch-Brite™ Hand Pad 7447.



2. Spray overlap with 50:50 IPA*:water and wipe clean.



3. Alternatively or additionally, apply 3M™ Adhesion Promoter 111*.



***Note:** When using solvents, extinguish all ignition sources, including pilot lights, and follow the manufacturer's precautions and directions for use.

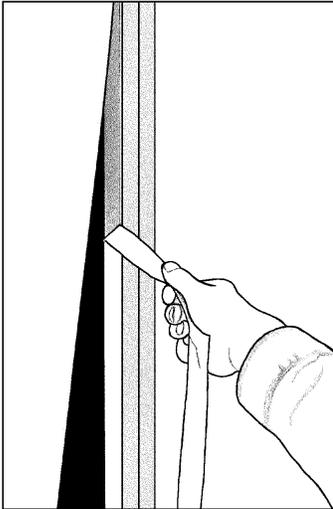
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IV. Panel Bonding Procedure (continued)

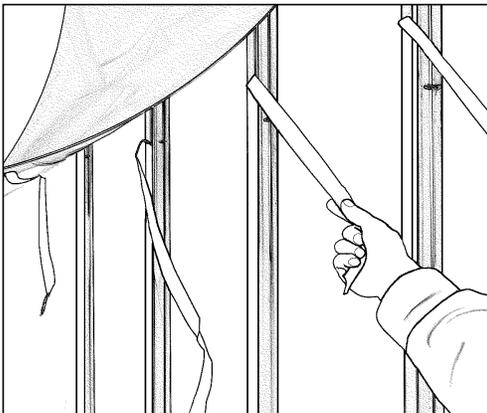
E. Panel assembly

1. Align panel.



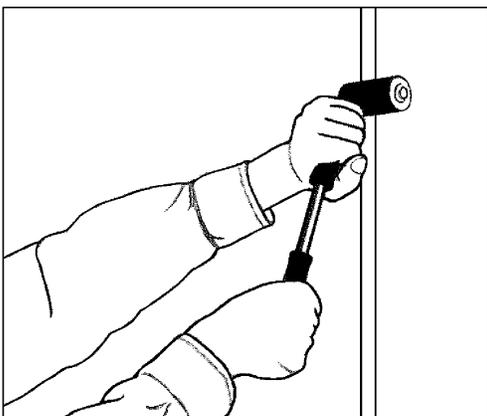
- a. Attach panels beginning at the rear of the trailer so overlap seams tend to push together, rather than pull apart, as the trailer is moving forward.
- b. Use point of utility razor knife or file cleaner brush to lift edge or corner of release liner.
- c. Remove and fold back a small portion of release liner from tape on the posts.
- d. Position panel on partially exposed adhesive and lightly attach panel.
- e. Optionally, snap caulk lines or otherwise mark location of posts underneath panels to assist with panel roll down.

2. Remove liners.



- a. Remove remaining release liner from between the post and panel by pulling sideways on the plastic film liner.
- b. Attach panels to taped posts and overlap seam.

3. Roll down 3M™ VHB™ Tape at posts and overlap seam with J-roller.



- a. Use a “two handed pressure roller” to ensure adequate adhesive “wet out”. Alternatively, a dual roller may be used. A dual roller may also be helpful to maintain proper roller alignment and also roll down the panel over two posts simultaneously.
- b. With the small pressure roller, use at least 15 psi (pounds per square inch) or 15 pounds of roller force. Double that if rolling down tape on two posts at same time.
- c. Remember that the adhesive bond strength may only be 50% within first 20 minutes, and may take up to 3 days for maximum bond strength.

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V. Troubleshooting

A. *Overlap Seam Delaminates*

1. Note the failure mode(s) of the bond. Some possibilities are listed below. Combinations of the below modes may be present.
 - a. Adhesion failure to the backside of the panel. This mode leaves 3M™ VHB™ Tape on the painted panel.
 - b. Adhesion failure to the front (painted side) of the panel. This mode leaves 3M™ VHB™ Tape on the backside of the panel.
 - c. Cohesion failure of the 3M™ VHB™ Tape leaving tape residue on both the backside and color painted front of the panel.
2. Possible causes for 1a. and 1b. above includes, but are not limited to:
 - a. Wrong tape, wrong amount of tape, wrong tape thickness;
 - b. Missed or inadequate surface preparation and cleaning;
 - c. Missed or inadequate tape roll down;
 - d. Tape application at temperature below listed minimums of either 50°F (10°C);
 - e. Change of paint on panel, change of post paint or surface treatment;
 - f. Inadequate rigidity of trailer frame and/or sidewall frame;
 - g. Constrained panels that cannot “float” to compensate for vibration, flexing, or thermal expansion mismatches.
3. Possible cause for 1c. above is:
 - a. Inadequate internal strength of the tape for that particular application. Cohesive failure of the tape indicates the adhesive strength of the tape, to both surfaces being bonded, is greater than the internal strength of the specific 3M™ VHB™ Tape being used.
 - b. Contact your local 3M specialist to assist in evaluating the design, increasing the amount or width of tape used, or review alternative tape or adhesive solutions.
4. Review compatibility of tape to surfaces being bonded, the entire panel installation steps, and materials actually being used. If necessary, contact your local 3M specialist for assistance analyzing failures.

B. *Panel to Post Delaminates*

1. Analysis and possible causes of panel-to-post failures are similar to the panel-to-panel failures at the overlap seam.
2. Particular attention should be given to proper rust, oil, dirt and paint overspray removal on the post prior to tape application.
3. Remember that final cleaning with 50:50 mixture of isopropyl alcohol* and water should follow any pre-cleaning or degreasing.
4. Remember that final abrasion of the post should not be coarser than the equivalent of fine, 180x grit abrasives.

C. *Liner is difficult to remove*

1. If tape lifts with liner, then tape is not properly adhered to panel or post.
2. If liner is simply difficult to separate from the tape, use the sharp point of a razor utility knife, or a file brush cleaner (stiff wire brush with short, slightly bent wires).

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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 Adhesives and Tapes Division

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