Overview

This bulletin provides information to help installers select the proper product for a given job, as well as providing guidance on basic general installation techniques. This includes information for preparing substrates, and instructions for dry application of films with pressure-sensitive or pressure-activated adhesive to relatively flat rigid substrates. Applying a graphic involves more than simply adhering the film to a substrate. Installers should read and follow all the information in this instruction bulletin, other instruction bulletins referenced in this bulletin, and the product bulletins of all materials they use for a given project.

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Information for Designers, Specifiers, Graphics Manufacturers, and Installers

A successful installation is the result of a collaboration between designers, specifiers, graphics manufacturers (or convertors), and installers in order to meet the needs of the customer. Being aware of the details of the installation helps ensure success.

Substrate Texture Definitions

Substrate. The actual surface to which a film is applied. This may be the finish (paint, varnish, wallpaper), a high tack film, a composite material, or the bare substrate. A substrate may consist of different finishes, textures, and compositions.

Texture. The feel, appearance, or consistency of a surface or substrate. Whether it is smooth or rough, texture has a significant effect on film choice, ease of application, film adhesion, and removal.

- **Smooth texture.** Little or no surface variation.
- **Unsmooth texture.** Has moderate high spots and low spots, which range from just a little texture (like fine sandpaper) to heavy texture (like brick). A single substrate may vary in texture. Use the following definitions to determine which films to test.
  - **Medium unsmooth texture.** Relatively equal distribution of moderately high and low spots.
  - **Heavy unsmooth texture.** Irregular and severe high spots and/or low spots.

Understand the Customers' Expectations

It is important to fully understand the customer's expectations for a finished installation and communicate the limits of an installation to the customer prior to beginning any installation. Factors to consider in these conversations include but are not limited to:

- Whether the customer requires the film to be removable
- How long the film must remain on the substrate
- Substrate preparation requirements prior to film installation
- Expectations as to the substrate's condition upon film removal

All parties should both also be aware that there is no warranty for the film or substrate besides that which 3M states explicitly within the relevant product and instruction bulletins, including this bulletin.

Know the characteristics of each substrate and the environment to which the film will be exposed.

- **Jobs that include multiple substrates.** Consider the characteristics of each substrate, which may vary in their textures, exposures, or finishes. If there are multiple substrate types, the graphics manufacturer may need to select more than one 3M film to complete the job.
- **Substrate soundness.** The soundness of any substrate may vary and no test can ensure consistent results over the entire substrate.
- **Substrate finishes.** Some substrate finishes may have silicone, graffiti-resistant, or texturizing additives that can make film adhesion even more difficult.
- **Physical contact.** Exposure to physical contact with people, animals, or equipment. Film applied in high traffic areas may require an additional physical protection such as a corner guard or bumper to prevent physical contact and damage to installed film.
- **Substrate conditions:**
  - **Variable temperature, and/or humidity, direct or indirect sunlight.** Frequent changes in environmental conditions may cause the film to fail.
  - **Walls concealing heating or cooling ducts, pipes, or water sources, behind or in close proximity to the substrate.** Moisture that seeps into wallboard, even if it's face has been sealed, will likely result in further wall damage upon removal of the film.
  - **Block walls in front of equipment such as a pool.** If the block walls are adequately sealed and cured, there may not be any problems applying film to this surface.
  - **Excessive texture.** More than an 1/8 in. (3 mm) variation between high and low spots of substrate texture and grout lines, as well as square cut or undercut grout lines, may cause film lifting.
  - **Insufficient adhesion.** If an installed film can be easily removed from a textured substrate using a force of <1 kg/2.5 cm (2.2 lbs/in.), it is unlikely to be durable in outdoor applications.
  - **Exposure to moisture.** Water can become trapped behind applied film, leading to lifting and the growth of mold. Applying sealant along the top of the film helps reduce these issues.

⚠ CAUTION

Graphics installed outdoors or in damp locations may develop mold or mildew on top of or behind the graphic, which may be a health concern for some individuals, especially during graphic removal.

- **Excessive temperatures.** Substrates that reach high temperatures may exhibit lifting, especially in grout lines.
- **Freezing and thawing cycles.** For textured masonry with both indoor and exterior facing sides and no effective moisture barrier, moisture vapor transmission occurs naturally when the indoor wall has a room environment warmer and moister than the outdoor wall. When film is applied to the outdoor wall and there are cycles of freezing and thawing, moisture can be trapped between the wall and the film, resulting in film lifting and spalling both within the wall and on the outdoor facing wall.
  - Salts passing through masonry may be trapped behind the film. Salt collection on the masonry wall for extended periods may cause staining or discoloration.
  - Always check and follow local building codes.
  - 3M is NOT responsible for damage caused by any wall application.

Graphics Manufacturing Considerations

- **Smooth Substrate.** Film must retain some flexibility in order to achieve maximum adhesion. Do NOT use a stiff or thick overlaminate (over 3 mils) on the base film.
- **Textured Substrate.** 3M film applied to a textured substrates requires using the recommended overlaminate: 3M™ Scotchcal™ Graphic Film for Textured Surface IJ8624 ("Film IJ8624") with 3M™ Scotchcal™ Luster Overlaminate 8524 ("Overlaminate 8524"), or 3M™ Envision™ Print Wrap Film LX480mC/SV480mC ("Film LX480mC/SV480mC") with 3M™ Envision™ 8548G Gloss Wrap Overlaminate ("Overlaminate 8548G"), 8549L Luster Wrap Overlaminate ("Overlaminate 8549L"), or 8550M Matte Wrap Overlaminate ("Overlaminate 8550M").

NOTE

Film IJ8624 with Overlaminate 8524 is intended *only* for use on textured surfaces. Film LX480mC/SV480mC with Overlaminate 8548G may be used on smooth substrates or textured substrates.

- **Imaging method.** Only use the inks recommended for use with the selected film and follow the inks' product and instruction bulletins for proper use guidelines. Solvent inkjet printed film must be allowed sufficient time for all solvent to evaporate before the graphics manufacturer applies the overlaminate. (3M recommends 24 hours for the best results.) Failure to do so may result in outgassing when the film is applied, which can contribute to poor or inconsistent film adhesion.
- **Inform the installer.** The graphics manufacturer needs to convey details about the graphic construction to the installer.

Examining Job Site Substrates

Prior to installation determine the following:

- Will any substrate repairs have sufficient time to dry properly?
- Will any new finishes have sufficient time to cure? Cure time varies greatly and can be as long as 30 days.

> **NOTE**
> Paint MUST be allowed to cure for the entire time period stated by the paint manufacturer.

- Does the substrate show a poor paint-to-substrate bond?
  - **Obvious:** Peeling, lifting, or bubbling of the paint
  - **Less obvious:** Multiple layers of paint on the substrate. The bond of one layer to another may not be adequate. The weight of the film on a substrate in this condition may contribute to the separation of paint layers, resulting in paint and film falling off the substrate.

Considerations in Bidding for a Job

Include time for performing 3M Adhesion Tests as described in 3M Instruction Bulletin Application: Walls. Bidding for these adhesion tests should include travel time and testing time.

The following estimates are based solely on 3M's experience performing these tasks.

- **Testing three different films on one smooth substrate:** 30 minutes
- **Testing one film on one textured substrate:** 45 minutes of hands on testing.
  - Remember, the film must be left in place for one week, so consider the travel time needed to return to the job site to evaluate the test.
- **Cleaning a substrate prior to installing the job:** 30 minutes per 125 sq ft (11.6 sq m)

Proper substrate cleaning is essential to promoting good adhesion.

Using the 3M™ Enhanced Adhesion Cleaning Method as described in 3M Instruction Bulletin Application: Walls helps promote adhesion. Adopting this as a best practice for every installation can be the difference between success and failure.

Film Adhesion Characteristics and Testing: Smooth and Textured

Adhesion is the ability of the film's adhesive to bond to the substrate. The amount of both initial and final adhesion varies depending on the film's adhesive, the texture of the substrate, the paint characteristics, the application temperature, and the application techniques. The adhesive bond builds with time. A film may never achieve its full bond if it is poorly applied or if the wrong film is used for a substrate or its paint, primer, or sealer.

Films applied to textured substrates using heat require the use of a recommended overlaminate. Proper graphic protection is critical to ensure adequate adhesion and performance for textured substrate applications.

> **NOTE**
> Heat is required during some application steps. Most films withstand a moderate amount of heat. However, films designated as polyolefin are more sensitive and can dull or curl if too much heat is used.

> ⚠ **CAUTION**
> Always provide adequate ventilation to remove emissions that result from the heat of flame treatment. Failure to provide adequate ventilation can result in operator exposure.

- **Final Adhesion.** The maximum amount of bond achieved by a film.
- **Initial Adhesion.** The amount of bond needed to hold the film in place during application.
- **Size of Film.** The larger the piece of film, the greater the initial and final adhesion to the substrate must be to support the film's weight.
- **Imaging Method.** Only use inks recommended for use with the film and follow the inks' product and instruction bulletins for proper use. Allow sufficient dry time for printed film before applying an overlaminate (see film and ink bulletins for more details). Failure to do so may contribute to poor or inconsistent film adhesion.
- **Stretched Film.** Film stretched during application may later shrink. This affects the film's adhesion to the substrate and may result in premature failure.

Tools

- Scotch® Masking Tape, 2 in. wide
- 3M™ Power Grip Applicator CPA-1
- 3M™ Plastic Applicator PA-1 Gold Squeegee
- 3M™ Rivet Brush RBA-1
- 3M™ Rivet Brush RBA-3
- 3M™ Air Release Tool 391X
- Cutting tools, such as a 13-point, 9 mm break-off precision utility knife
- Liner cutter
  - This tool has a guide under the blade that slips between the film and the liner so users only cut through the liner. This is sometimes called a wallpaper cutter.
- Industrial heat gun capable of attaining 500°F to 750°F (260°C to 399°C), or equivalent tool

Table A. 3M Installation Tools

3M™ Power Grip Applicator CPA-1	3M™ Air Release Tool 391X	3M™ Rivet Brush RBA-1	3M™ Rivet Brush RBA-3
			

Squeegee Technique

Proper squeegee technique is critical for achieving smooth, bubble free installations. Straight, horizontal movement of the squeegee is usually the best way to apply a graphic. Always progress down the graphic evenly throughout the installation, and make narrow passes to apply less material at one time, as this reduces the potential for wrinkles in the applied graphic.

1. Hold the squeegee at approximately a 45 degree angle.
2. Start in the center of the graphic (if possible) and apply firm pressure on the squeegee. Always squeegee the shortest distance from the center of the graphic out to the edges.
3. Ensure the squeegee completely passes the film edge with each squeegee pass to ensure the edge of the film properly adheres to the substrate.
4. Overlap each squeegee pass over the previous one by 50 percent.

NOTE

Installers should hold the remaining film away from the surface as they work their way down the graphic.

Resqueegeeing the Graphic

There are many situations when installers should resqueegee the graphic after it has been installed. This is to help ensure the finished graphic maintains adequate adhesion and does not lift at the edges or otherwise fail during its life time. Situations where resqueegeeing is appropriate include:

- After heating the graphic
- After repositioning the graphic
- After trimming the graphic
- After using 3M™ Knifeless™ Tape to cut the graphic
- After removing pre-spacing or pre-masking tape (re-squeegee the entire graphic in this instance)
- Resqueegee all edges of the graphic when the installation is complete.

General Installation Procedure

1. Clean the substrate according to the 3M™ Enhanced Adhesion Cleaning Method as described in 3M Instruction Bulletin Application: Substrate Selection and Preparation.
2. For larger graphics, place the film on the substrate using one of the following hinge methods:
   - **Horizontal Hinge Method—Most Common**. Ideal for film panels that are longer than they are wide.
     a. Tape the film to the substrate in the desired position.
     b. Apply a piece of tape horizontally across the film, 6 in. to 8 in. below the top edge.
     c. Remove the positioning tape strips.

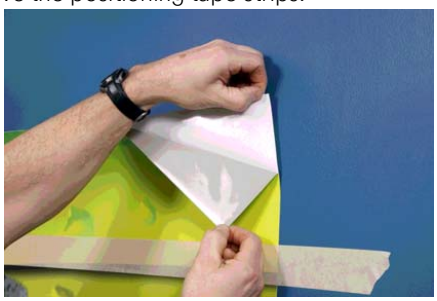

Figure 1. Horizontal Hinge

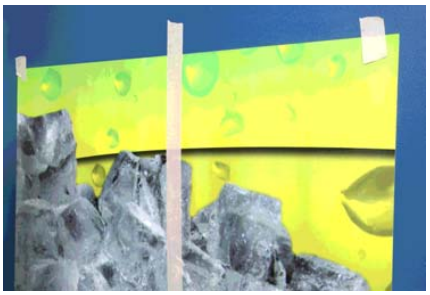

Figure 2. Vertical Hinge

   - **Vertical Hinge Method.** Ideal for film panels that are wider than they are tall.
     a. Tape the film to the substrate in the desired position.
     b. Apply a strip of tape vertically down the middle of the film.
   - **Self Hinge Method.** Ideal for smaller film panels; self hinges can be made at the top of the film or in the center of it.
     a. Lay the film graphic side down on a clean work table.
     b. Cut through the liner across the shortest width of the film, using a liner cutter.
     c. Make another liner cut about 4 in. (10.2 cm) to either side of the first, and remove the resulting strip of liner. (See Figure 3.)
     d. Position the film on the substrate and use your fingers to lightly adhere the film to the substrate in the area of the exposed adhesive.
     e. Squeegee the film along the exposed adhesive working toward the nearest edge.

Figure 3. Cutting Out Section of Liner for Self Hinge

Figure 4. Squeegeeing Exposed Adhesive for Self Hinge

3. Separate the liner from the film.
4. Roll back the edge of the film and use a liner cutter to make a straight cut through the liner, right next to the tape hinge (except when using a self-hinge).
5. Remove the liner, or as much of it as is needed.

NOTE

If exposed adhesive must be touched, keep fingers 2 in. (5.1 cm) or more away from the edge to avoid contaminating the vulnerable film edges.

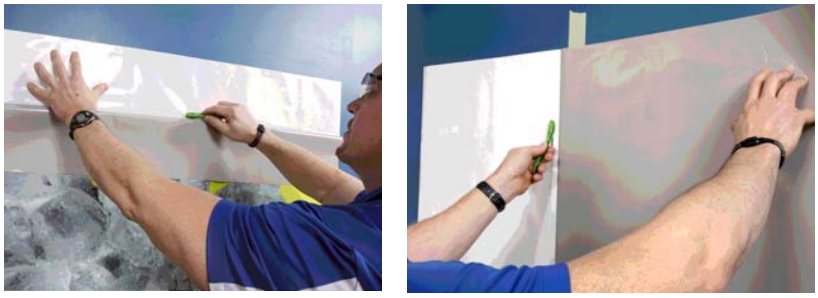

Figure 5. Cutting the Liner

6. Keep some tension on the film while squeegeeing to help it stay flat and smooth. Sometimes this requires holding both the film and the liner during part of the installation.
7. Starting in the middle of the film, squeegee to one edge, return to the center, and squeegee to the other edge.
   - Always push the air toward the nearest edge in either the ten o'clock or two o'clock position
   - Always end the squeegee stroke past the edge of the film.
   - Overlap every stroke by about half the width of the squeegee.

Figure 6. Keep tension on the unapplied film

Figure 7. Squeegee with the 10:00 and 2:00 O'clock positions.

Figure 8. End strokes past the film edge.

8. As needed, lift the film, grasp both sides of the liner, and pull away a few inches of liner. Continue applying film as before.
9. Before the job is considered done:
   a. Visually inspect how well the film conforms—even to an apparently smooth substrate. See the Note below.
   b. Resqueegee all film edges, as these are the most vulnerable and the first place film may begin to lift.

NOTE

Even an apparently smooth substrate may have more texture than you realize. Failure to use firm, overlapping strokes may prevent full adhesive contact with the substrate. Notice the area circled in red in Figure 9. The film which received additional pressure from the finger is now making more contact with the substrate (a finer, tighter visual texture) compared to adjacent areas that were poorly squeegeed.

Figure 9. Check for full adhesive contact with the substrate.

Edge Lifting: Causes and Repair

Edge lifting is generally caused by inadequate adhesion. It may be due to an insufficiently clean substrate, incorrect film usage, poor edge finishing during initial installation, or abrasion by people, equipment, or the installation area's environment. The following options for reattaching lifted edges can extend the life of the film and improve appearances, but they are aggressive and will likely damage the substrate.

- **Option 1:** Use this procedure if a large area of film has come loose, which is most likely to occur at the top edge. Pull down more film until it does not release easily. Protect the exposed adhesive with a piece of clean plastic sheeting. Follow the 3M™ Enhanced Adhesion Cleaning Method as described in 3M Instruction Bulletin Application: Walls. Reinstall the film using the normal procedure.
- **Option 2:** Apply a strip of two-sided 3M™ Transfer Adhesive 950 (5 mil [0.13 mm] thick, 0.5 in. by 60 yard [1.3 cm by 54.9 m] roll) to the back side of the film, close to the edge. Use a rivet brush to work the film in a circular motion all around the outer edges.
- **Option 3:** Use mechanical fasteners such as staples.

Graphic Cleaning

See 3M Instruction Bulletin Maintenance for detailed cleaning guidelines.

Troubleshooting

1. Ensure substrates are in good condition before applying graphics. This reduces installation time while improving graphic appearance and, if applicable, removal characteristics.
2. Review all troubleshooting options before deciding on a course of action.
3. Every paint must cure fully according to the paint manufacturer's recommendations.
4. Conduct a 3M Adhesion Test as described in 3M Instruction Bulletin Application: Walls for every film you intend to use and on each different substrate included in the installation.
5. Every installation substrate must be cleaned with the 3M™ Enhanced Adhesion Cleaning Method as described in 3M Instruction Bulletin Application: Walls before doing the 3M Adhesion Test and before doing the full installation.
6. Report installation issues to the graphics manufacturer.

Table B. Troubleshooting Table

Problem		What to Look For	Recommended Solutions
A. Pre-Installation Problems - All Substrates			
1	Unsound substrate or sub-structures	Evidence of a loose, inconsistent or damaged surface, loose paint, mixed surface finishes, abrasion, gouges, etc.	Repair the substrate as appropriate. Ensure new paint cures for the full amount of time recommended by the paint manufacturer before applying film. Reconsider whether to apply film at that location.
2		Moisture behind a substrate	Look for boarded up windows or walls backing up to cooling systems, water pipes, or overhead windows. Notify the graphics manufacturer or customer that applying film in these locations could create condensation or drip water onto the film, resulting in premature failure.
3	Unclean substrate	Substrate contamination such as dust, dirt, grease, food, vehicle exhaust, or cleaning products	Clean the substrate, using a degreaser if needed. Do NOT use cleaning solutions containing lotions, waxes, or oils. Then clean the substrate using the 3M™ Enhanced Cleaning Method as described in 3M Instruction Bulletin Application: Walls.
4	Film does not adhere well or falls off the substrate prematurely	The film was not tested on the substrate prior to installation.	Low VOC paint was used on the substrate. Always perform a 3M Film Adhesion Test as described in 3M Instruction Bulletin Application: Walls for each film and on each substrate before committing to the complete installation.
5		Substrate repairs were not properly sealed, primed, painted or cured.	Always perform a 3M Film Adhesion Test as described in 3M Instruction Bulletin Application: Walls for each film and on each substrate before committing to the complete installation.
6		The substrate was not washed with a mixture of 70% isopropyl alcohol and 30% water (except where not applicable).	Always follow the 3M™ Enhanced Cleaning Method as described in 3M Instruction Bulletin Application: Walls.
7		The substrate temperature was too low.	Check the film's product bulletin to determine the installation temperature range.
B. Post-Installation Problems - All Substrates			
8	Edges of film lift prematurely	Poor installation technique, or wrong tools	Review this bulletin and ensure you are using the right film, right tools, and right techniques for your substrate. Particularly for textured substrates, lots of practice is critical for consistent success.
9	Large portion of film lifts or falls off prematurely	Poor initial bond of paint to substrate	If the wrong film was used, perform a 3M Film Adhesion Test as described in 3M Instruction Bulletin Application: Walls. If the substrate was not properly cleaned, follow the 3M™ Enhanced Cleaning Method as described in 3M Instruction Bulletin Application: Walls.
10		Undercured paint	Ensure the paint is properly applied and fully cured before applying film.
11	The substrate or its paint or wallcovering is damaged during graphic removal	Poor bond of paint or wallcovering to substrate	Enhancing film adhesion because of low VOC paints will likely result in substrate damage even when removing removable or changeable films. Always set the customer's expectations accordingly prior to installation.
12		Improper removal technique	See 3M Instruction Bulletin Maintenance for 3M recommended removal techniques.
13		Cuts made to the graphic during the installation penetrated both the film and the substrate.	Use caution when cutting film near surfaces such as wallboard and wallpaper.

Problem		What to Look For	Recommended Solutions
C. Removal Problems - All Substrates			
14	Outdoor graphic caused substrate damage	The film was subjected to freeze-thaw cycles.	Freezing and thawing cycles can cause moisture vapor transmission issues. See details on page 2. Salts that pass through masonry may be trapped behind film and cause staining or discoloration of the substrate. Always check and follow local building codes. 3M is NOT responsible for damage caused by using this product outdoors
15	Substrate is damaged as film is removed	The film is too cold.	Warm the film with a heat gun set to about 250°F (121°C) while slowly pulling the film from the substrate.
16	Removal is difficult and time consuming	The film has degraded.	Time and exposure to environmental conditions may cause film to degrade so that the adhesive and film layer do not stay together during removal.

Technical Service

Contact a 3M sales representative or application engineer for assistance reviewing film adhesion test results or for other questions regarding graphic installations.

Health and Safety

Chemicals

When handling any chemical products, read the manufacturers' container labels and the Safety Data Sheets (SDS) for important health, safety, and environmental information.

Follow this link to obtain SDS sheets for 3M products.

Follow this link to obtain information about substances of very high concern (SVHC) for EU products.

Tools and Equipment Usage

When using any equipment, always follow the manufacturer's instructions for safe operation.

Air Quality Regulations

Country, state, or regional volatile organic compound (VOC) regulations may prohibit the use of certain chemicals with VOCs in graphic arts coatings and printing operations. Check with local environmental authorities to determine whether use of this product may be restricted or prohibited.

⚠ **CAUTION**

Ergonomics

Any activity performed for a long period of time in an awkward position or with a high amount of force is potentially a risk for causing musculoskeletal strain, pain or injury. When applying or removing graphics, follow these practices to improve comfort and avoid injury:

- Alternate your tasks during the application.
- Schedule regular breaks.
- Perform stretches or do exercises to improve circulation.
- Avoid awkward reaching.

Ventilation

Always provide adequate ventilation to remove emissions that may result from the use of heat. Failure to provide adequate ventilation can result in operator exposure.

Warranty Information

- Under-cured paint may continue to outgas and cause bubbles, even in film that appears to be well applied immediately after application.

Technical Information

Technical information, guidance, and other statements 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 to any intellectual property rights is granted or implied with respect to this technical information.

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