



Special Applications and Vehicles

Table of Contents

How to Use This Bulletin Effectively	1
Health and Safety	2
Understanding Adhesive Characteristics	2
Non-Reflective Films with Pressure-Activated Adhesive	2
Reflective Films with Pressure-Activated Adhesive	2
Films with Pressure-Sensitive Adhesive	2
Film with Comply™ Adhesive	3
Permanent, Removable or Changeable	3
Application Tools	3
Temperature and Environment	3
Conditions that Affect Graphic Application	4
Substrate Preparation	4
Application Sequence	4
Shelf Life, Storage and Shipping	4
Special Applications	4
Complex Curves and Contours	4
Which Films Can Be Stretched	5
Planning the Application	5
Convex Contours	5
Concave Contours	6
Vehicle Applications	7
Buses	7
Conspicuity	8
Corrugations	8
Applying Film To Corrugated Surfaces	8
Application Technique for Corrugated Surfaces	9
Finishing	11
Painted-in Graphics	12
Roll-up Doors	14
Thermacube Trailers	14
Vehicle and Architectural Windows	15
Warranty and Limited Remedy	17
3M Related Literature	18
Bulletin Change Summary	18

How to Use This Bulletin Effectively

The techniques described in this Bulletin are required when applying a 3M warranted graphic, but are also practical recommendations when using promotional materials for non-warranted graphics. Applying a graphic is more than just adhering the film to the substrate. Be sure you read and follow the instructions in all Bulletins referenced in the sections you are using.

Instruction Bulletin	Description
5.4 (this one)	General application of film. See Table of Contents.
5.1	Application, Substrate Selection, Preparation and Substrate-specific Application Technique
5.5	General Procedures for Interior and Exterior Dry Applications
5.36	Application Techniques for Automobiles, Vans and Buses
5.37	A Guide to Understanding and Applying Graphics to Common Smooth and Textured Wall Surfaces
5.42	Application: Special Considerations for Watercraft
5.44	Application and Maintenance of Petroleum Pump Graphics
5.45	Application Techniques for Railcars

Health and Safety



CAUTION

When handling any chemical products, read the manufacturers' container labels and the Material Safety Data Sheets (MSDS) for important health, safety and environmental information. To obtain MSDS sheets for 3M products go to 3M.com/MSDS, or by mail or in case of an emergency, call 1-800-364-3577 or 1-651-737-6501.

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



CAUTION

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 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.

Air Quality Regulations

State Volatile Organic Compound (VOC) regulations may prohibit the use of certain cleaning chemicals with VOC's in graphic arts coatings and printing operations. For example, the California South Coast Air Quality Management District prohibits use of certain solvent-based solutions without a permit and other California AQMD's prohibit use of certain solutions without a permit or a regulatory exemption. Check with your State environmental authorities to determine whether use of this solution may be restricted or prohibited.

Understanding Adhesive Characteristics

Non-Reflective Films with Pressure-Activated Adhesive

Pressure-activated adhesive (PA) is available only on 3M™ Controlltac™ Graphic Films, which is available in versions with or without Comply™ Adhesive.

Pressure-activated adhesive allows the film to slide easily on the substrate, be positioned with light finger pressure, and repositioned if it is not in the right place. However, so that a good adhesive bond is established, the positionability feature is lost when:

- Firm pressure with a squeegee or other application tool is applied.
- Application temperatures are above 100°F (38°C), even if only light finger pressure was used for tacking.
- If any part of the film is removed from the original liner and reapplied to the same or another liner.

Reflective Films with Pressure-Activated Adhesive

Some 3M™ Scotchlite™ Reflective Graphic Films have a pressure-activated adhesive that allows the film to slide easily on the substrate. Pressure applied by hand, squeegee or application tool immediately bonds the film to the substrate and the slideability feature is lost. Reflective film cannot be lifted and repositioned without damage.

Films with Pressure-Sensitive Adhesive

Some 3M™, Scotchcal™ and Scotchlite™ Graphic Films have pressure-sensitive adhesive (PSA), which bonds to the surface even with light pressure and cannot be repositioned.

Film with Comply™ Adhesive

Selected 3M graphic films have air release channels, a characteristic of Comply adhesive. This feature may be found in films with either pressure-activated or pressure-sensitive adhesive that is permanent, changeable or removable.

Comply adhesive is a versatile technology with multiple versions. The original Comply adhesive has a slightly visible pattern on the film surface. A designation like "Cv2" or "Cv3" (e.g. 180Cv2-10 or IJ380Cv3) indicates a different Comply pattern. In these two cases, the pattern is virtually invisible, and the Cv3 version features improved air bleed. Refer to the specific film's applicable Product Bulletin for details.

Continued on the next page.

Permanent, Removable or Changeable

Important Note!

Removing and attempting to change a film liner or reapplying the same liner damages air release channels.

When applying graphics, always work from the center out to the edges of the graphic to allow trapped air to exit through the air release channels. If the channels are closed off by firm pressure and air is trapped, use an air release tool to aid in removing air bubbles.

3M offers films with permanent, removable or changeable adhesive, which may be combined with other adhesive characteristics described above.

The type of application surface and its texture influences the following descriptions. Be sure to check the Product Bulletin for the film you are using for complete details.

Permanent adhesive means the film is not intended for removal at any time. Heat, chemicals, tools and effort may allow you to remove the film, but damage to the substrate is likely.

Removable adhesive means the film may be removed from an approved substrate within the stated warranty period and leaves 30% or less adhesive residue. Some removable films require heat and/or chemicals for successful removal. In some cases, the film may break into small pieces as it is removed, and substrate damage may occur.

Changeable adhesive means the film may be removed from an approved substrate within the stated warranty period without heat or chemicals and leaves little or no adhesive residue. This adhesive characteristic is available only in short-term films.

Application Tools

- Scotch® Masking Tape, 2 inch wide
- 3M™ Plastic Applicator PA-1 (Blue or Gold*)
 - The gold applicator is most generally used. It is stiffer than the blue applicator, which allows maximum application pressure.
 - The blue applicator is used when you need more flexibility. It is softer, which allows you to mold it around contours and corrugations.
- 3M™ Low Friction Sleeve SA-1*
- 3M™ Rivet Brush RBA-1 or RBA-3*
- Pin or 3M™ Air Release Tool 391X*
- 3M™ Primer 94
- 3M™ Edge Sealer * (Use the one recommended in the Product Bulletin)
- Cutting tools, such as a razor blade with a safety holder
- Industrial heat gun; must be capable of attaining 500° to 750°F (260° to 399°C), or equivalent
- Cotton gloves
- A 1/4 inch (0.6 mm) paint brush for applying edge sealer

*Available from 3M Commercial Graphics Division

Temperature and Environment

Apply graphics when the air, film and substrate temperatures are within the range specified in each film's Product Bulletin. If the temperature range of various components in your construction varies, use the most conservative values. The incorrect temperature may prevent the graphic from performing as expected.

Conditions that Affect Graphic Application

- Graphics applied above the maximum recommended application temperature may pre-adhere.
- Above the maximum recommended application temperature, graphics constructed of Controltac films may lose their positionability feature.
- The temperature of the substrate must be above the dew point to prevent moisture from condensing on the surface.
- In very humid conditions, it may be difficult to keep the substrate dry.

Continued on the next page.

- Below the minimum recommended application temperatures, film becomes stiff and brittle. The adhesive cannot bond adequately with the substrate.
- Substrates may be heated in order to raise the surface temperature above the minimum specified. Use an appropriate portable heater or heat lamps. Always check to ensure that heat will not damage the substrate.

Substrate Preparation

See Instruction Bulletin 5.1 for details on cleaning specific substrates and any special application techniques that are required.

- All substrates must be considered contaminated and must be cleaned prior to application of film or sheeting.
- If the substrate has dirt or loose paint on it, that is what the film adheres to--not the substrate itself. If the film does not make enough contact with a clean, dry substrate, it will not stick well, leading to premature graphic failure.
- Perform the final substrate cleaning step immediately before applying film. Dust and other contaminants can collect quickly on the substrate and prevent the film from adhering properly.
- Be sure the substrate, rivets and seams are thoroughly dry. Film adheres poorly even to a properly cleaned substrate if there is any moisture around the rivets and seams.

Application Sequence

Unless otherwise noted, follow the General Procedures in Instruction Bulletin 5.5.

Shelf Life, Storage and Shipping

Shelf Life

Total shelf life: 2 years from the date on the original box

Up to 2 years unprocessed, **OR** process within 1 year **and** apply within 1 year of processing

Storage Conditions

- 40° to 100°F (4° to 38°C) *Typical value; check your film's Product Bulletin for details.*
- Out of sunlight
- Clean dry area
- Original container
- Bring the film to print room temperature before using

Shipping Finished Graphics

Flat, or rolled with printed side out on 5 inch (13 cm) [6 inch/15 cm for reflective films] or larger core. This helps prevent the liner and application tape, if used, from popping off. *Typical value; check your film's Product Bulletin for details.*

Special Applications

Complex Curves and Contours

Covering complex curves and contours requires special techniques, including heating and stretching the film. Films and sometimes the inks with which they are printed, have differing abilities to stretch, so the amount of heat and tension depends on the graphic construction. The specific characteristics of a film and an ink, as well as whether the shape is concave or convex, determines how well the film holds to the curved substrate.

Before deciding to heat and stretch film, check your panel placement to determine if it can be applied simply using the techniques for corrugations. See page 8. Also check the Product Bulletin for the ink you are using.

Which Films Can Be Stretched

Easiest to Hardest

Graphics made with the following constructions are rated below from easiest (1) to hardest (4) to stretch:

1. 2 mil vinyl
2. 2 mil vinyl with an overlamine
3. 4 mil vinyl
4. 4 mil vinyl with an overlamine

Cannot be Stretched

Graphics made with the following constructions cannot be stretched, and, therefore, are not warranted for use on complex curves and contours surfaces:

- Film with polyolefin as a base film or overlamine
- Reflective graphic film (stretching damages the reflectivity)
- Polyester base film or overlamine

Planning the Application

Panel Placement

Lay out the graphics to determine the panel placement. If stretching is needed, be sure to follow the instructions that follow.

Overlapping Panels

When applying multiple, overlapping panels, be sure the overlaps cannot trap and collect moisture. On a vehicle, be sure the overlaps face away from the air flow.

- Vertical overlap (vehicles only): start at the back of the vehicle, and then work around toward the front.
- Horizontal overlap: start at the bottom of the substrate and work up.

Temperature

For ease of application, apply the film at room temperature or above, but not higher than the maximum recommended application temperature. Refer to the film's Product Bulletin.



CAUTION

Heat or open flames may contribute to a flash fire or burns. Follow these precautions when using a heat source for flame treating.

- Read and follow the instructions supplied with the heat source.
- Avoid personal contact with the heat source. Wear heat-resistant gloves and safety glasses.
- Do not use heat sources near solvent mixtures or residues, or where solvent vapors may be present.



CAUTION

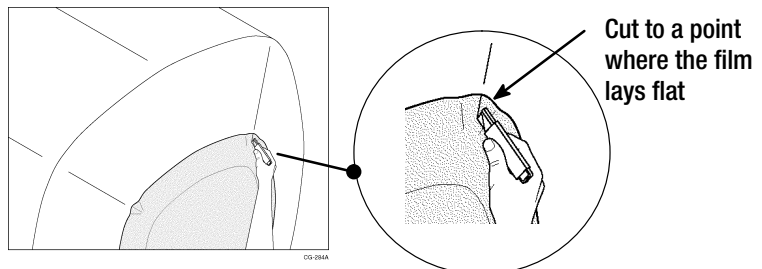
Always provide adequate ventilation to remove emissions that result from the heat of flame treating. Failure to provide adequate ventilation can result in operator exposure.

Convex Contours

Depending on the severity the curve, the film may bunch or ruffle and then wrinkle at edges.

1. Clean the substrate thoroughly using detergent and water followed by a solvent wipe.
2. Apply the graphic to the largest flat area first, then to other large flat areas.
3. For light bunching or ruffling, try using gentle heat to shrink the edges of the film slightly before squeegeeing.
4. To eliminate heavier bunching or ruffling, cut to where the film lays flat. See FIGURE 1.

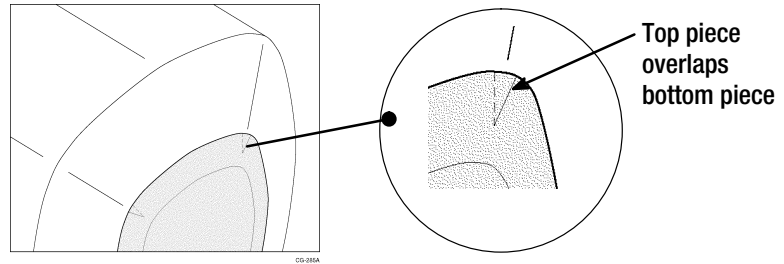
FIGURE 1
Cutting Excess Film
Illustration shows convex surface such
as on the rear of a tanker



5. Overlap the excess film so that the upper piece overlaps the lower piece. See FIGURE 2.
6. Make absolutely sure that the contact areas are clean, and then wrap the cut film edges around the hood, door, window and/or trunk openings.

Note: The most common reason for graphic failure (edge lifting) at seams and openings is dirt or other contamination.

FIGURE 2
Overlapping Cut Film Pieces



Concave Contours

Using Primer 94

1. Clean the substrate thoroughly using detergent and water followed by a solvent wipe.
2. Use primer 94 to help the film adhere in concave and corner areas.
 - This primer works well with most films.
 - It is not suitable for films with an adhesive that is "removable with heat only," which includes film series 160, 8640 and all perforated window graphic films.
 - Removing films from areas that are primed is more difficult than removing film from unprimed areas.
3. Shake the primer well before using.
4. Apply the primer as thinly as possible in a uniform coating. Apply it ONLY in the base or small radius areas; not the entire contour.
5. Allow the primer to dry.
6. Clean off any excess primer with isopropyl alcohol.

Apply the Graphic

1. Apply the graphic to the largest flat area first, then to other large flat areas.
2. Remove the application tape, if it is present.
3. Heat the film until it becomes soft and conformable.

Important Note!

Judging the Right Amount of Heat

-
- Heat softens the adhesive, which assures good initial adhesion.
 - The right amount of heat allows the graphic to be stretched so that it will conform to the complex contour.
 - Too much heat makes the films too soft and difficult to handle. It can also melt or shrivel the film.
 - Insufficient heat may cause the film to tear rather than stretch. It may also eventually lift out of the recesses.
-

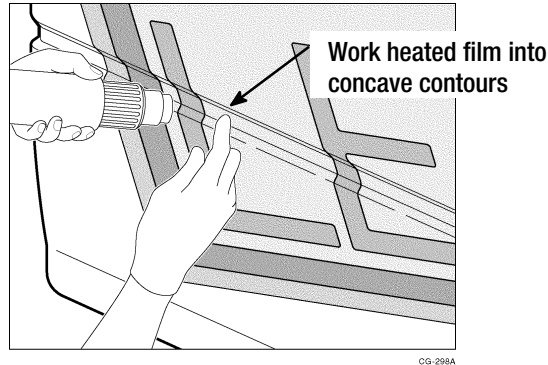
Important Note!

Stretching Film

Stretching the film too much can cause tears and breaks.

4. Gently stretch, push or form the film into the concave area with your hands. Wear cotton gloves for protection. See FIGURE 3.

FIGURE 3
Working Film into Concave Contours



5. Wherever the film has been stretched and formed into channels and corners, carefully make a single cut through the film along the entire length of that channel or corner. Be careful not to damage the substrate. Cutting relieves the stress on the stretched film and prevents the graphic from tenting. If the film has not been sufficiently heated and/or it has been stretched too much, it may shrink slightly in the cut area.

Note: Cutting too deeply will permanently damage the substrate.

6. Remove all trapped air using a pin or air release tool.
7. Carefully cut all substrate seams and openings such as body panel, hood, door, window and/or trunk seams.
8. Make absolutely sure that the contact areas are clean, and then wrap the cut film edges around the hood, door, window and/or trunk openings. Primer 94 can be used in these areas to ensure better adhesion.

Note: The most common reason for graphic failure (edge lifting) at seams and openings is dirt or other contamination.

9. Heat the edges and re-squeegee all seams, film edges and cuts.

The term "vehicle" refers to commercial fleet, buses, vans, automobiles and watercraft unless otherwise noted.

Use the following techniques in conjunction with Instruction Bulletin 5.5 or Instruction Bulletin 5.36. Additional techniques for applying permanent, changeable or removable graphics are similar to that for other vehicles.

Also see Vehicle and Store Windows, page 15.

Vehicle Applications

Buses



WARNING

Special Bus Application Safety Information

The Office of Vehicle Safety Compliance of the U.S. National Highway Traffic Safety Administration (NHTSA) has asked for 3M's assistance in communicating an important safety concern. NHTSA has observed that graphic films used for bus wraps could be, and in some cases have been, applied in such a way as to block or restrict emergency window exits.

Penalties For Non-compliance

Failure to trim film away from rubber gaskets surrounding emergency exit windows can render an emergency exit inoperable. This is a violation of Title 49 United States Code section 30122. Substantial civil penalties as set forth in Title 49 United States Code section 30165 may be incurred for such a violation.

Buses, Continued

1. Inspect the bus for areas that have the potential for paint failure. Any visible signs of paint peeling, lifting or bubbling, or rust indicates poor paint to substrate adhesion. Areas to pay special attention to are:
 - Bus rear
 - Wheel wells
 - Air intake vents
 - Windows
 - Rub rails
 - Air conditioning grills
2. Repair any problem areas according to the manufacturer's instructions, including the application of a prime coat. Only a *fully-cured* prime coat is needed.
3. Clean the bus thoroughly. Pay special attention to oily areas such as the rear of the bus.
4. Document all places where paint adhesion may be a problem. Obtain a customer sign-off using the Pre-installation Review found in Instruction Bulletin 5.36. A signed review is required as a condition for warranty on buses. See the 3M Related Literature section.
5. Film may not adhere to certain areas of the bus, including:
 - Rubber
 - Window and door gaskets
 - Plastics

Conspicuity

For application methods and graphic placement, see:

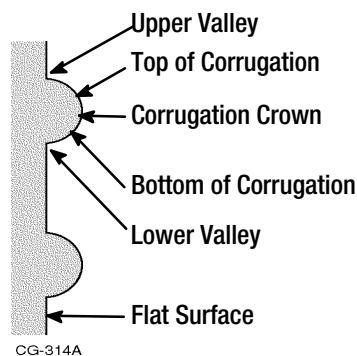
- Instruction Folder 4.9, *3M™ Diamond Grade™ and Flexible Prismatic Conspicuity Markings Application Instructions*, which discusses 3M™ Diamond Grade™ Conspicuity Markings Series 983.
- Instruction Bulletin 5.12, *Cutting and Applying Curtain Sided Vehicle Film*

Corrugations

The correct application method is to wrap the film around the corrugations. Do not bridge the film from one corrugation to the next and then use heat to push the film into the flat area. The film will tent in the valleys and cause the graphic to fail prematurely.

The profile of a standard corrugation has flat areas alternating with raised, rounded areas. FIGURE 4 identifies the parts of the profile by name.

FIGURE 4
Profile of a Standard Corrugation



Applying Film To Corrugated Surfaces

1. Review Instruction Bulletin 5.5 for pre-application information and hinge methods.
2. Position the film so that the top edge is on a flat surface and not a corrugation.
3. For multi-panel graphics, start 1/3 to 1/2 the distance down from the top edge of the film. This minimizes stretching and registration problems.

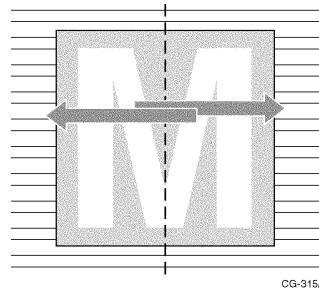
Application Technique for Corrugated Surfaces

Note: Be sure to use a gold or blue plastic applicator (also called a squeegee) for this procedure. The blue applicator is softer and allows you to conform it around corrugations.

Note: You can substitute a rivet brush for a plastic applicator in all of these sequences.

1. In the application sequence that follows, use these four techniques in each step. Each step shows the correction position to hold and use the applicator tool.
2. Start all squeegee strokes near the vertical center of the film.
3. Squeegee all the way to an edge.
4. Return to the center.
5. Starting at a place that overlaps the previous stroke by about 50%, repeat the procedure to the opposite edge. Use this technique for the upper valley, top of the corrugation, the corrugation crown, the bottom of the corrugation, and the lower valley. See FIGURE 5.

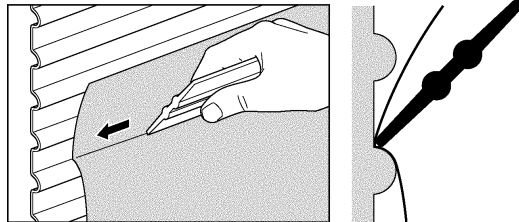
FIGURE 5
Overlap Your Squeegee Strokes



CG-315A

6. Use the edge of the plastic applicator in a continuous motion to bead the upper valley. See FIGURE 6.

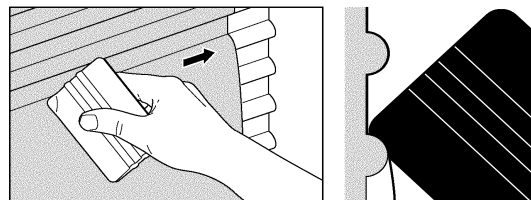
FIGURE 6
Bead the Upper Valley



CG-316A

7. Apply the film to the top of the corrugation with the corner of the plastic applicator. See FIGURE 7.

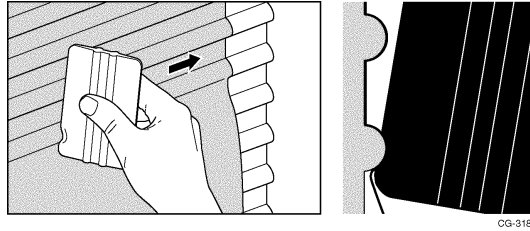
FIGURE 7
Squeegee the Top of the Corrugation



CG-317A

8. Squeegee the film along the crown of the corrugation using the edge of the plastic applicator. Use enough pressure to make the plastic applicator curl around the corrugation crown. This makes the film drape under the corrugation without pre-adhering it to the flat surface below. See FIGURE 8.
9. Conform the film around the bottom corrugation.

FIGURE 8
Squeegee Crown
of Corrugation



**Option 1:
Using Your Thumb**

10. Use your thumb to firmly press the film along the corrugation's bottom and lower valley. This step conforms the film around the bottom corrugation, reducing the amount of film stretching and wrinkling. We recommend wearing a glove as this technique tends to be abrasive on your skin. See FIGURE 9.

11. Squeegee the bottom corrugation with the corner of the plastic applicator. The thumb method alone does not adequately adhere the film to the surface. See FIGURE 10.

FIGURE 9
Conform Lower Valley
with Your Thumb

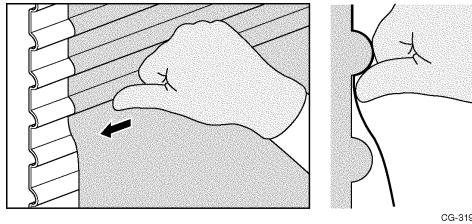
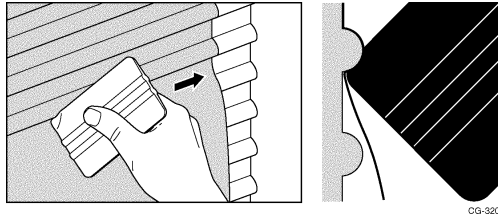


FIGURE 10
Squeegee Bottom Corrugation



**Option 2:
Using a Rivet Brush**

12. You can use a rivet brush for any corrugations where the distance between corrugations is 1.5 inches (3.8 cm). Do not use a rag. See FIGURE 11.

13. Bead the lower valley using the edge of the plastic applicator. The thumb method does not adequately adhere the film to the surface. See FIGURE 12.

FIGURE 11
Conform Lower Valley
with Rivet Brush

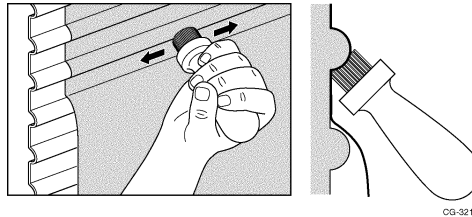
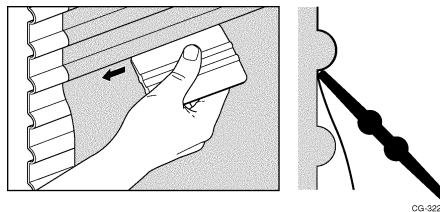


FIGURE 12
Bead Lower Valley



14. Apply the film to the flat area.

Option 1:

Squeegee the film, starting from the lower valley and moving to the upper valley of the next corrugation. Always start at the lower valley. Use overlapping strokes and firm pressure. See FIGURE 13.

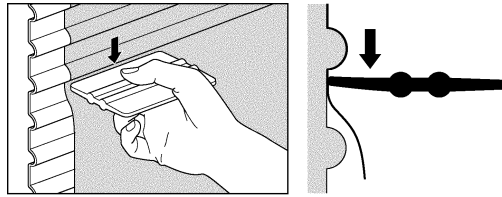
Option 2:

An alternate method is to use the rivet brush. Avoid premature application to the top of the next corrugation. This causes the film to stretch. See FIGURE 14.

15. Repeat steps 6 through 14 to the bottom of the graphic.

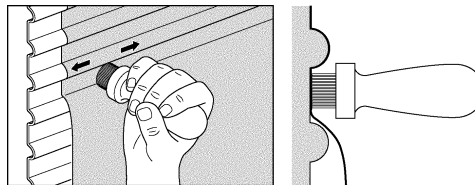
16. To apply the top half of the graphic, repeat Steps 2 through 7 in reverse:
 - a. Adhere the film to the flat surface (Step 7).
 - b. Bead the lower valley (Step 6).
 - c. Conform the film around the bottom corrugation (Step 5).
 - d. Squeegee the film along the crown of the corrugation (Step 4).
 - e. Apply the film to the top of the corrugation (Step 3).
 - f. Bead the upper valley (Step 2).

FIGURE 13
Use Squeegee to Adhere
Film to Flat Areas



CG-323A

FIGURE 14
Use Rivet Brush to Adhere
Film to Flat Areas



CG-324A

Finishing

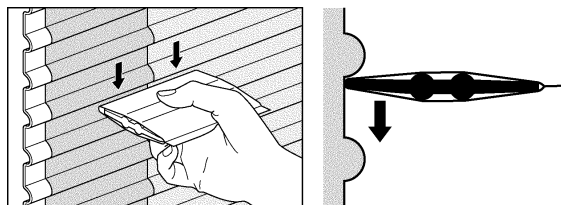
Please review the Finishing section of Instruction Bulletin 5.5, which provides important details for successful finishing.

1. Starting from a corner and working across the diagonal of the graphic, pull the application tape back over on itself, as shown. See FIGURE 15.
2. Re-squeegee all seams and outer edges with the plastic applicator and a low friction sleeve. Using firm pressure in an upward and downward motion. See FIGURE 16.



FIGURE 15
Remove Application Tape

FIGURE 16
Re-squeegee Seams



CG-326A

3. Re-bead the upper and lower valley of each corrugation at the film overlaps. Use firm pressure with the plastic applicator. Failure to do this step will result in lifting of the top film layer. See FIGURE 17.
4. Run your finger along the top and bottom of the corrugations to check for air bubbles. Remove any trapped air in the valleys. See FIGURE 18.
5. Follow the steps found in the Finishing section of Instruction Bulletin 5.5.

FIGURE 17
Re-bead Upper and Lower Valleys

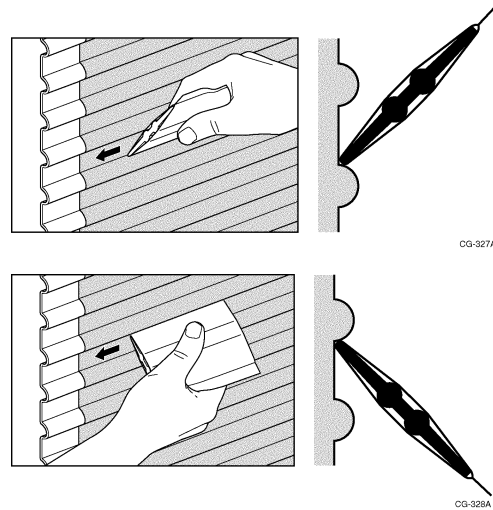
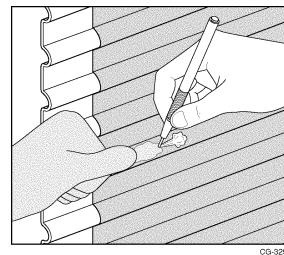


FIGURE 18
Remove Air Trapped in Valleys



Painted-in Graphics

Application tape protects the graphic from staining when overpainted with most finish paints. You can apply premasked graphics to the prime coat and then apply the finish coat. This effectively edge seals the graphic by imbedding the graphic in the paint.

Note: Always test premasked graphics for paint resistance prior to using this technique.

1. Apply the film. See Instruction Bulletin 5.5. Stop when you get to the Finishing section and return to this procedure. Do NOT remove the application tape.
2. Prepare the body seams.
 - a. Slit the film at all body seams with a razor blade or similar cutting tool. See FIGURE 19.
 - b. Then cover the slit body seams with a 2 inch (5.1 cm) wide strip of masking tape. See FIGURE 20.

FIGURE 19
Slitting Body Seams

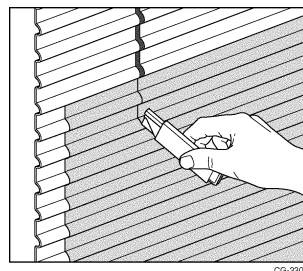
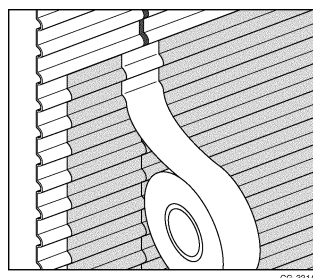


FIGURE 20
Taping Slit Body Seams



3. Apply multi-panel graphics. Refer to FIGURE 21A to FIGURE 24C.
 - a. Apply the first panel and squeegee in place.
 - b. Pull back the application tape approximately 1/2 inch (12 mm).
 - c. Apply the next piece of film over the edge of the first piece by 1/4 to 1/2 inch (6 to 12 mm). Do not apply the film over the application tape. Lay the application tape over the overlap.
 - d. Cover the seam with a 2 inch (51 cm) wide piece of masking tape.
4. Apply paint in the desired areas.

FIGURE 21A
Applying Multi-Panel Graphics, First Panel

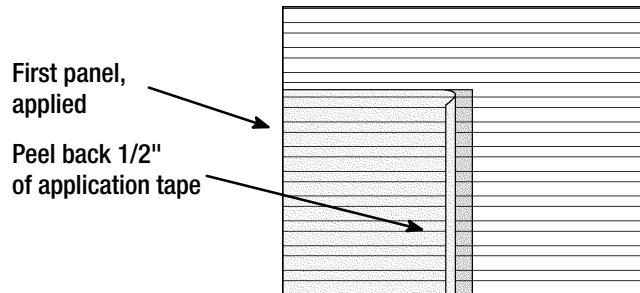


FIGURE 24B
Applying Multi-Panel Graphics, Second Panel

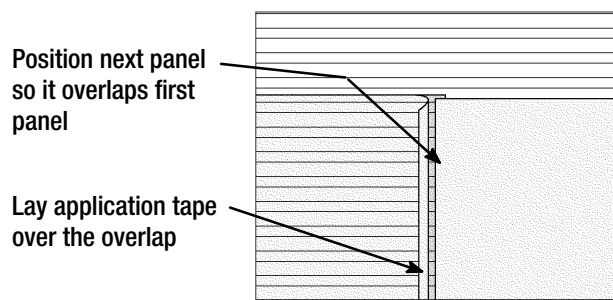
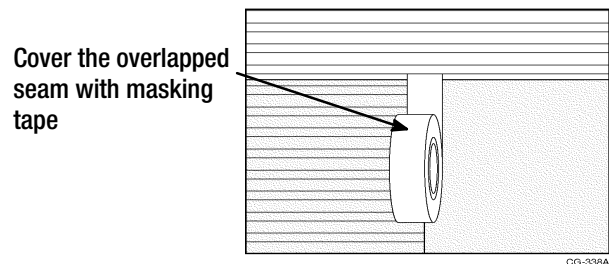


FIGURE 24C
Applying Multi-Panel Graphics, Covering Overlapped Seam

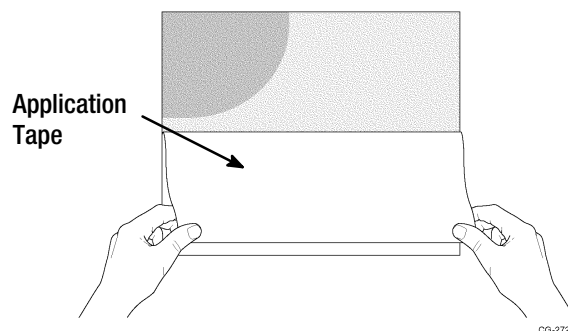


5. While the final paint coat is still tacky but not wet, remove the application tape by pulling it directly back on itself at a 180 degree angle. See FIGURE 22.

If the application tape will be left on during the paint's heat cycle:

- Test to make sure that the paint will not strike through.
- Test to make sure the application tape can still be removed after the heat cycle. Heat tends to increase the bond and you may not be able to remove the application tape.

FIGURE 22
Removing Application Tape

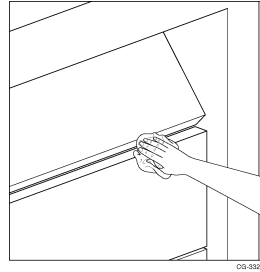


Roll-up Doors

The film on roll-up doors must be cut at all door fold seams. This requires two cuts to remove a thin strip of film between each seam. Two common reasons for graphic failure (edge lifting) at these seams are: (1) dirty door fold seams, and (2) film that extends over the seam or is not securely adhered to the substrate.

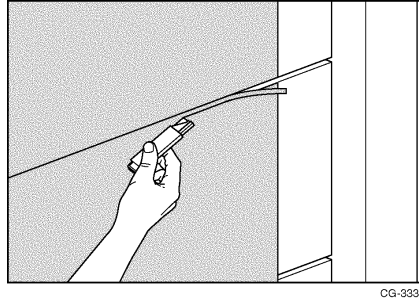
1. Make sure that the inside of the door seam is washed clean and then dried. Lift the door enough to thoroughly clean the top and bottom lips of the panels. See FIGURE 23.
2. Check the door construction. If they are covered with plastic but are not painted, they require a specific film or special application technique. Refer to Instruction Bulletin 5.1 for cleaning and surface preparation techniques.
3. Apply the film. See Instruction Bulletin 5.5.
4. Remove the application tape.

FIGURE 23
Cleaning the Door Fold Seams



5. Hold the cutting tool at a 45° angle and cut along both edges of the door fold seam. Remove the thin strip of film. See FIGURE 24.
6. Separate the panels by moving them apart as far as possible.
7. Heat the edges and squeegee the film, starting in the center and working to the edges.
8. Edge sealing is optional.

FIGURE 24
Cutting at the Door Fold Seams



Thermacube™ Trailers

Thermacube trailers have vertical corrugations. Refer to FIGURE 26.

1. Refer to Instruction Bulletin 5.5. Use the vertical hinge method to start the application. See FIGURE 25.
2. Apply the film using the same squeegee techniques as for corrugations. See *Application Technique for Corrugated Surfaces* on page 9 of this bulletin.

Note: The film **MUST** conform to the vertical recesses.

3. Re-squeegee all outer edges.
4. Cut the film in the vertical recesses of the two inside corners. See FIGURE 26.
5. Cut the film at all panel overlaps.

FIGURE 25
Vertical Hinge

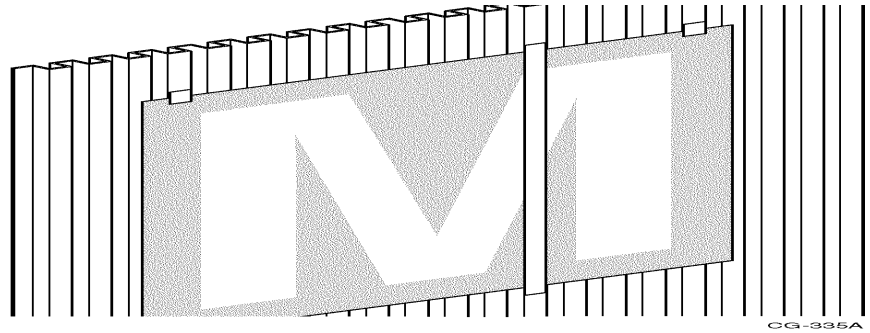
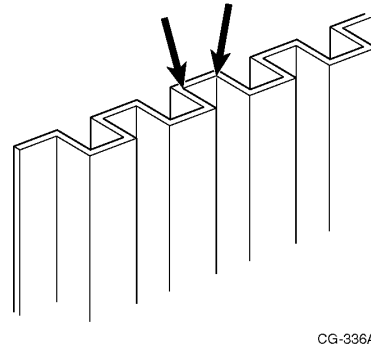


FIGURE 26
Thermacube Panel
Cutting the Film In Recesses



Vehicle and Architectural Windows

Application Restrictions

3M Commercial Graphics Division policy is not to support applications of perforated window graphic film when a driver's view is obstructed and/or where local laws prohibit its use.

The following uses and applications are specifically NOT recommended or warranted for perforated graphic film:

Restrictions for Architectural Graphics

- Non-vertical window surfaces.
- Windows with built-in heating or defrosting elements.
- Windows with coatings such as anti-reflection and scratch resistance.
- Window gaskets and rubber moldings.

Restrictions for Vehicle Window Graphics Only

- Graphics that are not trimmed away from all openings of any emergency window exit. See page 7 for additional details.
- Windows with windshield wipers.
- Application to windows that crank or roll down, rubber moldings or window gaskets
- Non-laminated or improperly laminated film on exterior windows that require an optically clear view.

WARNING

Applications that require an optically-clear view, such as vehicle window exteriors, must be laminated with overlamine 8914. Failure to apply this overlamine could result in obstructed or impaired viewing when the product becomes wet.

CAUTION

Some states have laws or regulations requiring minimum light transmission that may limit or preclude the use of this product on regulated vehicle windows, which may include passenger vehicles and vans. The user is responsible for determining and complying with all applicable standards.

Application Tapes for Digital Images

Do NOT use an application tape (premasking or prespacing) on film that has been laminated with overlamine 8914. The adhesive of the application tape can pull the overlamine off the graphic.

Application Temperature

Do not apply graphics if the air or surface temperature is less than 40°F (4°C).

Safety Guidelines for Applying Vehicle Window Graphics

- Before applying film, open all emergency exit windows to determine exactly where graphics must be trimmed to ensure no interference with the operation of these windows.
- If an emergency window is non-functioning, it is your responsibility to alert the bus maintenance personnel before proceeding.
- Always trim the film 1/8 - 1/4 inch away from all rubber gaskets. Do not apply film over rubber gaskets.
- Do not allow any graphic film, whether applied to windows or bus body, to overlap the opening of an emergency window exit.
- After graphic installation is completed, ensure that all emergency window exits are fully functional.

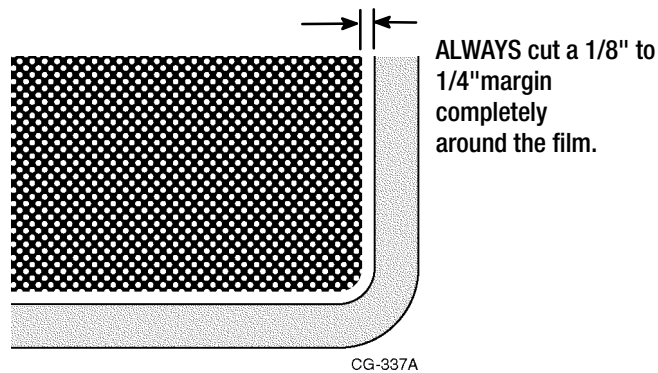
Sizing the Window

Measure the window opening and the graphic to make sure that it fits on the window. Apply the graphic and then cut away a margin of 1/8 to 1/4 inch (3 to 6 mm) all around the graphic. See FIGURE 27. This eliminates the need for edge sealing on full window coverage.

Do NOT apply the any film to any rubber gaskets or parts on the buses. This minimizes the chance of the graphic lifting, or absorbing water that may collect in the window edge. It also eliminates the need for edge sealing on full window coverages.

Do NOT allow any film to overlap the openings for any emergency window exits, which can prevent the window from operating properly in an emergency.

FIGURE 27
Leave a Space All Around the Window



Applying Perforated Window Graphic Film

Note: Before applying the film, be sure you understand what method of edge sealing will be used. See the next page.

1. Make sure that the glass is clean. Some glass has coatings that can prevent the graphic from adhering adequately. See Instruction Bulletin 5.1 for details on cleaning and how to determine whether there is a coating.
2. Always use a dry application method. Refer to Instruction Bulletin 5.5.
3. Use a low-friction sleeve on the plastic applicator to prevent scratching.
4. During application:
 - Do not stretch the film into the window well or onto the window itself, which causes tension that can resulting the graphic shrinking and its edges curling.
 - Cut the film to the approximate shape of the window before squeegeeing it. To do this, tack down the film in the center of the window, cut the graphic to shape, and squeegee the film to the window.
 - Do not use a heat source directly on the window. This can cause the film to shrink and its edges to curl.
5. When the application is completed and all window film has been trimmed, RESQUEEGEE ALL EDGES to ensure the best adhesion.

Painted Metal Surfaces Between Windows

If window graphic film is applied to narrow painted metal surfaces between windows, the image may not look consistent. To maintain a consistent image, an opaque 3M vinyl film may be applied to the surfaces between windows before the perforated film is applied. The color of vinyl film used depends on the image you want.

Seaming Side-by-Side Panels

If two panels are designed to meet side by side on a window, carefully trim the images so that the panels meet and form a butt seam. Do NOT overlap the panels. Always trim before starting the application. Do NOT cut the film while it is on the window as this may permanently scratch some window surfaces.

Edge Sealing Recommendations

Edge sealing improves the resistance to environmental damage and enhances the durability of the graphics. We recommend using one of these easy options on graphic edges.

You can order narrow rolls of overlaminate 8914 from 3M. Use part number 75-3469-0233-3 and specify 1/2 inch x 50 yard (13 mm x 43 m) rolls, or you may cut 1/2 inch (13 mm) rolls from your inventory of overlaminate 8914.

Option 1: Seal Edges with Strips of Overlaminate

This method can be used whether your graphic has overlaminate 8914 or a screen printed clear coat applied.

Apply a 1/2 inch (13 mm) strip of overlaminate 8914 so each strip evenly straddles the perforated film and substrate. Overlap the corners. See FIGURE 28 and FIGURE 29.

Important Note!

Never allow film or overlaminate to touch the rubber window molding.

FIGURE 28
Applying 8914 Edge Sealing Tape

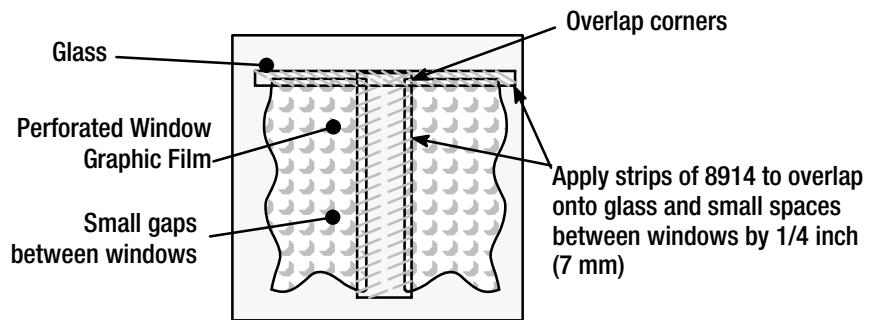
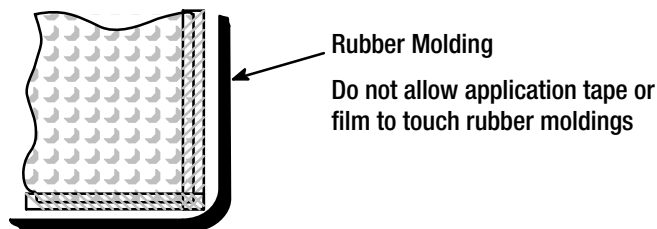


FIGURE 29
Avoid Rubber Moldings

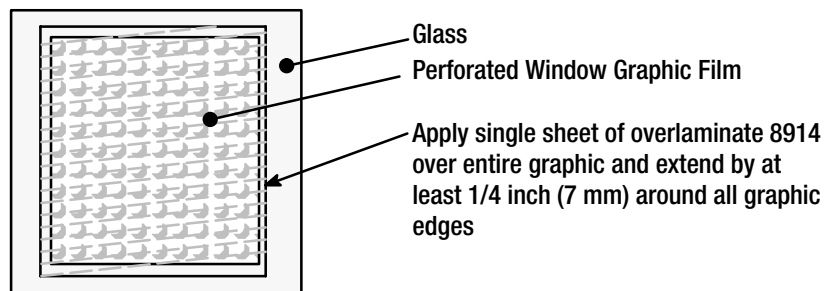


Option 2: Apply Oversized Piece of Overlaminate

This method is for use by experienced applicators and should be used only on graphics that cover just part of a window or have irregular shapes.

Cut overlaminate 8914 so it is at least 1/4 inch (7 mm) larger than the graphic and apply so it overlaps all edges of the perforated film. Contact us for more details, if needed. See FIGURE 30 and FIGURE 29.

FIGURE 30
Optional: Apply single sheet of overlaminate 8914 over entire graphic



Warranty and Limited Remedy

The information contained and techniques described herein are believed to be reliable, but 3M makes no warranties, express or implied, including but not limited to any implied warranty of merchantability or fitness for a particular purpose. 3M shall not be liable for any loss or damages, whether direct, indirect, special, incidental or consequential, in any way related to the techniques or information described herein.

3M Related Literature

Before starting any job, be sure you have the most current Product and Instruction Bulletins.

The information in 3M Product and Instruction Bulletins is subject to change. Current Bulletins are available at 3Mgraphics.com. The following applicable Bulletins provide information and processes you need to properly make the graphics described in this Bulletin. Additional Bulletins may be needed as indicated in the 3M Related Literature section of other 3M components you use.

Bulletin types: PB = Product Bulletin; PB-IB = Product & Instruction Bulletin; IB = Instruction Bulletin

Subject	Type	Bulletin No.
Films, Substrates, Overlaminates, Inks and Clears Please visit our website to identify and obtain the additional Product and Instruction Bulletins you need for a successful application.		
Application, substrate selection, preparation and substrate-specific application techniques	IB	5.1
Application, general procedures for indoor and outdoor dry applications	IB	5.5
Cutting and applying curtain sided vehicle film	IB	5.12
Applicator's quick reference guide for vehicle film	IB	5.35
Application techniques for automobiles, vans and buses and inspection forms	IB	5.36
A guide to understanding and applying graphics to common smooth and textured wall surfaces	IB	5.37
Application: Special Considerations for Watercraft	IB	5.42
Application and Maintenance of Petroleum Pump Graphics	IB	5.44
Application Techniques for Railcars	IB	5.45
Storage, handling, maintenance, removal	IB	6.5
3M Graphics Center Warranty Brochure	go to www.3Mgraphics.com , Warranties	

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Bulletin Change Summary

Improved layout. Added more explanatory information as marked by black bars in the margins. Corrected Figure 16, which shows the proper way to remove application tape.



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