For the most current 3M Technical Information available to successfully use this product, please view this Bulletin electronically and click on the blue underlined links to view the relevant documents.

1. 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 3M Bulletins referenced in the sections you are using. The underlined blue text are links to the 3M Product or Instruction Bulletin.

- 3M™ Vehicle Channel Applicator Tools. 3M Product & Instruction Bulletin V-Tools
- 3M™ Paint Protection Film on 3M Vehicle Wraps. 3M Instruction Bulletin 5.47
- Application, Substrate Selection, Preparation and Substrate-specific Application Technique. 3M Instruction Bulletin 5.1
- Edge Sealer 3950 and 4150S, Edge Sealer Tape 8914. 3M Product and Instruction Bulletin Edge Sealers

2. Health and Safety

CAUTION

When handling any chemical products, read the manufacturers' container labels and the Safety Data Sheets (SDS) for important health, safety and environmental information. To obtain SDS sheets for 3M products go to 3M.com/SDS, 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:

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

A. 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.Please contact 3M in case your kind of recess is not listed in the above table.

3. Understanding Adhesive Characteristics

A. Non-Reflective Films with Pressure-Activated Adhesive

Pressure-activated adhesive (PAA) is available on 3M™ Controltac™ Graphic Films, 3M™ Envision™ Wrap Films, and 3M™ Wrap Films, which are available in versions with or without Comply™ Adhesive.

- The pressure-activated adhesive on this film offers:
  - smooth sliding into position on a substrate;
  - fast finger tacking to check position; and
  - easy snap up and repositioning when you need it.
- Snap up and repositionability is lost when a good adhesive bond is affected by the following:
  - firm pressure with a squeegee or other application tool is applied. This ensures a good adhesive bond while completing the installation.
  - at application temperatures 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.
  - solvent from inkjet ink has not completely dried or cured, which affects both slideability and snap up.

B. Reflective Films with Pressure-Activated Adhesive

Some 3M™ Scotchlite™ Reflective Graphic Films have a pressure-activated adhesive (PAA) 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. Please note that reflective film cannot be lifted and repositioned without damage to its reflective properties.

C. 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.

D. Working with Air Release Channels

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 micro Comply™ version offers the ultimate in invisible air release channels. Refer to the specific film's applicable Product Bulletin for details.

- The channels will be damaged and effective air removal reduced if you remove and attempt to change liners or reapply the same liner.
- For the best results, 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. See Instruction Bulletin 5.4 for details.
- micro Comply versions of films offer the least visible and smallest air channels available. Due to this fact, squeegeeing with proper pressure and procedure is imperative. Checking for trapped air with a heat gun after installation is a best practice as one becomes familiar with using micro Comply films.

See how 3M's Comply adhesive technology works. Video

E. Permanent, Removable or Changeable Adhesive

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

IMPORTANT NOTE

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.

4. 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™ Tape Primer 94
- 3M™ Edge Sealer* (Use the one specified in the base film's 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

Application Tools continued

- Cotton gloves
- A 1/4 inch (0.6 mm) paint brush for applying edge sealer

*Available from 3M Commercial Solutions Division

5. 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.

A. 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.
- 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.

6. Substrate Preparation

See 3M 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.

7. Application Sequence

Unless otherwise noted, follow the General Procedures in 3M Instruction Bulletin 5.5.

8. Shelf Life, Storage and Shipping

A. Shelf Life

NOTE: Always check the 3M Product Bulletin for the film you are using. Some films have a shorter shelf life than those described below.

(1) Most Intermediate Films

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

(2) Most Premium Films
Total shelf life: 3 years from the date of manufacture on the original box.
If you do process the film, do so within 2 years and apply within 1 year.
If you do not process the film, apply it within 3 years.

B. 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

C. 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.*

9. Special Applications

A. Complex Curves and Contours

Covering complex curves and contours requires special techniques, including heating and stretching the film. Films, inks and clears 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 the film can be applied simply using the techniques for corrugations. See page 10. Also check the 3M Product Bulletin for the ink you are using.

WARNING

3M does not recommend using torches on clear coats. This may cause cracking.

B. Relative Stretching Capabilities of Common Wrap Film Graphic Constructions

NOTE: Graphic constructions not mentioned here are not recommended or warranted for the ability to stretch for typical vehicle wrap installations. It is solely the responsibility of the user to test and approve other constructions.

NOTE: Use the minimum stretch capability of the components you are using for your graphic construction, found in the 3 tables below. Ex: If your graphic construction used LX480Cv3 with 8518 and UV ink, your stretching capability would be 130% if you were applying it to a surface that was recommended in the LX480Cv3 Product Bulletin.

Film	Stretching Capabilities[1]
IJ3552C, 3552	• Not intended for stretching; use only types of surfaces recommended in the film's 3M Product Bulletin. Will tent over rivets; may lift from corrugations. Using primer helps keep the film from lifting but not the overlaminate. Relief cuts also help prevent lifting or tenting.
1080, IJ180, IJ180Cv3, IJ181, 180, 180C, 181	• Stretches up to 130% of the original dimension when the radius of the channel is 1/4 inch (6 mm) or less without using primer or making relief cuts.
LX480Cv3/SV480Cv3, IJ380Cv3	• Stretches up to 150% of the original dimension when the radius of the channel is 1/4 inch (6 mm) or less without using primer or making relief cuts.

[1] **Example of 150% Stretch:** A 10 inch [25 cm] piece of film can stretch to 15 inches (39 cm).
Example of 130% Stretch: A 10 inch [25 cm] piece of film can stretch to 13 inches (33 cm).
Stretching beyond these points requires the use of primer and relief cuts.

Graphic Protection	Stretching Capabilities[1]
Graphic Protection other than what is listed below	• Not intended for stretching; use only types of surfaces recommended in the film's 3M Product Bulletin. Will tent over rivets; may lift from corrugations. Using primer helps keep the film from lifting but not the overlaminate. Relief cuts also help prevent lifting or tenting.
1920DR, 8530, 8518, 8519, 8520, 8528, 8915	• Stretches up to 130% of the original dimension when the radius of the channel is 1/4 inch (6 mm) or less without using primer or making relief cuts. • Stretching more than 130% may cause the overlaminate to lift, even if primer was used with the base film.
9740i[2], 9730UV[2], 9800CL[2]	• Stretches up to 130% of the original dimension when the radius of the channel is 1/4 inch (6 mm) or less without using primer or making relief cuts. • Stretching more than 130% may cause the UV clear coat to crack; the use of primer has no impact on this.
8548G, 8549L	• Stretches up to 150% of the original dimension when the radius of the channel is 1/4 inch (6 mm) or less without using primer or making relief cuts. • Stretching more than 150% may cause the overlaminate to lift, even if primer was used with the base film.

[1] **Example of 150% Stretch:** A 10 inch [25 cm] piece of film can stretch to 15 inches (39 cm).
Example of 130% Stretch: A 10 inch [25 cm] piece of film can stretch to 13 inches (33 cm).
Stretching beyond these points requires the use of primer and relief cuts.

[2] To achieve stretching capability with 9740i, 9730UV, or 9800CL you have to follow optimal processing conditions.

Inks	Stretching Capabilities[1]
Most UV Inkjet Printed Inks	• Stretches up to 130% of the original dimension when the radius of the channel is 1/4 inch (6 mm) or less without using primer or making relief cuts. • Stretching more than 130% may cause UV inks to crack; the use of primer has no impact on this. • Stretching more than 130% may cause the overlaminate to lift, even if primer was used with the base film.
Most Solvent Inkjet Printed Inks	• Stretches up to 200% of the original dimension when the radius of the channel is 1/4 inch (6 mm) or less without using primer or making relief cuts. • Stretching more than 200% may cause Solvent ink to lighten; the use of primer has no impact on this.
GSLXr SuperFlex Ink	• Stretches up to 200% of the original dimension when the radius of the channel is 1/4 inch (6 mm) or less without using primer or making relief cuts. • Stretching more than 200% may cause the SuperFlex ink to crack; the use of primer has no impact on this.

[1] **Example of 150% Stretch:** A 10 inch [25 cm] piece of film can stretch to 15 inches (39 cm).
Example of 130% Stretch: A 10 inch [25 cm] piece of film can stretch to 13 inches (33 cm).
Stretching beyond these points requires the use of primer and relief cuts.

NOTE: The following products are mentioned above. Click the blue underlined links to go to the 3M Product Bulletin.

3M™ Envision™ Print Wrap Film LX480Cv3/SV480Cv3

3M™ Controltac™ Wrap Film with Comply™ Adhesive IJ380Cv3

3M™ Wrap Film Series 1080

3M™ Controltac™ Graphic Film IJ181

3M™ Controltac™ Graphic Film 181

3M™ Scotchcal™ Gloss Wrap Overlaminate 8548G

3M™ Scotchcal™ Luster Wrap Overlaminate 8549L

3M™ Screen Print UV Gloss Clear 9740i

3M™ Controltac™ Graphic Film Series 180 and Graphic Film with Comply™ Adhesive Series 180C

3M™ Controltac™ Graphic Film IJ180 and Graphic Film with Comply™ Adhesive IJ180C or IJ180Cv3

3M™ Controltac™ Changeable Graphic Film with Comply™ Adhesive IJ3552C

C. Planning the Application

(1) Panel Placement

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

(2) 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.

(3) 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.

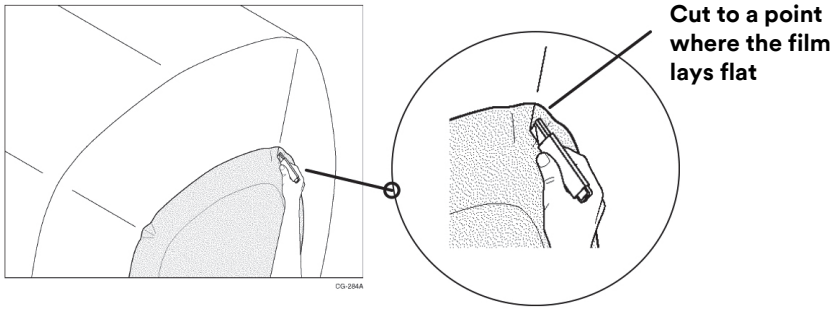
D. Convex Contours

Depending on the severity of the curve, the film may bunch or ruffle and then wrinkle at the 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, and then to other large flat areas.
3. For light bunching or ruffling, try using gentle heat to slightly shrink the edges of the film before squeegeeing.
4. To eliminate heavier bunching or ruffling, cut the film to the point where the film lays flat, using care not to scratch the substrate. See FIGURE 1.

FIGURE 1

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

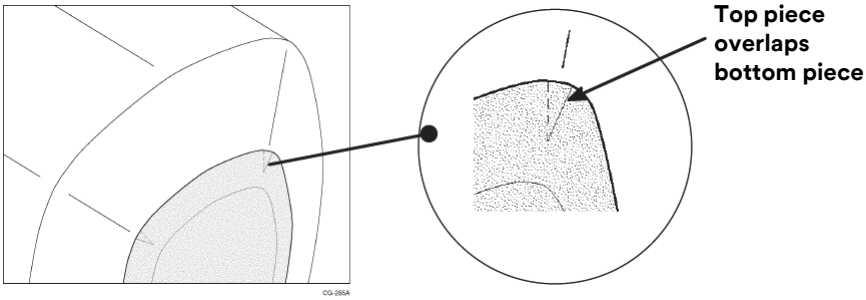


5. Overlap the excess film so that the upper piece overlaps the lower piece. See FIGURE 2.
6. Make absolutely sure that the contact areas are clean, and then wrap the cut film edges around the hood, door, window and/or trunk openings.

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



E. Concave Contours

(1) 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.
   - The primer is not suitable for films with an adhesive that is “removable with heat only," which includes film series 160 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.

(2) Apply the Graphic

1. Apply the graphic to the largest flat area first, then to other large flat areas.
2. Remove the application tape, by peeling it away from the graphic film at a low angle of approximately 180°.
3. Heat the film until it becomes soft and conformable.

(3) Judging the Right Amount of Heat

IMPORTANT NOTE

- 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.

CAUTION

UV cured inkjet inks and UV cured clears may crack if too much heat is used during graphic application to complex curves and deep contours as well as around rivets. When using heat during application, make sure the film surface temperature does not exceed 212°F.

Using additional heat in the post-application process may also cause UV inkjet ink to crack. 3M only recommends using heat guns for post-heating graphics.

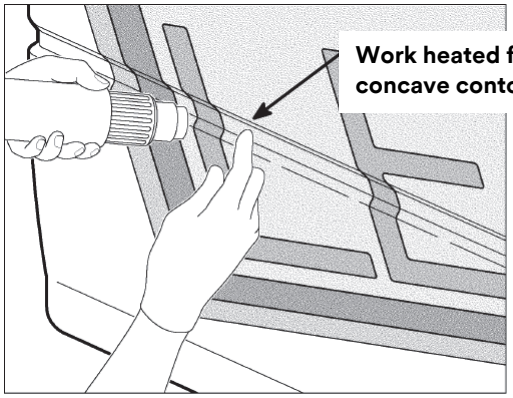
For best results, always do a test application of a UV printed graphic to determine how much heat can be used without damaging the image.

(4) Stretching Film

4. Please see the table in Section 9B, page 5, for important information on the stretchability of films.
5. 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



6. 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.

7. Remove all trapped air using a pin or air release tool.
8. Carefully cut all substrate seams and openings such as body panel, hood, door, window and/or trunk seams.
9. 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

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

10. Special Instructions for Film Series 1080

1. Always use masking tape to mark alignment. Do not use a grease pencil, which will embed in the film's texture, and attempting to remove it may damage the texture.
2. Use a felt squeegee, not a hard rubber squeegee, to minimize scratching. The unique finish on the film series 1080 is sensitive to scratches and requires careful handling.
3. Use a heat gun, instead of a torch, when heat is required. A torch is likely to alter the appearance of the finish.

11. Vehicle Applications

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

A. Buses

Use the following techniques in conjunction with 3M Instruction Bulletin 5.5 or 3M 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 16.

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.

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. 3M recommends using a catalyzed 2 part epoxy primer on all substrates. Remember to give the epoxy time to out-gas similar to paint or a clearcoat.
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 3M 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

B. Conspicuity

For application methods and graphic placement, see:

- 3M Instruction Folder 4.9, *3M™ Diamond Grade™ and Flexible Prismatic Conspicuity Markings Application Instructions,* which discusses 3M™ Diamond Grade™ Conspicuity Markings Series 983.

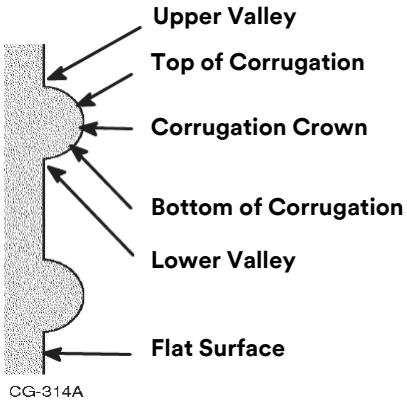
C. Corrugations

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



D. Applying Film To Corrugated Surfaces

1. Review 3M 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.

E. Application Technique for Corrugated Surfaces

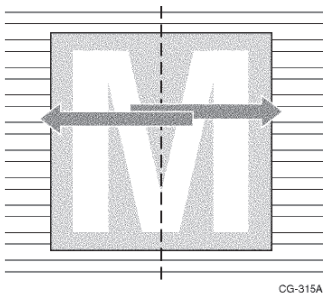
NOTE: Be sure to use a gold or blue plastic applicator (also called a squeegee) for this procedure. The blue applicator is softer and allows you to conform it around corrugations.

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

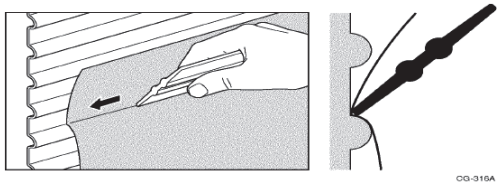
Overlap Your Squeegee Strokes



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

FIGURE 6

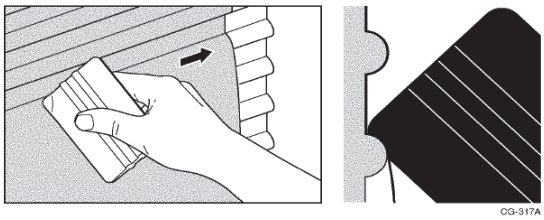
Bead the Upper Valley



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

FIGURE 7

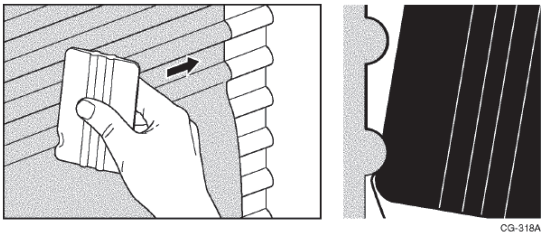
Squeegee the Top of the Corrugation



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.If washed in an automatic car wash, do not select "spot-free rinse" option.

FIGURE 8

Squeegee Crown of Corrugation



(1) Corrugation Bottom and Lower Valley

a. 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

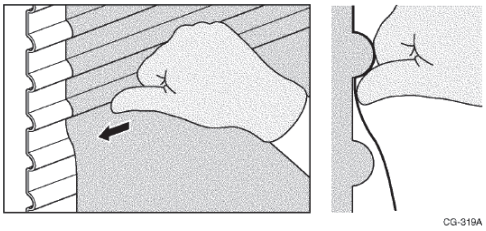
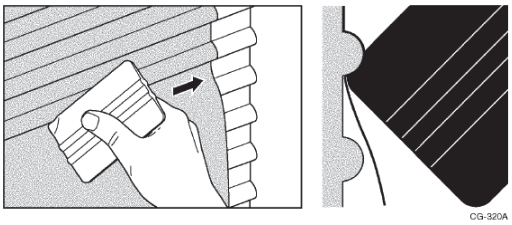


FIGURE 10

Squeegee Bottom Corrugation



b. 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

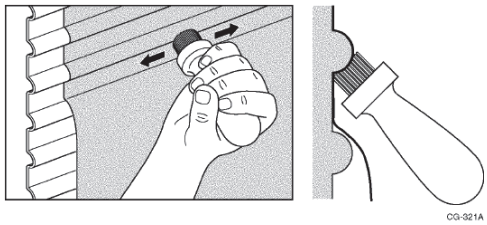
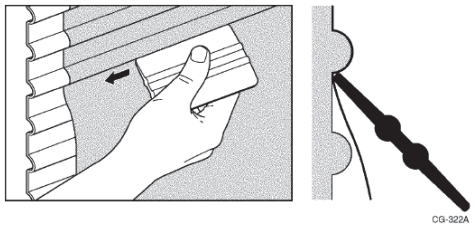


FIGURE 12

Bead Lower Valley



(2) Flat Areas

14. Apply the film to the flat area.

a. 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.

b. 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

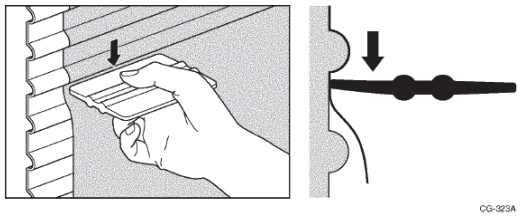
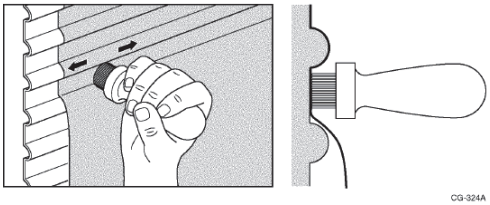


FIGURE 14

Use Rivet Brush to Adhere Film to Flat Areas



F. Finishing

Please review the Finishing section of 3M 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

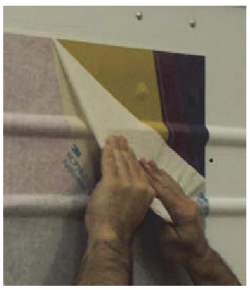
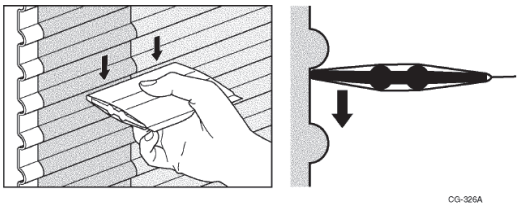


FIGURE 16

Re-squeegee Seams



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 3M Instruction Bulletin 5.5.

FIGURE 17

Re-bead Upper and Lower Valleys

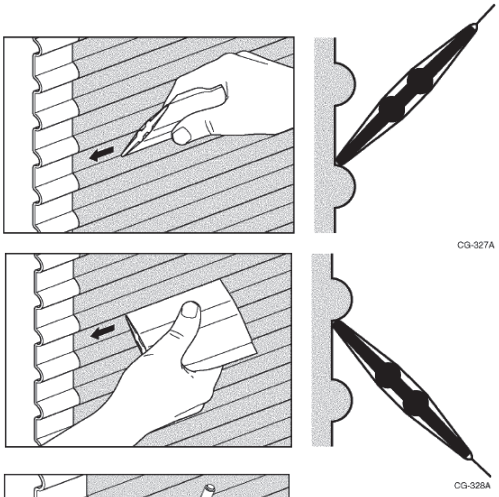
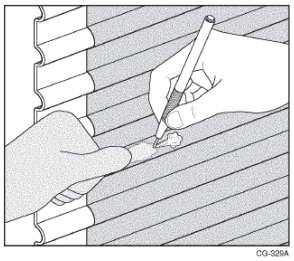


FIGURE 18

Remove Air Trapped in Valleys



G. 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 3M 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

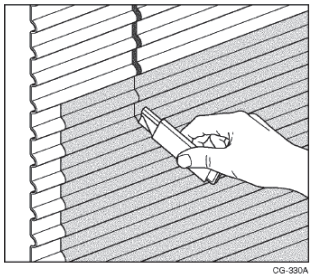
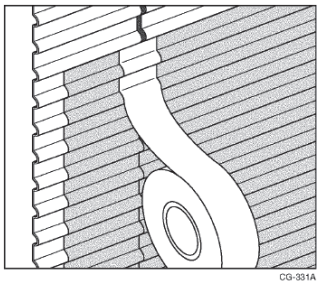


FIGURE 20
Taping Slit Body Seams



3. Apply multi-panel graphics. Refer to FIGURE 21A to FIGURE21C.
   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

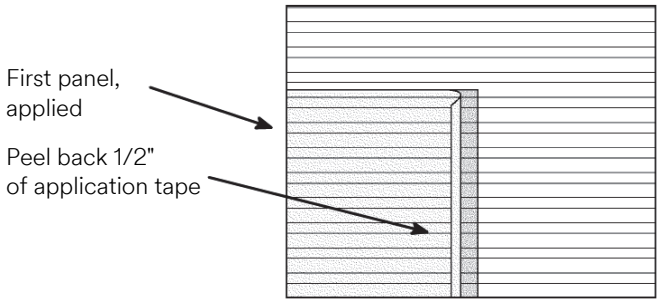


FIGURE 21B

Applying Multi-Panel Graphics, Second Panel

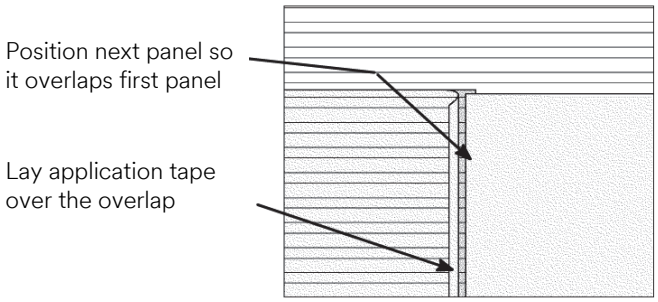
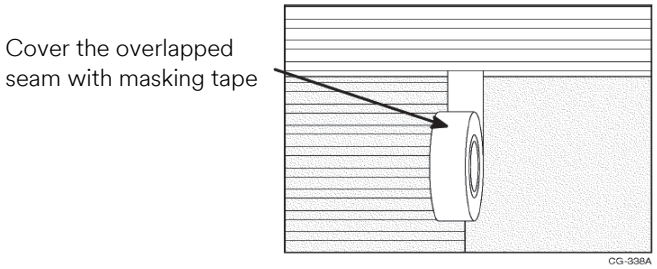


FIGURE 21C

Applying Multi-Panel Graphics, Covering Overlapped Seam

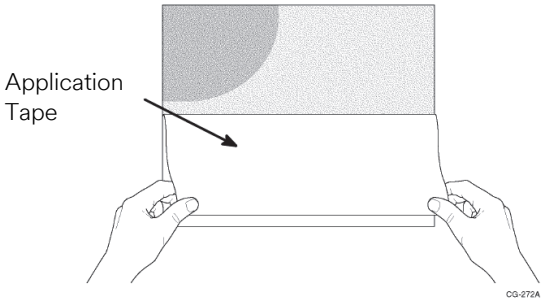


5. While the final paint coat is still tacky but not wet, remove the application tape by pulling it directly back on itself at a 180 degree angle. See FIGURE 22.

   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



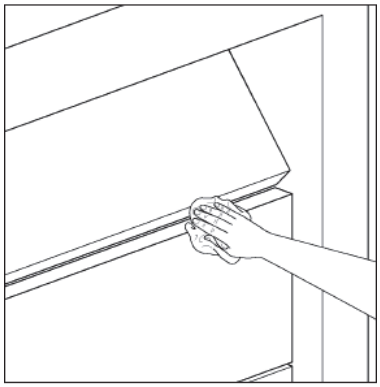
H. Roll-up Doors

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 3M Instruction Bulletin 5.1 for cleaning and surface preparation techniques.
3. Apply the film. See 3M Instruction Bulletin 5.5.
4. Remove the application tape.

FIGURE 23

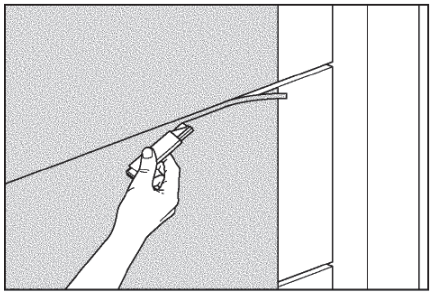
Cleaning the Door Fold Seams



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



I. Thermacube™ Trailers

Thermacube trailers have vertical corrugations. Refer to FIGURE 26.

1. Refer to 3M 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 10 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

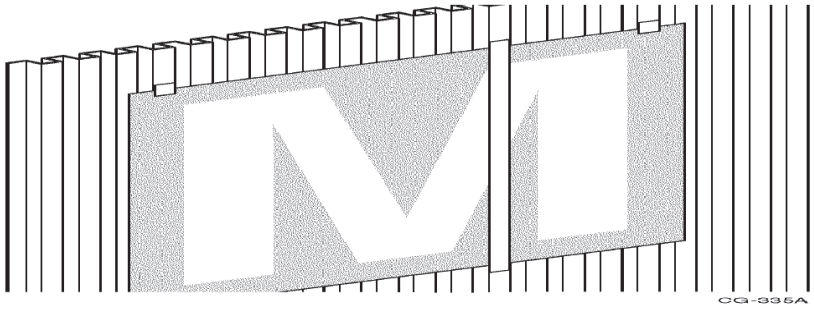
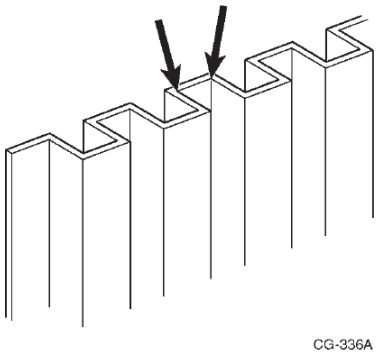


FIGURE 26

Thermacube Panel Cutting the Film in Recesses



J. Application Tapes for Digital Images

Do NOT use an application tape (premasking or prespacing) on film that has been laminated with glossy overlaminates. The adhesive can dull the surface of glossy overlaminates.

K. Application Temperature

In general do not apply graphics if the air or surface temperature is less than 40°F (4°C). Selected films may have a higher application temperature requirement: always check the film's Product Bulletin.

12. 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.

A. Limitation of Liability

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B. Additional Warranty Information

The 3M Graphics Warranties website at 3Mgraphics.com/warranties, along with the applicable 3M Product Bulletins, provide the details to any warranty offered for the 3M graphics products described in this bulletin.

13. Bulletin Change Summary

Black bars in the margin indicate a change or addition. Added a reference to Instruction Bulletin 5.47, 3M™ Paint Protection Film on 3M Vehicle Wraps. Updated descriptions of pressure-activated adhesive and working with air release channels. Added 3M's Envision™ Print Wrap Film as the most conformable film available. Added important new information in Section 10B regarding the Relative Stretching Capabilities of Common Wrap Film Graphic Constructions. The 3M Related Literature section has been replaced by direct links to the most current versions of Bulletins or warranty information you may need to successfully use this product. All links are blue underlined text.

3M Canada
PO Box 5757
London, ON N6A 4T1
1-800-265-1840
Fax 519-452-6245

3M México S.A. de C.V.
Av. Santa Fe No. 55
Col. Santa Fe, Del. Alvaro
Obregón México D.F. 01210
General 5255-5270-0400
Fax 5255-5270-2277

3M Puerto Rico, Inc.
350 Chardon Avenue
Suite 1100
San Juan, PR 00918
General 787-620-3000
Fax 787-620-3018

Commercial Solutions Division
3M Center, Building 220-12E-04
St. Paul, MN 55144

1-800-328-3908
3M.com/Graphics