General Information

- This Bulletin is specifically for the application of conformable reflective film.
- Be sure you obtain and use the most current supporting Product and Instruction Bulletins referenced in this Bulletin.
- Make sure each installer reads and understands this Bulletin before beginning.
- Follow each step in the order given, Do not take short cuts.

Quick Links

3M Graphics Warranties
Technical Information Selector
Safety Data Sheets (SDS)
Videos

Some of these links lead to web-based resources that are not product-specific.

IMPORTANT NOTE

Conformable reflective film must be post-heated after installation to prevent lifting. See “Use Heat in Post-Application” on page 6.

Do Not Apply Film to These Surfaces

- Low surface energy (LSE) plastics
- Weather stripping rubber
- Stainless Steel
- Textured plastic substrates. 3M does not warrant the application of film to textured plastic substrates under any circumstances. However, if you wish to try, using heat and a rivet brush to conform the film to the texture may be satisfactory for an unwarranted application.

Recommended Films

- 3M™ Scotchlite™ Print Wrap Film 780mC-10R
- Use the inks, printers and graphic protection recommended in the 3M Product Bulletin for the film you are using.

Understanding Reflective Films

Typical Retroreflective Properties

Reflective films use glass beads or cube corners to reflect light back directly to the source. The beaded reflective films typically use a very thin layer of aluminum located behind the glass bead (as shown in the diagram below). This causes the light to reflect back through the glass bead, returning to the light source. Damaging the aluminum layer (during handling and installation, etc.) will decrease the effectiveness of the retroreflective film.

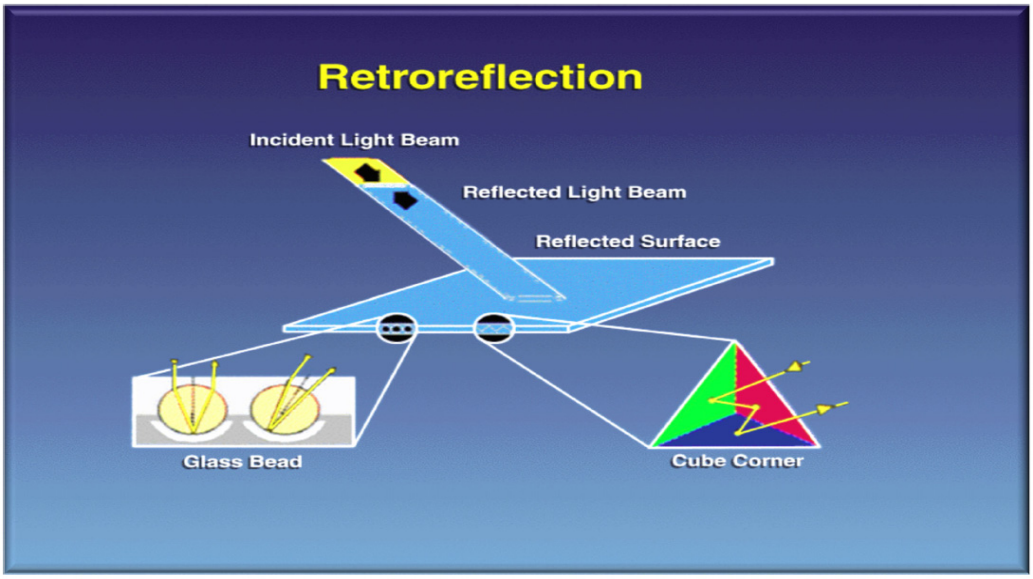


Figure 1. Retroreflective Image

Stretching

When applying beaded reflective films, the majority of visual defects are a direct result of damaging the thin aluminum layer, usually when stretching or manipulating the film. Therefore, extra care must be taken when handling and repositioning reflective film.

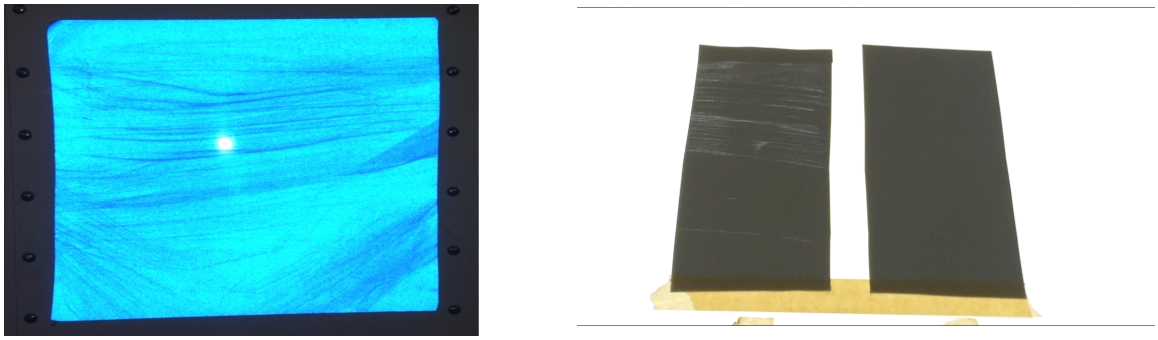


Figure 2. Bruising of Reflective Film Caused by Over Stretching

Conformable Reflective Properties

Typical beaded reflective films bruise easily when over stretching, or stretching in short increments. Conformable reflective films allow for more stretch and can be conformed around contours.

Heat Recovery - Bruising and Color Shift

In certain situations, using a heat gun to super-heat areas of minor bruising or color shift has proven to minimize or eliminate a defect caused by over stretching or stretching film in short increments.

Click on the videos below for more details.





Angularity

Conformable reflective films deliver higher retroreflective brightness than standard beaded reflective films when viewed at more extreme angles (greater than 45 degrees), which improves overall visibility.

Click on the video below for more details.



Smooth Release

Repositioning standard reflective film is difficult and can cause unwanted bruising and defects from pulling up or “snapping up” the film. Conformable reflective film is easier to reposition after applying to a substrate, provides a smooth release from the substrate compared to a “shocky” release and limits the amount of bruising that can happen during this process.

Click on the video below for more details.



About Film Memory

Film has a memory for its original shape. Consequently, stretching the film does result in some shrinkage as it attempts to return to its original dimensions. As it shrinks, you can expect minor tenting and lifting. Heating the film helps reduce its memory, which reduces tenting and lifting around sharp changes in contour. This is discussed more later in this Bulletin.

Effect of Ink on Film’s Ability to Stretch

Unprinted films have the least stretch and solvent printed films have the most stretch, although UV inkjet inks may also inhibit the stretchiness of the film. Also read about the effect of using application heat with UV inkjet inks. See “Soften Film with Heat” on page 6. Refer to the specific ink and film Product Bulletins for comments on special application techniques or limitations of use.

Adhesive Considerations

The recommended 3M films have pressure-activated adhesive that is slideable, positionable and repositionable until film application pressure is applied. 3M™ Comply™ adhesive, available on some of the films, has been proven to improve speed and ease of application with virtually no trapped air bubbles.

Application

Application Tools

These tools are recommended for a successful application. See 3M Quick Reference Guide Film Installation Tools for complete tool details.

- 3M™ Plastic Applicator (squeegee) PA-1*
- 3M™ Rivet Brush RBA-1* or RBA-3*
- 3M™ Air Release Tool 391X*
- 3M™ Vehicle Channel Applicator Tool VCAT-2* (See page 6 for information).
- 3M™ Roller S*
- 3M™ Roller L*
- 3M™ Tape Primer 94*
- 3M™ Edge Tape 8914*
- 3M™ Edge Sealer 3950*
- 3M™ IR-500 Infrared Thermometer*
- 3M™ Knifeless Tape
- Snap-off cutting knives or razor blades in safety holders
- Industrial heat gun, or the equivalent, that is capable of attaining at least 500 to 750 °F (260 to 399 °C)**
- Wrap Glove

*Available from 3M
** Higher temperatures are required for rough wall applications

Cleaning Products

This list of tools and cleaners is provided for your convenience; other acceptable cleaners may be available. 3M does not endorse any particular chemical manufacturer or supplier.

IMPORTANT NOTE

Avoid using tire conditioners as they may lead to film installation issues.

Non-Petroleum Based Cleaner

- 3M™ Citrus Base Industrial Cleaner*

Petroleum Distillate-based Cleaners

- 3M™ Adhesive Cleaner and Wax Remover 8984*
- DuPont Prep-Sol™ Solvent Cleaner 3919S**
- Sherwin Williams R7K156 Sher-Will-Clean™**
- Sherwin Williams R7K158 Sher-Will-Clean™**

* Available from 3M Commercial Solutions Division

** Available from automobile supply houses handling DuPont or Sherwin Williams products

Final Cleaning Agent

- Isopropyl Alcohol and Water (70/30 mixture)

Surface Preparation

All substrates must be considered contaminated. Clean the substrate immediately before applying the film. Dust and other contaminants can collect quickly on the substrate and prevent the film from adhering properly. Even a freshly painted substrate can collect dust before graphics can be applied.

1. Use a solution of 1 ounce of a good quality liquid dish detergent per gallon of lukewarm water to thoroughly clean the application area. Rinse with water.
   - Avoid soaps or preparations that contain waxes, oils or lotions; some window cleaners contain waxes!
   - Be aware that the chemicals used in some automated washing equipment may prevent good film adhesion.
2. Dry the surface thoroughly with clean, lint-free paper towels. A heat gun may be used to apply moderate heat and accelerate the drying.
   - Moisture prevents the adhesive from adhering correctly, can cause bubbles, and can freeze in cold environments. Any moisture trapped beneath the graphic will cause the graphic to fail prematurely.
   - Moisture on the substrate results from:
     - Inadequate drying after cleaning, as well as from application solutions.
     - Condensation at low temperatures.
     - High humidity environments.
3. Wipe the surface again with a solvent-based cleaner. Refer to the list of cleaners, above. Be sure that the cleaner does not damage the application surface's paint.
   a. Saturate a clean paper towel with a solvent.
   b. Wipe with a lint-free paper towel before the solvent evaporates from the substrate. As the paper towel becomes dirty, discard it. A dirty towel will simply move the dirt around, rather than remove it.
   c. Make sure the substrate is completely dry. If necessary, use a heat gun to dry any retained solvents.
4. Wipe the surface again with isopropyl alcohol and water (70/30 mixture).
   a. Saturate a clean paper towel with the IPA/Water solution.
   b. Wipe with a lint-free paper towel before the solvent evaporates from the substrate. As the paper towel becomes dirty, discard it. A dirty towel will simply move the dirt around, rather than remove it.
   c. Make sure the substrate is completely dry. If necessary, use a heat gun to dry any retained solvents.
5. Using all of the instructions that follow in this Bulletin, apply the graphic immediately. Dust and contaminants prevent the adhesive from performing as expected.

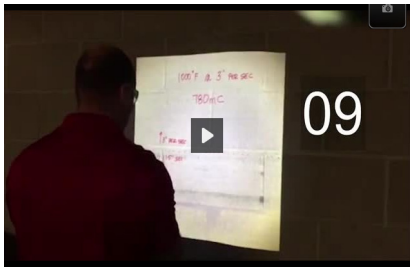
Best Application Temperature

For the best success with the films recommended for conformable reflective graphics, always apply the graphics when the air and application surface are both above 60 °F (16 °C) but no more than 90 °F (32 °C).

Textured Wall Application

Conformable reflective film can be applied to textured walls. See 3M Instruction Bulletin 5.37 for complete details.

Click on the video below to see conformable reflective film being applied a to textured wall.



How to Reduce or Avoid Film Lifting

Identify all areas on the substrate where the graphics may tend to lift such as in concave channels and edges that are under stress.

Use Primer

1. Use 3M™ Primer 94 to promote better film adhesion where the film will be stretched. Always allow the primer to dry for 5 minutes and then apply the film within 1 hour.
   - In concave channels, apply a thin layer of primer over most of the concave area.
   - When going around convex areas, apply a thin layer of primer at the outer edges of the curve to prevent film edge lifting.
   - Using Primer 94 along cut edges will also ensure that edge lifting does not occur along those edges.

See the video below for an example.



Flat Areas First

2. Apply the film to flat areas of the substrate first.

Soften Film with Heat

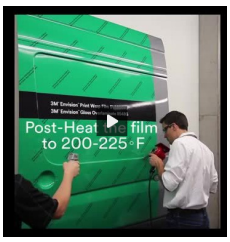
3. Use heat to soften the film when stretching it around and into complex curves.
   a. Warm film until it is pliable and gently begin stretching and conforming around and into contours. Cold stretching is preferred when possible.
   b. Film cools within seconds so gently stretch the film immediately after the heat source is removed. The film should be too hot to touch with unprotected hands; be sure to wear wrap gloves.
   c. To apply film into concave channels, use wrap gloves or use a soft edged squeegee. Press the heated and softened film into the middle of the channel first so that the film is stretched evenly across the channel.

Use Heat in Post-Application

4. After the film has been applied, apply heat to the graphic to reduce the internal stress in the vinyl film.
   a. Adjust the heat source so that the film temperature is too hot to touch—about 200 °F (94 °C).
   b. Move the heat source slowly across the stretched film surface.

Stretching in Deep Channels

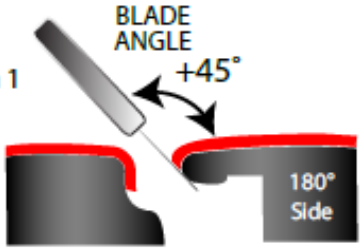
5. Cutting the film in deep channels relieves the inherent stress of the applied film. This technique is used with films for longer term applications. Due to the density of reflective films, sprinter channels should be relief cut rather than heated and stretched into the channels. In general, cutting is not necessary if the previous application techniques have been followed unless the film is expected to lift in the high stress areas. See the video below.



Recommended Cutting Best Practices

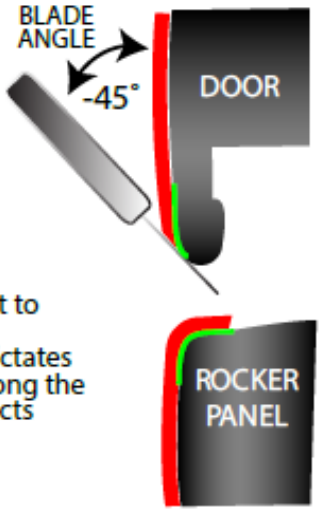
Film Layer — 3M Primer 94™

Diagram 1



*Typical +45° edge cut for standard wrap films.

Diagram 2



*Reflective films are typically 9 mil+ thick which is nearly 3x as thick as standard wrap films. Thicker films present lifting challenges that require slightly different approaches to cutting and tucking in wrap applications. Typical knife angles are +45° along 180° pinch welds (Diagram 1) in an effort to keep just enough film around the edge to conceal paint. With thinner films this is okay, but with conformable reflective films, the film thickness dictates that we modify the angle to -45° so as to place a slight bevel (Diagram 3) along the edge of the film which will minimize the likelihood of lifting caused by objects grabbing that edge and lifting it.
If you are tucking/rolling film around 180° pinch welds, (Diagram 5) you need to cut corners as a 45° angle prior to rolling the film around the edge. *Use Primer 94 along inside edge (Diagram 6).

Change blades frequently !

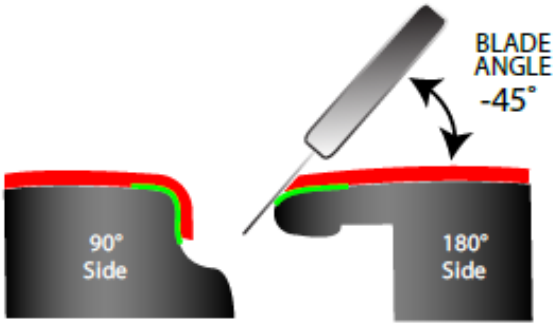


Diagram 3

GOOD

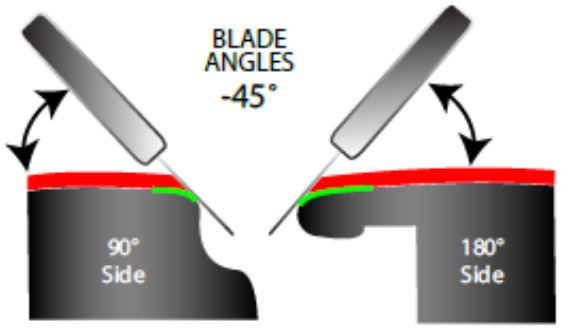


Diagram 4

BEST

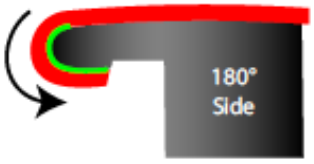


Diagram 5

Not Recommended

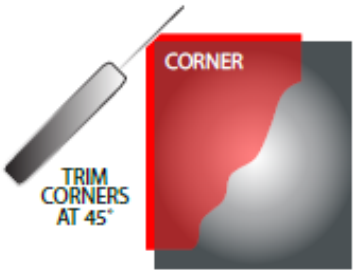
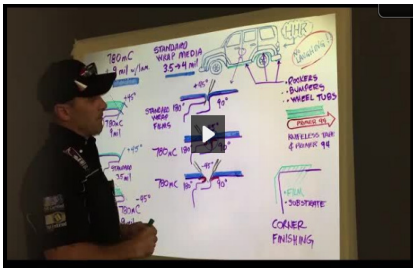


Diagram 6

*If 180° edges are tucked, cut corners at a 45° angle prior to tucking the film around the edge.

Click the video below for more details.



Removal

Refer to the film's Product Bulletin for information on its removability, and 3M Instruction Bulletin 6.5 for additional details on film removal.

Health and Safety

CAUTION

When handling any chemical products, read the manufacturer's 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 manufacturer's instructions for safe operation.

CAUTION

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.

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 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 regulatory exemption. Check with your State environmental authorities to determine whether use of this solution may be restricted or prohibited.

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.

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