# Storage, Handling, Maintenance and Removal of Films and Sheetings

Instruction Bulletin 6.5
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## 2. Overview

This bulletin gives you basic procedures for storing, handling, maintaining, and removing films manufactured or sold by 3M Commercial Solutions Division. These procedures help maximize the life of the graphic. Refer also to the Product Bulletins for each product in your graphic construction for specific details that may influence the information in this Bulletin.
DO NOT use these procedures for 3M flexible substrates. Refer instead to Instruction Bulletin 6.1.

## 3. Definitions

### A. Substrate

The material to which a graphic is applied, such as painted metal or wallboard.

### B. Surface

The typography or physical characteristics of the substrate, such as flat, textured or corrugated.

### C. Film

Refers to both film and sheeting.

## 4. Health and Safety

- When handling any chemical products, read the manufacturer's container labels and the Safety Data Sheets (SDS) for important health, safety and environmental information.
- Follow the link to obtain SDS sheets for 3M products on 3M.com/SDS.
- Follow the link to obtain information about substances of very high concern (SVHC).
- When using any equipment, always follow the manufacturers' instructions for safe operation.

## 5. Storage

These values are typical. Refer to your film's Product Bulletin for specific information.

### A. Unapplied Graphics

- Clean dry area.
- Away from direct sunlight, excessive atmospheric moisture or humidity.
- Ambient temperatures less than 38°C and a relative humidity less than 80%.
- Apply graphics to a substrate within the time period specified in the Product Bulletin of the product(s) you are using.

### B. Rolls

- Store horizontally in the shipping carton, with the end caps in place, and covered with the original plastic.
- Rolls that have been removed from the carton can be suspended horizontally from a rod or pipe placed through the core.

### C. Cut Sheets

- Store cut sheets lying flat.
- Do not stack cut sheets face-to-face.
- Do not apply pressure to stacks of cut sheets.
- Wrap stacks of cut sheets with polyethylene film and seal with tape to prevent moisture absorption by the liner, which can cause the sheets to curl or ripple.

### D. Fabricated Sheets: Most Screen Printed

Note: Refer to your base film's Product Bulletin to check for any unique details.

- Store and ship sheets lying flat or rolled onto a core
  - For rolling screen printed graphics, use a core with a diameter of 150 mm.
  - For rolling electronically imaged graphics, use a core with a diameter of 150 mm or larger.
  - Wrap the graphic onto the core, graphics-side out. This helps prevent graphics or premask tape from popping off the liner.
- Do not stack cut sheets face-to-face.
- The final color and/or overprint clear must be completely dry before packaging.

**E. 3M™ Scotchlite™ Films 680CR or IJ680CR (all variations)**

When 3M™ Scotchlite™ Reflective Graphic Films 680CR or IJ680CR are used for cut graphics and 3M™ Prespacing Tape SCPS-55 is applied, store and ship graphics lying flat, only.

**F. Applied Graphics: On Panels, Sheet Metal, Plastic Sheet, etc.**

- If the substrate has been printed or decorated on two sides, protect each side with the liner paper.
- Large graphics should also be padded to reduce the risk of damage.
- Store applied panels on edge.
- Avoid banding, crating or stacking, and corrugated cardboard dividers, all of which put severe pressure on applied graphics.
- Store indoors and keep dry until ready to use. If the packaged graphics become wet, remove the slip sheeting and padding immediately, lay the graphics flat, and allow to dry. Repackage using new, dry materials.

## 6. Handling

Applied graphics must be handled carefully during shipment and installation to prevent damage to the face of the graphic.

**A. Remove Premask Tape Before Exposing Graphic to Sunlight**

Always remove any premask or application tape from the graphic immediately after application. Premask tape left on the graphic after application can quickly and permanently adhere to the graphic when exposed to sunlight.

**B. Temporarily Covering Installed Graphics**

If it is necessary to temporarily cover installed graphics, which is sometimes called “bagging", use caution to avoid damaging the graphics.

- You may use:
  - Porous cloth covers that are folded over the graphic edges and secured to the back of the graphic work well for one-sided graphics.
  - If porous cloth covers are used for two-sided graphics, secure the cloths to one another, not to the graphic.
  - Any 3M graphic film that includes the word “Ultra Removable" in its product name may be temporarily applied over other 3M products with ultimate adhesion of medium to high values, see Removal Table for details. Careful removal of the Ultra Removable films are important. Try to avoid peeling the edges of the applied graphics during removal. Peel at a high angle to avoid peeling edges and pulling the applied graphics from the substrate. Resqueegee all edges.

Note: DO NOT bag any graphic applied to 3M flexible substrates.

- Avoid using:
  - Any type of tape, which can quickly and permanently bond to the graphic.
  - Paper or plastic covers, due to possible plasticizer migration.
  - Ropes or wire fasteners, which may abrade the graphic.

## 7. Maintenance

**A. Graphics with a Screen Print Clear or Overlaminate**

Use a cleaner designed for high-quality painted surfaces. The cleaner must be wet, non-abrasive, without strong solvents, and have a pH value between 3 and 11 (neither strongly acidic nor strongly alkaline).

**B. Digitally-Printed Graphics with a Clear Coat**

Use a wet, non-abrasive solution that contains NO solvents and NO alcohol and has a pH value between 3 and 11 (neither strongly acidic nor strongly alkaline).

**C. Power Washing Graphics**

Power washing, or pressure washing, may be used. However, aggressive washing can damage the graphic.

Excessive pressure during power washing can damage the graphic by forcing water underneath the graphic. Water lessens the adhesion of the graphic to the substrate allowing the graphic to lift or curl. These problems are

magnified by wind. Avoid pressure washing perforated window graphic films without edge sealing tape.

To avoid edge lifting or other damage to the graphics, follow these important steps:

- Use a spray nozzle with a minimum 40 degree wide spray pattern.
- Be sure the spray nozzle includes a nozzle protector (tip guard).
- Use a maximum pressure of 80 bar.
- If the system is heated, limit the water temperature to 60°C or less.
- Hold nozzle at least 30 cm away from and perpendicular (90 degrees +/- 10) to the graphic or a minimum of 100 cm away from the graphic at a 30° angle, or higher.
- Do not direct the water stream between 0° - 60° to the edge of the graphic.

Loose graphics could tear away from a moving vehicle or from a building and cause an obstruction to motorists and pedestrians. After washing, check all the graphics carefully for edge lifting and repair, remove or replace damaged graphics.

To reduce the risk of serious injury from high pressure spray:

- Do not place your hand or body near the nozzle or the spray.
- Do not direct the spray toward anyone else.

**D. Automatic brush washing may be used, but keep these two points in mind:**

- Brushes can catch a loose edge of the graphic and cause further damage to the graphic.
- Brushes can dull the finish of the graphic.

**E. Hand Washing Exterior Graphics**

1. Flush the graphic with clean water to remove loose dirt particles. A trigger-type hose nozzle is convenient for this purpose.
2. Use a mild liquid detergent and water solution and wash the graphic with a soft brush, rag or sponge.

- Wash thoroughly from the top down.
- Avoid abrading the graphic by unnecessary scrubbing.
- After applying the cleaning solution, keep a steady stream of water flowing on the graphic to wash away dirt particles.

3. Rinse the entire graphic thoroughly with clean water. Allow to dry naturally.

**F. Hand Washing Interior Graphics**

1. Use a mild liquid detergent and water solution and wash the graphic with a soft brush, rag, or sponge.

- Wash thoroughly from the top down.
- Avoid abrading the graphic by unnecessary scrubbing.

2. Wipe the graphic with a water-soaked brush, rag or sponge to wash away the detergent and dirt.
3. Dry the graphic with clean toweling.
4. Refer to Removing Difficult Contaminants, below, if necessary.

**G. Caring for Matte, Textured or Other Unique Film Finishes**

Special care must be taken to avoid abrading or scratching the film. Scratching and abrasion marks may be visible and you may not be able to work them out of the unique finish of the film. To help avoid such damage, avoid using harsh chemicals, brushes or hard scrubbing when cleaning your vehicle, and avoid parking near shrubs and trees or any other items that could scratch the film.

Clean as directed in Step 7.A., above. Rinse thoroughly after cleaning and dry with a clean, soft cloth or soft rubber squeegee to avoid water spots.

Do not apply waxes, polishes, paint or clear coat over these films.

If there is wax and wax residue on the film, remove with an all-purpose cleaner. To help restore the finish of the film, clean it with isopropyl alcohol and water (2:1 ratio).

**H. Removing Difficult Contaminants**

Some contaminants may remain after following the normal cleaning procedures. Most contaminants can be removed using one of these methods. Other cleaning products and methods should be used only on a customer test-and-approve basis.

1. To remove tar, oil, diesel smut or bituminous material:

- Wipe with 3M™ Citrus Base Cleaner or a rag dampened with kerosene, mineral spirits, heptane, or VM&P naphtha. Do not use other solvents.

2. To remove pollen and fungus:

- Wash the graphic with 3M™ Marine Mildew Stain Remover (PN 09067), a 3 to 5% sodium hypochlorite (full-strength household bleach) solution, or mild liquid detergent and water.
- Rinse with clean water immediately.

3. To protect the graphic from pollen and fungus, apply 3M™ Marine Mildew Stain Remover as a part of regular maintenance:

- Remove any existing mildew stains. Clean and dry the surface. Using 3M™ Marine Mildew Block (PN 09065), spray surface and gently wipe to ensure a uniform coating over the graphic, including the edges. Ensure a uniform coating without leaving droplets, streaks, or puddles. Remove any over-spray with a damp cloth, and allow to dry (typically for one hour). Repeat after cleaning*.

*Use of some cleaners can remove the protective coating and reduce the length of graphic protection. To maintain protection, simply re-apply this product after cleaning.

4. To remove crayon, lipstick, or similar materials:

- Select an appropriate solvent and test it in an inconspicuous area to ensure it removes the contaminant without damaging the graphic. This must be done on a customer test and approve basis.
- Wash immediately with mild liquid detergent and water, then rinse with clean water.

**I. Graphic Repair**

Once the graphic has been exposed to outdoor weathering, it is not possible to repair to the original state. Repair is possible if color and/or gloss is not relevant. For vehicle wraps it is recommended to replace total components or replace the full wrap.
Sometimes graphic damage can be repaired, but visible differences will most likely occur. However, repaired graphics are not warranted. These procedures are for information only.

**(1) Damage to Face of Graphic**

1. Trim and clean loose areas of film before patching.
2. The color or gloss of the new film is different due to weathering of the original material.
3. Cut the patches so they overlap all sides of the damaged area by at least 6.4 mm.
4. Position the patch over the damaged area.
5. Hold the patch in place at the top with a strip of Scotch™ Masking Tape.
6. Remove the film's liner.
7. Squeegee the film firmly into place using a plastic applicator.
8. Use a heat gun to heat all edges of the patch, and then re-squeegee all edges.
9. If using films with a metallic flake (i.e. 1080-SP10), make sure the patch piece is applied in the same direction as the original piece. This may require the film to be applied outside.

**(2) Edge Damage**

1. Trim loose edges back to the point where the adhesive is firmly adhered to the substrate.
2. Edge repair can be done with edge sealer or preferably with edge sealing tape. Apply an edge sealing tape that matches the gloss level of the existing graphics.

## 8. Removal Factors

The terms ultra removable, removable with heat, removable with heat and/or chemicals and not intended for removal indicate how easy or difficult it is to remove the film from smooth, flat surfaces, and how much adhesive remains on the substrate.

For the best results, ultra removable and removable with heat films should be removed within the time period specified in the film's Product Bulletin. Removable with heat and/or chemicals films can be removed with varying degrees of difficulty and success at almost any time. Results will vary when removing any graphic from non-flat, non-smooth surfaces. Not intended for removal films are not designed to be removed. In some cases they can be removed, but with great difficulty and likely damage to the substrate.

Warranted removal for fleet applications as part of the 3M™ MCS™ Warranty depend upon: (A) substrates that were in good condition at the time of the application, (B) use of 3M's recommended removal methods, and (C) notification to 3M no later than five business days after the attempted removal so that 3M may assist in or verify the removal method.

Example of Adhesive Characteristics Table, see product bulletin for details of the product mentioned below.

| 3M™ Wrap Film Series 2080-X | | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|---|
| Installation Characteristics | Challenging/High Skill | | | | | ■ | Easy/Low Skill |
| 24-hour adhesion | Low | | | ■ | | | High |
| Long term adhesion | Low | | | | ■ | | High |
| Removability | Not Designed for Easy Removal | | | | ■ | | Designed for Easy Removal |

Follow the link for complete details about the criteria above and a comparison of all 3M films

### Removal Table

This table describes the removal of 3M films with various adhesives. Refer to the product bulletins for specific details on adhesive types.

| Removal Category | Ultra Removable | Removable with Heat | Removable with Heat and/or Chemicals | Not Removable |
|---|---|---|---|---|
| **Product Bulletin Lifecycle Rating** | **5** | **4/3** | **2** | **1** |
| **Ease of Removal (assume overlaminate is used)** | Best | Better | Good | Difficult |
| **Removal information** | These films can be removed without any aids such as heat and chemicals without leaving adhesiveresidue. | These films can be removed with the aid of heat. Expectation is little to no adhesive residue but in some conditions it could be up to 10%. | These films can be removed with the aid of heat and/or chemicals. These films may leave more than 30% adhesive residue. | These films are not intended to be removed. In some cases they can be removed, but with great difficulty and could damage the substrate. If they are removed, they may leave significant adhesive residue. |
| **Warranted removal*** | In some conditions it could be up to 5% adhesive residue. | In some conditions it could be up to 10% adhesive residue. | Not Warranted | Not Warranted |
| **Ultimate Adhesion Strength** | Low | Medium | Medium/High | High |
| **Primary Method of Removal** | No Heat | Heat | Heat and Chemicals | Heat and Chemicals |
| **Secondary Method(s) of Removal** | Heat | Heat and Chemicals | Chemicals or Mechanical | Mechanical |
| **Typical amount of adhesive left behind**** | None | None/Minimal | Medium/High | High |
| **Primary Pull-off Angles** | High | High | Low | Low |

*3M warrants the expectations of adhesive residue left on a substrate. In some instances, there may be more adhesive residue than expected. If adhesive residue is higher than the percent indicated, a claim can be filed. 3M does not warrant ease or speed of removal for any graphic films.

**Based on OEM vehicle paint within warranted period

The ease with which a graphic can be removed depends on nine primary factors, listed below. Any one of these factors can significantly affect the speed and ease of removal. Different combinations of factors cause different results. For example, if one of two identical graphics is exposed to more UV light than the other (Factor H., page 8) over the same period of time, the graphic exposed to the most UV light may be more difficult to remove. It is important to understand and assess each of these factors before estimating the time, labor and related costs for removal.

**A. Properties of the Film**

3M offers a variety of films to meet various end uses. Generally, these materials can be categorized into three physical types and four adhesive types.

**(1) Physical Types**

- Cast film
- Calendered film
- Reflective film

NOTE: Thicker ultra removable or removable films and films with an overlaminate are the easiest to remove since they will not break and tear under most conditions.

**(2) Adhesive Types**

There are four categories of adhesive: ultra removable, removable with heat, removable with heat and/or chemicals and not intended for removal. The descriptions assume the film is applied to a recommended and properly prepared sound substrate with a smooth surface. Any other substrate may give other results. Whether a film is removable is largely, but not exclusively, a function of the adhesive.

- Ultra-removable films can be removed without any aids, such as heat and chemicals, and without leaving adhesive residue.
- Removable with heat films can be removed with the aid of heat. The expectation is little to no adhesive residue, but in some conditions it could be up to 10%.
- Removable with heat and/or chemicals. These films may leave more than 30% adhesive residue.
- Not intended for removal films are not designed to be removed. In some cases they can be removed, but with great difficulty and likely damage to the substrate. If they are removed, they may leave significant adhesive residue.

**B. Type of Substrate and Surface**

- The type of substrate and surface to which a particular film is applied can affect both the initial adhesion and ultimate adhesion.
- Graphics applied to low surface energy substrates (i.e. plastics) are easier to remove than graphics applied to high surface energy substrates (i.e. glass or bare metal).
- Some substrates are not designed to have graphics removed and removal may damage the substrate. These substrates include unpainted wallboard and some flexible materials.
- Removal is not warranted from substrates that have coatings such as anti-reflection and scratch resistance, which may be damaged by film removal.
- Rough or sharp edges on a surface may initiate tears in the film which slows down the removal.

**C. Temperature**

Film becomes brittle in cold weather, causing it to break into small pieces during removal. For the best results, remove film when the temperature is above 10°C. Generally, the higher the temperature, the better the results. Applying heat will help with most removals, but use care not to damage the substrate with excessive heat. Letting the film to sit out exposed to the sun will heat the film up evenly which allows for a quick removal.

**D. Condition of the Substrate at Application**

Removing graphics from substrates that were not in good condition at the time of application may result in substrate damage. We recommend discussing any concerns with your customer if you suspect that damage will result.

- Slightly oxidized (not chalked), painted substrates actually develop a much higher adhesion than newly painted substrates. Such substrates have a texture similar to anodized, bare aluminum, which promotes

higher adhesion. Graphic removal may require more effort and is not covered by the fleet applications removal warranty.

- However, highly oxidized substrates, such as chalked paint, have poor adhesion and graphics may remove more easily.
- Painted substrates must be dried or cured per the paint manufacturer's recommendations. Graphics that were applied to freshly painted substrates, before the paint had sufficient time to cure, make removal difficult. This is not covered by the application's removal warranty. Substrate damage may also occur.

**E. Type and Amount of Ink**

The type and amount of ink used affects the elongation and tear characteristics of printed film. UV-cured inks tend to be harder and more durable than solvent inks. Thicker and/or more durable inks stretch less so that graphics tear more easily during removal.

**F. Type of Overlaminate or Clear**

Adding an overlaminate or clear (an ink) further affects the elongation and tear characteristics of a graphic. An overlaminated film is thicker and may be easier to remove than a clear coated graphic.

**G. Age of the Graphic**

Older graphics become brittle and their adhesion to the substrate increases with time. Both of these conditions make removal more difficult.

**H. Outdoor Exposure**

Exposure to higher temperatures and UV light (sunlight) affects removal. Prolonged exposure to these elements can make the film brittle, changing its tensile strength. This film may tear and break easily, making removal very slow and tedious.

**I. Cut, Torn and Damaged Film**

Film tears along any cuts or damage so it tends to pull off in small pieces rather than large ones. This makes removal very slow and tedious.

## 9. Removal Methods for Removable or Ultra Removable Films

Before starting to remove a graphic, read About Angle of Pull-off and Speed of Removal and About Using Heat Sources. These sections apply to all removal methods.

If you do not know the characteristics and history of the graphic, try the simplest removal techniques first. The techniques are listed in order from easiest (1) to most difficult (4), starting on page 10.

**A. About Angle of Pull-off and Speed of Removal**

The angle at which you pull off film is important. It depends on the film and may affect the amount of adhesive residue that remains on the substrate. Ultra removable and removable with heat films usually require a high angle, such as pulling the film back onto itself, such as for 3M™ Controltac™ Graphic Films. A low angle is recommended for 3M™ Scotchcal™ Perforated Window Graphic Films and removable 3M™ Scotchlite™ Reflective Films and Sheetings. Sometimes the pull-off angle affects the amount of adhesive residue. Experiment with the angle until you get the best removal results. See Figure 1.

The speed, or rate, at which you pull off the graphic can affect how much adhesive residue remains on the substrate. Some films can be pulled off quickly, or “snapped" off. Brittle films can sometimes be peeled off slowly.

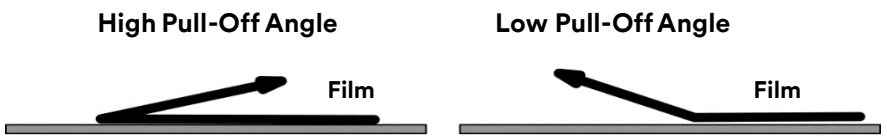


**Figure 1. Angle of Pull-Off**

**B. About Using Heat Sources**

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.

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.

Heating a graphic eases removal of almost any film, even films that can typically be removed without aids. Heat softens the adhesive, reducing the pull-off force needed. However, film printed with some UV inks become brittle when using heat unless moisture is also used.
The applicator/remover must determine the appropriate tools, techniques and safety precautions for each situation. For most situations, use a heat source that can raise the applied graphic temperature to 72°C to 93°C can be used. Exposure to the sun may be sufficient. Other sources include heat lamps, hot water, industrial heat guns, steamers, hand torches and weed burners.
Each tool has limitations. Heat sources that develop higher BTU can heat larger areas more quickly, but are less safe to use. They also may oxidize or burn painted areas around the graphic, and may emphasize any shadow that remains where the graphic was applied.
Use care not to scorch, burn or otherwise damage the film or substrate when using heat.

**(3) Heat Sources on Window Graphics**

Certain substrates require lower heat. They are:

- For acrylic or polycarbonate windows, heat the substrate only to 21°C to 38°C.
- For glass, heat is not required if the glass window panels are warmer than 16°C.

**(4) Glass Breakage**

Important Note

3M is not responsible for glass breakage due to the application or removal of film, or damage caused to a substrate due to incorrect removal techniques.

**C. Unaided Film Removal**

Ultra removable films can be removed without any aids within the time period specified in the film's Product Bulletin.

1. Use a razor, knife or air release tool to lift up a corner of the graphic.
2. Pull the graphic from the substrate. Ultra removable films usually require a high pull-off angle.
3. If the removal is done in cooler temperatures, heating the graphic and/or cutting it into 30 cm to 380 cm wide strips makes removal even easier. Be careful not to damage the substrate.

**D. Heat-aided Film Removal**

Removable with heat films usually come off with just the aid of heat within the time period specified in the film's Product Bulletin.

**NOTE:** Some substrates are heat sensitive. Composites bonded together with foam or adhesive may separate when heat is applied. Before using heat, check to make sure that heat will not damage the substrate.

1. Review the section, About Using Heat Sources, page 9.
2. Use a razor, knife or air release tool to lift up a corner of the graphic.
3. Pull the graphic from the substrate. Removable films usually require a low pull-off angle. Some films can be “snapped" off in sections.
4. Score the graphic into 30 cm to 38 cm wide strips to make removal easier. Be careful not to damage the substrate.

**E. Chemically-aided Film Removal**

Chemical aids may be needed for removable films if the film cannot be removed with heat alone. This may occur when the graphic has been exposed to excessive environmental conditions or has remained on the substrate longer than intended.

There are several chemical methods available, some of which require special precautions to use in a safe, environmentally-responsible manner. The user must obtain, read, and follow the SDS sheet for any chemical used.

Some chemicals may damage the substrate or its finish. Always test the chemical in a small, inconspicuous area, allowing the chemical to remain on the graphic for the recommended length of time. Remove the film and check for substrate damage.

**NOTE: 3M is not liable for damage caused to the substrate from chemical-aided removal.**

**(1) 3M™ Woodgrain & Stripe Remover System Part No. 08907 and 08908**

This remover system may be used on all 3M removable graphic films, except 3M™ Controltac™ Graphic Films with or without Comply™ Adhesive. 3M woodgrain and stripe remover system may not be as effective on graphics printed with UV inks.

1. Follow the manufacturer's safe handling instructions, including wearing appropriate protective equipment such as rubber gloves and safety goggles.
2. Mask around the graphic. This helps protect the substrate from damage.
3. Make a drip tray using wide masking tape that has been doubled over and adhered immediately below the graphic. This prevents residue from dripping around the graphic. See Figure 2 below.

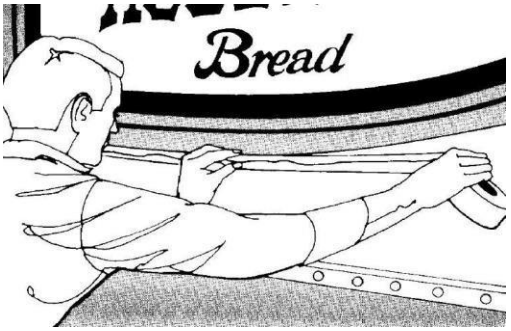

Figure 2. Making a Drip Tray

4. Spray the graphic lightly with the remover.
5. Cover the graphic with an absorbent material such as paper toweling.
6. Spray the remover onto the toweling until it is thoroughly wetted.
7. Cover the saturated toweling with polyethylene sheeting to retard evaporation, especially if it is warm or windy.
8. Allow the saturated toweling to remain in place for 3 to 4 minutes.
9. Carefully remove the toweling; most of the graphic will be removed with the paper.
10. Spray the remover on the adhesive residue.
11. Allow the remover to work for 3 to 5 minutes.
12. Scrape off the residue with a plastic applicator, cleaning of the tool regularly with toweling.
13. Continue applying the remover to the adhesive, waiting, and scraping, as needed.
14. Remove the masking tape.
15. Rinse the area thoroughly with clean water and dry.

**(2) CitriStrip Varnish Remover**

This method is intended for removing 3M™ Envision™ Wrap Film LX480mC. Ink, laminate and substrate may alter the effectiveness of this removal method.

NOTE: 3M is not liable for damage caused to the substrate from chemical-aided removal.

1. Follow the manufacturer's safe handling instructions, including wearing appropriate protective equipment such as gloves and eye protection.
2. Clean the graphic surface with mild detergent and water. Dry thoroughly.

3. Mask around areas or remove vehicle parts to reduce exposure of the chemical to unprotected areas such as headlights, chrome and plastic components, etc. This helps protect the substrate from damage.
4. Make a drip tray using wide masking tape that has been doubled over and adhered directly below the graphic. This prevents residue from dripping around the graphic. See FIGURE 2 above.
5. Working in small sections, thoroughly coat CitriStrip using a small nap paint roller. The chemical should cover the graphic. Areas not exposed to the chemical may be difficult to remove. For tough-to-reach areas use a paint brush to apply the chemical.
6. Wait 30 - 50 minutes, allowing the chemical to penetrate the film. You will notice the CitriStrip becoming chalky and the film beginning to swell. Leave it on for a longer time in cooler temperatures.
7. Test removability by grasping a corner of the graphic and pulling it from the surface at a low angle — less than 90 degrees. The film should come off with low to moderate force.

   If the film is still too brittle, apply a second coat, let dry, and repeat the removal test. A plastic applicator tool or rivet brush may be needed to remove thefilm.

   If the film removes easily, continue with Step7.
8. Remove any remaining adhesive residue with the CitriStrip or other citrus based adhesive removers. See Section 10.
9. Allow the adhesive remover to penetrate for 30 to 60 seconds.
10. Remove the adhesive with a plastic applicator or rivet brush. Wipe the loosened residue with a cloth saturated with adhesive remover. Repeat this procedure as needed.
11. Remove the drip tray and maskingtape.
12. Clean the entire surface with a solvent wipe and follow with a mild detergent and water wash.
13. Dry the surface.

**F. Mechanically-aided Film Removal**

**NOTE:** Damage to the substrate caused by mechanical removal of graphics is not covered by any 3M warranties.

Most mechanical removal techniques result in substrate damage. Tools such as scrapers, abrasive wheels and particle blasting devices are Difficult to control in a way that removes only the graphic. You may want to consider using these tools if the substrate will be repainted or refinished after graphic removal.

The following recommended tools are not suitable for graphics covering large areas. They work best on removing stripes, small letters or graphics or the outside edges from large graphics.

**(1) 3M™ Stripe Off Wheel**

The Stripe Off Wheel has a solid 12.7 cm thick wheel and is the best tool for removing the edges of a graphic. It does not scratch or damage acrylic enamel or urethane paint. It is designed to be used with common 7.6 cm pneumatic and electric tools with a 500 to 4000 RPM speed range. The optimum performance is 2000 +/- 200 RPM.

The Stripe Off Wheel is sold by 3M Automotive Aftermarket Products and Systems Division and is listed in their catalog.

- Part number 051131-07498: Stripe Off Wheel and 7.6 cm mandrel (5 per package)
- Part number 051131-07499: Stripe Off Wheel without the attachment hardware (5 per package)

**(2)3M™ Scotch-Brite™ Large Area Stripe Removal (LASR) Disc Assembly**

The LASR disc has stacked, solid wafer construction, 20.3 cm x 12.7 cm. It is designed to be used with the Black and Decker Buffmaster #6138, a variable speed buffer with a 1500 - 3000 RPM speed range. It has a larger contact area than the Stripe Off Wheel, so removal may take less time. This tool does not scratch or damage acrylic enamel or urethane paint.

The LASR disc is sold by 3M Automotive Aftermarket Products and Systems Division and is listed in their catalog.

- Part number 051131-07517: LASR disc assembly for 5/8 -11 shaft
- Part number 051131-07519: adapter for attaching a LASR disk assembly to a 5/8 - 11 external shaft

**G. Detergent/Water Solution for Films on Glass Surfaces**

This method is intended for vinyl products like glass decorative films that have been on glass surfaces and difficult to remove.

NOTE: Do not use heat sources or chemicals to remove films from glass.

1. Mix 2 tsp. of cleaning detergent with 1 liter of water in a spray container. Use a cleaning agent designed for high quality glass surfaces. The cleaning agent must be wet and non- abrasive with a pH value between 6 and 8 (neither strongly acidic nor strongly alkaline).
2. Wet down the film surface entirely with the detergent/water mixture making sure there is enough solution to penetrate the film surface.
3. Apply a plastic sheeting (i.e. bubble wrap or cling wrap) to the film surface.
4. Cover all the film surface making sure maximum there is maximum contact between plastic sheeting and film surface. This will allow the detergent/water to penetrate into the adhesive and not dry out the film.
5. Wait for minimum of 2 hours and maximum of 4 hours.
6. Remove plastic sheeting.
7. Start at edge and pull at low peel angles.
8. If the large sheet continues to be difficult to remove, try to cut the sheet into smaller sections with a razor blade. Make sure the razor blade is stainless steel to avoid cutting the glass surface.
9. Clean up the area.

## 10. Removing Adhesive Residue from the Substrate

Some adhesive residue may be left on the substrate after removing the film. Always read and follow the SDS sheet for the products you use.

**A. Products Used In Residue Removal**

- 3M™ Citrus Based Industrial Cleaner
- 3M™ Woodgrain and Stripe Adhesive Remover 08908
- 3M™ General Purpose Adhesive Cleaner 08984 (several sizes are available)
- ZEP® Big Orange - Liquid (Citrus Solvent Degreaser) - Test it in an inconspicuous area to ensure it removes the residue without damaging the graphic. This must be done on a customer test and approve basis.

**B. General Residue Removal Steps**

These steps may vary depending on the product you are using.

1. Read the manufacturer's instructions for the adhesive remover product. Use the product only as directed and only in a well-ventilated area.
2. Follow the manufacturer's safe handling instructions, including wearing appropriate protective equipment such as rubber gloves and safety goggles.
3. Test the remover by applying in an inconspicuous area to make certain that it does not damage the substrate.

4. Apply the remover as directed and allow the prescribed time for the chemical to penetrate the adhesive.
5. Remove the softened adhesive by scraping with a plastic applicator or rivet brush.
6. Pick up the loosened adhesive with a cloth saturated with the adhesive remover.
7. Repeat steps 4 through 6 as needed.
8. After the residue is removed, clean the entire surface with a solvent wipe and then wipe dry with clean toweling before the solvent evaporates.
9. Wash the entire substrate with a solution of detergent and water.
10. If you are applying a new graphic, dry the substrate thoroughly with a clean, lint-free towel.

## 11. Disposing of Removed Graphic Material

Adhesive or film removers, and solvent wipes or film wetted with the removers, should be incinerated in a permitted hazardous waste incinerator. Since regulations vary, consult the applicable regulations or authorities before disposal.

## Limited Remedy

Unsuitable End Uses

3M recommended product end uses are listed in each 3M graphics product bulletin. End uses not listed in the applicable 3M Graphics Product Bulletins are typically not eligible for 3M Graphics Warranties. For non-recommended and/or non-warranted end uses or applications, users must test and approve the end uses or applications, assume any associated risks, and acknowledge that 3M has no liability for such end uses or applications. Please contact your 3M representative with any questions about graphic applications, end uses, and warranties.

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3M Commercial Solutions products are not tested against automotive manufacturer specifications!



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