

Description

This bulletin details procedures for preparation, application, maintaining, and removing films manufactured or sold by 3M Commercial Solutions Division for the use in rail applications. 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.

Note: This document uses hyperlinks. Please follow the links for additional information.

Pre-Installation Inspection Record Requirement

3M requires that a properly-executed and signed [Pre-installation Inspection Record](#) be completed before any application to a railcar, using 3M™ Graphic Films. This record, which identifies any potential problem areas, is mandatory if a warranty claim is made in the future. Make a copy of the appropriate record, at the provided link, for each railcar. 3M recommends that graphics manufacturers clearly define mutual obligations between the railcar operating companies and themselves, and strongly suggests that graphics manufacturers seek written limitations of claims or liabilities on individual railcars for unsound paint, whether using warranted or unwarranted Products.

Substrate Requirements

To obtain a high-quality, long-lasting graphic, use the proper preparation and application techniques for each type of substrate. Films can be applied to most substrates that are:

In Good Condition

Substrates that were not in good condition at the time of application may result in substrate damage. 3M recommends discussing any concerns with the end customer if the possibility of damage is suspected. Some important considerations are listed below:

- Slightly oxidized painted substrates (not chalked) actually develop a much higher adhesion than newly painted substrates. Such substrates have a texture similar to anodized, bare aluminum, which promotes higher adhesion.
- 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 applied to freshly painted substrates, before the paint had sufficient time to cure, make removal difficult, and are not covered by the application's removal rate warranty. Substrate damage may also occur. Refer to the paint manufacturer's specification for drying and curing times. Note that these times can be affected by the temperature and humidity of the ambient environment.

Clean

All substrates must be considered contaminated and must be cleaned prior to application of film or sheeting, with the last cleaning step being done immediately before application. A freshly cleaned or painted substrate can quickly collect dust.

Note: Before application, clean all surfaces including, but not limited to, corners, edges, and recesses where dirt and debris can accumulate. Poor adhesion to unclean areas can cause the film to lift and fail prematurely. These areas are easily overlooked.

Dry

Any moisture trapped beneath the graphic can cause the graphic to fail prematurely. Moisture prevents the adhesive from adhering correctly, can cause bubbles, and can expand or freeze in cold environments.

Moisture results from:

- Inadequate drying after cleaning.
- Condensation at low temperatures.
- High-humidity environments.

It is impossible to keep the substrate dry if graphics are applied in high ambient humidity. Because of the difficulty in removing all of the moisture, wet application is not recommended on vehicles or non-flat surfaces. Moisture is also difficult to remove from beneath 3M™ Controltac™ Graphic Films and 3M™ Scotchlite™ Reflective Graphic Films, with or without Comply™ Adhesive.

Relatively Non-porous

Porous materials absorb moisture that affects the ability of the film or sheeting to adhere to the surface.

Smooth

It is more difficult for the adhesive to make good contact with textured surfaces rougher than 150 grit sandpaper. Refer to [3M™ Instruction Bulletin 5.5, General Procedures for Interior and Exterior Dry Applications](#), for application techniques specific to rough surfaces.

Adhesion Testing Procedure

Prior to installation of 3M™ graphic films, 3M recommends conducting an adhesion test to determine which film is best for the intended application. The 3M™ adhesion test kit is a tool that can also be used to determine if the substrate is sound and ready for graphic application.

General Cleaning Procedure

The general steps for cleaning a substrate in preparation for graphic film application are listed for your convenience. Refer to [Instruction Bulletin 5.1](#) for the recommended cleaning methods and specific steps needed to clean the substrate, as every step listed below may or may not be required. Improperly prepared substrates void any 3M™ warranty.

The following list of cleaners for each step are also provided for convenience; other acceptable cleaners may be available. 3M does not endorse any chemical manufacturer or supplier.

Note: See [Instruction Bulletin 5.1](#) for recommended cleaning methods on specific substrate types.

Test cleaners in an inconspicuous area before using. Some cleaners may dull the substrate or leave contaminants on it. Cleaners with low solvent content may not remove the type of contaminants you have. Clean the substrate immediately before applying film. Dust and other contaminants can collect quickly on the substrate and prevent the film from adhering properly. 3M™ does not warrant graphics applied to unclean surfaces.

Step 1: General Cleaning

1. Use detergent and water to clean the substrate.
 - For most surfaces, interior or exterior, wash the substrate with 30 ml of synthetic detergent per 3.8 liter of lukewarm water.
 - Avoid soaps or preparations that contain waxes, oils or lotions. Be aware that some window cleaners contain waxes.
 - Be aware that the chemicals used in some automated vehicle washing equipment may interfere with adhesion.
2. Dry the surface thoroughly with clean, lint-free toweling. A heat gun may be used to apply moderate heat and accelerate the drying.
 - Moisture prevents the proper adhesion, can cause bubbles, and can freeze in cold environments. Moisture trapped beneath the graphic is likely to cause premature failure.

Note: Moisture on the substrate can result from:

- Inadequate drying after cleaning as well as from application solutions, if used.
- Condensation at low temperatures.
- High humidity environments.
- Porous materials absorb moisture. Provide adequate time and conditions to dry.

Step 2: Solvent Cleaning

For substrates, where grease and/or oil is present on the substrate, wash the substrate with a solvent based cleaner/de-greaser to remove the oil/grease. Prepare the solution according to the manufacturer's written instructions. Grease and oils prevent the film from adhering properly. Test the solvent cleaner before application to be sure that the cleaner does not damage any finish on the railcar.

Note: Use a solvent-based cleaner to thoroughly remove any waxy residues.

1. Saturate a clean, lint-free towel with a solvent. See the list below for appropriate cleaners.
2. Wipe the surface with a lint-free paper towel before the solvent evaporates from the substrate. As the

paper towel becomes dirty, discard it. A dirty towel does not remove debris.

3. Make sure the substrate is completely dry. If necessary, use a heat gun to dry any retained moisture. The following list of cleaners is provided for the user's convenience; other acceptable cleaners may be available. 3M does not endorse any chemical manufacturer or supplier. Check with your local 3M representative for available cleaners in your region.

Cleaner with Low Solvent Content:

- 3M™ Surface Preparation System

Several other products are widely available from local building products stores.

Cleaners with Petroleum Distillate:

- 3M™ General Purpose Adhesive Cleaner*
 - 1 liter container, 08984
 - 1 liter bottle, 08986

* 3M™ Automotive Aftermarket Division

Step 3: Isopropyl Alcohol Cleaning

1. Saturate a clean paper towel with isopropyl alcohol (IPA).
 - If using industrial grade IPA, mix it in a ratio of 2 parts IPA to 1 part water.
 - If using 70% rubbing alcohol, do not dilute it.

Isopropyl alcohol evaporates quickly: the user must wipe the substrate dry before it evaporates. The evaporation rate increases in warm and/or windy environments.

2. Wipe the substrate with a lint-free paper towel before the IPA evaporates from the substrate. As the paper towel becomes dirty, discard it. A dirty towel does not remove dirt.
 3. Make sure the substrate is completely dry. If necessary, use a heat gun to dry out any retained moisture.
- Note: This should be the final step before applying graphics, as this will remove any residual left behind by the solvent-based cleaners.

Apply the graphic immediately. If dust, loose particles or debris appear on the substrate prior to installation, proceed to step 4. These types of contaminants prevent the adhesive from performing as expected.

Step 4: Dust and Dry Particle Cleaning

Use this method when the surface has no contamination other than dust or other loose particles or debris. Dust and loose particles may interfere with film adhesion.

Smooth Surfaces

Wipe down the entire surface with a clean 3M™ Scotch-Brite™ High Performance Cleaning Cloth. Follow the product directions for cleaning the cloth.

Rough or Textured Surfaces

- Vacuum the entire surface with a soft-bristled vacuum head to dislodge and remove any loose particles or dust (preferred method)
- Brush the entire surface with a soft-bristled broom to dislodge any loose particles or dust (alternate method)

Note: See [Instruction Bulletin 5.1](#) for recommended cleaning methods on specific substrate types.

Adhesion of 3M™ graphics can vary significantly based on the type of surface and adhesive used. Performing an adhesion test using the 3M™ Adhesion Test Kit can be helpful in selecting a film. Contact your local 3M™ Sales Representative for more information.

Application of 3M™ Graphics

3M™ Graphic Considerations

Windows

Do NOT apply graphic film to windows under these circumstances:

- The film in any way restricts the safe operation of emergency window exits
- When an operator's view is obstructed by the film and/or where local laws prohibit its use

- Windows with windshield wipers
- Windows that crank or roll down, have rubber moldings, or have window gaskets
- Windows that require an optically clear view, unless protected by 3M™ Scotchcal™ Optically Clear Overlamine 8914i

Plastic, Rubber, or Silicone Surfaces

Do NOT apply any graphic film to these substrates:

- Unpainted plastic substrates. 3M™ does not warrant the application of film to textured plastic substrates under any circumstances. However, using heat and a rivet brush to conform the Product to the texture may help to provide satisfactory adhesion for an unwarranted application.
- Rubber, silicone or flexible plastics. The adhesives on the recommended Products do not adhere to these materials.

Note: Never allow film or overlamine to touch the rubber window molding.

Application Temperature and Environment

Best Application Temperature

For the best success with films recommended for railcar graphics, always apply the graphics when the air and railcar surface are both above +16°C. See Product Bulletin for specific installation temperatures with intended Products.

Cool Application Conditions

When film is applied below the recommended minimum application temperature:

- It will cool too quickly, and not maintain the needed temperatures for uniform stretching.
- The initial adhesive bond may be insufficient to ensure the film remains adhered after application.
- Moisture may condense on the railcar surface at temperatures below the local dew point.
- In very humid conditions, it may be difficult to keep the substrate dry.

Very Warm Application Conditions

When the film is applied above the recommended maximum application temperature:

- Graphics may pre-adhere and trap air.
- The adhesive will be more aggressive.
- Controltac™-brand films may lose their positionability feature.
- The film may stretch.

Post-Application Conditions

To develop the best film bond, keep the surface temperature above +16°C for at least 12 hours before exposing the railcar to either a cold or wet climate. Subjecting the film to conditions outside of its specifications can cause premature graphic failure.

Application Tools

- 3M™ Plastic Applicator (squeegee) gold PA-1¹
- 3M™ Protection Buffer¹
- 3M™ Rivet Brush RBA-1¹ or RBA-3¹
- 3M™ Air Release Tool 391X¹
- 3M™ Roller L and Roller S¹
- Snap-off cutting knives or razor blades in safety holders
- Industrial heat gun, or infrared heater that is capable of maintaining at least +260°C
- Infrared thermometer
- Liner cutter
- 3M™ Primer 94 Adhesion Promoter
- 3M™ Edge-Sealer
- Scotch™ Masking Tape
- 3M™ Knifeless Tape
- Laser level

- Tape measure
- Wrap gloves
- Lint-free cloth or Scotch-Brite™ 2022

1: Available from 3M™ Commercial Solutions Division authorized distributors.

General Application Techniques and Standard Operating Procedures

For rail-specific installation techniques, see the [Standard Operating Procedures](#).

1. Use firm, even application pressure.
2. Use overlapping squeegee strokes to be sure you don't miss any areas. Firm, consistent pressure with an applicator tool must be applied over all parts of the graphic to bond the adhesive to the substrate. A missed area leaves bubbles in the applied film. These are areas where pre-mature film failures may occur.
3. Carefully cut the film at all seams in railcar body panels, being sure not to scratch the paint. Seams on railcars flex as the railcar moves. If they are not cut, the graphics will pull away from the seam, resulting in premature failure.
4. Strive for a bubble-free application. Although puncturing air bubbles improves the appearance of the graphic, it can contribute to premature graphic failure if the film is torn or cut rather than neatly punctured.
5. Re-squeegee all edges and overlaps to ensure good adhesion before releasing the railcar for use.

Overlapping Film

Environmental conditions (wind, rain, and blowing debris) stress the overlapped edges of graphics. Use careful planning for both vertical and horizontal film overlaps to reduce the stress and damage. Overlaps greater than 13 mm may contribute to edge lifting.

Vertical Film Overlaps

Vertical overlaps must face away from the front of the railcar. Apply the first piece of film at the rear of the railcar. Work to the front, overlapping each additional piece by 6 to 13 mm. Repeat for the opposite side, again beginning at the rear.

Horizontal Film Overlaps

Apply the lower piece of film first. Work toward the top, overlapping each subsequent piece by 6 to 13 mm.

Note: For railcars that travel in both directions along the track, horizontal seams are preferred.

Post-Heating

After the film has been applied, apply heat to the graphic to reduce the internal stress in the vinyl film, especially in areas where the graphic has been stretched.

1. Adjust the heat source so that the film temperature is at the film's recommended temperature. See Instruction Bulletin for specific post-heating temperatures with intended films.
2. Move the heat source slowly across the stretched film surface.

For best performance, press the stretched areas of film with 3M™ Roller S while the material is still hot. This helps fully wet-out the adhesive onto the substrate and reduces the risk of lifting after application.

Adhesion Promoters

The usage of adhesion promoters will increase the adhesion of the graphic film. It is considered an extra level of insurance to avoid film lifting. Repositionability and removability will be lost in areas where adhesion promoters are used. 3M offers different adhesion promoters to build higher adhesion to the substrate.

3M™ Tape Primer 94

- Can be used to improve the overall adhesion of tape, film and vinyl graphics to polyethylene, polypropylene, ABS, PET/PBT blends, concrete, wood, glass, metal, and painted metal surfaces
- May be applied with a brush, swab, pressurized flow gun, knurled roller, or similar type of equipment
- Can be removed with isopropyl alcohol (vigorous scrubbing may be required)

3M™ Adhesion Promoter 111

- Fast-acting
- Isopropyl alcohol-based solution designed to promote better and faster adhesion
- Works particularly well for adhesion to high surface energy substrates, such as bare metals and painted surfaces

3M™ VHB™ Tape Universal Primer UV

- Promotes adhesion to polypropylene, ABS, PET/PBT blends, and other difficult to stick to substrates
- Improved environmental, health, and safety profile compared to 3M™ Tape Primer 94
- UV indicator verifies primer application, reducing priming errors and increasing quality control
- Quick dry time speeds process and increases throughput
- Can be applied with brush, swab, felt-tipped dauber bottle applicator, knurled roller or similar type of equipment
- Cleans up with acetone

Edge Sealing

Edge sealing improves the resistance to environmental damage and enhances the durability of the graphics. In addition, it helps protect the graphic film from wind abrasion and rain. 3M recommends using one of these easy options on graphic edges:

- 3M™ Edge Sealer 3950
- 3M™ Edge Sealer 4150S
- 3M™ Edge Sealer ES2000
- 3M™ Edge-Sealing Tape 8914i

Note: Improper application may result in lifting. Apply the edge sealer consistently along the length of the exposed edge, and then allow the edge sealer to fully cure.

The edge sealer also increases the resistance to fluids at the graphic film edges.

Other edge sealers may be used on a customer test-and-approve basis. Some customers have had success using a clear coat of the paint system used on the railcar. Problems attributed to such test-and-approved materials are not covered by the 3M™ warranty. Always follow the manufacturer's recommendations on usage.

3M recommends the following areas be edge-sealed:

- Leading edges of the graphic
- Edges where the graphic has been cut for doors, access panels, and similar items
- Any cut-out repair areas where the new film overlaps the original graphic

Note: For high-speed applications, 3M requires the use of an edge sealer for all exposed edges.

For further details please see 3M Customer Information [‘Edge Sealing Rail Applications’](#).

Option 1: Application of Edge Sealers and Edge Tape

See [Standard Operating Procedures](#) for instructions on application of edge sealers and edge tape.

Option 2: Apply Oversized Piece of Overlamine

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

1. Cut overlamine 8914i so it is at least 7 mm larger than the graphic and apply so it overlaps all edges of the perforated film.
2. Contact 3M for more details, if needed.

Special Considerations for Window Applications

Application Tapes

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

Application Temperature

- Do not apply window graphics if the air or surface temperature is less than +4°C.
- Do not use a heat gun or torch to heat the window: uneven heat could cause glass breakage.

Safety Guidelines for Applying Graphics on Emergency Exit Windows

The operator should confirm whether or not local regulations permit the applications of graphics to exit windows, and any guidelines or requirements relating to the installation of such graphics.

- Before applying film, open all emergency exit windows to determine exactly where graphics must be trimmed to ensure no interference with the operation of these windows.
- If an emergency window is non-functioning, it is your responsibility to alert the railcar maintenance personnel before proceeding.
- Always trim the Products 6 mm away from all rubber gaskets. Do not apply film over rubber gaskets.
- Do not allow any graphic film, whether applied to windows or railcar body, to overlap the opening of an emergency window exit.
- After graphic installation is completed, ensure that all emergency window exits are fully functional.

Sizing the Window

1. Measure the window opening and the graphic to make sure that it fits on the window. Apply the graphic and then cut away a margin of 6 mm all around the graphic. This eliminates the need for edge sealing on full window coverage.
2. Do NOT apply any film to any rubber gaskets or parts on the railcars. This minimizes the chance of the graphic lifting, or absorbing water that may collect in the window edge. It also eliminates the need for edge sealing on full window coverages.
3. Do NOT allow any film to overlap the openings for any emergency window exits, which can prevent the window from operating properly in an emergency.

Other Important Information

Refer to [Instruction Bulletin 5.5](#) for information regarding:

- Graphic placement
- Making film overlaps
- Registering the graphic
- Removing the adhesive's liner

Application sequences (specific to the graphic type in question)

Applying Perforated Window Graphic Film

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

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

Special Considerations for Applications over Existing Graphic

Except in interior wallboard applications, 3M™ graphic films (either a single layer of film, or a fabricated multi-layer construction) can be applied on top of one existing 3M™ graphic, as long as the application meets the requirements below.

Requirements

Condition of Bottom Graphic

The bottom graphic must be in good condition and well adhered to the substrate.

Size and Edge Gap

One of the following two statements must be true:

- The top graphic is larger than the bottom graphic, and it extends beyond the edge of the bottom graphic by at least 1.3 cm along the entire edge of the bottom graphic.
- The top graphic is smaller than the bottom graphic, and all its edges are at least 1.3 cm inside the edges of the bottom graphic.
 - Refer to [Instruction Bulletin 6.5](#) before removing part or all of an existing graphic.

Compatibility with Substrate Material

The bottom graphic must be recommended for application to the substrate.

If the top graphic is larger than the bottom graphic, the top graphic must also be recommended for application to the primary substrate.

Compatibility with Substrate Shape

The top and bottom graphic must both be recommended for application to the shape of the application surface (e.g., corrugated surfaces).

Warranty and Removal

Specific warranty details and limitations for each film is in its Product Bulletin. If the requirements above are not met, no finished graphic warranty will be honored.

Removal of only the top film in this type of application is not warranted unless:

- The top film is changeable, and
- The bottom film is removable with heat and/or chemicals, or is non-removable

Cleaning Procedure

Exterior Applications

- Method 1: General Cleaning; followed by Method 2: Solvent Cleaning; AND then, followed by Method 3: Isopropyl Alcohol Cleaning.

Interior Signage

- Method 1: General Cleaning AND then, followed by Method 3: Isopropyl Alcohol Cleaning

Painted Metal Surfaces Between Windows

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

Seaming Side-by-Side Panels

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

Quality Inspection of Graphic Films for Railcar

A quality inspection should be performed after the graphic installation is completed.

Use the [Quality Inspection Guidelines for Exteriors](#) as a reference for the level of acceptance required for installation of graphic films on railcars.

Inspection Conditions for Graphic Films / Inspection Environment

Inspect the film finished effect on the production site or inspection station. The site or station should meet the following conditions:

Unaided Eye

The visual inspection must be conducted with the naked eye, with visual corrections if necessary. The use of a magnifying glass is not allowed. If a defect is detected by the inspector, it shall be identified by applying a “defect” stamp in order to point out the defect.

Luminosity

Outdoor, cloudy, natural light or the artificial light source of appropriate brightness in the room similar to the above lighting conditions with a minimum of 400 lux.

Inspections shall be carried out, as far as possible, outdoor under daylight. If inspections have to be carried out indoors, luminosity of the surrounding area shall be, as near as possible, minimum 400 lux ± 20 measured at 2 m from the platform inspection spot.

Distance

A distance of 1 to 1.5 m from the platform inspection location.

Walking Speed and Height

Inspection shall be carried out at station platform height, walking along the aisle at continuous pace 1 m per second.

Allowed Measurement Equipment

Gloss and Color should be specified before final inspection with the use of gloss meter and colorimeter.

The final inspection must be conducted with the naked eye, with visual corrections if necessary. The use of a magnifying glass or other measuring tools should not be allowed.

Aesthetic Acceptance Criteria for Graphic Films — Exterior Surfaces Excluding Glass

Aesthetic acceptance criteria relevant to finished film-coated surfaces are listed below. This content details the minimum acceptable criteria as defined by 3M Commercial Solutions Division. Other criteria may be integrated if some difference is required by the contract; these variations should be described in a separate document written for the project by the engineering department.

3M™ Graphic Films Installation Completion Certificate

Installation Completion Certificate Requirements

The [Graphic Films Installation Completion Certificate](#) should be completed along with every graphic installation.

1. Complete the [Pre-Installation Inspection Record](#).
 - Carefully and thoroughly examine each railcar and record all potential problem areas prior to installing the graphics. 3M recommends washing the railcar so that potential problem areas are easily seen.
2. Complete a [Post-Installation Quality Inspection](#).
3. Make and distribute copies to all signing parties.
4. Maintain a file with the signed form and photographs.

Graphic Maintenance and Removal

Always refer to the film's Product Bulletin for information on its removability.

For complete details, we recommend reading [Instruction Bulletin 6.5](#) which contains details on cleaning a variety of graphic constructions, removal procedures, cleaning adhesive residue from the substrate and disposal of removed graphic material.

The following is a very brief overview:

Removal of short-term graphics with changeable adhesives leave little or no adhesive residue. These films will not damage a soundly painted surface or a previously applied 3M™ vinyl graphic unless the surface was corroded, rusted, blistered, scratched or previously damaged, or if it was damaged since the graphic application.

To remove a changeable film, grasp a corner of the graphic and peel it back at approximately a 120 degree angle. Any remaining adhesive can be removed with an adhesive cleaner such as 3M™ Citrus Base Industrial Cleaner.

Cleaning

Prior to cleaning the graphics, test cleaners in an inconspicuous area before using. Some cleaners may dull the substrate or leave contaminants on it. Cleaners with low solvent content may not remove the type of contaminants of concern.

Graphics with a Screen Print Clear Coat or Overlamine

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.)

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).

Power Washing or Automatic Brush Washing

Power washing or washing with an automatic brush may be used with caution. Aggressive washing can damage the graphic, and perforated window graphic film is especially susceptible to damage. It can also loosen graphics, which may become a hazard. 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.

Note: 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 for repair, remove or replace damaged graphics.

Removing Tar, Oil, Diesel Smut or Bituminous Material

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

Removing Graffiti

Graffiti can be removed from the surface 3M™ Anti-Graffiti Overlaminates using one of the 3M™ Graffiti Remover Systems listed below.

3M™ Graffiti Remover GR1500

Note: This product is designed for use on 3M™ Scotchgard™ Graphic and Surface Protection Film Series 8991, 8993, and 8995, as well as 3M™ Anti-Graffiti Overlaminates 8588G and 8590M.

1. Apply masking tape surrounding the graffiti, in order to avoid drip-through to the rest of the graphic film.
2. Apply 3M™ Graffiti Remover GR1500 using a soft brush, rag, or sponge. Ensure that the entire graffiti surface is covered.
3. Allow to dwell on the surface for 3 to 5 minutes.

4. Thoroughly wipe the surface with a damp rag, damp sponge, or damp cloth.
5. Rinse thoroughly with water, and dry the surface with a clean, dry rag or towel.

3M™ Graffiti Remover System

Note: This product is designed for use ONLY on 3M™ Scotchgard™ Graphic and Surface Protection Film Series 8991, 8993, and 8995.

1. Apply masking tape surrounding the graffiti, in order to avoid drip-through to the rest of the graphic film.
2. Apply 3M™ Graffiti Remover System using a soft brush, rag, or sponge. Ensure that the entire graffiti surface is covered.
3. Allow to dwell on the surface for 5 to 10 minutes.
4. Thoroughly wipe the surface with a damp rag, damp sponge, or damp cloth.
5. Rinse thoroughly with water, and dry the surface with a clean, dry rag or towel.

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 can be matched. When possible, 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.

For graphic repair procedure see the [Standard Operating Procedures](#).

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, with edge sealing tape. Apply an edge sealing tape that matches the gloss level of the existing graphics.

Removal

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 is likely to remain 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 railcar 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.

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 the characteristics and history of the graphic are not known, try the simplest removal techniques first.

Removal Considerations

Stretching the film results in some shrinkage as it attempts to return to its original dimensions. As it shrinks, some minor tenting and lifting occurs. Heating traditional film helps void its memory, which reduces tenting and lifting.

See Product Bulletins for more information about the specific Product used for the intended application.

About Angle of Pull-off and Speed of Removal

The angle at which film is pulled from the surface 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 the best removal results are achieved.

The speed, or rate, at which the graphic is pulled 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.

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° to +93°C. 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 temperature 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.

Adhesive Types

There are three categories of adhesive: changeable, removable and non-removable. The descriptions assume the film is applied to a recommended and properly prepared sound substrate with a smooth surface. Any other substrate may give different results. Whether a film is removable is largely, but not exclusively, a function of the adhesive.

- Changeable films can be removed without any aids such as heat or chemicals and without leaving adhesive residue.
- Some removable films can be removed with the aid of heat only. Others may require chemicals or accessories. These films leave less than 30% adhesive residue.
- Non-removable 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.

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 a flat surface are the easiest to remove. Surfaces with rivets are more difficult, and corrugated surfaces are usually even more difficult.
- 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.

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.

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. 3M recommends discussing any concerns with your customer if you suspect that damage will result.

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.

Type of Overlamine or Clear Coat

Adding an overlamine or clear coat (an ink) further affects the elongation and tear characteristics of a graphic. A laminated film is thicker and may be easier to remove.

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.

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.

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.

Films with ultra-removable adhesive are typically recommended for applications of less than one year. These films have lower adhesion, typically on the order of 0.4 kg/cm to 0.9 kg/cm peel-back adhesion, which allows the film to be removed easily without the aid of heat or chemicals and without adhesive residue. However, the lower adhesion may result in some lifting of film in areas where the film is highly stretched.

Heat Sources on Window Graphics

Certain substrates require lower heat. They are:

- For DuPont Lucite® SAR and GE Plastics Lexan® MRG windows, heat the substrate only to +21° to +38°C.
- For glass, heat is not required if the glass window panels are warmer than +16°C.

Glass Breakage

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.

Unaided Film Removal

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

- Use a razor, knife or air release tool to lift up a corner of the graphic.
- Pull the graphic from the substrate. Ultra removable films usually require a high pull-off angle.
- If the removal is done in cooler temperatures, heating the graphic and/or cutting it into 300 mm to 380 mm wide strips makes removal even easier. Be careful not to damage the substrate.

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 12.

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 300 to 380 mm wide strips to make removal easier. Be careful not to damage the substrate.

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 Safety Data Sheet (SDS) 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.

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.

Removing Adhesive Residue from the Substrate

Some adhesive residue may be left on the substrate after removing the film. Always read and follow the Safety Data Sheet (SDS) for the products used.

Products Used In Residue Removal

- 3M™ Citrus Based Industrial Cleaner
- 3M™ Woodgrain and Stripe Adhesive Remover 08908
- 3M™ General Purpose Adhesive Cleaner 08984

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.

Disposing of Removed Graphic Material

Dispose of contents/container in accordance with the local/regional/national/international regulations. Reclaim if feasible. If product can't be reclaimed, dispose of waste product in a sanitary landfill. Alternatively, incinerate the waste product in an industrial, commercial, or municipal incinerator.

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.

Air Quality Regulations

Local Volatile Organic Compound (VOC) regulations may prohibit the use of certain cleaning chemicals with VOC's in graphic arts coatings and printing operations. Check with local environmental authorities to determine whether use of any solutions may be restricted or prohibited.

Limited Remedy

Unsuitable End Uses

This bulletin provides technical information only. Before using, the user must determine the suitability of the product for its required or intended use, and the user assumes all risk and liability whatsoever in connection therewith. As outdoor graphics age, natural weathering occurs causing a gradual reduction in gloss, slight color changes, some lifting of the graphic at the edges or around rivets, and ultimately a minor amount of cracking. These changes are not evidence of product failure and are not covered by a 3M warranty.

Limitations of liability

All questions of warranty and liability relating to this product are governed by the terms and conditions of the sale, subject, where applicable, to the prevailing law.

Health and Safety

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

Follow the link to obtain Safety Data Sheets (SDS) for 3M products on [3M.com/SDS](https://www.3m.com/SDS).

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

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