



Select and Prepare Substrates for Graphic Application

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2. How to Use this Bulletin Effectively

The techniques described in this Bulletin are required when applying a 3M warranted graphic, but are also practical recommendations when using promotional materials for non-warranted graphics.

- How to select and prepare a substrate so that the 3M film or sheeting will adhere well.
- How to apply film or sheeting to specific types of substrates.
- Use this bulletin in conjunction with other applicable 3M Product and Instruction Bulletins for your graphic application. See Section 11. 3M Related Literature.
- Read **Substrate Requirements**, which helps you determine the general types of substrates that can be used. Refer to the film or sheeting Product Bulletin for specific substrate recommendations.
- Review the cleaning methods starting on page 3. All recommended substrates can be cleaned with one or more of these methods.
- Locate the type of substrate you plan to use and review the preparation and application techniques provided.

3. Health and Safety

A. MSDS



CAUTION

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

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

B. Air Quality Regulations

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

C. Ergonomics



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.

4. Substrate Requirements

To obtain a high-quality, long-lasting graphic, use the proper preparation and application techniques for each type of substrate.

Important Note!

Also read to [Instruction Bulletin 5.37](#), *A Guide to Understanding and Applying Graphics to Common Interior Wall Surfaces*, which contains important considerations and techniques.

Films can be applied to most substrates that are:

- **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.
 - *For wall applications:* Be sure to clean the edges under the ceiling and all corners. 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 freeze in cold environments.

Moisture results from:

 - Inadequate drying after cleaning.
 - Failure to pre-dry some substrates such as polycarbonate sheeting.
 - Condensation at low temperatures.
 - High humidity environments.

It is impossible to keep the substrate dry if there is condensation or high humidity. Because of the difficulty 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™ 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 [Instruction Bulletin 5.5](#), *General Procedures for Interior and Exterior Dry Applications*, for application techniques to rough surfaces.

5. Cleaning Methods

- Read *Health and Safety* on page 2 before continuing.
- The type of substrate determines which of the four basic cleaning methods to use.
- Improperly prepared substrates void any 3M warranty.
- 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.

Important Note!

Clean the substrate immediately before applying film. Dust and other contaminants can collect quickly on the substrate and prevent the film from adhering properly.

A. Method 1: General Cleaning

1. Use detergent and water to clean the substrate.
 - For most surfaces, interior or exterior: Wash the substrate with 1 ounce of synthetic detergent per gallon 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.
 - For interior walls where grease and/or oil is present on the substrate: Wash the substrate with a solution of trisodium phosphate (TSP) and lukewarm water. Prepare the solution according to the manufacturer's written instructions.
2. Dry thoroughly with clean, lint-free paper towels.

Note: Porous materials absorb moisture. Provide adequate time and conditions to dry.

B. Method 2: Solvent Cleaning

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

(1) Cleaners with Low Solvent Content

- 3M™ Prep Solvent *
 - 16 oz. (0.5 L) spray applicator, 08973
 - 1 gal. (3.8 L) container, 08983
- Several other products are available from your local building products store.

(2) Cleaners with Petroleum Distillate

- 3M™ General Purpose Adhesive Cleaner *
 - 1 qt. (0.95 L) container, 08984
 - 5 gal. (19 L) pail, 08986
 - 20 oz. (0.6 L) aerosol can, 08987
- DuPont Prep-Sol™ Solvent Cleaner 3919S **
- Sherwin Williams R7K156 or R7K158 Sher-Will-Clean™ **
- Xylol, lacquer thinner, or VM&P Naphtha ***

* 3M Automotive Aftermarket Division.

** Auto parts suppliers handling DuPont or Sherwin Williams products.

*** Look up "Solvents" in the Yellow Pages. If not available locally, small quantities can be mail-ordered from companies such as E. H. Sargent and Co. and Fisher Scientific.

(3) Cleaning Procedure

Clean the substrate immediately before applying film. Grease and oils prevent the film from adhering properly.

1. Saturate a clean paper towel with a solvent.
2. 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 does not remove dirt.
3. Make sure the substrate is completely dry. If necessary, use a heat gun to dry any retained moisture.
4. Apply the graphic immediately. Dust and contaminants prevent the adhesive from performing as expected.

C. Method 3: Isopropyl Alcohol Cleaning

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

1. Saturate a clean paper towel with isopropyl alcohol (IPA).
 - If you are using industrial grade IPA, mix it in a ratio of 2 parts IPA to 1 part water.
 - If you are using 70% rubbing alcohol, do not dilute it.
2. Wipe 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.
4. Apply the graphic immediately. Dust and contaminants prevent the adhesive from performing as expected.

D. Method 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.

(1) Smooth Surfaces

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

(2) Rough or Textured Surfaces

- **Preferred Method:** Vacuum the entire surface with a soft-bristled vacuum head to dislodge and remove any loose particles or dust.
- **Alternate Method:** Sweep the entire surface with a soft-bristled broom to dislodge any loose particles or dust.

6. Substrate Cleaning and Application Tips

Methods for cleaning start on page 3.

When given more than one option, read the descriptions for each method and select the most appropriate for your circumstances.

7. 3M Graphics: Application over Existing Graphic

Except in interior wallboard applications, you can apply one 3M graphic (which could be a single layer of film or a fabricated multi-layer construction) on top of one existing new or old 3M graphic as long as the application meets the requirements below.

A. Requirements

(1) Condition of Bottom Graphic

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

(2) 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 1/2 inch (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 1/2 inch (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.

(3) 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.

(4) **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).

(5) **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 permanent.

(6) **Cleaning Procedure**

Clean the surface.

Fleet applications:

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

Signs:

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

B. Building Materials

(1) **Exterior Brick**

1. Prepare a muriatic acid solution according to the manufacturer's instructions. Muriatic acid can be found in most home improvement stores.
2. When using muriatic acid, follow the manufacturer's safe handling instructions, including wearing appropriate protective equipment such as rubber gloves and safety goggles.

(2) **Interior Brick**

- **Method 1:** General Cleaning
- OR **Method 4:** Dust and Dry Particle Cleaning

(3) **Ceramic Tile, Countertop Laminate, Marble, Decorating Stone**

- **Method 3:** Isopropyl Alcohol Cleaning
- OR **Method 4:** Dust and Dry Particle Cleaning

(4) **Concrete, Bare**

Note: If you are applying 3M™ Sidewalk Signs, refer to [Instruction Bulletin 5.33](#).

1. Allow new concrete to cure 6 to 12 months. Curing is necessary to remove the strong alkali in fresh concrete.
2. Brush with a wire brush to remove loose debris.
3. Use the same steps recommended for Brick substrates.

Methods for cleaning start on page 3.

(5) **Concrete, Sealed and Painted**

- **Method 1:** General Cleaning
- OR **Method 4:** Dust and Dry Particle Cleaning.

(6) **Indoor Flooring**

See [Instruction Bulletin 5.19](#) (formerly IB 5.26).

(7) **Interior Wallboard and Wall Coverings**

See [Instruction Bulletin 5.37](#), *A Guide to Understanding and Applying Graphics to Common Indoor and Outdoor Wall Surfaces*, which contains important considerations and techniques for interior wall graphics.

Removing even changeable graphics may damage wallboard, especially if the wallboard is cut during application.

1. Paint or prime the substrate. Then follow the cleaning and preparation recommendations in Painted or Primed Substrates, page 8.
2. Test for substrate integrity with the Tape Snap Test, page 12.
3. Clean the surface. Use **Method 4:** Dust and Dry Particle Cleaning.

(8) **Wall Coverings**

All seams and edges must have good adhesion to the wall. Clean the surface using:

- **Method 1:** General Cleaning
- OR **Method 4:** Dust and Dry Particle Cleaning.

C. Composites

(1) Body Fillers

Some composites require special consideration to ensure that the graphic performs as expected.

(2) FRP (Fiberglass Reinforced Plywood)

Because most plastic type body fillers are porous, they can absorb moisture. Before installing the film, apply an epoxy-based primer on the body filler to help seal surface.

Gelcoat that cracks will also crack the film or sheeting.

Perform the Outgassing Test, page 11.

If the gel coat has chalked, use a mild abrasive or buffing wheel to remove any residue.

- **Method 1:** General Cleaning AND then, followed by **Method 2:** Solvent Cleaning.

(3) Urethane Foam-filled Trailer Sides and Doors

Perform the Outgassing Test, page 11.

- **Method 1:** General Cleaning AND then, followed by **Method 2:** Solvent Cleaning.

D. Flexible Substrates

(1) Banners

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

(2) 3M Flexible Awnings and Sign Faces

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

For additional application instructions, see [Instruction Bulletin 5.7](#).

E. Glass

(1) Waxes and Other Coatings on Glass

3M accepts no liability for glass breakage due to temperature differences across the glass, which can be caused by sunlight on dark areas of the graphic. Glass size, thickness, quality of cut, edge treatment, tinting and frame design also greatly affect the likelihood of breakage.

Many glass surfaces have wax or other invisible coatings on them that interfere with adhesion. Perform the following procedure to identify and eliminate any coatings.

1. Place drops of water on several regions of the glass.
2. If the water forms into beads, there is a coating that must be removed. Use a cleaner such as Bon Ami® Glass Cleaner or Soft Scrub® to remove the coating. Follow the manufacturer's instructions. Return to step 1
3. If the water does not form into beads, there is no coating that needs to be removed.
4. Use **Method 3:** Solvent Cleaning.

F. Metals

(1) Aluminum

Any painted surface with bare metal or rust spots should be entirely resurfaced as recommended for the following metals.

- For the best results, use etched and degreased aluminum or anodized aluminum.
- Use **Method 3:** Isopropyl Alcohol Cleaning.
- For other types of aluminum, follow these additional procedures prior to cleaning.
 - Badly Pitted or Oxidized Substrate
Use a commercial acid-brightener.
 - Uncoated and Unetched
 1. Remove white rust (oxidation).
 2. Smooth with 150 grit or finer abrasive.
 3. Degrease the metal.
 4. Etch the surface or prepare it with an amorphous chromate or non-chrome conversion coating.

- Conversion Coated
 1. Coating should meet one of the following requirements:
 - Chromate: ASTM B 449, Class 2
 - Non-chromate: ASTM B 449, Class 1
 - Air-dried, acrylic on non-chrome coated: ASTM D 3359 for tape snap adhesion or ASTM D 4541 for adhesion the same as a chromate coated aluminum of the same alloy.
 2. Remove white rust (oxidation).
 3. Be sure that coating adheres tightly to the aluminum and is free of any powdery residue.

(2) Chrome

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

(3) Stainless Steel

The film or sheeting used must be recommended for stainless steel. Refer to the film's Product Bulletin.

- **Method 1:** General Cleaning; followed by **Method 2:** Solvent Cleaning; AND then, followed by **Method 3:** Isopropyl Alcohol Cleaning.
- For vehicles, also:
 - Make sure that there is no moisture remaining on the substrate, underneath the rivets, or in body seams.
 - Special consideration must be given to the lower panel on all panel seams. Use a 3M™ Plastic Applicator PA-1 wrapped with a clean paper towel to clean difficult to reach areas.

(4) Steel

Do not apply film directly to unpainted steel. Any painted surface with bare metal or rust spots should be entirely refinished. After painting, follow the preparation recommendations in *Painted or Primed Substrates*, page 8.

- Untreated or Electro-Galvanized. Includes bare metal, zinc electroplated, cold rolled, hot rolled pickled and black iron.
 1. Contact metal treatment suppliers for recommendations on treatment and finishing.
 2. Prime and paint.
- Phosphate-Coated Galvanized
 1. Remove white rust (oxidation) with a 3M™ Scotch-Brite™ Cleaning Pad.
 2. Rinse with water and dry. All moisture must be removed.
 3. Check for moisture by applying a piece of film to the steel. Bake in a 300°F (149°C) oven for 5 minutes. Check for blisters in the film.
 4. Prime and paint.
- Rusted
 1. Abrade the substrate lightly with a right angle grinder or random orbital sander. Use a 3M™ Scotch-Brite™ Surface Conditioning Disc (super fine-gray) of appropriate size or 3M™ Scotch-Brite™ Cleaning Pad.
 2. Use **Method 3:** Isopropyl Alcohol Cleaning.
 3. Test the cleaned substrate by wiping with a clean paper towel. If there is any evidence of dust or solvent film on the paper towel, return to step 2
 4. Prime and paint the substrate. Apply a fast-dry paint to any bare-metal areas and allow to cure thoroughly.

(5) Unwarranted Metals

- Brass
- Copper
- Lead
- Magnesium
- Tin, tin plate or alloys

G. Painted or Primed Substrates

All surface treatments, primers and topcoats must adhere well to the base material. If the paint is not firmly attached to the base material, the graphic and the paint may pull away from the substrate. Any visible signs of peeling, lifting, or bubbling of the paint indicates poor paint-to-substrate adhesion. Original paint may not have adequate adhesion to some substrates. Even removing changeable films may pull off paint that is not firmly attached to the base material.

- Avoid finish paints that tend to chalk. Chalked paint on weathered surfaces must be removed by mechanical buffing. Chalked paint that is on the interior must be re-primed.
- Test for chalking with the Tape Snap Test, page 12.
- Be aware that some tinted paints may bleed through some films.
- Be aware that some graphic materials may bleed through onto the paint.
- Avoid paints that contain migratory agents or agents that are difficult to adhere to. Some paints, especially those sold as graffiti-resistant, may contain high concentrations of ingredients such as silicones or chlorinated waxes. It may not be possible to obtain adequate adhesion to these types of paint.
- Follow the drying and curing times recommended by the paint manufacturer. Under-cured paint may outgas, prevent the adhesive from adhering adequately, or prevent a removable or changeable product from removing as expected.
- 3M recommends using an epoxy-based primer. Primer surfacers do not provide a good base for adhering film.
- The primer and the paint should be produced by the same manufacturer and formulated as companion products to ensure good adhesion between the paint layers.

(1) Baked Enamel Paint

Bake according to the manufacturer's recommendations. Cool to room temperature.

- **Method 1:** General Cleaning AND then, either followed by:
 - For weathered paint: **Method 2:** Solvent Cleaning
 - For new paint: **Method 4:** Dust and Dry Particle Cleaning

(2) Enamel or Oil-Based Paint

- **Method 1:** General Cleaning
- OR **Method 4:** Dust and Dry Particle Cleaning.

(3) Latex Paint

For better results, use high quality gloss or semi-gloss paints. Low luster or matte paints contain matting agents that may contribute to poor film adhesion.

Some paints do not allow films to adhere well. Paint testing is available from 3M. Call Technical Service at 1-800-328-3908 for information.

Although most paints are usually dry to the touch within one hour, you cannot apply the graphic immediately after painting. Paint manufacturers typically recommend waiting one week. Even latex paint contains solvents that continue to evaporate for a period of time. If the paint is not thoroughly cured, the graphic may not adhere or its edges may curl. If you must apply the graphic sooner, perform the Tape Snap Test, page 12, in several locations.

- **Method 1:** General Cleaning
- OR **Method 4:** Dust and Dry Particle Cleaning.

(4) Two-part Urethane Paint

Cure two-part urethane paints before applying a graphic. If the paint has not thoroughly cured, bubbles will form under the applied graphic. Follow the paint manufacturer's instructions.

Proper curing generally requires temperatures above 70° F (21° C). This type of paint does not cure at temperatures below 50° F (9° C).

Perform the Outgassing Test, page 11.

- **Method 1:** General Cleaning AND then, followed by **Method 2:** Solvent Cleaning.

(5) Powder-coated Paint

Waxes used in powder coatings can negatively affect adhesion; always test for acceptable paint adhesion. Paint testing is also available from 3M. Call Technical Service at 1-800-328-3908 for information.

- **Method 1:** General Cleaning AND then, followed by **Method 2:** Solvent Cleaning.

(6) Textured Paints

- **Method 1:** General Cleaning.
- Test for substrate integrity with the Tape Snap Test, page 12.
- If any dust comes off on the tape, clean the surface again.

H. Plastics and Rubber

Because of the wide variety of plastic and rubber materials, it is important that you clean an inconspicuous area before cleaning the entire substrate to be sure the method does not damage the material.

For rigid plastic sheets that will be thermoformed, dry the material according to the manufacturer's instructions. Use the method recommended by the plastic manufacturer. Failure to properly dry the plastic can cause bubbling within the plastic sheet or under the applied film during thermoforming.

PETG sheeting and some acrylic sheeting may not need pre-drying. Consult the plastic manufacturer.

Common types of plastic are listed below. Contact 3M Technical Service at 1-800-328-3908 for unlisted plastics.

(1) Acrylonitrile Butadiene Styrene (ABS)

- **Method 1:** General Cleaning AND then, followed by **Method 2:** Solvent Cleaning.

(2) Acrylic (such as Lucite® and Plexiglas®)

- **Method 3:** Isopropyl Alcohol Cleaning.

(3) Fiberglass

1. Perform the Outgassing Test, page 11. Time factors for this test should duplicate the time involved between production of the fiberglass and the application of film.
2. If bubbles appear under the film, cure the fiberglass 1 week or bake for 2 hours at 150°F (65°C) and retest.
3. If no bubbles appear:
 - **Method 1:** General Cleaning; followed by **Method 2:** Solvent Cleaning; AND then, followed by **Method 3:** Isopropyl Alcohol Cleaning.

(4) Copolyester Sign Sheet

- **Method 3:** Isopropyl Alcohol Cleaning.

(5) Polycarbonate (such as Lexan®)

The mechanical strength of molded safety products, such as sports helmets, may be reduced if certain films are applied. Therefore, 3M does not warrant such applications.

Follow the fabrication and handling procedures recommended by the resin manufacturer. Molding and filling techniques, surface preparation and handling also affect the mechanical strength.

Perform the Outgassing Test, page 11. If there is bubbling, do not use the substrate; outgassing can continue for extended periods and may take weeks to show up in the field.

See [Instruction Bulletin 5.16](#) for specific instructions on thermoforming.

- **Method 3:** Isopropyl Alcohol Cleaning.

(6) Polypropylene and Polyethylene

If the film is not specifically recommended for these substrates, flame treat the substrate, (see Flame Treating on page 11).

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

(7) Polystyrene, Styrene

Do not use for exterior applications.

- Use **Method 1:** General Cleaning.

I. Rubber and Caulking Materials

Not warranted or recommended. Films have poor adhesion to these materials.

J. Poster Board

(1) Expanded PVC (such as Sintra® and Lustra®)

- **Method 3:** Isopropyl Alcohol Cleaning
- OR **Method 4:** Dust and Dry Particle Cleaning.

(2) **Paper-based Poster Board**
(such as Fome-cor®)

- **Method 3:** Isopropyl Alcohol Cleaning
- OR **Method 4:** Dust and Dry Particle Cleaning.

K. Wood Products

Because wood absorbs moisture, it must have a thick, smooth coating of high-quality paint on both sides and all edges.

All faces of exterior surfaces must be primed and painted with high-quality exterior wood paints.

All faces of interior surfaces require only a prime coat.

Some substrates listed below require edge sealing. Two examples of appropriate sealers are aluminized, urethane edge sealer or polysilicone paint.

(3) **Fiberboard or Oriented Strand Board**

1. Test for paint coating integrity with the Tape Snap Test, page 12.
2. Clean the surface as outlined in Painted or Primed Substrates, page 8.

(4) **Hardboard**

1. Use material that is fused or tempered and is smooth on both sides.
2. Fill voids with wood filler and sand with fine-grit sandpaper.
3. Prime and paint.
4. Clean the surface as outlined in Painted or Primed Substrates, page 8.

(5) **Plywood**

Surface must be smooth, impermeable and weatherproof.

1. Fill voids with wood filler and sand with fine-grit sandpaper.
2. Coat the edges multiple times with an edge sealer.
3. Remove any loose debris.
4. Clean the surface as outlined in Painted or Primed Substrates, page 8.

(6) **High Density Overlaid**
U.S. Product Standard PS 1
General use or sign grade
only

1. Seal the edges.
2. Scuff the face with 200 grit or finer sandpaper.
3. Lightly wipe with a tack cloth to remove any dust.
4. Clean the surface as outlined in Painted or Primed Substrates, page 8.

(7) **Medium Density Overlay**
Plywood
Exterior Grade Plywood
(fir only, not oil treated)

1. Seal the edges.
2. Prime and paint the substrate.
3. Clean the surface as outlined in Painted or Primed Substrates, page 8.

(8) **Simpson Highway® HDO**
Panels or Equivalent,
U.S. Product Standard PS 1

1. Seal the edges.
2. This has an overlay on both faces and does not require sanding or solvent wiping.
3. Lightly wipe with a tack cloth to remove any dust.
4. Clean the surface as outlined in Painted or Primed Substrates, page 8.

(9) **Other Wood Products**

Avoid heavy resin-coated woods. Follow the wood supplier's surface preparation recommendations.

1. Seal the edges.
2. Prime and paint the substrate.
3. Clean the surface as outlined in Painted or Primed Substrates, page 8.

8. Special Testing or Surface Preparation



CAUTION

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

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



CAUTION

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

A. Flame Treating

Flame treating changes the molecular structure of the substrate. It oxidizes a very thin layer of the substrate allowing the adhesive to wet the surface and make a good bond.

1. Clean the substrate so that it is free of dirt and oil.
2. Use a burner designed to produce a continuous, straight or curved ribbon of flame, or use a series of small burners, as appropriate for the shape of the substrate.
3. Obtain a volumetric air to natural gas ratio of 11 or 12 to 1, or an air to propane gas ratio of 24 to 1.
4. Touch the tip of the flame's outer blue envelope (*not* the inner, yellow or red cone) to the material for 1 second. Longer exposure can deform or soften the material. Flame treating is *not* heat treating.
5. Check for proper treatment by pouring water on the substrate. If the water forms into beads, the surface is not adequately treated. If the water does not form into beads, the surface is adequately treated.
6. Thoroughly dry the surface, but do not touch it with your bare hands.
7. Apply the film to the substrate soon after flame treating. The surface oxidation will disappear within minutes after treatment.

B. Outgassing Test

3M assumes no liability for bubbling of films due to outgassing

1. Apply a 5 by 5 inch (135 by 135 cm) piece of polyester film or the film or sheeting used to make the graphic. Films vary in their ability to allow the gas to escape. Use reflective film 680 or polyester for greatest assurance that the substrate will not outgas.
2. Wait for 24 hours or, if possible, oven bake for 2 hours at 150°F (65°C) or 5 minutes at 350°F (176°C).
3. If bubbles appear under the film, the substrate is outgassing: repeat the test daily until bubbles do not appear. If outgassing continues after repeated tests, contact the manufacturer for assistance.
4. If no bubbles appear, the material is not outgassing.

C. Tape Snap Test

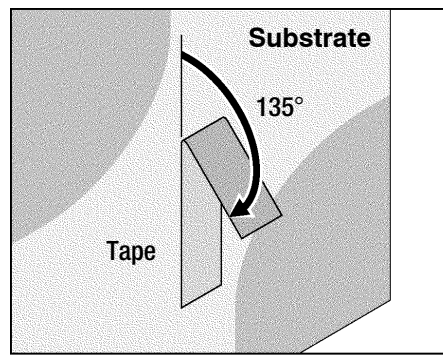
This test can be used to help determine if a substrate appears to have sufficient integrity to remain intact during eventual graphic removal, but passing the test does not mean that non-damaging removal is warranted. If a substrate is damaged during removal of removable or changeable products because of failure of the substrate's integrity, substrate damage is not covered by the 3M warranty.

1. Using 3M™ Plastic Applicator PA-1, firmly apply a 1 inch strip of aggressive, pressure-sensitive tape (Scotch® Tape 610) over the area.

Note: Plastic applicator PA-1 is available from 3M Commercial Graphics. Tape 610 is available through most film or tape distributors.

2. Remove the tape by pulling it back upon itself at a 135° angle using a rapid, firm pull. See FIGURE 1.
3. No separation should occur between the top coating and the layers underneath. No paint or chalking should be present on the tape.
4. If separation occurs, removal without damage is not warranted for removable or changeable products.

FIGURE 1
Pull of masking tape at 135° angle



CG-354A

9. Disclaimer

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.

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11. 3M Related Literature

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

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

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

Subject	Type	Bulletin No.
Films, Substrates, Overlaminates, Inks and Clears		
Please visit our website to identify and obtain the additional Product and Instruction Bulletins you need for a successful application.		
Application, special applications and vehicles	IB	5.4
Application, general procedures for indoor and outdoor dry applications	IB	5.5
Application, wet method for translucent screen printed, thermal mass transfer and cut graphics	IB	5.7
Premium Banners with Electrostatically Imaged Graphics and 3M™ Panaflex™ Awning and Sign Facing 945GPS	IB	5.18
Floor graphics	IB	5.19
Application and maintenance of Inkjet graphics for floors	IB	5.29
Application and maintenance of sidewalk signs	IB	5.33
Thermoforming	IB	5.16
Application techniques for automobiles, vans and buses and inspection forms	IB	5.36
A Guide to understanding and applying graphics to common indoor and outdoor wall surfaces	IB	5.37
Application of 3M pressure sensitive films to Panagraphics substrate	IB	5.30
Storage, handling, maintenance, removal	IB	6.5
3M Commercial Graphics Warranty Brochure		www.3Mgraphics.com

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12. Bulletin Change Summary

Reformatted instructions to clarify when more than one cleaning method is required. Added Isopropyl Alcohol Cleaning (Method 3) to substrates used typically for fleet and vehicles. Removed general cleaning (Method 1) from polycarbonate cleaning instructions. Provided additional application instructions to use an epoxy-based primer as the base for adhering the film.



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