Instruction Bulletin 4.26
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See Bulletin Change Summary at end of Bulletin

How to Construct Backlit Sign Faces

For All Imaging Methods

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How to Use This Bulletin

1. Determine the type of backlit graphic you want to make. See the options starting on page 4. This section also helps you determine which compatible products are suitable for your graphic and printer platform. We encourage you to experiment with multiple options to determine the best one for your customer's needs.
2. Review *Maximizing Image Quality*, page 8.
3. Review the Product Bulletins for the films you are using to determine any special usage details or restrictions, and whether an overlaminate is required.
4. Refer to the Product and Instruction Bulletins for the ink or toner you are using to determine processing conditions for backlit signs.
5. Use a wet application method for applyiong the film.
   a. See *General Assembly Methods*, page 10.
   b. Follow the assembly method for your specific construction.

Important Note

Making a successful sign requires that you consider many factors. This Bulletin provides basic guidelines for simple sign construction options; many other options may be available to achieve dramatic special effects. Please contact Technical Service (1-800-328-3908) before you start if you have questions or concerns about making a sign.

Compatible Products

3M Graphic Materials

This Bulletin provides details about graphic construction options for backlit signs. For other recommended uses and durability of these products, refer to the Product Bulletin for the base film or substrate (media) you are using. See 3M Related Literature at the end of this bulletin.

Electrostatic Printers, Toners, Transfer Paper

- Scotchprint® Printer 2000
- Scotchprint® Toner Series 8700/8800
- 3M™ Trident Transfer Paper

Electrostatic Film

- 3M™ Scotchcal™ Clear Graphic Film 8626 ES
- 3M™ Scotchcal™ Translucent Graphic Film 8628 ES

Piezo Inkjet Printers and Inks

Ink Series	Printer
3M™ Piezo Inkjet Ink Series 2200UV	EFI™ VUTEk® PV 200 Printer
3M™ Piezo Inkjet Ink Series 2600UVv2	3M™ Printer 2500UV
3M™ Piezo Inkjet Ink Series 2500UV	3M™ Printer 2500UV
3M™ Piezo Inkjet Ink Series 2700UV	Durst Rho 160R Printer
3M™ Piezo Inkjet Ink Series 2800UV	EFI™ VUTEk® QS2000/QS3200 Printers
3M™ Piezo Inkjet Ink Series 5400UV	MacDermid ColorSpan 5400uv Printer
3M™ Piezo Inkjet Ink Series 1500v2	EFI™ VUTEk® 150, 2360/3360, 3300/5300 and 3000/5000 Printers
3M™ Piezo Inkjet Ink Series 4600	HP Scitex Pressjet-W™ Printer
3M™ Piezo Inkjet Ink Series 4800	HP Scitex TJ8300 Series Digital Press
3M™ Piezo Inkjet Ink Series 5500	Océ Arizona 600 Printer
3M™ Piezo Inkjet Ink Series 6000	Océ Arizona 30s Printer
3M™ Piezo Inkjet Ink Series 6800	Océ Arizona 180 and 90 Printers

Piezo Inkjet Films

- 3M™ Scotchcal™ Translucent Graphic Film IJ3630-20, FN3630-20, RG3630-20
- 3M™ Scotchcal™ Graphic Film IJ3650-114, FN3650-114, RG3650-114

Colored Film

- 3M™ Scotchcal™ Translucent Graphic Film Series 3630
- 3M™ Scotchcal™ Translucent Graphic Film Series 3632GPS

Light Management Films

- 3M™ Diffuser Films 3635-30
- 3M™ Diffuser Films 3635-70
- 3M™ Blockout Film 3635-20B
- 3M™ Blockout Film 3630-22B
- 3M™ Day-Night Film 3635-91
- 3M™ Light Enhancement Film 3635-100
- 3M™ Chrome Graphic Film 3635-110
- 3M™ Dual-Color Film Series 3635-200

Diffused Sign Substrates

- 3M™ Panagraphics™ II Intermediate Flexible Substrate
- 3M™ Panagraphics™ III Wide-Width Flexible Substrate
- 3M™ Panaflex™ Awning and Sign Facing 945GPS

Rigid Substrates

- Clear or translucent substrates such as glass or plastic

Overlaminates

- 3M™ Scotchcal™ Matte Overlaminate 3640GPS
- 3M™ Scotchcal™ Luster Overlaminate 3642GPS
- 3M™ Scotchcal™ Luster Overlaminate 8519
- 3M™ Scotchcal™ Matte Overlaminate 8520

Tools Needed

- 3M™ Plastic Applicator PA-1 (blue or gold)*
- 3M™ Low Friction Sleeve SA-1*
  (Use a low friction sleeve on the plastic applicator to minimize the possibility of scratching the film)
- Pin or 3M™ Air Release Tool 391X*
- Razor blades/cutting knives
- Straight edge
- Tape measure
- Pencil or pen
- Spray bottle or plastic garden sprayer
- Clean, soft, lint-free cloths or paper toweling
- Light table
- Adequate clean work area

*Available from 3M Commercial Graphics Division.

Warranty and Durability

For complete details on durability and warranty, please refer to the base film's Product Bulletin. See the 3M Related Literature at the end of this document.

Health and Safety

⚠ 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 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.

Air Quality Regulations

State Volatile Organic Compound (VOC) regulations may prohibit the use of certain cleaning solutions. 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. You should check with your State environmental authorities to determine whether use of this solution is restricted or prohibited.

Construction Options

Several first and second surface options are illustrated and their assembly order discussed on the following pages.

- The proportions of the construction option illustrations are intentionally exaggerated to provide more detail about the order of the materials used.
- For all constructions, the adhesive side of the film faces the substrate.

Typical Stacked Constructions

FIGURE 1 and FIGURE 2 illustrate some common stacked constructions. Refer to the Options starting on page 5 for complete details.

Note: A diffuser is usually not required when a diffused substrate such as 3M's Panaflex substrate is used in the construction.

FIGURE 1
Diffuser in front of clear substrate

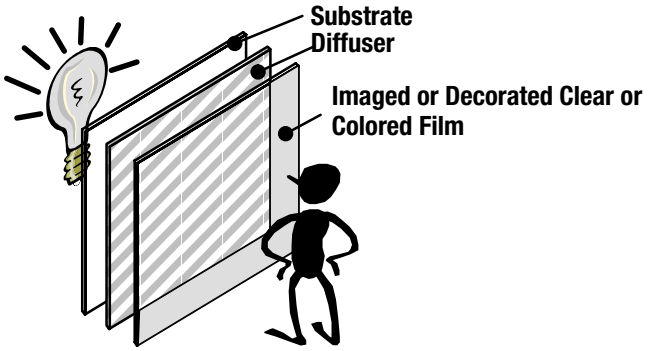
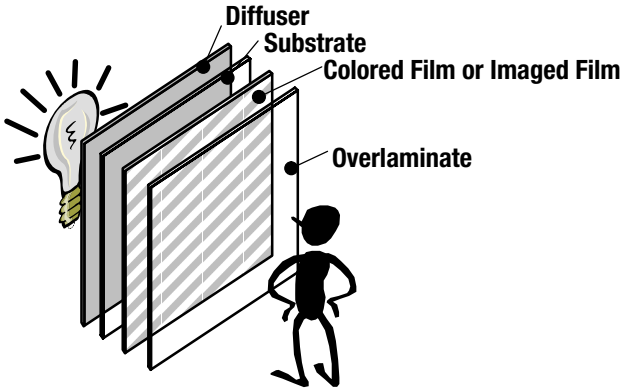


FIGURE 2
Diffuser behind clear substrate

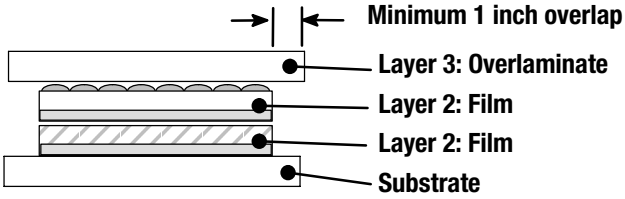


Using Three Film Layers

Whenever three consecutive layers of film (two layers of printed film and an overlaminate) are used, the top layer of film must extend beyond the edges of the two underlying layers of film by at least one inch all around. There are two ways to do this:

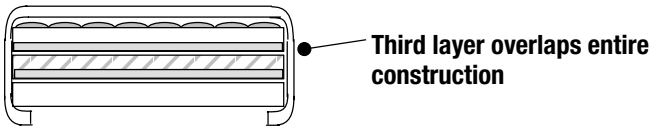
- Cut the underlying two layers smaller than the substrate so that the top (third layer) can be adhered to the substrate.

FIGURE 3
Two film layers with overlaminate cut larger



- Wrap at least a one inch margin of film around the substrate. This is a good method for First Surface graphics but not for second surface graphics.

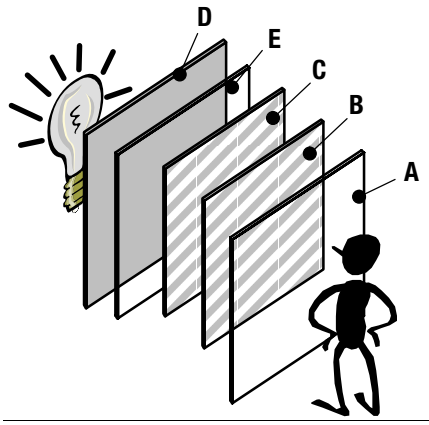
FIGURE 4
Overlaminate shown wrapped around construction



First Surface Sign Face Options

For first surface graphics the film image is right reading and technically you see the ink or color before the film. An overlaminate is required for electrostatically imaged graphics but is usually optional for other constructions. An overlaminate can change gloss and provide protection from abrasion and UV light, and it may increase the graphic's warranted durability.

OPTION A1, First Surface, Clear Substrate



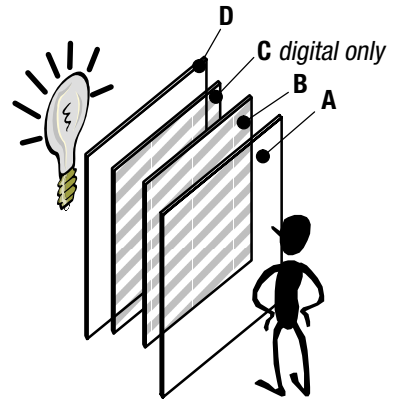
Ref. Letter	Component	Graphic Construction		
		Non-Digital	Electrostatic	Piezo Inkjet
A	**Overlaminate**	3640GPS or 3642GPS or None	8519 or 8520	8519 or 8520 or None
B	**Imaging Film** *first or only layer*	3630 or 3632GPS *(no overlaminate)*	8628 ES	IJ3630-20 or FN3630-20 or RG3630-20
C	**Imaging Film** *second layer*	3630, *optional*	8626 ES	IJ3650-114 or FN3650-114 or RG3650-114
D	**Diffuser**	3635-30 or 3635-70		
E	**Substrate**	Rigid Clear		

Option A1 Assembly Order

1. Before cutting the film for digitally printed graphics, read *When Using Three Layers of Film,* page 4. Notice in this example that the two middle layers (B, C) are cut smaller
2. Read the *General Assembly* instructions, page 10. Note that the adhesive always faces the substrate.
3. For digitally printed film, apply the imaging film (C) to the front of the substrate (E) and then align and apply the next layer of imaging film (B) to imaging film (C).
4. For non-digitally printed film, apply the imaging film (B) to the front of the substrate (E).
5. Apply the overlaminate (A) to the imaging film (B).
6. Apply the diffuser film (D) to the back (second) side of the substrate (E).

Note: Read more about using a diffuser film on page 9.

OPTION A2, First Surface, Diffused Substrate

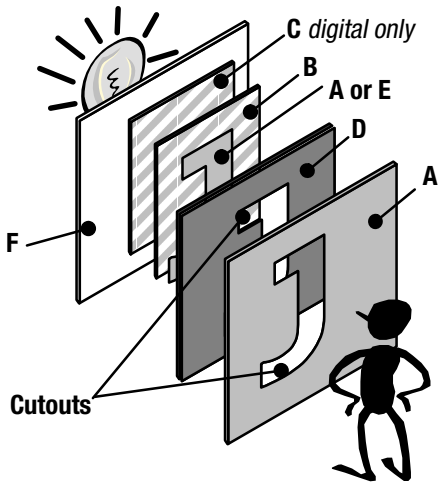


Ref. Letter	Component	Graphic Construction		
		Non-Digital	**Electrostatic**	**Piezo Inkjet**
A	**Overlaminate**	3640GPS or 3642GPS	8519 or 8520	8519 or 8520 or None
B	**Imaging Film** *first or only layer*	3630 or 3632GPS *(no overlaminate)*	8628 ES	IJ3630-20 or FN3630-20 or RG3630-20
C	**Imaging Film** *second layer*	3630, *optional*	8626 ES	IJ3650-114 or FN3650-114 or RG3650-114
D	**Substrate**	Diffused Flexible or Rigid		

Option A2 Assembly Order

1. Before cutting the film for digitally printed graphics, read *When Using Three Layers of Film,* page 4. Notice in this example that the two middle layers (B, C) are cut smaller.
2. Read the *General Assembly* instructions, page 10. Note that the adhesive always faces the substrate.
3. For digitally printed film, apply the imaging film (C) to the front of the substrate (D) and then align and apply the next layer of imaging film (B) to imaging film (C).
4. For non-digitally printed film, apply the imaging film (B) to the front of the substrate (D).
5. Apply the overlaminate (A) over the film.

OPTION A3, First Surface, Diffused Substrate



NOTE: 3 Layers Maximum. See page 4.

Ref. Letter	Component	Graphic Construction		
		Cut Graphic or Screen Printed	**Electrostatic**	**Piezo Inkjet**
A	**Colored Film**	3630		
B	**Imaging Film** *first or only layer*	3630	8628 ES	IJ3630-20 or FN3630-20 or RG3630-20
C	**Imaging Film** *second layer*	N/A	8626 ES	IJ3650-114 or FN3650-114 or RG3650-114
D	**Blockout film**	3635-20b or 3635-22b		
E	**Day/Night Film**	3635-91 *may use 3630 instead*		
F	**Substrate**	Translucent Diffused, Flexible or Rigid		

Option A3 Assembly Order

Note: This is a very complex construction and there are multiple ways it could be made. Be sure you understand any restrictions on number of film layers, your goals and the expected results before starting this construction. If in doubt, call Technical Service at 1-800-328-3908.

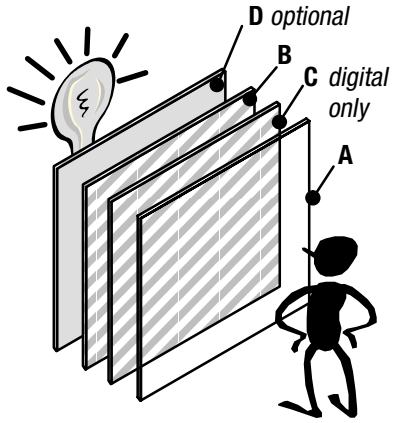
Note: Before cutting the film, read *When Using Three Layers of Film,* page 4. Notice in this example that two of the middle layers are cut smaller.

1. Cut the desired shapes from the day/night film (D), blockout film (C) and colored film (A).
2. Read the *General Assembly* instructions, page 10 and *Assembly Method For Complex Constructions Using Trapping Film or Seams (Overlaps*), page 13. Note that the adhesive always faces the substrate.
3. For digitally printed film only, apply the imaging film (C), cut no larger than necessary, to the substrate (E). Then apply the second layer of printed imaging film (B) to imaging film (C).
4. Apply the day/night film (E) or colored film (A) to the imaging film (B).
5. Apply the blockout film (D) to the construction already on the substrate (F).
6. Apply the top colored film (A) so that its margins extends past the other film layers and adhere to the substrate.

Second Surface Sign Face Options

The graphic is printed as a mirror image and technically the viewer sees the film layer before seeing the printed image. The clear, rigid substrate protects the graphic.

OPTION B1, Second Surface, Clear Substrate



Ref. Letter	Component	Graphic Construction		
		Non-Digital	Electrostatic	Piezo Inkjet
A	**Substrate**	Rigid Clear		
B	**Imaging Film** *first or only layer*	3630	8626 ES	IJ3630-20 or FN3630-20 or RG3630-20
C	**Imaging Film** *second layer*	N/A	8628 ES	IJ3650-114 or FN3650-114 or RG3650-114
D	**Diffuser Film** *Optional*	3635-30 or 3635-70		

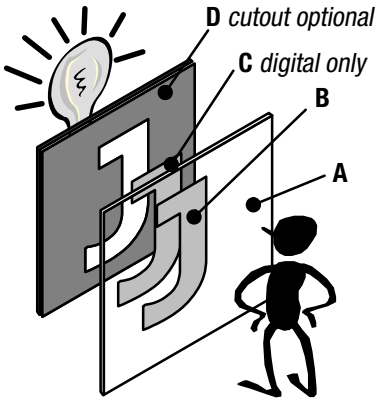
Option B1 Assembly Order

1. Read the *General Assembly* instructions, page 10. Note that the adhesive always faces the substrate.
2. Apply the imaging film (B) to the back (second side) of the substrate (A).
3. For digitally printed film only, align and apply the second layer of imaging film (C) to the first layer of film (B).

Note: Use care when constructing an electrostatically-imaged graphic to avoid damaging the toners if an overlaminate is not used.

4. A diffuser film (D) could be applied to the imaging film. If you do this, read *Using Three Film Layers*, page 4.

OPTION B2, Second Surface Surface, Clear Substrate



Ref. Letter	Component	Graphic Construction		
		Non-Digital	Electrostatic	Piezo Inkjet
A	**Substrate**	Rigid Clear		
B	**Imaging Film** *first or only layer*	3630	8628 ES	IJ3650-114
C	**Imaging Film** *second layer*	N/A	8626 ES	IJ3620-20
D	**Background Film**	3630, 3635-20b, 3635-22b, 3635-30 or 3635-70 Note: Some constructions may need a diffuser in addition to a clear film.		

Option B2 Assembly Order

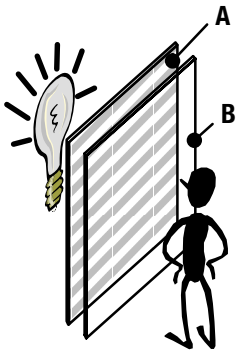
Note: Before cutting the film, read *When Using Three Layers of Film,* page 4.

1. Cut the desired shapes from the background film (C) and imaging film (B).
2. Read the *General Assembly* instructions, page 10 and *Assembly Method For Complex Constructions Using Trapping Film or Seams (Overlaps)*, page 13. Note that the adhesive always faces the substrate.
3. Apply the first (or only) layer of imaging film (B) to the back of the substrate.
4. Align and apply the second layer of imaging film (B, digital only) to the first layer of film.
5. Align and apply the background film (C).

Direct Printing on Panagraphics Substrate

You can direct print on Panagraphics substrate with 3M piezo inkjet inks. Refer to Product Bulletin P2 or P3 and the Product Bulletin for the ink series you are using to determine compatibility and printing parameters.

OPTION C, Direct Piezo Inkjet Printing on Panagraphics Substrate



Component	Graphic Construction	
	Piezo Inkjet Ink Series	Overlaminate (B)
Panagraphics II or III Substrate (A)	1500Vv2 2600UVv2 *Other 3M piezo inkjet ink series may also be suitable for this application; check with Technical Service.*	8519 8520 3640GPS 3642GPS none

Option C Assembly Order

1. Refer to the Product and Instruction Bulletins for the ink you are using to determine processing conditions for backlit signs. Do not exceed 300% total ink coverage. Note that if you use ink series 1500v2 *without* an overlaminate, you must use the double strike mode.
2. Refer to substrate Product Bulletins P2 or P3 for additional information.
3. Apply the overlaminate, if used. See Instruction Bulletin 4.22.
4. Skip ahead in this Bulletin to *Installing Decorated Substrates in Sign Frame*, page 16.

Special Effective Films

Dual-Color Film Series 3635-200

This film series offers unique special effects offering one color during the day and another at night. Refer to Product Bulletin 3635-200 for construction options.

Chrome Graphic Film 3635-110

This film offers a chrome-like appearance. Refer to Product Bulletin 3635-110 and contact 3M Technical Service, 1-800-328-3908, to discuss construction options.

Maximizing Image Quality

It is more difficult to create a successful backlit graphic than an opaque graphic. Good image density is the most important factor. However, you must consider all of the following points and work to balance them until you achieve the desired results. We encourage you to experiment with multiple options to determine the best one for each of your customers' needs.

Color and Design in Graphics

- Digitally printed large areas of solid color, unless they are all pastel, always need two imaging film layers to achieve sufficient image density and consistency. Some pastel images look better with two layers of film, however.
- Very bright or dark images, when digitally printed, need two imaging film layers to achieve sufficient image density.
- For any type of printed image, busy images are usually most successful, but digitally printed dark or bright images still need two imaging film layers.
- Only a single film layer is needed when using translucent colored film series 3630, but two layers may be used for most constructions, if desired.
- Inconsistent light distribution within the light box may be more noticeable when the image has a lot of variations in light and dark colors. To help reduce this problem, use more light diffusion.

Purpose of a Diffuser

A diffuser reduces the amount of light transmission through the graphic and reduces the uneven or stripped effect caused by some types of light sources. Too little diffusion can also make the image look lighter (more washed out) than desired. Usually, sufficient diffusion may be achieved by using a translucent substrate, a translucent imaged film, and/or a translucent film specifically designed as a diffuser.

3M diffuser film 3635-30 has 30% light transmission and is a common diffuser choice. Diffuser film 3635-70 has 60% light transmission and allows more light through which may be more effective on darker images.

Blockout films 3635-20b or 3635-22b must also be used to blockout transmitted light in some signs.

Note: Backlit signs made with translucent films must have a separate diffuser film or be made with a diffused substrate such as 3M's Panaflex or Panagraphics flexible substrates.

Type of Substrate Used

First surface graphics can use translucent or clear, flexible or rigid substrates. Second surface graphics require a clear rigid plastic substrate.

Characteristics of Light Box

To minimize hot spots and washed out graphic appearance:

- Use a diffuser film between the light source and the image. There will be some loss in overall image brightness, but a more uniform image.
- To maximize the use of light inside a light box, line the box with 3M's light enhancement film 3635-100. This is a highly efficient diffuse reflective film that creates a brighter, more uniform appearing sign face.

Printing or Imaging Methods

Piezo Inkjet Printing

Refer to the ink's Product Bulletin for detailed printing recommendations. DO NOT exceed the total ink coverage recommendations in an attempt to increase image density. This will cause other performance problems.

Electrostatic Printing

Print the image on Trident transfer paper, and then transfer by heat and pressure to the imaging film. Refer to Product Bulletin Trident for additional information.

Screening Patterns for Double Layer Backlit Signs that Minimize Moire

If Using Scotchprint® Graphic Maker Software 4.1 or higher

Use one of the following screening methods.

- 3M Stochastic
  - Rip both graphic layers using the Stochastic screening method.
- 3M Fast Dither
  - Rip the first graphic layer using Stochastic.dth or DotGrowth.dth.
  - RIP the second layer graphic using 3M stochastic_180.dith or DotGrowth_180.dth.
- 3M Halftone (not recommended for piezo Inkjet)
  - Rip first dg4a.
  - Rip second dg4a90.

If Using PosterShop ™ Software

Print the clear and translucent films using the same screen combination. Do not use 154 or 309 screen pattern to print two film layers for backlit signs.

Use one of the following screening methods.

- 309 Stochastic
- 309 FDRP Diffusion
- 154 FDRP Diffusion

Overlaminates

Applying an Overlaminate with a Laminator

An overlaminate can be applied with a cold roll laminator if you allow the assembled backlit film/substrate construction to dry for at least 24 hours *and* your laminator can handle the thickness and rigidity of the construction. See Instruction Bulletin 4.22.

Electrostatic Graphics

All first surface electrostatically-imaged graphics require an overlaminate in order to be warranted.

Piezo Inkjet Graphics, Cut Graphics, or Screen Printed Graphics

An overlaminate is optional on most piezo Inkjet graphics as well as colored or screen printed graphics. An overlaminate can be used to change gloss. It also provides protection from abrasion and UV light, and may increase the warranted durability of a graphic. Refer to the film's Product Bulletin for details.

General Assembly

Key Graphic Construction Tips

Keep these key application tips in mind before and during application.

1. **Clean work area.** Make sure the work surface and surrounding area are properly cleaned to avoid contaminating the graphics.
2. **Temperature.** Make sure the film, air and surface temperatures are between 60° and 100°F (16° and 39°C).
3. **Wet application method.** Use only the detergent and water application method. Other application techniques cause dark marks that are visible in transmitted light.
4. **Handling paper liners.** If the film you are using has a paper liner, DO NOT allow the liner to get wet before removing it from the film. A wet liner is difficult to remove.
5. **Seams and overlaps.** Seams can be made using the overlap method. See page 13.
6. **Applicator tools.** Use plastic applicator PA-1 that is smooth and not nicked. To initially flatten and adhere the film, a large window squeegee may be used with *light* pressure. The final squeegeeing must be done with a PA-1 squeegee covered by a low friction sleeve SA-1.
7. **Squeegeeing.** Review the *Squeegee Techniques and Squeegee Procedures*, page 12.
8. **Puncture air bubbles** using a pin or air release tool; do not use a knife or blade. See page 16.
9. **To remove an application tape,** if used, always peel it back on itself—as close as possible to 180 degrees—and immediately re-squeegee the film.
10. **Cut and weed** within one hour after application, for the best results. See page 16.
11. **Keep newly fabricated sign faces in ambient shop temperatures for at least 24 hours.** This allows any remaining moisture to diffuse through the film.
12. **Re-squeegee the edges** 24 hours after fabricating the sign face.

Note: When using Panagraphics substrate in your construction, please refer to Instruction Bulletin 5.30 for additional details to help ensure a successful application.

⚠ 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.

Prepare the Substrate

1. Prepare the plastic substrate.

   Plastic substrates (also called plastic sheet) have a protective covering. Be sure you peel it off and remove all traces of the adhesive. Then clean the substrate.

   Dry polycarbonate substrate before applying the film. Use the method recommended by the plastic manufacturer. Failure to properly dry the plastic can result in outgassing, which may cause the film to bubble.

Note: High temperature copolyesters and most acrylic substrates need no pre-drying. Consult your plastics manufacturer.

2. Prepare the Panaflex or Panagraphics substrate.

   Clean as instructed below before applying any film.

⚠CAUTION Before handling any chemical products, always read the container label and the MSDS.

3. Clean the substrate

   Consider all substrates to be contaminated and clean immediately prior to application.

   a. Be sure the solvent and plastic substrate are compatible before cleaning. Refer to the plastic sheet manufacturer's recommendations. Isopropyl alcohol and water often do a good job.

   b. Saturate a clean paper towel with solvent that is compatible with the plastic substrate being used, and immediately wipe the substrate dry and clean.

   c. Dry the substrate with a lint-free paper towel *before* the solvent evaporates.

   d. Wash the substrate with a synthetic, free-rinsing detergent. Do NOT wash the substrate with a soap or detergents containing cream or lotion. Wipe dry with a lint-free cloth.

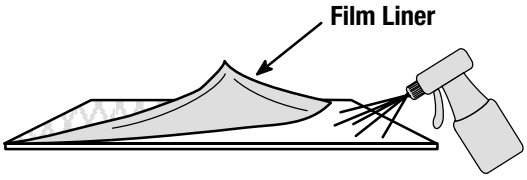
Assembly Preparation

1. Make the wetting solution

   - Use a mild liquid dish detergent (not soap) that contains no creams or fragrance. Other types of detergents will interfere with the bond of the adhesive.
   - Make a wetting solution using mild liquid dish detergent and one quart of cool water. If the detergent is concentrated, use of one-half teaspoon (3 cc); if it is not concentrated use one teaspoon (6 cc).
   - For further details, see Instruction Bulletin 5.1.

2. Learn how to remove a liner and wet the adhesive

FIGURE 5
Remove the Liner; Wet the Film



   a. Place the film so it is liner-side-up on a clean light table.

   b. Lift one corner of the liner while spraying the wetting solution onto the exposed adhesive. See FIGURE 5.

Note: Avoid wetting a paper liner, which may cause it to separate and make it more difficult to remove.

   c. Continue removing the liner and spraying the solution. By the time the liner is completely removed, the entire adhesive surface should be wet. Spray on more solution, if necessary.

3. Learn the proper squeegee technique. See FIGURE 6.

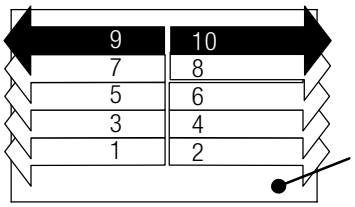
   a. Always squeegee across the shortest distance (center to edge). Start in the center of the graphic and squeegee straight out to one edge. Do NOT use an arcing stroke, which traps the wetting solution and air.

   b. Return to the center and squeegee to the opposite edge.

   c. Return to the center and start the next stroke so it overlaps the previous one by about 50 percent.

   d. Continue up the graphic, return to the center of the graphic, and continue down until the film is completely adhered.

FIGURE 6
Typical Stroking Sequence for Squeegeeing



Numbers show a typical stroking sequence from center to top of graphic. Overlap each stroke by 50 percent.

Film

4. Learn the proper squeegee procedure

   Without Premasking Tape

   a. To avoid friction, spray additional wetting solution onto the surface that you will be squeegeeing.

   b. The first time over the film a large window cleaning squeegee can be used to smooth out film wrinkles and remove much of the application solution. A large, nick-free window squeegee can do this quickly. If a large amount of film builds up ahead of the squeegee, use your hand to push out the excess water and smooth the film. Then continue with light overlapping strokes across the entire graphic.

   c. Go over the film again with a standard four-inch squeegee with a low friction sleeve using firm squeegee strokes.

   d. Dry the graphic with a lint-free clean cloth or soft paper toweling. Be sure to absorb the moisture along the edges, too.

   With Premasking Tape

   e. Follow the same squeegee technique using firm strokes with a four inch squeegee.

   f. Remove the premasking tape at a 180 degree angle.

   Finish the Squeegee Procedure

   g. Re-squeegee the entire graphic until all water is removed between the image and the spacer. This may require going over the graphic several times. If needed, use a little of the detergent and water solution to lubricate the squeegee.

   h. If the application has bubbles, refer to Removing Bubbles Under the Film, page 16.

   i. Check for good adhesion by trying to lift a corner.

5. Re-squeegee After 24 Hours

   After 24 hours at room conditions, re-squeegee all film edges. Use a low friction sleeve SA-1 on the applicator to prevent scratching.

Assembly Method: Single Panels with No Overlaps or Trapping Film

Note: This example is based on Option A1 (see page 5), which is a first surface graphic. Each film layer is applied one at a time using the wet method. Adapt this procedure for your construction.

1. Be sure you have followed the instructions in *Prepare the Substrate*, page 11.
2. Remove the liner as you wet the adhesive on the diffuser film.
3. Thoroughly flood the substrate with wetting solution.
4. Position the adhesive side of the diffuser film against the *second surface* of the plastic substrate.
5. Wet the the top of the diffuser film.
6. Squeegee thoroughly. See **Squeegee Techniques and Squeegee Procedures** on page 12.
7. Turn the substrate over so the *first surface* is facing up.
8. Remove the liner as you wet the adhesive on the translucent film.
9. Thoroughly flood the *first surface* of the substrate with wetting solution.
10. Position the adhesive side of the translucent film against the substrate.
11. Wet the the top of translucent film. Squeegee thoroughly.
12. If you are using an overlaminate:
    a. Remove the liner as you wet the adhesive on the overlaminate.
    b. Thoroughly flood the translucent film with wetting solution.
    c. Position the adhesive side of the overlaminate against the translucent film.
    d. Wet the top of the overlaminate. Squeegee thoroughly.
13. Re-squeegee all edges after 24 hours.
14. Mount the construction in the light box.

Assembly Method: Complex Constructions Using Trapping Film or Seams (Overlaps)

Complex Constructions with Trapping Film

To create a unique effect, trap a solid colored translucent film between the imaging film and an overlaminate. Construction Options A4 (FIGURE 7) and B2 (FIGURE 8) illustrate this technique. Keep the following points in mind.

- The films used may require electronic cutting and premasking tape. These elements of the construction are not discussed in this procedure, but you will need to consider them.
- There will be some gloss difference where the overlaminate film ends, if it is not applied over the entire sign face.
- The various films used may also have different durability; the warranty, when offered, is equal to the lowest warranty for any product used in the 3M recommended construction.

FIGURE 7
Option A4

First surface, two imaging film layers, overlaminate and trapping film

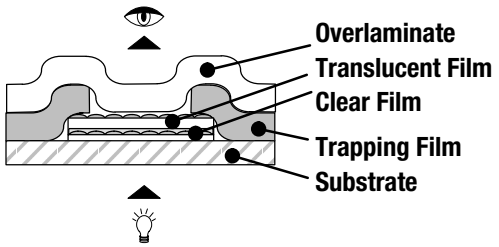
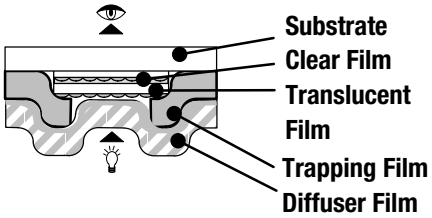


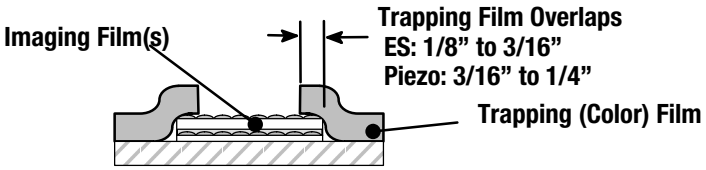
FIGURE 8
Option B2

First surface, two imaging film layers, trapping film and diffuser film



1. Be sure you have followed the instructions in *Prepare the Substrate*, page 11.
2. Remove the liner as you wet the adhesive on the clear film. See *Remove a Liner and Wet the Film,* page 11.
3. Thoroughly flood the substrate with wetting solution.
4. Position the adhesive side of the clear film against the substrate.
5. Wet the top of the clear film.
6. Squeegee thoroughly. See *Squeegee Techniques and Squeegee Procedures*, page 12.
7. Remove the liner as you wet the adhesive on the diffuser film or translucent film.
8. Thoroughly flood the clear film with wetting solution.
9. Position the adhesive side of the diffuser film or translucent film against the clear film.
10. Wet the top of the diffuser film or translucent film. Make sure the images on both imaged or colored film layers are precisely aligned. Squeegee thoroughly.
11. **Re-squeegee all edges after 24 hours.**
12. Mount the construction in the light box.
13. Remove the liner as you wet the adhesive on the trapping film.
14. Position the trapping film over the imaging film, ensuring the overlap specified in FIGURE 9.

FIGURE 9
Overlaps Required for Trapping Film

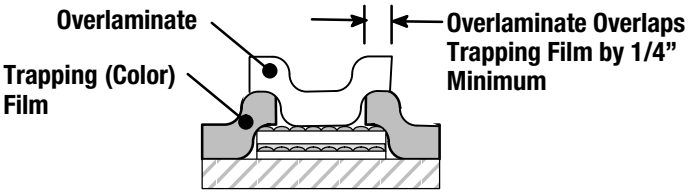


15. Thoroughly flood the surface of the trapping film with wetting solution. Squeegee thoroughly.
16. Remove the liner as you wet the adhesive on the overlaminate or diffuser film.
17. Thoroughly flood the trapping film with wetting solution.
18. Position the wet adhesive side of the overlaminate or diffuser film against the wet trapping film.
19. Wet the surface of the overlaminate or diffuser film. Squeegee thoroughly.
20. Re-squeegee all edges after 24 hours.
21. Mount the construction in the light box.

Alternative Overlaminate Application for Option A4

Covering the trapping film completely with the overlaminate is the preferred method. However, you can apply the overlaminate over just the imaged or center film as long as it overlaps the trapping film by a minimum of 1/4 inch. See FIGURE 10.

FIGURE 10
Alternative Overlaminate Application

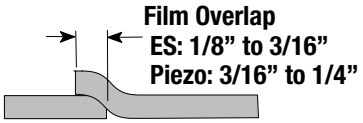


Complex Constructions with Seamed Film

For most digitally-imaged graphics, you can create multi-panel signs. However, take these points into consideration:

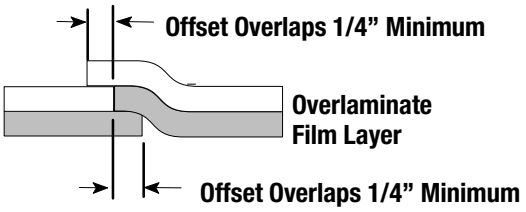
- Digitally-imaged film may shrink after installation.
- If the film shrinks at a seam, there will be a light leak that is usually unacceptable unless the film has a sufficient overlap.
- The appearance of light leaks can be reduced or eliminated by creating an overlap at the panel seams. The seam does appear darker than the rest of the image, especially when backlit, but it is generally more acceptable than a light leak. This is the only method recommended by 3M. See FIGURE 11.
  - Overlap electrostatically-imaged graphic panels by 1/8 to 3/16 inch.
  - Overlap piezo-imaged graphic panels by 3/16 to 1/4 inch.

FIGURE 11
Recommended Film Overlaps



- Use only horizontal or only vertical seams in one sign; do not use a combination of seam directions. If you are making horizontal seams (rain lap), lap the top panel over the bottom panel.
- Seams for each layer of film, diffuser and/or overlaminate must each be offset by at least 1/4 inch. FIGURE 12 illustrates the preferred method of offsetting the overlaps. This method eliminates all gaps except the one in the bottom layer of film and creates a better sealing seam.

FIGURE 12
Offset Overlaps Required for Each Layer



Finishing Techniques

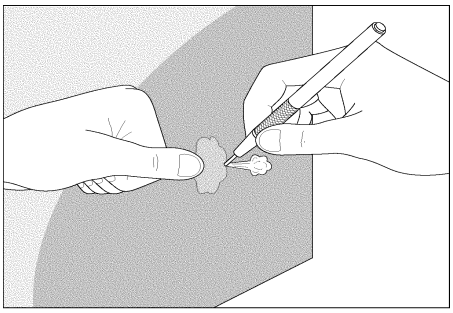
Removing Bubbles Under the Film

1. To remove entrapped bubbles, puncture the film at one end of the bubble with a pin or other sharp, round pointed tool, such as air release tool 391X. Press out the entrapped air or wetting solution with the thumb or squeegee, moving toward the puncture. See FIGURE 13.

Note: Do not use a knife or razor blade to puncture the film; those tools create an opening through which light will leak eventually.

2. Some bubbles may be removed by spraying the top area with solution and squeegeeing it out with rapid strokes of the squeegee.

FIGURE 13
Using a Pin to Remove Bubbles



Cutting and Weeding After Application

For the best results, cut and weed the film within 1-1/2 hours after application. The adhesive bond builds with time and weeding becomes more difficult.

1. Cutting may be done with conventional graphic knives, either fixed or swivel, or with a sharp razor blade in a safety holder.
2. Patterns may be placed on the surface of the applied film by pouncing with chalk or carbon dust. Some carbon papers and some graphic pens may permanently mark the film so check suitability before using.
3. Avoid or minimize over-cuts to eliminate light leaks.
4. To weed, carefully pick up a corner of the weed and pull with sharp, short jerks at a shallow angle. If adhesive transfers to the substrate during removal, warm the surface slightly during removal to reduce the amount of transfer.
5. Any adhesive left on the substrate may be removed by rubbing with the thumb or finger.

Installing Decorated Substrate in Sign Frames

There are two steps for preparing the edges of the decorated plastic substrate to reduce the chance of damage when installing it in a sign frame.

1. Trim away the film at least 1/8 inch from the edges of the substrate all around the graphic. The trimmed area will be hidden by the retainer.
2. Apply a clear protective tape to the edges of the graphic to reduce the risk of film damage due to constant rubbing.

Use care when inserting the sign face into the sign frame to ensure that sharp edges do not catch or tear the film.

Warranty and Limited Remedy

The information contained and techniques described herein are believed to be reliable, but 3M makes no warranties, express or implied, including but not limited to any implied warranty of merchantability or fitness for a particular purpose. 3M shall not be liable for any loss or damages, whether direct, indirect, special, incidental or consequential, in any way related to the techniques or information described herein.

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 www.3Mgraphics.com or through our Fax-on-Demand system. 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.

Fax on Demand Phone Numbers

United States or Canada: 1-800-364-0768
International: 1-651-732-6506

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

Subject	Type	Bulletin No.	FOD No.
3M™ Scotchcal™ Translucent Graphic Film IJ3630-20, RG3630-20, FN3630-20	PB	PIJ3630	4527
3M™ Scotchcal™ Graphic Film IJ3650-10, RG3650-114, FN3650-114	PB	PIJ3650	4544
3M™ Scotchcal™ Translucent Graphic Film Series 3630	PB	3630	3009
3M™ Scotchcal™ Translucent Graphic Film Series 3632GPS	PB	3632	3023
3M™ Scotchcal™ Graphic Film Series 3650	PB	3650	1509
3M Light Management Films -3M™ Blockout Films 3635-20B, 3635-22B -3M™ Diffuser Films 3635-30, 3635-70 -3M™ Day/Night Films 3635-91	PB	3635	3010
3M™ Light Enhancement Film 3635-100	PB	3635-100	3025
3M™ Chrome Graphic Film 3635-110	PB	3635-110	3038
3M™ Dual-Color Film Series 3635-200	PB	3635-200	3032
3M™ Scotchcal™ Clear Graphic Film 8626 ES	PB	8626	3533
3M™ Scotchcal™ Translucent Graphic Film 8628 ES	PB	8628	3534
3M™ Panaflex™ Awning and Sign Facing 945GPS	PB	945	4006
3M™ Panagraphics™ II Intermediate Flexible Substrate	PB	P2	4010
3M™ Panagraphics™ III Wide-Width Flexible Substrate	PB	P3	4012
3M™ Scotchcal™ Matte Overlaminate 3640GPS and 3642GPS	PB	3640/3642	3011
3M™ Scotchcal™ Luster Overlaminate 8519 and 8520	PB	8519/8520	4524
Cold roll lamination	IB	4.22	6522
Application, substrate selection, preparation and substrate-specific application techniques	IB	5.1	7001
Application, wet method for translucent screen printed, thermal mass transfer and cut graphics	IB	5.7	7007
Application of 3M pressure sensitive films to Panagraphics substrate	IB	5.30	7030
3M Graphics Center Warranty Brochure			9503

Warranties

Bulletin Change Summary

This bulletin has been completely rewritten to add construction options and more important information. Please read it in its entirety.

These products have been discontinued: 3M™ Scotchcal™ Luster Overlaminate 8910 ES and 8911; 3M™ Scotchcal™ Graphic Film 8650-114; 3M™ Translucent Intermediate Graphic Film Series 1330; 3M™ Panaflex™ Enhanced Image Sign Facing 645EI.

These products have been added: 3M™ Panagraphics™ II Intermediate Flexible Substrate; 3M™ Panagraphics™ III Wide Width Flexible Substrate; 3M™ Scotchcal™ Overlaminate 8519 (luster) and 8520 (matte); 3M™ Scotchcal™ Translucent Graphic Film Series 3632GPS.

Improved piezo inkjet inks and additional piezo inkjet printer platforms have been introduced since this bulletin was last updated, which includes the following: 3M™ Piezo Inkjet Ink Series 2200UV for EFI™ VUTEk® PV 200 Printer; 3M™ Piezo Inkjet Ink Series 2600UVv2 and 3M™ Piezo Inkjet Ink Series 2500UV for 3M™ Printer 2500UV; 3M™ Piezo Inkjet Ink Series 2700UV for Durst Rho 160R Printer ; 3M™ Piezo Inkjet Ink Series 2800UV for EFI™ VUTEk® QS2000/QS3200 Printers 3M™ Piezo Inkjet Ink Series 5400UV for MacDermid ColorSpan 5400uv Printer; 3M™ Piezo Inkjet Ink Series 1500v2 for EFI™ VUTEk® 150, 2360/3360, 3300/5300 and 3000/5000 Printers ; 3M™ Piezo Inkjet Ink Series 6000 for Océ Arizona 30s Printer; 3M™ Piezo Inkjet Ink Series 4600 for HP Scitex Pressjet-W™ Printer; 3M™ Piezo Inkjet Ink Series 4800 for HP Scitex TJ8300 Series Digital Press; 3M™ Piezo Inkjet Ink Series 5500 for Océ Arizona 600 Printer; 3M™ Piezo Inkjet Ink Series 6800 for Océ Arizona 180 and 90 Printers.

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