



Application, Maintenance and Removal

3M™ Exterior Aircraft Graphic Film A7706 and 3M™ Exterior Aircraft Graphic Film A7322

NB: These films will be referred to as EAGF throughout this bulletin

READ THIS! This Instruction Bulletin has been substantially updated and contains critical information. All parties involved in specifying or designing aircraft graphics, aircraft owners/operators, graphic manufacturers and installers should read the entire Bulletin before proceeding with the installation. Contact 3M Technical Service if you have questions.

For the most current 3M Technical Information available to successfully use this product, please view this Bulletin electronically and click on the blue underlined links to view the relevant documents.

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1. Description

This Bulletin describes the application, maintenance and removal of 3M™ Exterior Aircraft Graphic Film A7706 and 3M™ Exterior Aircraft Graphic Film A7322 (collectively “EAGF”), and is intended for use by experienced and qualified aircraft graphics installation professionals.



CAUTION

3M does not claim that the 3M™ Exterior Aircraft Graphic Films (EAGF) satisfy, are tested or approved by, or are in compliance with any aviation authority or regulation, including the U.S. Federal Aviation Administration (FAA). Users are responsible for obtaining any necessary approvals and determining fitness for any particular use.

All specifiers, purchasers and users must obtain and read all current, related 3M Literature including this Instruction Bulletin 5.27 and Product Bulletin A7322 and/or Product Bulletin A7706.

2. Approved Graphic Construction Materials

(1) Aircraft Film

- 3M™ Exterior Aircraft Graphic Film A7706
- 3M™ Exterior Aircraft Graphic Film A7322

(2) UV Inkjet Inks and Printers

- 3M™ Piezo Inkjet Ink Series 2200UV
- 3M™ Piezo Inkjet Ink Series 2800UV
- EFI™ VUTEK® GS 3M™ Premium UV Inks
- EFI™ VUTEK® GSr 3M™ Premium UV Inks
- EFI™ VUTEK® GSLXr 3M Superflex UV Ink (*excludes White Ink*)
- EFI™ R3225 3M™ UV Ink
- Mimaki LF-200 Ink Series
Manufactured by 3M
- Mimaki UV Ink LUS-200
Manufactured by 3M
- EFI™ VUTEK® PV200 Printer
- EFI™ VUTEK® QS2000, QS3200, QS3220 and QS220 Printers
- EFI™ VUTEK® GS2000, GS3200 & GS3250 Printers, including GS Pro Series
- EFI™ VUTEK® GS5000r & GS3250r Printers
- EFI™ VUTEK® GS3250LXr and GS5500LXr Pro Printers
- EFI™ R3225 UV Roll-to-Roll Printer
- Mimaki UJV-160, JFX-1631 & 1615R Printers
- Mimaki UJV500-160 Printer

(3) Clear Coats

- 3M™ Screen Print Gloss Clear 1920DR
- 3M™ Screen Print Matte Clear 1930
- 3M™ Screen Print UV Gloss Clear 9740i

(4) Application Tapes Edge Sealers (check for availability in your region)

- 3M™ Prespacing Tape SCPS-2
- 3M™ Prespacing Tape SCPS-100, *where available*
- 3M™ Premasking Tape SCPM-3 *where available*, SCPM-19
- 3M™ Edge Sealer 3950
- 3M™ Edge Sealer 4150S
- 3M™ Edge Sealer ES2000, *where available*

3. Compatible Product, Uses and Application Surfaces Matrix

EAGF	Screen Printing		UV Inkjet Printing		Electrostatic Imaging		Prespace Tape	Premask Tape	Edge Sealer**	Applications and Uses	Application Surfaces and Substrates
	Ink Series	Clear	Ink Series	Clear	Toner Series	Clear					
A7706	UV 9800	9740i	2200UV 2800UV GS GSr GSLXr R3225 LF-200 LUS-200	9740i			SCPS-2 SCPS-100*	SCPM-3 SCPM-19*	ES2000	<ul style="list-style-type: none"> Printed graphics for aircraft exteriors Aircraft identification graphics Non-regulatory exterior labels Printed graphics for aircraft exteriors 	<ul style="list-style-type: none"> Clean, bare, primed or painted aluminum Flat surfaces with or without flush rivets Simple curved surfaces
	Solvent 1900	1920DR					SCPS-2 SCPS-100*	SCPM-3 SCPM-19*	ES 2000 4150S		
A7322	UV 9800	9740i	2200UV 2800UV GS GSr	9740i	8700/ 8800	1920DR 1930	SCPS-2 SCPS-100*	SCPM-3 SCPM-19*	3950 ES2000	<ul style="list-style-type: none"> Printed graphics for aircraft exteriors Aircraft identification graphics Non-regulatory exterior labels Printed graphics for aircraft exteriors 	<ul style="list-style-type: none"> Clean, bare, primed or painted aluminum Flat surfaces with or without flush rivets Raised bead riveted surface [maximum dimensions of rivets: 3/8" (9.5 mm) wide by 1/8" (3 mm) high]
	Solvent 1900	1920DR 1930					SCPS-2 SCPS-100*	SCPM-3 SCPM-19*	3950 ES2000		

*Where available.

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

4. Limitations of End Uses

Aircraft owners/operators, graphics manufacturers and installers have both unique and shared responsibilities for the proper, successful installation and use of EAGF.

3M has identified certain limitations for the use of EAGF. However, 3M does not claim that the information provided in Section 3, above, and statements in Section 4 identifies all possible Product limitations or all responsibilities of the participating parties, nor that following these Limitations will ensure that all other applications are safe or will provide acceptable performance. Refer to the Product Bulletin for the EAGF you are using for additional details.



WARNING

Serious product failure, such as the EAGF lifting off the surface, can result if the EAGF is used on surfaces for which it is not intended or if it is improperly applied or maintained.

A. Specific Film Limitations

- EAGF A7706 is a polyester film and is not as conformable as the vinyl EAGF A7322. This is a property for all polyester film constructions on the market. Keep in mind that polyester film does not conform well over rivets, ridges, valleys and other contours. Also read the Application and Uses section in the individual Product Bulletins. When applied to raised, bead-riveted surfaces, the installer must cut around EAGF A7706 and remove it from the raised rivet.
- EAGF A7706 and A7322 must not be used for any regulatory-required graphics.
- EAGF A7706 and A7322 are available in both perforated and non-perforated versions.
 - Perforated film is recommended for pressurised portions of the aircraft.
 - Non-perforated film is optional for non-pressurised portions of the

aircraft.

- B. Graphic Construction Limitations
- Graphic Protection: Use of an overlamine is not neither recommended nor warranted for these films. Only liquid clear coats are recommended.
 - Application Tape: An application tape is always required on EAGF to help protect the graphic during installation and provide stiffness, which makes large panels easier to install.
- C. Determining Suitability of EAGF for Your Need
- Determine the suitability of the selected EAGF for the intended imaging method and end use.
 - EAGF is only for exterior aircraft graphics. The aircraft owner/operator is responsible for determining if installing EAGF requires regulatory approval from the owner/operator's authorizing agent or appropriate aviation authorities.
 - Complete, sign and return the Designated Engineering Representatives (DER) letter to 3M as stated on the DER. A copy of the DER letter is attached to this document.
- D. EAGF Is NOT INTENDED for Regulatory or Controlled Installations
- Do not use EAGF for the following regulatory or controlled installations. This is not intended to be a definitive list.
- Installations that require conformance to Mil-P-38477A (USAF) or A-A59485.
 - Using for regulatory-required markings.
 - Application to the interior of the aircraft.
- E. EAGF is NOT INTENDED to Be Installed on These Areas or Used in These Conditions
- Do not apply EAGF on the following areas or under the following conditions.
- Movable flaps.
 - Horizontal areas below level of main wings.
 - Wings or engines.
 - Areas covering or surrounding any access panel. Safety requirements dictate that all access panels be visible for emergency access when required. If EAGF is used on the door of an access panel, a margin of EAGF must be removed from the out edge of the door, and the frame around the door equal to 6 to 12 mm (1/4" to 1/2").
 - Doors, windows, hatches, hinges, locking mechanisms or other similar uneven surfaces or safety equipment. EAGF must be cut along the edges or seams of such areas, and/or removed from such areas.
 - Areas exposed to high operating temperatures. Contact 3M's Technical Service if you have questions.
 - Irregular surfaces, extreme, sharply rounded or complex curves, including raised, bead-riveted aircraft surfaces —1.6 to 6 mm (1/16" to 1/4") — unless the EAGF is cut around and removed from the raised rivets.
 - Areas exposed to severe abrasion.
 - Installation of EAGF within 406 mm (16") of the leading edges of any aircraft surface.
 - Application to aircraft skin that is or may be exposed to fluids, such as LD-4, jet A, JP4, aviation gasoline, Mil-L-7808 (synthetic oil), Mil-H-5606A (hydraulic fluid) and blue fluid (lavatories).
- F. Inspecting Installed EAGF
- It is the responsibility of the aircraft owner/operator to periodically inspect the EAGF for lifting, fraying and tearing. Damaged EAGF should be removed and/or repaired immediately by a qualified person, such as the original installer.

5. 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 3M.com/MSDS. When using any equipment, always follow the manufacturers' instructions for safe operation.



CAUTION

When cutting the liner, use care not to damage the skin of the aircraft.



CAUTION

Solvents may ignite near heat or open flame. Do not use heat sources near solvents. Failure to avoid the use of heat sources near solvents can cause flash fire.



CAUTION

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

A. 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. Check with your country environmental authorities to determine whether use of this solution may be restricted or prohibited.

6. EAGF Storage Conditions

- 4° to 38°C (40° to 100°F)
- Out of sunlight
- Clean dry area
- Original container, roll ends inserted, horizontally stored
- Bring the EAGF to print room temperature before using

7. Installation Overview

A. Tools (check for availability in your region)

- 3M™ Plastic Applicator PA1-G Gold, also called “squeegee”
Note: One side can be covered with PTFE tape and one side with the loop portion of 3M™ Hook and Loop Fasteners.
- 3M™ Air Release Tool 391X
- 3M™ Rivet Brush Applicator RBA-1
- 3M™ Power Grip Rivet Brush Applicator RBA-3 (Optional, only needed if the aircraft has raised rivets)
- Scotch™ Masking Tape - 25.4 mm, 50.8 mm and 76.2 (1" and 2" or 3") wide roll
- 3M™ Safety Glasses
- Scissors
- Knifeless™ Tape
- Retractable blade and used blade container
- Measuring tape (for registration)
- Lint-free toweling
- Garbage bags (if the facility does not provide them)
- Isopropyl alcohol (IPA). Isopropyl alcohol (IPA) in a 2 parts IPA to 1 part water mixture or undiluted rubbing alcohol (70%) in spray bottles
- 3M™ Surface Preparation System
- 3M™ Prep Solvent 70.

B. Keys for a Successful Installation

(1) Contact the Aircraft Installation Site's Safety Officer

1. Discuss rules, safety, location of aircraft, entry into building, scaffolding, power, etc.
2. Arrange an on-site inspection to examine the aircraft for rough spots, damage or other problems. Notify the Graphics Manufacturer if you discover any problems; they are your conduit to the aircraft owner/operator.
3. Coordinate the installation date with the site.

(2) Prepare for the Installation

1. Make sure you have all the tools you need, including scaffolding, long power cords and a sufficient quantity of the edge sealer you will need for the EAGF you are using.
2. Review and follow the Layout Plan provided by the graphics manufacturer.
 - Aircraft graphics are generally large and multi-panel. Make sure you have a sufficiently large layout area that is clean and/or covered with a protective cloth to avoid contaminating the EAGF.
 - Layout and dry fit the EAGF panels. Make note of all doors, windows, access panels and openings where the film must be cut away, or joints and seams where the film must be cut to ease stress on the film. Make appropriate alignment marks on the EAGF and aircraft.

IMPORTANT NOTE!

The Layout Plan you receive with the EAGF is intended for a specific model of aircraft and may not position correctly on a different model.

It is your responsibility to ensure that you are installing the EAGF on the correct model of aircraft. If you find a discrepancy, contact the graphic manufacturer and do not proceed until you get clarification.

(3) Installation Reminders

3. Check the temperatures.
 - Air, EAGF and substrate: all between 50°-100°F (10°-38°C).
 - Use an infrared thermometer to check temperatures.
4. Clean the installation areas of the aircraft skin just before installing the EAGF.
1. Use a dry installation technique.
2. Use a sharp, nick free PA-1 applicator with a PTFE and/or loop tape protected edge, or a low friction sleeve.
3. Know and use the correct dragging and plowing squeegee techniques.
4. Keep the EAGF adhesive contaminate free.
5. Install EAGF on flat surfaces with or without flush rivets, and simple curves, keeping in mind that vinyl film A7322 offers more conformability than the polyester film A7706.
6. Use firm squeegee pressure with overlapping strokes.
 - Work out all air bubbles by pushing the air out to the nearest edge or perforation.
 - Puncture the end of bubbles with a 3M™ Air Release Tool 391X tool **only** and push air toward the puncture. Apply heat and squeegee to close the puncture.
 - Work EAGF down into irregular areas with a rivet brush.
7. Overlap adjacent EAGF panels by at least 6 mm (1/4"), but not more than 13 mm 1/2").
8. Remove the premasking tape. Typically start in a corner and pull off diagonally at a 180 degree angle.
9. When cutting, use care not to scratch the aircraft skin. Consider using Knifeless™ Tape as an alternative to cutting with a blade. Information on how to use Knifeless Tape is available at www.knifelesstechsystems.com.

(4) Finishing Steps

1. Cut the EAGF over all substrate seams, around raised rivets, around doors, windows and access panels.
2. Post-heat and squeegee all edges.
3. Apply edge sealer (required for all installations) to all exposed edges.

(5) Plan Your Workflow for

Since most EAGF will be applied while working on scaffolding, plan your workflow so that you do all cutting, weeding, post-heating and resqueegeeing,

and edge sealer application before you move the scaffolding to the next area.

C. Surface Preparation

1. Do not assume that the aircraft application surface is clean. All application surfaces must be cleaned.
2. Do not apply new EAGF over existing film.
 - a. Remove the existing graphic and remove all adhesive residue.
 - b. Then clean the substrate using the appropriate technique.
 - c. Clean the sections of the aircraft you will be working on the day of the installation.
 - d. EAGF failure that occurs because the aircraft skin was not properly cleaned will void any 3M Warranty.
3. To clean unpainted, primed or top-coated aircraft skin:
 - a. Clean with a solvent wipe, using either 3M™ Surface Preparation Cleaner or 3M Prep-Solvent 70 (check for regional availability).
 - b. Follow by cleaning with the 70% IPA solution.
 - c. Refer to instruction bulletin **5.1 Substrate Selection, Preparation and Substrate-specific Application Techniques** for additional details.

(1) About Surface Finishes

- All new surface finishes must be fully cured before applying EAGF to them. Two-part polyurethane paint systems and clear coats outgas as they cure, which can result in the EAGF bubbling.
- If the aircraft has a matte surface (such as some military aircraft), it must be finished to a smoothness comparable to glossy paint or clear coat, especially in areas where the EAGF's leading edge and edge sealer are applied.
- If you have any concerns about the aircraft's surface finish, please contact your graphics manufacturer, who should be aware of such details on any aircraft you are assigned to work on.

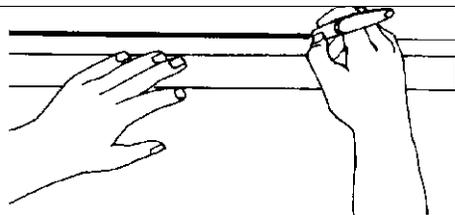
D. Layout and Register the EAGF Panels

1. Position the EAGF on the surface following the graphic manufacturer's supplied Layout Plan.
2. Make registration marks on the surface to position the top or side edges of the EAGF. See FIGURE 1.

IMPORTANT NOTE!

When making registration marks, use a type of marker approved by the aircraft manufacturer for use on the skin of the aircraft. Do not use chalk lines, china markers or grease pencils, which prevent the adhesive from bonding to the surface.

FIGURE 1
Making registration marks



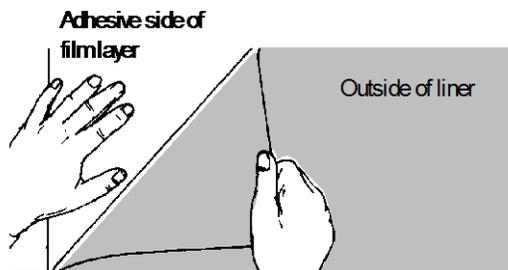
8. Installation Methods

A. Graphics Smaller Than 4 Square Feet (0.4 Square Meters)

The installation methods you use depend on the size of the EAGF. Consider all options before determining the best one for each panel you install.

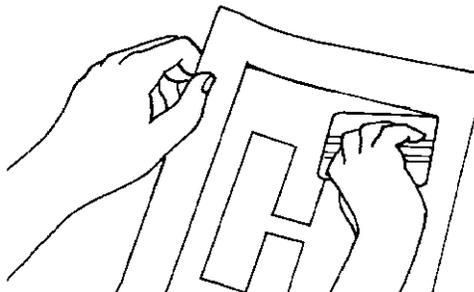
1. Separate the liner and film layer by flicking the film edge away from the liner with the ball of your thumb or a fingernail. A small bend at the corner or edge will also make the liner separate from the film layer.
2. Lay the EAGF face down against the side of the aircraft or on a clean flat surface. Pull off the entire liner in a continuous motion at a 180 degree angle. If the liner is scored, bend at the seam and remove. Always remove the liner from the film layer, not the film layer from the liner to avoid stretching. See FIGURE 2.

FIGURE 2
Remove liner from film layer



3. Tack the EAGF in place with thumb pressure in the upper corners.
4. Hold the rest of the EAGF away from the surface to avoid pre-adhesion. See FIGURE 3. Using firm, initial squeegee pressure, begin at the centre of the EAGF and work outward in all directions.
5. To avoid wrinkles, release the tack points and then squeegee over them.

FIGURE 3
Hold EAGF away from the surface
to prevent pre-adhesion



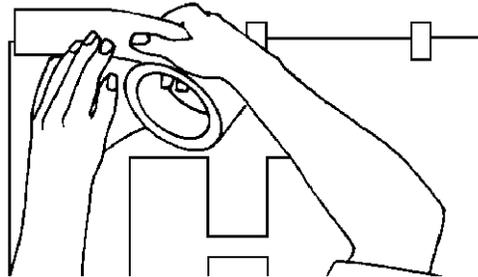
B. Graphics Larger Than
4 Square Feet
(0.4 Square Meters)

1. Centre Hinge Method
 - Good for stripes less than 305 mm (12") wide.
 - Apply a masking tape hinge perpendicular to the longest dimension of the EAGF. See page 9.
 - If the surface is curved, position the hinge so that when the EAGF is folded back, it wrinkles as little as possible.
2. Split Liner Method
 - Good option when masking tape is not available or for horizontal applications. See page 11.
3. Double-Scored Liner
 - Good for all application methods.
 - Remove the liner from the EAGF between the scored lines.
 - Apply the EAGF using the Split Liner Method. See page 11.

C. Top Horizontal Hinge
Method

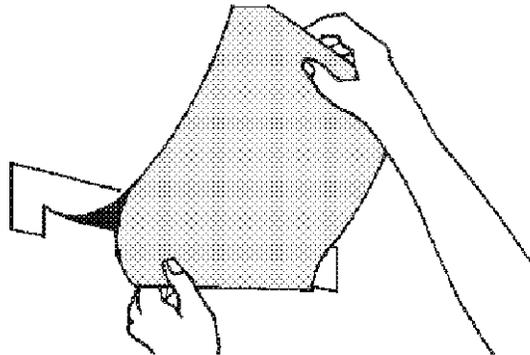
1. Align and tape the EAGF into position with tabs of masking tape.
2. Apply a 51-76mm (2 or 3") wide strip of masking tape over the top edge to make a hinge. See FIGURE 4.

FIGURE 4
Make a hinge



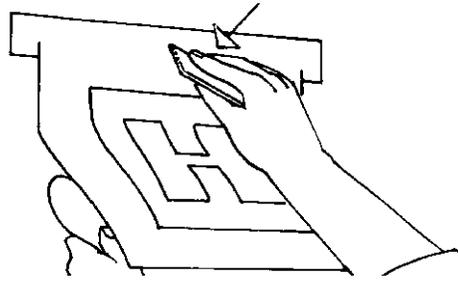
3. Lift up the EAGF, grasp the liner, and peel several inches of liner off the EAGF. See FIGURE 5.

FIGURE 5
Peeling back the liner



4. Hold the EAGF away from the surface with one hand. Allow the adhesive to touch the application surface only as pressure is applied.
5. With firm overlapping squeegee strokes, begin at the top centre and work out to the each edge.
6. Work down the EAGF, peeling off several more inches of liner as needed. See FIGURE 6.
7. Remove the tape hinge and tape tabs and then post-heat and re-squeegee all edges.

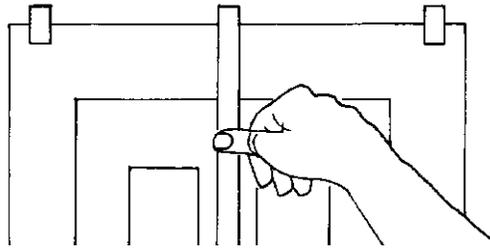
FIGURE 6
Squeegee the EAGF



D. Centre Hinge Method

1. Align and tape the EAGF into position with tabs of masking tape.
2. Apply a 51-76mm (2 or 3") wide strip of masking tape through the centre (horizontally or vertically, but typically the longest dimension) of the EAGF to make a hinge. See FIGURE 7.

FIGURE 7
Make a centre hinge



3. Remove the tape tabs on the side you will begin work.
4. Gently fold half the EAGF back over the hinge.
5. Grasp the liner at the exposed end of the EAGF and peel it off the film layer all the way back to the tape hinge.
6. Carefully cut the liner along the hinge and discard.

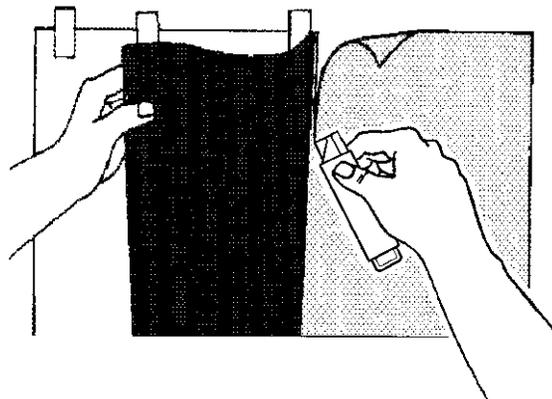


CAUTION

When cutting the liner, use care not to damage the skin of the aircraft.

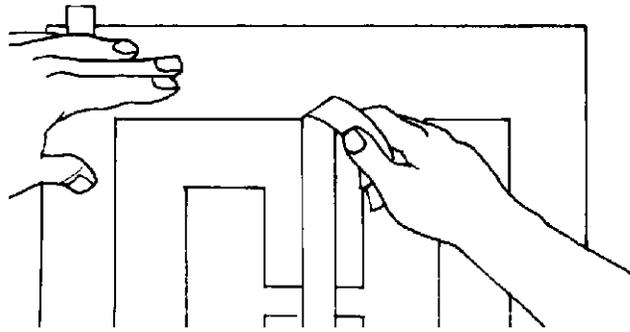
7. Hold the EAGF away from the surface with one hand. Allow the adhesive to touch the application surface only as pressure is applied.
8. With firm overlapping squeegee strokes, begin in the centre and work the shortest distance to the edges, overlapping the previous stroke as you work toward the exposed edge of the EAGF. See FIGURE 8.

FIGURE 8
Cutting off the liner



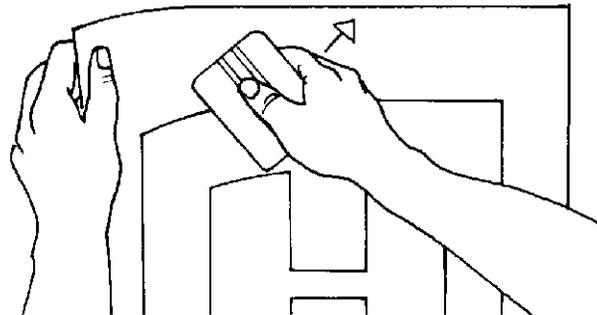
9. Remove the tape hinge. See FIGURE 9.

FIGURE 9
Remove the tape hinge



10. Gently fold over the other side of the EAGF and repeat steps 3 to 8, above. See FIGURE 10.

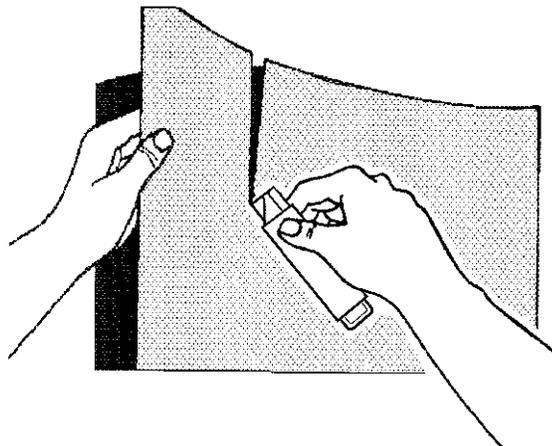
FIGURE 10
Squeegee the EAGF



E. Split Liner Method

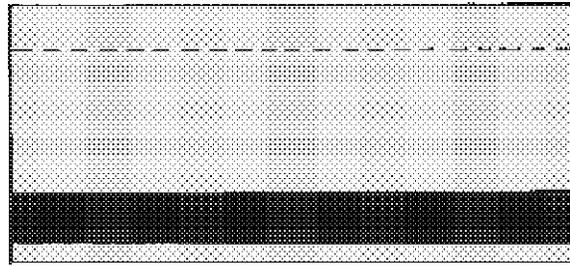
1. Place the EAGF face down on a clean, flat surface. Peel back several inches of the liner and cut off and retain about 1/3 of it. Use care not to contaminate the adhesive or liner. See FIGURE 11.

FIGURE 11
Remove a third of the liner



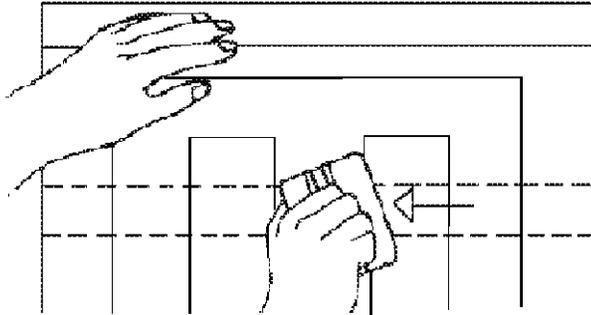
2. Reposition the loose piece of the liner so that 1 to 2 inches (25 to 51 mm) of the adhesive remains exposed. Gently squeegee the plastic side of the liner (the side that originally was in contact with the adhesive) back onto the remaining adhesive. The liner will exceed the dimension of the EAGF, as indicated by the dotted line in FIGURE 12.

FIGURE 12
Moving the liner



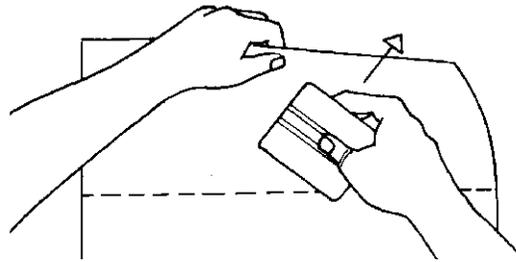
3. Position the EAGF on the aircraft. Squeegee the EAGF where the liner has been removed, which is indicated by the parallel dotted lines in FIGURE 13. This now serves as a hinge.

FIGURE 13
Squeegee the EAGF where liner
has been removed



E. Split Liner Method,
continued

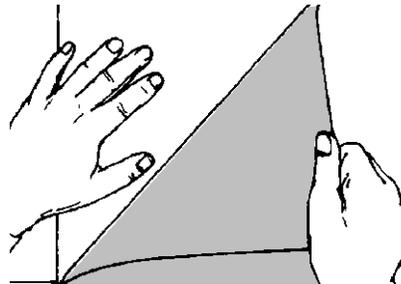
FIGURE 14
Apply the rest of the EAGF



4. Remove the smaller piece of the liner and proceed as for the Centre Hinge Method, Steps 4 to 8, above. Also see FIGURE 14.

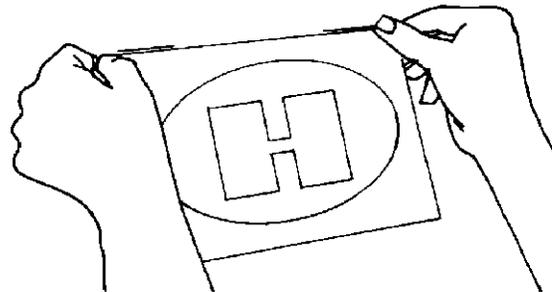
F. Small Pre-Spaced EAGF

FIGURE 15
Remove the liner



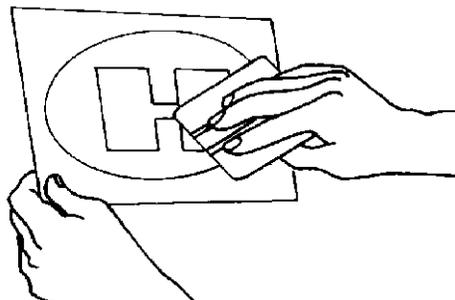
1. Separate the liner and film layer by flicking the film edge away from the liner with the ball of your thumb or a fingernail. A small bend at the corner or edge will also make the liner separate from the film layer.
2. Lay the EAGF face down against the side of the aircraft or on a clean, flat surface. Peel the entire liner off the EAGF in a continuous motion at a 180 degree angle. If the EAGF has a scored liner, bend at the seam and remove. Always remove the liner from the film layer, not the film layer from the liner. See FIGURE 15.

FIGURE 16
Tacking the corners



3. Tack the EAGF in place with thumb pressure in the upper corners. See FIGURE 16.

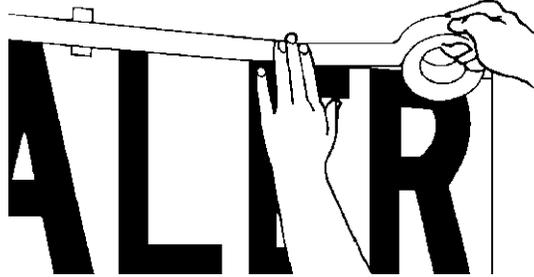
FIGURE 17
Squeegee the EAGF



4. Using firm initial squeegee pressure, begin at the top of the EAGF in the centre and work down and out to the edges. See FIGURE 17.
5. To avoid wrinkles, release the tack points before squeegeeing those areas of the EAGF.

G. Large Prespaced EAGF

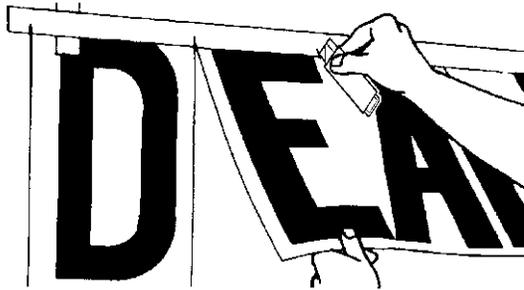
FIGURE 18
Make a top hinge



1. Position the EAGF and tape in place using the **Horizontal Top Hinge Method** as discussed on page 8. See FIGURE 18.

2. Create an independent top hinge for each letter or number (element) by cutting through the premask and into the masking tape. See FIGURE 19.
3. Remove the liner from one element and squeegee it using firm overlapping strokes. Be sure to squeegee the areas where there is just premask. This helps prevent wrinkles and misalignment. Continue with the other elements.

FIGURE 19
Create a top hinge for each character



H. Finishing Steps

1. Remove the premasking tape by pulling it back on itself at a 180 degree angle.
2. Look for air bubbles in the flat areas. To remove a bubble, puncture it at one end with a 3M™ Air Release tool; never use a razor blade. Use a finger to push the air toward the puncture and press out the trapped air.
3. Work the EAGF down into the irregular areas with a rivet brush.
4. Squeegee the EAGF again wherever it is not firmly bonded to the surface. Especially after the application tape has been removed, use a felt or edge-protected squeegee to prevent scratching the EAGF surface. Post-heat and resqueegee all exposed edges and overlaps using very firm pressure.
5. Cut the EAGF on all substrate seams using a sharp blade, in a holder, e.g. a scalpel or similar cutting tool. Post-heat and resqueegee the edges with an edge-protected squeegee or a rivet brush.

I. Edge Sealing

Read all Cautions on page 4.



WARNING

Edge sealer is required on all exposed edges of EAGF applied to aircraft. Improper application may result in lifting and serious product failure. Always use the correct edge sealer for the EAGF you are using, overlap the EAGF and substrate by 1/4" (6 mm) on both side of the EAGF edge, apply consistently along the length of the exposed edge, and then allow the edge sealer to fully cure.

(1) What Edge Sealer to Use

Edge sealing helps protect the EAGF from in-flight wind abrasion and rain. The sealer also increases the resistance to fluids at the EAGF edges. Use the edge sealer specified below:

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

EAGF	Screen Printing		UV Inkjet Printing		Edge Sealer**
	Ink Series	Clear	Ink Series	Clear	
A7706	UV 9800	9740i	2200UV 2800UV GS Gsr	GSLX LF-200 LUS-200 R3225	ES2000
	Solvent 1900	1920DR			
A7322	UV 9800	9740i	2200UV 2800UV GS GSr		3950 ES2000
	Solvent 1900	1920DR 1930			

(2) Where to Edge Seal

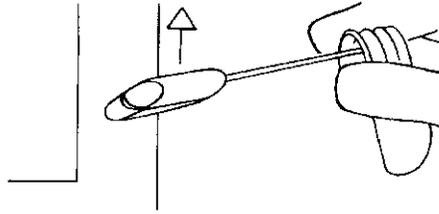
These areas must be edge sealed:

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

(3) How to Apply Edge Sealer 3950 and 4150S

1. Apply the edge sealer with the dauber that comes with it or a brush.
2. Place the dauber so that it covers both the aircraft surface and EAGF equally.
3. Pull the dauber along the EAGF edge in a smooth, continuous motion. See FIGURE 21.
4. Allow the edge sealer to dry in 24 hours at room temperature before returning the aircraft to service.

FIGURE 21
Applying edge sealer



Storage of Edge Sealer 3950 and 4150S

1. Cap the container tightly after each use.
2. If using large quantities, consider transferring the amount you will need into a clean, lidded container to avoid drying out the contents of the larger container and/or cross-contaminating it.
3. Store edge sealers in a cool, dry place.

- (4) How to Apply Edge Sealer ES2000 (This product is not available in all markets, please contact your local representative for product recommendations and technical guidelines.)

3M™ Edge Sealer ES2000 is packaged in Duo-Pak cartridges as part of the 3M™ Scotch-Weld™ EPX™ Applicator System.

1. Follow the applicator instructions for assembly, cartridge loading and dispensing the sealer. Make sure you select the correct Applicator Plunger for the selected sealer.
2. After loading the Duo-Pak cartridge into the EPX applicator, remove the cartridge cap and apply the nozzle to the cartridge.
3. To ensure adequate mixing and to minimize air entrapment in the nozzle, point the nozzle end of the loaded Duo-Pak cartridge in a vertical upward position and slowly expel sealant from the cartridge into the nozzle. Once sealant has reached the tip of the nozzle, expel sealant until no air bubbles are present.
4. Apply sealant to the desired surface/edge using desired position. Properly applied sealant should be transparent with minimal air entrapment.
5. Once Part A and Part B of the sealant materials come in contact with each other, the sealant begins to cure. Depending on the time and temperature, the sealant can set up within the nozzle if it is not dispensed within the working time of the sealant.
6. Idle Times: If after a long idle time, the sealant will not flow, remove and replace the mixing nozzle. For idle times less than the set up time of the sealant, a good practice is to leave the mixing nozzle on the tube until the next time it is used. This will prevent cross contamination of Parts A and B.

J. EAGF Overlaps

- (1) Vertical Overlaps

Apply the rear most piece of EAGF first. The next piece must overlap the first one about 6 mm (1/4"), but not more than 13mm (1/2").

- (2) Horizontal Overlaps

Apply the lower most piece of EAGF first. The next piece must overlap the lower one about 6 mm (1/4"), but not more than 13 mm (1/2").

9. Maintenance

Read all CAUTIONS on page 4.

A. Inspection

It is the responsibility of the aircraft owner/operator to periodically inspect the EAGF for lifting, fraying and tearing. Damaged EAGF should be removed and/or repaired immediately by a qualified person, such as the original installer.

B. Cleaning

EAGF damaged by improper cleaning is not covered by the 3M Warranty. The cleaner must be:

- a wet cleaner suitable for high quality painted surfaces
- non-abrasive.
- It should have a pH value between 3 and 11 (neither strongly acidic nor strongly alkaline.)
- free of strong aromatic solvents, chlorinated solvents and ketone containing solvents, like acetone and methyl ethyl ketone.

C. Repairing Damaged Areas

1. Mask around the damaged area with 5 cm (2") masking tape. This will keep the primer on the damaged area. It is not necessary to mask the windows.
2. Carefully remove the lifted, frayed, or torn part of the EAGF, and trim the area to create a neat edge.
3. Cut a replacement patch to 6 - 12 mm (1/2") larger than the repair area.
4. Clean the area thoroughly with a solvent wipe and then with the isopropyl alcohol cleaning solution.
5. Apply the EAGF following the usual application method.
6. Edge seal all the edges with the recommended edge sealer. See Edge Sealing on page 14.
7. Install the EAGF following the same recommended installation techniques as for a new graphic, including: how to overlap EAGF; cutting at seams and around doors; window; access panels an similar areas; bubble removal; post-heating; resqueegeeing.
8. Apply edge sealer to all edges of the new EAGF piece.

10. EAGF Removal

Read all CAUTIONS on page 4.

A. Removal Characteristics of EAGF

Note: The aircraft skin is very thin and can be damaged easily. Always use caution when removing the EAGF.

- EAGF A7706
 - Aggressive, permanent, pressure-sensitive adhesive.
 - Difficult to remove.
 - Damage caused by removal is not covered by 3M Warranty.
- EAGF A7322
 - Permanent, pressure-activated adhesive.
 - Easier to remove than EAGF A7706 on short term graphics, but difficult to remove on longer term graphics.
 - Removal is possible but may damage substrate, which is not covered by 3M warranty.

B. About the Removal Methods

3M does not warrant the clean or successful removal of EAGF. All methods should be performed on a customer test and approve basis. Be sure the aircraft owner/operator concurs on which method to use.

Four removal methods are described below, in the order of easiest/most common to the more challenging methods, which may be appropriate if the EAGF has remained on the aircraft for a long time and has become brittle.

C. Heat Gun Removal Method

Using a heat gun to soften the EAGF's adhesive can be successful when the EAGF has not been on the aircraft very long.

1. Use a heat gun, use only a temperature controlled heat gun with a maximum operating temperature of 131°C (250°F).
2. Heat the corner of the EAGF with an industrial heat gun set to 50° - 60°C (122° - 140°F).
3. Carefully peel up the heated edge with an air release tool (be careful not to damage the aircraft skin).
4. Slowly pull back the EAGF at an angle less than 90 degrees while continuing to apply heat.
5. Use 3M™ Citrus Based Cleaner or any airline-approved adhesive remover to remove the remaining adhesive residue.
6. Finish the job by wiping with the IPA solution.

IMPORTANT NOTE!

Before using a heat gun, consult the aircraft manufacturer regarding the maximum temperature to which the skin of the aircraft can be heated without affecting surface integrity.

D. Steam Removal Method

Steam removal uses a professional steaming unit, such as a wallpaper steamer to soften the EAGF adhesive, which allows it to be pulled up more efficiently. Especially when used within the EAGF's warranty period, it is typical for very little adhesive residue to remain on the aircraft skin.

Note: Always wear protective gloves to prevent from scalding.

1. Set up the wallpaper remover according to the manufacturer's instructions and read and follow all safety instructions.
2. Turn on the unit and allow it to warm up until it emits steam.
3. Never leave the unit unattended when switched on!
4. In the meantime, cover all switches and sockets securely so that no water or steam can enter them. Do not point the unit directly at the switches or sockets.
5. When the unit is ready, place the steam shield/plate/holder in a suitable location from which to start pulling off the EAGF. Leave it in place for about 20-30 seconds. You may need to adjust this time period depending on the results you achieve.
6. Use a plastic scraper to gently loosen an edge of the EAGF from the aircraft.
7. Slowly remove the EAGF at an angle less than 90 degrees to maximize the amount of adhesive that is removed with the EAGF and to minimize damage to the finish of the aircraft.
8. Use 3M™ Citrus Based Cleaner or any airline-approved adhesive remover to remove the remaining adhesive residue.
9. Finish the job by wiping with the IPA solution.

E. Primer and Tape Method

Important Notice
Before using this removal method, contact your local technical for approval.

In this method, an adhesive primer is applied to the top of the EAGF and then a tape is applied. The tape strengthens the EAGF and makes it easier to remove. It works better to have two people working together removing one stripe at a time. For the best results, work when the air and surface temperatures are 16° to 32°C (60° to 90°F).

(1) Materials Needed

- Scotch™ Masking Tape, 51 mm (2")

- 3M™ Fastbond™ Adhesive 30NF
- Scotch™ Box Sealing Tape 375, 101 mm (4")
- 3M™ Citrus Base Industrial Cleaner

(2) Procedure

1. Gently break the EAGF loose from any edge sealer using a sharp, hard plastic tool.
2. Break the EAGF loose from any edge sealer using a sharp, hard plastic tool.
3. Apply adhesive 30NF with a paint roller/brush to the EAGF.
4. Starting at the rear most position of the EAGF, apply tape 375 to the EAGF.
5. Apply the tape perpendicular to the longest interrupted length of EAGF using a squeegee.
6. Carefully lift the trailing edge of the EAGF at an angle less than 90 degrees.
7. Attach the lifted end of the EAGF to a 10 cm (4") diameter PVC tube.
8. Carefully roll the EAGF onto the tube by rotating the tube slowly.
9. Use 3M's citrus based cleaner or any airline-approved adhesive remover to remove the remaining adhesive residue.
10. Clean the surface with IPA before applying new EAGF.

IMPORTANT NOTE!

DO NOT use Film Remover R221 or Adhesive Remover R221 on graphics protected by UV clear 9740i or if you are uncertain which liquid clear coat was used.

DO NOT use this procedure if the adhesive residue exceeds approximately 25 percent after the EAGF has been removed

F. Film Remover R221 and Adhesive Remover R231

The removal system consists of 3M™ Film Remover R221 and 3M™ Adhesive Remover R231. This system is compatible with aluminum surfaces. However, always test for compatibility before using. The removal system may damage certain paints or finishes. To determine the suitability of the system, test the remover in a small, unmarked and inconspicuous area.

(1) Storage

The film remover and adhesive remover (product) may be stored unopened for up to 3 years from purchase without affecting product performance. The maximum storage life of the product is 3 years from receipt from 3M with these exceptions:

- The product storage life is 1 year after opening the container.
- The product may be stored up to 2 years unopened.

(2) Coverage Rate

Approximate coverage rates when used on EAGF A7322

Product	Rate
Film remover R221	3.7 square metres/litre (150 square feet/gallon)
Adhesive remover R231	37 square metres/litre (1500 square feet/gallon*)

* Based on the maximum adhesive residue left by 37 square metres (1500 square feet) of EAGF.

(3) Removal Conditions

Condition	Rate
Minimum surface temperature	10°C (50°F)
Number of applications of film remover R221	1

Minimum drying time for film remover R221	15 minutes
Minimum drying time for adhesive remover R231	30 seconds

(4) Equipment

- 51 mm (2") wide masking tape
- Paper towels
- Paint brush or paint roller
- Plastic applicator
- Rivet brush
- Plastic squeeze bottle or trigger-type bottle
- Appropriate safety equipment. See the MSDS for recommendations.

(5) Preparation

Reminder: DO NOT use this procedure for graphics protected by UV clear 9740i or if you are uncertain which liquid clear coat was used.

DO NOT use this procedure if the adhesive residue exceeds approximately 25 percent after the EAGF has been removed

1. Wash and dry the EAGF and the surface around it.
2. Be sure that the surface temperature is at least 10°C (50°F) but not more than 29°C (85°F). If the surface is outside this range, the aircraft must be moved to a suitable location or the work delayed.
3. If the surface is painted, test the surface in an inconspicuous place for possible surface finish damage. See Step (6)1, below, for the test procedure.
4. Mask off the area surrounding the EAGF.
5. Construct a drip trough to catch the fluids and minimize cleanup using one of these methods:
 - a. Mask the surface around the EAGF and make a "drip trough" with masking tape or cardboard to prevent residue from dripping onto surfaces around the EAGF.
 - b. Spray the surface around the edge of the EAGF with a commercially-available release agent, such as vegetable cooking spray. Form a "drip trough" with masking tape or cardboard along the bottom to prevent residue dripping onto the surface below the EAGF. Care should be taken to ensure that the release agent is not sprayed onto the EAGF which is to be removed. Any release agent accidentally sprayed onto the EAGF must be wiped off.

(6) Painted Surface Test Procedure

1. Wear any safety equipment and observe any safety practices recommended in the MSDS.
2. Using a paint brush or sponge-type roller, thoroughly wet a small area of the surface with film remover R221.
3. Allow the remover to dry for at least 15 minutes. If the ambient temperature is below 21°C (70°F), longer drying time is required; see Drying Time Requirements.
4. Peel the dried film remover from the painted surface.
5. Check for surface finish or surface damage. If any occurs, discontinue using this method and clean the affected area.

(7) General Procedure

1. Wear any safety equipment and observe any safety practices recommended in the MSDS.
2. Clean the surface and the EAGF with detergent and water. Dry the surface thoroughly.

Note: Film remover R221 is extremely difficult to remove from weathered paint; therefore, it is imperative that the surface around the EAGF be masked off or sprayed with a release agent.

3. Using a paint brush or roller, thoroughly coat with the film remover R221.

Keep the container covered when not in use to prevent rapid evaporation of solvent.

4. Allow the film remover R221 to dry for at least 15 minutes after application. Cooler temperatures require additional drying time.

(8) General Procedure

Drying Time Requirements for Film Remover R221

Temperature	Approximate Drying Time
27°C (80°F)	15-20 minutes
21°C (70°F)	15-30 minutes
16°C (60°F)	15-45 minutes
10°C (50°F)	30-60 minutes or longer

5. Test for removability by grasping a corner of the EAGF and pulling from the surface at less than a 90 degree angle with gentle/moderate force.
6. The EAGF should stretch like rubber while being removed; if it is brittle, stop, apply a second coat, let dry and proceed with the removal.
7. When the EAGF has been completely removed, pull off the masking tape but leave the drip trough in place.
8. Fill a squeeze or trigger-type bottle with adhesive remover R231. Squirt this liquid in 1 square foot sections onto any adhesive residue remaining. Allow the liquid to penetrate for at least 30 seconds, but not longer than 60 seconds.
9. Remove the adhesive by scraping with a plastic applicator or rivet brush. Once loosened, wipe the residue with a cloth saturated with adhesive remover. Repeat these steps if necessary.
10. Remove the drip trough. Clean the entire surface with a solvent wipe, followed by a wash with detergent and water. Dry the surface.
11. Failure to properly wash and remove all excess adhesive remover will adversely affect the adhesion of new EAGF applied to the surface.

Note: If new EAGF is to be applied, the surface must be solvent wiped following the procedures outlined in this 3M Instruction Bulletin 5.27

11. Disposal of Waste

Please handle all waste in a responsible manner. Refer to any applicable MSDS sheets. Since regulations vary, consult applicable regulations or authorities before disposal.

12. Warranty

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.

See the Specific Warranty for 3M™ Exterior Aircraft Graphic Films in the applicable aircraft graphic film Product Bulletin, which gives the terms, additional limitations of the warranty, if any, and limitations of liability.

13. Limitation of Liability

Except where prohibited by law, 3M shall not under any circumstances be liable to purchaser or user for any direct, indirect, special, incidental, or consequential damages (including, but not limited to, labor, non-3M material charges, loss of profits, revenue, business, opportunity, or goodwill) resulting from or in any way related to seller's products, services or this bulletin. This limitation of liability applies regardless of the legal or equitable theory under which such losses or damages are sought including breach of contract, breach of warranty, negligence, strict liability, or any other legal or equitable theory.

14. Bulletin Change Summary

This Instruction Bulletin has been substantially updated. All installers must read the entire Bulletin before proceeding with the installation. Ink Series 2700UV has been discontinued.

15. Health & Safety

Refer to the package label and the Material Safety Data Sheet for health, safety, and handling information on the products referenced in this bulletin. For 3M products, if necessary, you may contact our Toxicology/Product Responsibility Department on 01344 858000.

Important Notice to Purchaser

The 3M products described in this publication are covered by a 3M warranty and limitation of liability.

3M's warranty provides that if 3M finds that goods are defective in material or workmanship they will be replaced or the price refunded at 3M's option but note that 3M does not accept liability for other direct losses (except for personal injury or death) or consequential losses relating to defective products or from information supplied by 3M.

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