BOMBARDIER
Toronto Site
PROPRIETARY INFORMATION

PPS 10.38

PRODUCTION PROCESS STANDARD

REPAIR OF DECORATIVE FILM COVERED COMPONENTS

Issue 5
- This standard supersedes PPS 10.38, Issue 4.
- Vertical lines in the left hand margin indicate changes over the previous issue.
- Direct PPS related questions to christie.chung@aero.bombardier.com or (416) 375-7641.
- This PPS is effective as of the distribution date.

Signed original on file. Validation of paper prints is the responsibility of the user.

Prepared By:	(Christie Chung)	December 7, 2015
	PPS Group	
Approved By:	(Hai Yen Tran)	December 11, 2015
	Materials Technology	
	(Stephen Pitt)	December 17, 2015
	Quality	

TABLE OF CONTENTS

Sections **Page**

Figures

1 SCOPE

1.1 This Production Process Standard (PPS) specifies the acceptable limits of defects in the decorative film of interior furnishings components; it also specifies which defects are repairable, what authority is required for such repairs, and the applicable repair procedure.

1.1.1 This PPS complements the engineering drawings that specify its use as an authorized instruction. The procedure specified in this PPS shall be followed to ensure compliance with all applicable specifications. In general, if this PPS conflicts with the engineering drawing, follow the engineering drawing. The requirements specified in this PPS are necessary to fulfil the engineering design and reliability objectives.

1.1.2 Refer to PPS 13.26 for the subcontractor provisions applicable to this PPS.

1.1.3 Procedure or requirements specified in a Bombardier BAPS, MPS, LES or P. Spec. do not supersede the procedure or requirements specified in this PPS. Similarly, the procedure and requirements specified in this PPS are not applicable when use of a BAPS, MPS, LES or P. Spec. is specified.

2 HAZARDOUS MATERIALS

2.1 Before receipt at Bombardier Toronto, all materials shall be approved and assigned Material Safety Data Sheet (MSDS) numbers by the Bombardier Toronto Environment, Health and Safety Department. Refer to the manufacturer's MSDS for specific safety data on any of the materials specified in this PPS. If the MSDS is not available, contact the Bombardier Toronto Environment, Health and Safety Department.

3 REFERENCES

3.1 BAERD GEN-023 - Contamination Control for Compressed Air.

3.2 PPS 10.35 - Fabrication of 250°F Cure, Epoxy Resin Pre-Impregnated, Fibre Reinforced Composite Parts.

3.3 PPS 10.40 - Repairs to Laminates & Sandwich Panels.

3.4 PPS 13.26 - General Subcontractor Provisions.

3.5 PPS 25.31 - Bonding using Bostik/Boscodur Adhesive.

3.6 PPS 25.53 - Bonding using EC-2262 Adhesive.

3.7 PPS 25.55 - Bonding using DHMS A6.11 Type II Class 1 Adhesive.

3.8 PPS 25.57 - Application of DHMS A6.10 Type I Adhesive.

3.9 PPS 31.17 - Solvent Usage.

4 MATERIALS, EQUIPMENT AND FACILITIES

4.1 Materials

4.1.1 Laminate (Film), Plastic, Interior, Decorative to DHMS P1.28 (colour to DS82).

4.1.2 Vacuum bagging film, DSC 234-1 or DSC 234-3.

4.1.3 Breather/bleeder cloth, DSC 234-9.

4.1.4 Vacuum bag sealant, DSC 234-17.

4.2 Equipment

4.2.1 Compressed air shall meet the requirements of BAERD GEN-023.

4.2.2 Support tool, approximately 4" larger on all sides than the part.

4.2.3 Hot air guns capable of heating the decorative film to 100°C (212°F).

4.2.4 Heating oven capable of maintaining a temperature of 100°C (212°F).

4.2.5 A shop vacuum source capable of maintaining a vacuum of 28" Hg.

4.2.6 Spray equipment, rollers and brushes for applying adhesive.

4.3 Facilities

4.3.1 This PPS has been categorized as a Controlled Special Process according to PPS 13.39 and as such only facilities specifically approved according to PPS 13.39 are authorized to perform repair of decorative film covered components according to this PPS.

4.3.2 Bombardier subcontractors shall direct requests for approval to Bombardier Aerospace Supplier Quality Management. Bombardier Aerospace facilities shall direct requests for approval to the appropriate internal Quality Manager.

4.3.3 Facility approval shall be based on a facility report, a facility survey and completion of a qualification test program, if required. The facility report shall detail the materials and equipment to be used, the process sequence to be followed and the laboratory facilities used to show compliance with the requirements of this PPS. Any deviation from the procedure or requirements of this PPS shall be detailed in the facility report. Based upon the facility report, Bombardier Toronto Materials Technology may identify additional qualification and/or process control test requirements. During the facility survey, the facility requesting qualification shall be prepared to demonstrate their capability. Once approved, no changes to subcontractor facilities may be made without prior written approval from Bombardier Toronto Materials Technology.

4.3.3.1 For approval of subcontractor facilities to perform repair of decorative film covered components according to this PPS, completion of a test program and submission of suitable test samples representative of production parts is required. Test samples shall meet the requirements as defined by Bombardier Toronto Materials Technology.

5 PROCEDURE

5.1 General

5.1.1 Throughout this PPS, whenever reference is made to MRB consider the reference to include Bombardier MRB or Bombardier delegated MRB only.

5.1.2 DHMS P1.28 film is used as a decorative facing material for aircraft interior components.

5.1.3 Refer to PPS 10.46 for a more detailed description of the decorative film (i.e., general description, classes, types, inspection requirements, etc.) and film application procedures.

5.1.4 For the purposes of this PPS, items such as buffet, bulkheads, toilet, doors, ceiling panels, side wall, window reveals and dado panels above the window reveals are considered high visibility items and items such as dado panels and sidewall panels below the window reveals are considered low visibility items.

5.1.5 For the purposes of this PPS, defects which do not require MRB authority to repair are considered minor defects and defects for which MRB authority is required to repair are considered major defects.

5.2 Applicability of Repairs

5.2.1 For low visibility items, bumps caused by contamination entrapped on the glue line up to 1/8" in diameter with a maximum height of 0.020" do not require repair if there are no more than 2 per panel.

5.2.2 Refer defects in the panel visible through the decorative film which exceed the acceptable limits specified in PPS 10.35 to MRB for disposition (this may include removal of the decorative film, repair of the panel according to PPS 10.40 and re-covering of the panel as specified herein).

5.2.3 MRB authority is not required for repair of the following minor defects:

- Lack of adhesion up to 1" in width and length up to 25% of the edge. Repair according to paragraph 5.3.1.
- Entrapped air bubbles: up to 1 square inch in area and no more than 1 per square foot on high visibility items; up to 2 square inch in area and no more than 2 per square foot on low visibility items. Repair according to paragraph 5.3.2.
- Surface scratches, abrasions, cuts or tears up to 1" in length, 1/8" in width and no more than 1 per square foot on low visibility items. Repair according to paragraph 5.3.3.

5.2.4 For the following major defects, MRB authorization is required for repair. Repair by re-covering part of the component according to section 5.4 or by re-covering the entire panel according to section 5.5, as specified by MRB.

- Any wrinkles on high or low visibility items.
- Any stains which are not removable by washing on high or low visibility items.
- Surface scratches, abrasions, cuts or tears on high visibility items and on low visibility items if more than 1" in length, more than 1/8" in width or there are more than 1 such defect per square foot.
- Bumps caused by contamination entrapped on the glue line on high visibility items or on low visibility items that are more than 1/8" in diameter, more than 0.020" in height or more than 2 per panel.
- Lack of adhesion on edges of both high visibility or low visibility items, if the defect area is more than 1" in width or the defect length is more than 25% of the edge.
- Entrapped air bubbles on high visibility items which are more than 1 square inch in area or more than 1 such defect per square foot.
- Entrapped air bubbles on low visibility items when the defect is more than 2 square inches in area or more than 2 such defects per square foot.

5.3 Repair of Minor Defects (MRB Authority not Required)

5.3.1 MRB authority is not required to repair lack of adhesion up to 1" in width and length up to 25% of the edge on either high visibility or low visibility items. Heat the delaminated area using a hot air gun and roll down with a rubber roller. This may re-activate the adhesive. If this is not successful, apply the solvent specified in PPS 31.17 to the glue line using a small brush, and roll down with a rubber roller. If proper adhesion is still not obtained, repair delamination of decorative film along edges as follows:

Step 1. Prepare a small quantity of DHMS A6.11 Type II Class 1 or EC-2262 adhesive according to PPS 25.55 or 25.53 respectively.

Step 2. Using a small brush, apply the adhesive to the glue line.

Step 3. Roll down firmly using a rubber roller. Roll in such a manner as to spread the adhesive into all unbonded areas. Adhesion may be enhanced by heating the bond area with a hot air gun while rolling down.

Step 4. Remove excess adhesive by solvent cleaning according to PPS 31.17.

5.3.2 MRB authority is not required to repair entrapped air bubbles up to 1 square inch maximum area and no more than 1 per square foot on high visibility items, or up to 2 square inch maximum area and no more than 2 per square foot on low visibility items. Repair entrapped air bubbles as follows:

Step 1. Puncture the air bubble using a sharp instrument, provided no visible damage occurs.

Step 2. Heat the area of the air bubble using a hot air gun and roll down using a rubber roller. Roll in such a manner as to move the entrapped air towards and out the puncture.

5.3.3 MRB authority is not required to repair surface scratches, abrasions, cuts or tears up to 1" in length, 1/8" in width and no more than 1 per square foot on low visibility items. Repair such defects as follows:

Step 1. Remove any loose film at the location of the scratch, abrasion, cut or tear by carefully trimming with a sharp knife (X-Acto or similar).

Step 2. Fill in the scratch, abrasion, cut or tear with semi-gloss or matt paint using a small brush. Ensure that the colour matches the colour of the decorative film, including the colour of the decorative pattern, if applicable.

5.4 Re-covering Part of Component - Using Decorative Film Patch

5.4.1 Repair defects by re-covering only the damaged portion of the decorative film (repair patch) only if authorized by MRB. Ordinarily repair patching is only allowed on low visibility items when the extent of the defect area is no more than 12" in length, 4" in width and only 1 such area per panel.

5.4.2 Replace the affected portion of the decorative film with a patch of DHMS P1.28 film of the same Class, Type, colour and decorative pattern as the original.

5.4.3 Prepare the patch as follows (see Figure 1):

Step 1. Place a piece of the decorative film over the damaged area, match the decorative pattern and tape securely to the component with masking tape.

Step 2. Using a sharp knife (X-Acto or similar), cut through the new and the original film in a lenticular pattern. Using only sufficient pressure to cut the film, taking care not to penetrate the outer laminate of the component.

Step 3. Remove the new patch.

Step 4. Heat one corner of the old patch using a hot air gun and carefully lift up the patch.

Step 5. Apply heat to the glue line while pulling on the film to peel the old patch off.

Step 6. Remove residual adhesive from the component by solvent cleaning according to PPS 31.17. Except for fully cured BOSTIK 7132, repeat solvent cleaning as necessary until all traces of adhesive have been removed (solvent cleaning will not remove fully cured BOSTIK 7132 and is not necessary).

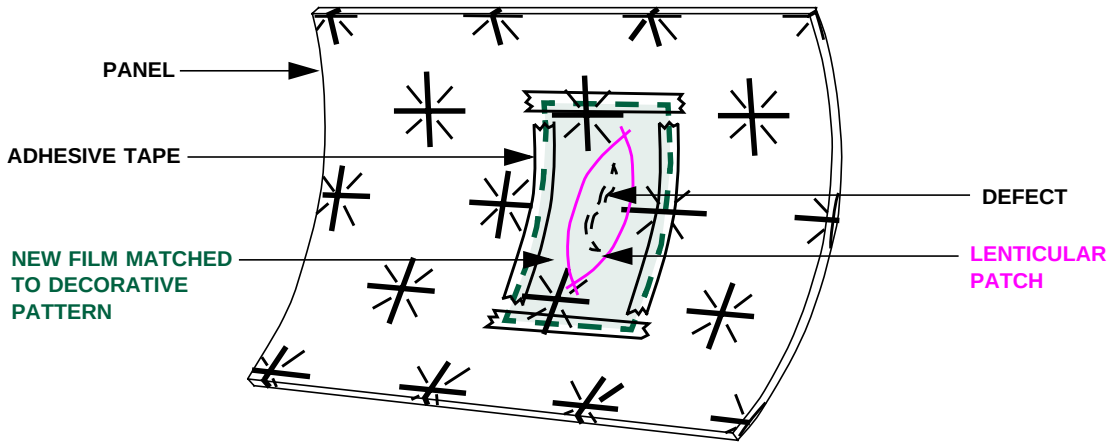

FIGURE 1 - CUTTING OF PATCH

5.4.4 If the component (i.e., laminate or sandwich panel) has been damaged, refer to PPS 10.40 for the repair authority required and the repair procedures.

5.4.5 Apply the decorative film patch as follows:

Step 1. Scuff the surface of the component with 120 - 180 grit abrasive paper.

Step 2. Wipe the component with a clean, dry rag or blow clean with oil-free, compressed air; then tack-rag the surface.

Step 3. Prepare a sufficient quantity of EC-2262 adhesive according to PPS 25.53.

Step 4. Apply a thin, even brush coat of EC-2262 to the bonding surface of the component.

Step 5. When using DHMS P1.28, Class 1 (with no adhesive coating) decorative film, it is necessary to apply a coat of EC-2262 to the contact side of the film. It is not necessary to apply adhesive to DHMS P1.28, Class 2 film (it is already coated with adhesive).

Step 6. Allow the adhesive to become tacky (approximately 3 - 5 minutes).

Step 7. Carefully place the patch in position on the component.

Step 8. Roll down using a rubber roller, taking care not to disturb the positioning of the patch. Adhesion may be enhanced by heating the patch with a hot air gun while rolling down.

Step 9. Remove excess adhesive by solvent cleaning according to PPS 31.17. Use solvent sparingly to prevent solvent seeping through the splice, softening the adhesive.

5.5 Re-Covering the Entire Panel

5.5.1 Carry out repair by re-covering the entire component only if authorized by MRB. Re-covering the entire panel is ordinarily required for repair of defects on low visibility items when the extent of the defect is more than 12" in length, 4" in width or more than 1 such area per panel and on all high visibility items. It is easiest to remove the film within the first two hours of application; the longer the adhesive ages, the more difficult it is to remove the film.

5.5.2 Re-cover the component using DHMS P1.28 film of the Class, Type, colour and decorative pattern specified.

5.5.3 Remove the damaged decorative film using one of the following methods:

- Use a hot air gun to apply heat to the glue line while pulling the film.
- Use an oven to heat the glue line to 100°C (212°F) maximum, remove the part and quickly pull off the decorative film before the glue line cools.
- Apply solvent to the glue line while pulling the film. A pressure squirt gun is recommended to maintain a supply of solvent at the glue line. Position the component so as to form a reservoir at the glue line.

5.5.3.1 After removing the damaged decorative film, remove residual adhesive from the component by solvent wiping according to PPS 31.17. Repeat as necessary until all traces of adhesive have been removed. After solvent cleaning, heat the component in an oven operating at 60°C (140°F) for one hour to drive off residual solvent; this is particularly important for honeycomb core sandwich panels where the solvent may have entered core cells through pinholes in the facing plies.

5.5.4 If the component (i.e., laminate or sandwich panel) has been damaged, refer to PPS 10.40 for the repair authority required and the repair procedures.

5.5.5 Re-cover the component using the decorative film and adhesive specified by MRB. If BOSTIK 7132 adhesive is specified, apply the film according to PPS 10.46. If DHMS A6.10 Type I or EC-2262 is specified, apply the film as follows:

Step 1. Unroll the decorative film on a clean, flat surface and cut off a piece slightly larger than the component to be covered.

Step 2. Scuff the surface of the component with 120 - 180 grit abrasive paper. Vibrating sanders may be used.

Step 3. Wipe the component with a clean, dry rag or blow clean with oil-free compressed air; then tack-rag the surface. Do not solvent clean the component as solvent may become entrapped, particularly in honeycomb cells, causing blistering of the decorative film during or after film application.

Step 4. Prepare a sufficient quantity of DHMS A6.10 Type I or EC-2262 according to PPS 25.57 or PPS 25.53, respectively.

Step 5. Apply one coat of adhesive to the bonding surface of the component. Also apply a coat of adhesive to the bonding surface of the decorative film if applying DHMS P1.28, Class 1 (i.e., with no adhesive coating) decorative film; it is not necessary to apply adhesive to DHMS P1.28, Class 2 film as it is already coated with adhesive. If possible, apply DHMS A6.10 Type I adhesive by spray; thin the adhesive for spray application by adding solvent as specified in PPS 31.17. EC-2262 is not suitable for spray application. In other applications, the adhesive may be rolled or brushed on; avoid heavy brush marks as they will show through the decorative film.

Step 6. Allow the adhesive to air dry for 1 to 5 hours. Protect the adhesive coated surfaces from dust and other contamination. During the adhesive drying period, puncture all air bleed holes in the component with a pin as they will have become plugged with adhesive.

Step 7. Remove the backing paper from the decorative film and place the film onto the component, ensuring that pattern orientation, as applicable, is according to the engineering drawing.

Step 8. In order to eliminate movement of the film during handling and bagging, the film may be locally tacked to the component by heating with a hot air gun.

Step 9. Apply heat and pressure to the assembly using the vacuum press (paragraph 5.5.5.1), vacuum bag (paragraph 5.5.5.2) or hand lay up (paragraph 5.5.5.3) methods to thermoform the decorative film to the part contour and to reactivate the adhesive.

5.5.5.1 If possible (i.e., for flat parts or curved parts for which a support tool is available), thermoform the decorative film to the part contour and reactivate the adhesive using the vacuum press method according to PPS 10.46. Use the vacuum press cure cycle shown in PPS 10.46 whether using BOSTIK 7132/BOSCODUR #1, DHMS A6.10 Type I or EC-2262 adhesive.

5.5.5.2 If use of the vacuum press method is not possible, thermoform the decorative film to the part contour and reactivate the adhesive using the vacuum bag method as follows:

Step 1. Cover the face of the component with breather cloth. When the component is not on the tool, also cover the back of the component with breather cloth.

Step 2. Seal the assembly (tool where applicable, component and film) in a vacuum bag using standard shop practice and apply 2 - 5" Hg of vacuum. See Figure 2 and Figure 3.

Step 3. Transfer the bagged assembly to an oven and follow the applicable heat/pressure (i.e., vacuum) cycle shown in Figure 4. The particular cure cycle to be used depends on the shape of the part and the material being applied (i.e., the first cycle shown below is a higher temperature cycle required for thermoforming TYPE 8 film into compound curvatures).

Step 4. When the part has cooled to 45°C (115°F), release the vacuum, de-bag and remove the component.

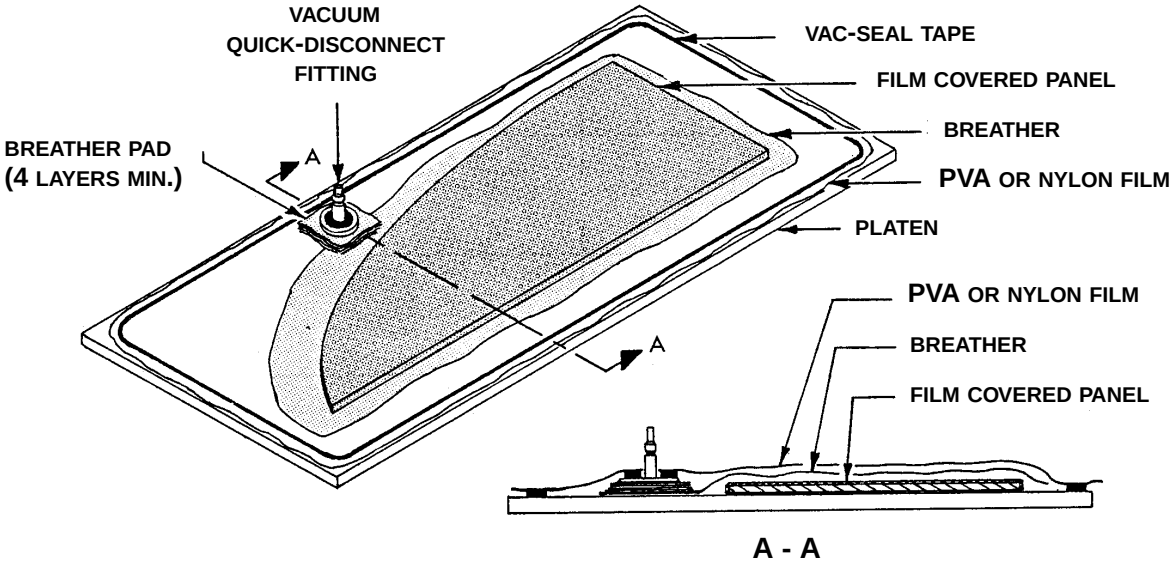

FIGURE 2 - VACUUM BAG (ON TOOL)

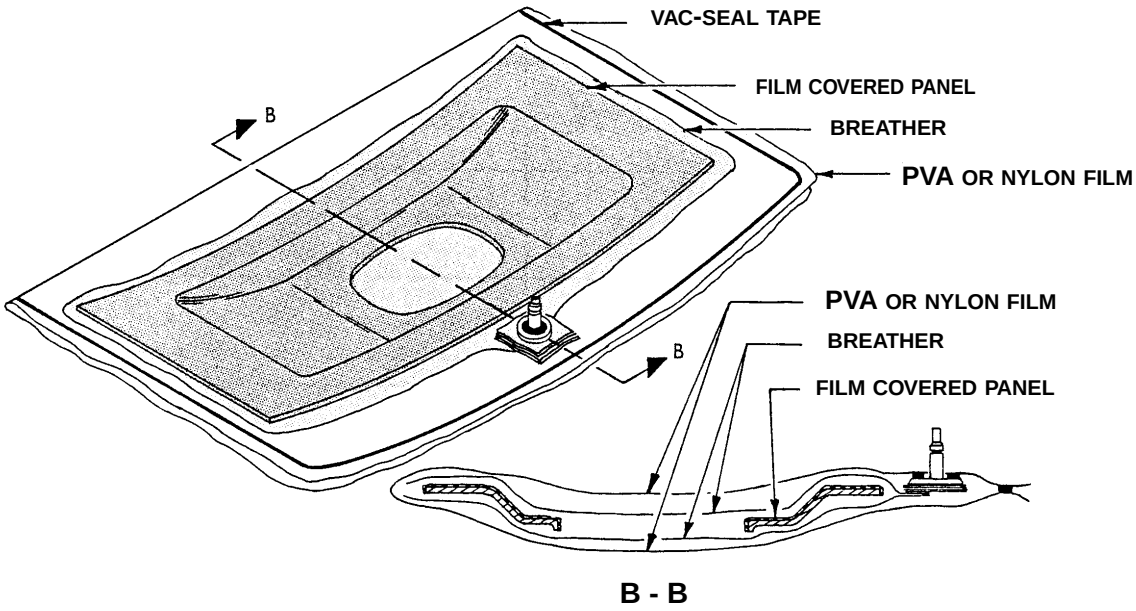

FIGURE 3 - VACUUM BAG (NO TOOL)

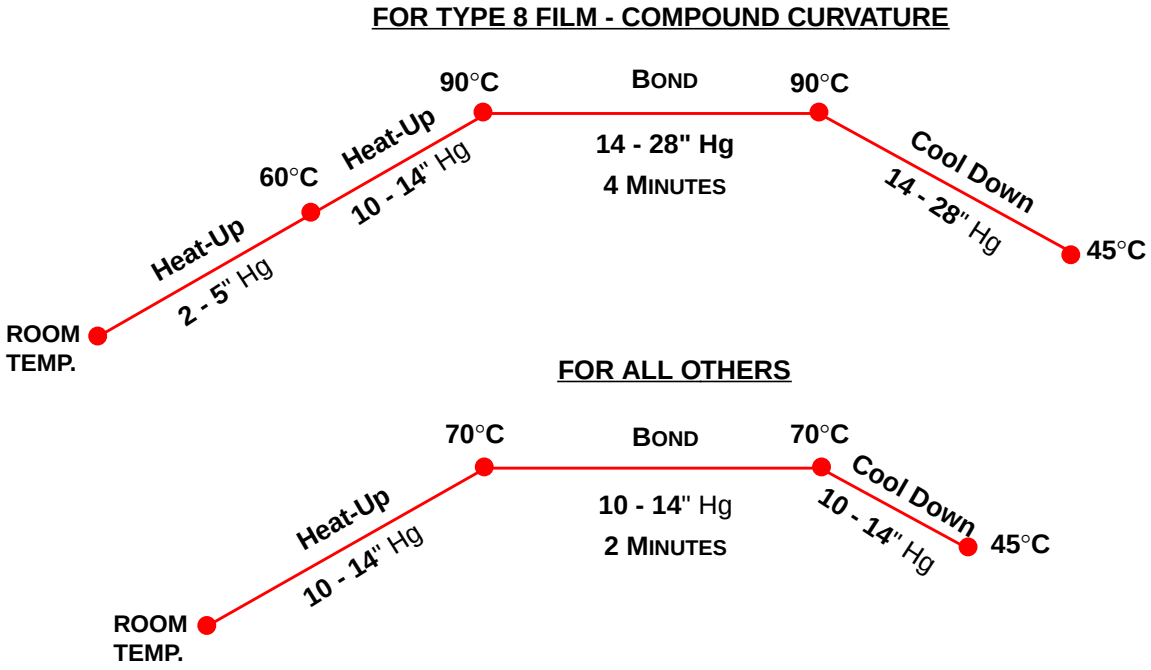

Figure 4 - CURE CYCLES

5.5.5.3 Use the hand lay-up (i.e., 'Wallpaper') method as follows to thermoform the decorative film to the part contour and reactivate the adhesive if it is not possible to use the vacuum press or vacuum bag/oven methods, provided the component is flat, single curvature, or very mildly contoured.

Step 1. Position the film on the component. Match patterns where required.

Step 2. Starting in the centre of one edge, bond the film to the component. The area from which to start may vary with different components, however, if pattern matching is required, bonding shall start at that edge.

Step 3. The heat and pressure necessary to achieve a bond may be applied by a heat gun and rubber roller or by 'pressing' with a clothes iron. When heating with a heat gun, direct the heat onto the decorative film long enough to heat the film and the adhesive on the surface of the component to 70 - 100°C (160 - 212°F), while applying pressure with the roller. When using an iron, set the heat at slightly over 100°C (212°F) and move the iron so that the temperature of the film and the adhesive on the surface of the component reaches 70 - 100°C (160 - 212°F). To protect the surface of the decorative film when applying heat with an iron it may be necessary to place a layer of bleeder, Fibre Mat, or similar material over the film to prevent direct iron contact with the film surface.

Step 4. Work outwards from the centre, progressively heating a small section at a time.

Step 5. Check each section, immediately after rolling or ironing, for entrapped air (blisters) and wrinkles. Remove them, if present, as they occur. To remove blisters, push them with the roller to the nearest edge, heating a path with the heat gun. If this is unsuccessful, prick the blister at one end and push the air towards the hole with the roller. If still unsuccessful, de-bond the film back to the blister using the heat gun. This third method may also be used to remove wrinkles.

Step 6. It is possible to form the film over mild contours. Use the heat gun and appropriately shaped rubber rollers to form the film to these contours.

Step 7. Place the component on top of the vacuum diaphragm on the vacuum press, in an oven or under a bank of heat lamps and heat the decorative film covered surface to 70°C (160°F) for 3 - 4 minutes. There are two reasons for this heat cure: to enhance adhesion and to detect solvent entrapment (either through entrapment in the honeycomb core cells or through insufficient air drying of the adhesive).

Step 8. Remove the heated assembly and, if bubbles are present, roll the film down with a rubber roller. Bubbles may be needle pricked provided no appearance defect results.

5.5.6 After film application has been completed, it is normally necessary to finish the edges by folding the film back over the edges as follows. Refer to the Engineering drawing for specific details.

Step 1. Trim off excess decorative film, leaving sufficient for fold back to the dimensions shown on the engineering drawing, normally approximately 3/8".

Step 2. At corners it will be necessary to notch or slit the film.

Step 3. Apply by brush, a thin uniform coat of adhesive to both the decorative film and the component in the fold back area. Allow the adhesive to air dry until it becomes tacky but does not transfer to the finger when lightly touched. Use DHMS A6.11 Type II Class 1 adhesive for fold back, except DHMS A6.10 Type I or EC2262 adhesive may be used if these adhesives were used for bonding the remainder of the panel.

Step 4. Fold the film over and press down firmly. If the adhesive has dried too long, re-activate with a hot air gun. The hot air gun will also assist in forming the film.

Step 5. Trim off excess film to the dimensions shown on the Engineering Drawing.

5.6 Partial Removal of Decorative Film to Allow Panel Edge Trimming

5.6.1 If specified by MRB to facilitate installation, partially remove decorative film to allow panel edge trimming as follows:

Step 1. Heat the edge of the decorative film in the area to be trimmed using a hot air gun and carefully lift up the edge of the film. Apply the solvent specified in PPS 31.17 sparingly to the glue line to assist in peeling the film back. Do not pull hard as permanent deformation (stretching) of the film may occur. Peel back only far enough to clear the area to be trimmed. Masking tape may be used to hold the film clear of the area to be trimmed.

Step 2. Remove residual adhesive from the panel and decorative film by solvent cleaning according to PPS 31.17.

Step 3. Trim the panel to required shape according to MRB instructions.

Step 4. Solvent clean the bond surface of the panel and the bond surface of the decorative film according to PPS 31.17.

Step 5. Prepare a sufficient quantity of DHMS A6.11 Type II Class 1 adhesive to re-bond the decorative film. Stir the adhesive in its own container before use.

Step 6. Apply a thin, even brush coat of DHMS A6.11 Type II Class 1 adhesive to the bonding surface of the decorative film and the panel.

Step 7. Allow the adhesive to become tacky (approximately 3 - 5 minutes) and roll down using a rubber roller. Adhesion may be enhanced by heating the area with a hot air gun while rolling down.

Step 8. Trim off excess film to the dimensions shown on the Engineering drawing.

5.7 Clean-Up

5.7.1 Remove dirt, fingerprints, etc., from the decorative film using warm water and detergent.

5.7.2 Remove excess adhesive from decorative film by solvent cleaning according to PPS 31.17. Test the solvent on a scrap piece of film before using.

5.7.3 Remove adhesive from tools and work area by solvent cleaning according to PPS 31.17.

6 REQUIREMENTS

6.1 Except for authorized repairs as specified herein (e.g., punctures as specified in paragraph 5.3.2, paint as specified in paragraph 5.3.3, lenticular cuts as specified in section 5.4, etc.), Inspection shall ensure that all repaired components are free of defects as specified in section 5.2.

7 SAFETY PRECAUTIONS

7.1 Refer to PPS 31.17 for the safety precaution regarding use and handling of solvents.

7.2 Refer to PPS 25.31, PPS 25.53, PPS 25.55 and PPS 25.57, as applicable, for the safety precautions for use and handling of particular adhesives.

8 PERSONNEL REQUIREMENTS

8.1 This PPS has been categorized as a Controlled Special Process according to PPS 13.39. Refer to PPS 13.39 for personnel requirements.

9 STORAGE

9.1 Store solvents according to PPS 31.17.

9.2 Store adhesives according to PPS 25.31, PPS 25.53, PPS 25.55 and PPS 25.57, as applicable.

9.3 Storage of decorative film material shall be according to PPS 10.46.