DE HAVILLAND AIRCRAFT OF CANADA LIMITED

PPS 10.25

PRODUCTION PROCESS STANDARD

PROPRIETARY INFORMATION

STORAGE AND APPLICATION OF FILM ADHESIVES USED IN COMPOSITE ASSEMBLIES

Issue 8
- This standard supersedes PPS 10.25, Issue 7.
- Vertical lines in the left hand margin indicate technical changes over the previous issue.
- Direct PPS related questions to christie.chung@dehavilland.com or (416) 375-7641.
- This PPS is effective as of the distribution date.

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Issue 8 - Summary of Changes (over the previous issue)

The following summaries are not detailed and are intended only to assist in alerting PPS users to changes which may affect them. Refer to the applicable sections of this PPS for detailed procedure and requirements.

- Replaced throughout PPS where “Bombardier” is specified with “De Havilland Aircraft of Canada Limited” or “DHC”.
- Revised Facilities section.
- Specified to perform receipt testing according to the applicable DHMS’s batch acceptance testing requirements in place of QAMTR 007.
- Clarified that for subsequent testing of DHMS A6.03 adhesive shall also be to PPS 36.10.
- Specified storage life to be the same as that specified in the respective DHMS’s. Specified that material shall be shipped within 90 days from date of manufacture.
- Added new Disposal of Chemical Wastes section.
- Added new Storage section.
- Specified to refer to PPS 13.28 for the storage life of composite materials and products (i.e., DHMS A6.03, DHMS A6.06 and DHMS A6.08).
- Specified to always use the oldest stock first (i.e., first in/first out (FIFO) basis).

TABLE OF CONTENTS

Sections **Page**

Tables

Figures

1 SCOPE

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for the storage, handling and application of film adhesives in the manufacture of composite assemblies and metal bonded assemblies.

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.

2 HAZARDOUS MATERIALS

2.1 Before receipt at De Havilland Aircraft of Canada Limited (DHC), all materials shall be approved and assigned Material Safety Data Sheet (MSDS) numbers by the DHC 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 DHC Environment, Health and Safety Department.

3 REFERENCES

3.1 DH4906 (see Figure 1) form - Material Room Temperature Exposure Log - *DHC internal Quality procedure*.

3.2 DHMS A6.03 - Modified Epoxy, High Strength, Structural Film Adhesive System.

3.3 DHMS A6.06 - Core Splice, Expandable Film Adhesive.

3.4 DHMS A6.08 - Epoxy Adhesive Film for Composite Material.

3.5 PPS 10.24 - Preparation of Honeycomb Cores for Lay-Up in Sandwich Panel Assemblies.

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

3.7 PPS 10.43 - Fabrication of 350°F Cure, Epoxy Resin Pre-Impregnated, Fibre Reinforced Composites Parts.

3.8 PPS 10.48 - Fabrication of 280°F Cure, Phenolic Resin Pre-Impregnated, Fibre Reinforced Composite Parts.

3.9 PPS 13.26 - General Subcontractor Provisions.

3.10 PPS 13.28 - Storage Life of Adhesives, Sealants, Paints and Composite Products.

3.11 PPS 13.39 - Bombardier Toronto Engineering Process Manual.

3.12 PPS 36.10 - Metal Bonding of Bombardier Parts to BAC 5555 and BAC 5514.

MATERIAL ROOM TEMPERATURE EXPOSURE LOG

MAT'L DHMS TYPE

DESCRIPTION

RIP or MRV # BATCH # ROLL #

DATE MFG'D RECEIPT DATE

LAB REPORT TIME EXPIRED DATE

DATE	ROOM TEMP (°F)	TIME OUT	TIME IN	ELAPSED TIME	ACCUMULATED TIME	INSP

DH4906R1

FIGURE 1 - MATERIAL ROOM TEMPERATURE EXPOSURE LOG (FORM DH4906)

4 MATERIALS, EQUIPMENT AND FACILITIES

4.1 Materials

4.1.1 DHMS A6.03 supported epoxy film adhesive.

4.1.2 DHMS A6.06 expandable epoxy film adhesive.

4.1.3 DHMS A6.08 epoxy film adhesive.

4.2 Equipment

4.2.1 Refrigeration unit, capable of maintaining a temperature of 0°F or below and of sufficient size to provide supported horizontal storage of the adhesive rolls and sheets. Support shall be through the core of the roll.

4.2.2 Protective gloves - neoprene (e.g., DSC 422-5), latex rubber (e.g., DSC 422-2), nitrile (e.g., DSC 422-8) or lint-free cotton gloves (e.g., DSC 422-1).

4.2.3 Suitable shop tools for cutting and application of uncured adhesives.

4.3 Facilities

4.3.1 This PPS has been categorized as a Controlled Critical Process according to PPS 13.39 and as such only facilities specifically approved according to PPS 13.39 are authorized to perform the storage, handling and application of film adhesives in the manufacture of composite assemblies and metal bonded assemblies according to this PPS.

4.3.2 Subcontractors shall direct requests for approval to DHC Quality.

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, DHC Engineering 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 DHC Quality.

4.3.3.1 For approval of subcontractor facilities to perform the storage, handling and application of film adhesives in the manufacture of composite assemblies and metal bonded assemblies according to this PPS, completion of a test program and submission of suitable test samples representative of production parts may be required. Test samples shall meet the requirements specified in by DHC engineering.

5 PROCEDURE

5.1 General

5.1.1 For the purposes of this PPS, the term “MRB” (Material Review Board) is considered to include DHC MRB and DHC delegated MRB.

5.1.2 For the purpose of this PPS, the term shop life and working life are used interchangeably. The maximum shop/working life of the adhesives specified herein is the total accumulated time out of the storage freezer and has not exceeded the time specified in Table I.

5.1.3 For the purpose of this PPS, the term shelf life and storage life are used interchangeably. The storage life shall be as specified in Table I.

5.1.4 Only apply film adhesives as specified herein if specified on the engineering drawing.

5.1.5 The storage life defines how long an adhesive may be held in storage before it becomes unusable without further testing (i.e., Storage Life Extension Testing).

5.1.6 The shop and storage life of adhesive films shall be as specified in Table I.

5.1.7 Always wear protective gloves (see paragraph 4.2.2) when handling (i.e., any physical contact with the material) film adhesives to prevent contamination of the material.

5.2 Storage of Film Adhesives

5.2.1 Immediately upon receipt, transfer film adhesive to a storage freezer operating at 0°F or below.

5.2.2 Store DHMS A6.03 and DHMS A6.08 adhesive rolls horizontally supported by suitable racks through the core of the roll. Do not stack adhesive rolls.

5.2.3 Protect film adhesives during shipping and storage from damage and loads other than their own weight. It is recommended that each roll be stored in the original shipping carton with all the material identification data and left in the airtight wrapper.

5.2.4 Store DHMS A6.06 adhesive sheets with the protective waxed paper in place and in airtight polyethylene wrappers at all times during storage.

5.2.4.1 DHMS A6.06 adhesive sheets are brittle when frozen. Take care not to bend or fold the frozen adhesive sheets.

5.2.5 Adhesive which has been removed from the storage freezer and has not been used on that shift shall be re-wrapped in its protective waxed paper and re-sealed in its original storage bag or replaced with film wrapper of equivalent weight and maintain a moisture proof seal before returning to freezer storage for future use on a first in/first out (FIFO) basis provided that:

- the maximum working life has not been exceeded.
- the separator paper or backing film has not been removed.
- the adhesive has not been contaminated in any way.

5.2.6 Issue all film adhesive rolls and sheets on a FIFO basis. Do not issue material to Production if the storage life expiry date has passed or the maximum shop life has been exceeded.

5.2.7 For expired materials, perform storage life extension testing according to section 6.4.

5.3 Handling and Application of Adhesives

5.3.1 DHMS A6.06 Expandable Epoxy Adhesive Sheet

5.3.1.1 Use DHMS A6.06 expandable epoxy adhesive to butt splice honeycomb core sections both before and during lay-up.

5.3.1.2 Prepare the honeycomb core sections for splicing according to PPS 10.24.

5.3.1.3 Before use, remove the adhesive sheet from the storage freezer with the protective waxed paper still in place and in its storage bag. Allow to warm to within 10°F of ambient temperature before use. If possible, allow the adhesive (with protective waxed paper still in place and sealed in its storage bag) to stabilize at room temperature by leaving it out of the freezer overnight. DHMS A6.06 adhesive sheets are brittle when frozen; take care not to bend the adhesive sheets until they have warmed to within 10°F of ambient temperature. To check if the adhesive sheets have have warmed to within 10°F of ambient temperature, wipe the protective waxed paper and storage bag free of moisture and then if condensation re-appears on the waxed paper or bag, the material is not yet warm enough to be applied.

5.3.1.4 When properly warmed, remove the sheet from the storage bag and cut the required size of adhesive with the protective waxed paper still in place. Use 0.05" thick material for 1/8" core cells and 0.10" thick material for 3/16" and larger core cells.

5.3.1.5 Replace unused adhesive in the bag with protective waxed paper in place, re-seal the bag and return to the freezer. Ensure that the shop time of the adhesive used is properly recorded (e.g., Form DH4906 - see Figure 1). It is not necessary to return adhesive to the freezer if it will be used up before the shop life, according to Table I, has expired. Do not use adhesive that exceeds the shop life specified in Table I.

5.3.1.6 Before applying DHMS A6.06 adhesive, clean the core according to PPS 10.24.

5.3.1.7 Apply the strip to the core edge using light finger pressure.

5.3.1.8 Remove the backing paper and join the core edges with light hand pressure.

5.3.1.9 Cure DHMS A6.06 adhesive that is to be cured separate from the lay-up at 260 ± 10°F for 60 to 70 minutes. Cure adhesive that is to be cured as part of the lay-up according to the applicable fabrication PPS.

5.3.2 DHMS A6.03 and A6.08 Film Adhesives

5.3.2.1 DHMS A6.03 and DHMS A6.08 film adhesives are included in the lay-up of composite or metal bonded assemblies if specified on the engineering drawing.

5.3.2.2 Before use, remove the adhesive roll from the storage freezer in its storage bag and allow to warm to within 10°F of ambient temperature. If possible, allow the roll (sealed in its storage bag) to stabilize at room temperature by leaving it out of the freezer overnight. To check that the adhesive has warmed to within 10°F of ambient temperature, wipe the storage bag free of moisture and then if condensation reappears on the bag, the material is not yet warm enough to be applied.

5.3.2.3 When properly warmed, remove the roll from the storage bag and cut off the required amount.

5.3.2.4 Replace unused material in the bag, re-seal the bag and return to the freezer. Ensure that the shop time for the material used is properly recorded (e.g., DH4906 - see Figure 1). It is not necessary to return adhesive to the freezer if it will be used up before the shop life specified in Table I has expired. Do not use material that exceeds the shop life specified in Table I.

5.3.2.5 Apply the film to the part surfaces and roll down lightly to ensure contact.

5.3.2.6 Remove the backing paper and join or install the parts as applicable.

5.3.2.7 Cure DHMS A6.03 or DHMS A6.08 adhesive that is to be cured separate from the lay-up at 260°F ± 10°F for 60 to 70 minutes. Cure adhesive that is to be cured as part of the lay-up according to the applicable fabrication PPS.

6 REQUIREMENTS

6.1 General

6.1.1 Maintain all information regarding receipt control, production control and shop processing as specified herein.

6.1.2 All personnel are required to wear protective gloves (see paragraph 4.2.2) when handling (i.e., any physical contact with the material) film adhesives to prevent contamination of the material.

6.2 Acceptance Testing

6.2.1 Each batch of film adhesive shall be received with one copy of an Acceptance Test Report, which has been completed by the material manufacturer/supplier as specified in the applicable DHMS. Maintain a copy of the Acceptance Test Report on file. Complete and affix a form to each adhesive roll marked with the storage life expiry date (e.g., DH4906 - see Figure 1).

6.3 Receipt Testing

6.3.1 Except as noted in paragraph 6.3.1.1 (i.e., DHMS A6.03 supported film adhesives utilized for metal bonded assemblies), perform receipt testing of all film adhesives according to the respective DHMS's. Perform the "Batch Acceptance Tests" requirements as specified in the DHMS upon receipt, before release to Production use.

6.3.1.1 Perform receipt and subsequent testing of DHMS A6.03 supported film adhesives utilized for metal bonded assemblies according to PPS 36.10.

6.3.2 Prior to release of film adhesive to Production, ensure the following:

- Identify film adhesives upon receipt.
- Successful completion of batch acceptance testing as specified by the applicable DHMS.
- Each roll of adhesive shall have a form marked with the storage life expiry date (e.g., DH4906 - see Figure 1).

6.3.3 Material failing the initial receipt testing may be re-tested one additional time without MRB authority. If the second receipt testing fails, then MRB authorization is required and is subject to M&P Engineering approval.

6.4 Storage Life Extension Testing

6.4.1 Test all adhesive films on expiry of storage life, or storage life extension, according to Table I. Quarantine expired material until laboratory report indicates a shelf life extension has been approved.

6.4.2 Include as a minimum the following data with the Laboratory Request:

- Material supplier
- Material Receipt Voucher (MRV) numbers or manufacturer's Certificate of Conformance (C. of C.)
- Applicable material specification (i.e., DHMS) number

6.4.3 Adhesive which has received an extension of the storage life shall have the old form removed and a new form (e.g., DH4906 - see Figure 1) completed and attached to the roll. Maintain all forms on file specifying the expired storage life. Dispose of adhesives that does not meet the extension requirements according to section 9.

6.4.4 Storage life extension has **no effect** on the working/shop life of the material. When the accumulated time out of the freezer exceeds the maximum working/shop life specified in Table I, the adhesive shall be rejected and dispose of according to section 9 regardless of its storage life status.

TABLE I - STORAGE AND WORKING LIFE OF ADHESIVE MATERIALS

MATERIAL	STORAGE LIFE AT 0°F OR BELOW (Notes 1 & 2)	STORAGE LIFE EXTENSION				MAXIMUM WORKING/ SHOP LIFE (Notes 1, 3 & 4)
		TEST METHOD	1st EXTENSION	2nd EXTENSION	SUBSEQUENT EXTENSIONS	
DHMS A6.03 Adhesive Film	180 days from the date of shipment, 210 days from the date of manufacture	Metal Bonded Assemblies - Extension Test according to PPS 36.10			Subsequent extensions require MRB authorization and are subject to DHC M&P Engineering approval	10 days (Note 5)
		Composite Lay-Ups - Tensile Shear according to DHMS A6.03	90 days	30 days		
DHMS A6.06 Expandable Adhesive	180 days from the date of manufacture	Thickness Expansion according to DHMS A6.06	90 days	30 days		7 days (Note 6)
DHMS A6.08 Adhesive Film	180 days from the date of shipment, 270 days from the date of manufacture	Shear Strength on Aluminum according to DHMS A6.08	90 days	30 days		10 days (Note 5)

Note 1. Discard pre-impregnated material when the working life has been exceeded.
Note 2. Material shall be shipped within 90 days from date of manufacture.
Note 3. The working life is the total accumulated time out of the storage freezer.
Note 4. Where the working life specified in a material specification (i.e., DHMS) conflicts with a PPS, the PPS shall take precedence.
Note 5. The working life specified is material exposure to temperature not exceeding 77°F with a relative humidity not greater than 60%.
Note 6. The working life specified is material exposure to temperature not exceeding 70°F with a relative humidity not greater than 70%.

6.5 Additional Test Requirements

6.5.1 If required, DHC may request additional testing and such testing shall meet the requirements as specified by DHC.

6.6 Work Area Conditions

6.6.1 Work areas shall be isolated from machining operations or conditions that will generate dust or other contaminating airborne particles. Propane powered vehicles are not permitted in the lay-up area.

6.6.2 Floors, work surfaces, all tooling and shelvings shall be clean and free of dust and other contaminants and swept or cleaned at least once a day.

6.6.3 Air entering the lay-up area shall be filtered and a positive air pressure differential is maintained so that unfiltered air does not enter.

6.6.4 Machines and tools used for cutting raw materials shall not deposit internal lubricating fluids onto the work surfaces.

6.6.5 Parting or release agents and uncured silicone bearing material shall not be used in lay-up areas.

6.6.6 Keep the lay-up area temperature and relative humidity within the limits specified in Figure 2. If the temperature or relative humidity exceeds the limits specified in Figure 2, vacuum bag partially completed parts and store them under a minimum vacuum of 24" Hg.

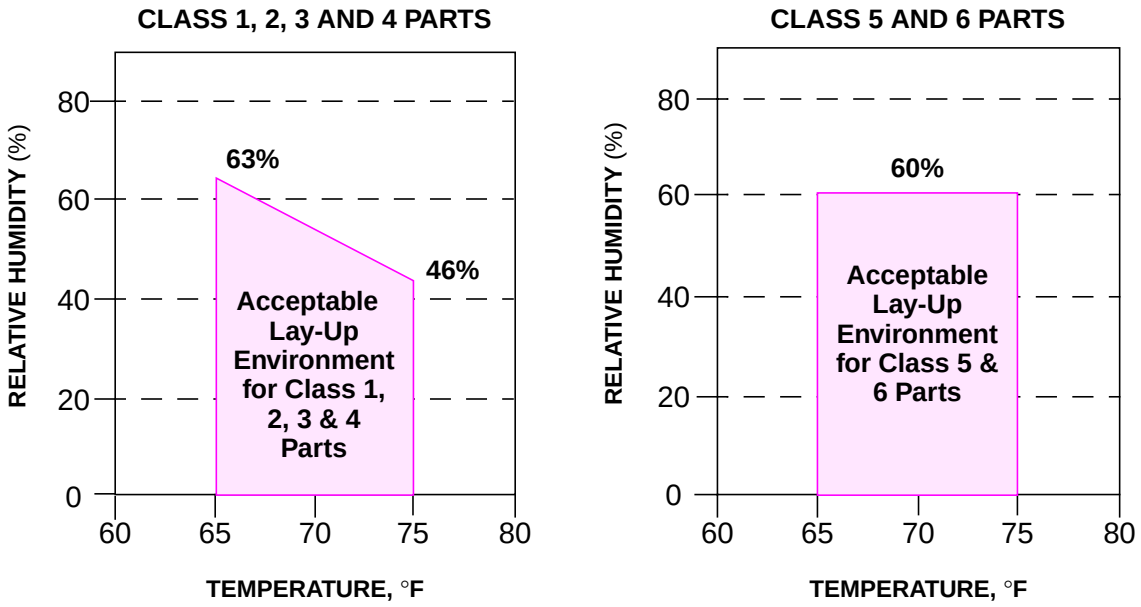

FIGURE 2 - TEMPERATURE AND RELATIVE HUMIDITY LIMITS

7 DHC SAFETY PRECAUTIONS

7.1 Safety precautions applicable to the materials and procedures specified herein shall be defined by the subcontractor performing the work for DHC. However, suppliers, subcontractors and partners are responsible for ensuring that their own environmental, health and safety precautions satisfy the appropriate local government regulations.

8 PERSONNEL REQUIREMENTS

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

9 DISPOSAL OF CHEMICAL WASTES

9.1 Dispose of all chemical wastes according to national legislation and local regulations.

10 STORAGE

10.1 Refer to PPS 13.28 for additional storage requirements of composite materials and products specified herein (i.e., DHMS A6.03, DHMS A6.06 and DHMS A6.08).

10.2 Always use the oldest stock first (i.e., first in/first out (FIFO) basis).