BOMBARDIER
Toronto Site
PROPRIETARY INFORMATION

PPS 10.23

PRODUCTION PROCESS STANDARD

STORAGE, HANDLING AND PREPARATION OF PRE-IMPREGNATED MATERIALS

Issue 13
- This standard supersedes PPS 10.23, Issue 12.
- Vertical lines in the left hand margin indicate technical 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.

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1 SCOPE

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for the storage, handling and preparation of pre-impregnated materials before lay-up.

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.

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-018 - Engineering Requirements for Laboratories.

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

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

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

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

3.6 PPS 13.26 - General Subcontractor Provisions.

3.7 PPS 13.39 - Bombardier Toronto Engineering Process Manual.

MATERIAL ROOM TEMPERATURE EXPOSURE LOG

MAT'L DHMS TYPE

DESCRIPTION

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

FIGURE 1 - MATERIAL ROOM TEMPERATURE EXPOSURE LOG

4 MATERIALS, EQUIPMENT AND FACILITIES

4.1 Materials

4.1.1 Pre-Impregnated materials as listed in Table I.

TABLE I - LAY-UP AND CURING PROCESSES

MATERIAL		PPS
DHMS	**DESCRIPTION**	
P1.22	Glass Fibre/Epoxy Resin	10.35
P1.24	Aramid Fibre/Epoxy Resin	
P1.35	Graphite Fibre/Epoxy Resin	
P1.38, Type 2	Aluminized Glass Fibre/Epoxy Resin	
P1.38, Type 3	Aluminized Glass Fibre/Epoxy Resin	10.43
P1.39	Aramid Fibre/Epoxy Resin	
P1.40	Aramid Fibre/Epoxy Resin	
P1.41	Glass Fibre/Epoxy Resin	
P1.44	Glass-Graphite Fibre/Phenolic Resin	10.48
P1.48	Flyscreen, Glass-Fibre/Epoxy Resin	10.24
P1.59	Glass-Graphite Fibre/Phenolic Resin	10.48
P1.64	Aluminum Foil Epoxy Resin	10.35
		10.43

4.2 Equipment

4.2.1 Refrigeration unit, capable of maintaining a temperature of 10°F or below and of sufficient size to provide supported horizontal storage of the fabric rolls. 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).

4.3 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 preparation of pre-impregnated materials before lay-up 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 the storage, handling and preparation of pre-impregnated materials before lay-up according to this PPS, completion of a test program and submission of suitable test samples representative of production parts may be required.

4.3.3.2 All testing and evaluation specified herein must only be performed by Bombardier Toronto Materials Laboratory or by laboratories accredited according to BAERD GEN-018.

5 PROCEDURE

5.1 General

5.1.1 Pre-impregnated material consists of woven fabric or unidirectional fibre tape which has been supplied by the manufacturer in a “B” stage condition suitable for vacuum or pressure curing. The term “material” used throughout this PPS refers to all the pre-impregnated material types listed in Table I unless a particular type is specified.

5.1.2 Unless otherwise noted on the engineering drawing, lay-up and cure pre-impregnated materials according to the PPS specified in Table I.

5.1.3 For the purpose of this PPS, the term shop life and working life are used interchangeably. The maximum shop/working life of the pre-impregnated materials specified herein is the total accumulated time out of the storage freezer and has not exceeded the time specified in Table II.

5.1.4 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 II.

5.1.5 Perform receipt testing of pre-impregnated material according to section 6.4.

5.2 Storage of Pre-Impregnated Material

5.2.1 Immediately upon receipt, transfer pre-impregnated material to a storage freezer operating at 10°F or below.

5.2.2 Store the material horizontally supported by suitable racks through the core of the roll. Do not stack rolls.

5.2.3 Protect pre-impregnated material 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 Material 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 fabric has not been contaminated in any way.

5.2.5 Issue pre-impregnated material on a FIFO basis. Do not issue material to Production if the storage life expiry date has passed or the maximum working life has been exceeded.

5.2.6 For expired materials, perform storage life extension testing according to section 6.5.

5.3 Handling of Pre-Impregnated Material

5.3.1 If possible, only handle pre-impregnated material by the separation paper or film backing. Do not remove the separation paper or film backing from pre-impregnated material until just before lay-up.

5.3.2 Always wear protective gloves (see paragraph 4.2.2) when handling (i.e., any physical contact with the material) pre-impregnated materials to prevent contamination of the material.

5.4 Preparation of Pre-Impregnated Material

5.4.1 Prepare pre-impregnated material as follows:

Step 1. After removing a roll of pre-impregnated material from the storage freezer, allow the roll to remain within the storage bag for a minimum of 8 hours to allow the material to warm to within 10°F of ambient temperature.

Step 2. After a minimum of 8 hours of exposure to ambient temperature check that the material has warmed to within 10°F of ambient temperature by wiping the storage bag free of moisture. If condensation (i.e., moisture) reappears on the storage bag within a short time, the material is not yet warm enough to be removed.

Step 3. Use templates or patterns, if provided, to cut the material to the correct size and shape, ensuring to orient the warp direction (woven fabric) or fibre direction (unidirectional tape) to that specified on the engineering drawing. For woven fabric (i.e., not unidirectional tapes or aluminum foil), trim off the selvedge (approximately 1/2" borders on the width of the roll) from the ply during cutting. An automatic cutter may be used with a Bombardier Toronto approved polyethylene film placed on top of the material to facilitate cutting.

Plies may be pre-cut and assembled into kits for later use. Place prepared kits in sealed, airtight storage bags and return them to the freezer. Ensure that the kit storage life date corresponds to that of the particular ply or plies of the material that has the earliest working life expiry date. Use kits on a first in/first out basis.

Step 4. After trimming sufficient material for the parts to be manufactured, immediately replace the roll in the storage bag and return it to the freezer unless it is a high usage pre-impregnated material that will be used up before the working life (according to Table II) has expired. Record the total accumulated time out of the storage freezer on a suitable log card which should be attached to each roll of material (see Figure 1 for an example of what data should be recorded). Reject pre-impregnated material which has an accumulated time out of the freezer exceeding the maximum working life specified in Table II.

TABLE II - PRE-IMPREGNATED MATERIAL STORAGE AND WORKING LIFE

MATERIAL					STORAGE LIFE AT 10°F MAX. (Notes 1 & 2)	MAXIMUM WORKING LIFE (Notes 1 & 3) (Hours)
DHMS	TYPE	CLASS	STYLE	GRADE		
P1.22	1	—	181, 1581 or 7781	—	DHMS P1.22	240
	2	—	S-2 (Unidirectional)	—		168
	3	—	7781	—		240
P1.24	1	—	220	—	DHMS P1.24	240
	2	—	281	—		
	3	—	285	—		
	6	—	Unidirectional Tape	—		
P1.35	II	1	Unidirectional Tape	—	DHMS P1.35	240
	II	2	Woven Fabric	—		
P1.38	2	—	—	B	DHMS P1.38	240
	3	—	—	B		168
P1.39	3	1	—	—	DHMS P1.39	240
	3	2	—	—		
P1.40	3	—	—	—	DHMS P1.40	168
P1.41	1	—	—	—	DHMS P1.41	168
P1.44	1	—	—	—	DHMS P1.44	1440
	2	—	—	—		
P1.48	1	—	—	—	DHMS P1.48	240
P1.59	1	—	—	—	DHMS P1.59	240
	2	—	—	—		
P1.64	1	—	—	—	DHMS P1.64	240
	2	—	—	—		

Note 1. Discard pre-impregnated material when the working life has expired. The working life is the total accumulated time out of the storage freezer.
Note 2. Storage life shall be as specified by the DHMS. Perform storage life extension according to section 6.5 at the end of the storage life specified.
Note 3. Where the working life specified in a material specification (i.e., DHMS) conflicts with a PPS, the PPS shall take precedence.

6 REQUIREMENTS

6.1 General

6.2 All testing and evaluation specified herein must only be performed by Bombardier Toronto Materials Laboratory or by laboratories accredited according to BAERD GEN-018.

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

6.2.2 All personnel are required to wear protective gloves (see paragraph 4.2.2) when handling (i.e., any physical contact with the material) pre-impregnated materials to prevent contamination of the material.

6.3 Acceptance Testing of Pre-Impregnated Material

6.3.1 Each batch of pre-impregnated material shall be received with a 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 roll of material with the storage life expiry date (see Figure 1 of an example of what data should be recorded).

6.4 Receipt Testing of Pre-Impregnated Material

6.4.1 Upon receipt, identify each roll of material so as each roll is traceable back to its original batch number.

6.4.2 Test all material according to the applicable DHMS receipt testing requirements.

6.4.3 Only upon successful completion of receipt testing, shall the pre-impregnated material be released to Production.

6.4.4 Material failing the initial receipt testing may be re-tested one additional time without Bombardier Toronto MRB authority. If the second receipt testing fails, then MRB authorization is required and is subject to Bombardier Toronto Materials Technology approval.

6.4.5 Each roll of pre-impregnated material shall have a form marked with the storage life expiry date.

6.5 Storage Life Extension Testing

6.5.1 When the storage life expires for a particular roll of material, the storage life may be extended if the results of new resin flow and gel testing of that material according to the applicable DHMS are acceptable. The first storage life extension will extend the storage life for another 90 days. The second storage life extension will extend the storage life for another 60 days. Subsequent extensions require Bombardier Toronto MRB authorization and are subject to Bombardier Toronto Materials Technology approval. If the resin flow or gel time test results for any extension test are unacceptable according to the applicable DHMS, submit the material test values to Bombardier Toronto MRB for disposition. For **each** storage life extension, record the total accumulated time out of the storage freezer for that material at the time of storage life extension testing. When requesting storage life extensions beyond the second storage life extension, include with the request all previous test results (i.e., receipt testing, 1st shelf life extension, 2nd shelf life extension, etc.) as well as the total accumulated time out of the storage freezer at each storage life extension and current total accumulated time out of the storage freezer.

6.5.2 Quarantine expired material until laboratory report indicates a shelf life extension has been approved.

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

- Material supplier
- Manufacturer's Certificate of Conformance (C. of C.)
- Batch and Roll number
- Applicable material specification (i.e., DHMS or BAMS) number

6.5.4 Pre-impregnated material which has received an extension of the storage life shall have the old form removed and a new form completed and attached to the roll. Maintain all forms on file specifying the expired storage life. Dispose of pre-impregnated material that does not meet the extension requirements according to section 6.8.

6.5.5 Storage life extension has **no effect** on the working life of the material. When the accumulated time out of the freezer exceeds the maximum working life specified in Table II, the pre-impregnated material shall be rejected and dispose of regardless of its storage life status.

6.6 Additional Test Requirements

6.6.1 At the request of Bombardier, lay-up a test panel as specified by Bombardier. Record all processing data, including the following:

- identification of the test panel
- cure batch number
- material type and batch number
- honeycomb core type and batch or lot number
- lay-up date and processing information
- ambient temperature and humidity during lay-up

6.7 Work Area Conditions

6.7.1 Work areas shall be isolated or located away 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.

6.7.2 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.

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

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

6.7.5 Parting or release agents, uncured silicone bearing material, and solvents shall not be used in work areas.

6.7.6 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.

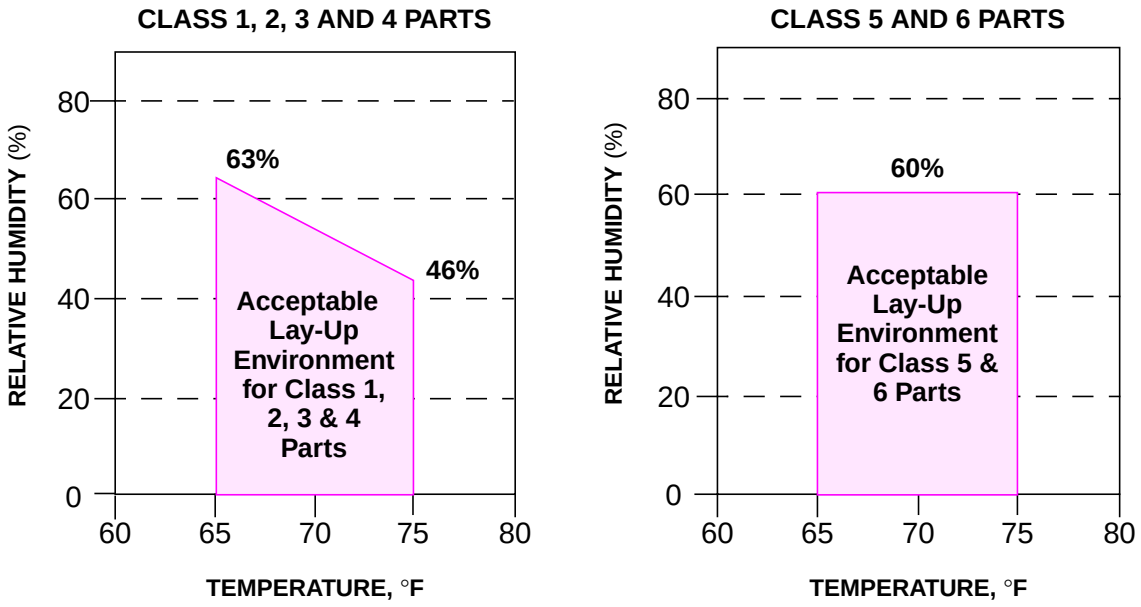

FIGURE 2 - TEMPERATURE AND RELATIVE HUMIDITY LIMITS FOR WORK AREA

6.8 Disposal of Wastes

6.8.1 Dispose of pre-impregnated material as specified herein according to national legislation and local regulations.

7 SAFETY PRECAUTIONS

7.1 Safety precautions applicable to the materials and procedures specified herein shall be defined by the subcontractor performing the work for Bombardier Toronto.

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 additional personnel requirements. Certified and/or qualified personnel shall have a good working knowledge of the following, as applicable:

- relevant engineering drawing and work order notes regarding the lay-up of composite parts.
- relevant sections regarding the lay-up of composite parts of PPS 10.23, PPS 10.24, PPS 10.25, PPS 10.35, PPS 10.43, PPS 10.48, PPS 31.14 and PPS 31.17.
- equipment used in the lay-up of composite parts (e.g. cutting tools, radiused Teflon and nylon blocks).
- benefit of pre-heating the mould before starting to lay-up parts.
- purpose of aluminum mesh.
- purpose of core edge stabilization and core stabilization.
- purpose of potting cells.
- reason for ply orientation.
- reason for sometimes needing a moisture barrier film.
- reason for sometimes needing de-bulking.