BOMBARDIER

Toronto Site

PROPRIETARY INFORMATION

PPS 10.26

PRODUCTION PROCESS STANDARD

PLATEN PRESS CURING OF 250°F CURE, EPOXY RESIN PRE-IMPREGNATED, FIBRE REINFORCED COMPOSITE PARTS

Issue 6

- This standard supersedes PPS 10.26, Issue 5.
- 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.

Prepared By:	(Christie Chung)	October 28, 2015
	PPS Group	
Approved By:	(H.Y. Tran)	October 29, 2015
	Materials Technology	
	(S. Pitt)	November 3, 2015
	Quality	

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1 SCOPE

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for the curing of 250°F cure, epoxy resin pre-impregnated, fibre reinforced composite parts using a platen press.

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 PPS 10.22 - Preparation of Moulds.

3.2 PPS 10.28 - Assembly of Wire Thermocouples.

3.3 PPS 10.52 - Certification of Platen Press.

3.4 PPS 13.26 - General Subcontractor Provisions.

3.5 PPS 13.39 - Bombardier Toronto Engineering Process Manual.

4 MATERIALS, EQUIPMENT AND FACILITIES

4.1 Materials

4.1.1 DSC 234-12-1 parchment paper, 250°F cure.

4.2 Equipment

4.2.1 Platen press, certified according to PPS 10.52 (e.g., Italpresse 24060 Bagnatica).

4.2.2 Separating sheet, 0.125" thick minimum.

4.2.2.1 Materials other than a metallic sheet may be used, providing the surface is smooth, non-adhering and will not transfer any substance that would be detrimental to the part or subsequent processes.

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 curing of 250°F cure, epoxy resin pre-impregnated, fibre reinforced composite parts using a platen press 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 curing of 250°F cure, epoxy resin pre-impregnated, fibre reinforced composite parts using a platen press 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 Only use platen press curing to cure fibre reinforced epoxy parts if the engineering drawing specifies the following:

“PLATEN PRESS CURE - PPS 10.26 - XX psi”

5.2 High Pressure Platen Press Curing

5.2.1 Perform high pressure platen press curing as follows:

Step 1. Transfer the parts to the platen press bed.

Step 2. Connect the thermocouple leads from the parts to the appropriate connectors in the platen press. Connect a minimum of 2 thermocouples for each platen press load. If the part or parts have not been laid-up with thermocouples, connect 2 thermocouples prepared according to PPS 10.28. Place thermocouples outside the trim line between the platen press bed and the part and between the part and the separating sheet.

Step 3. Select a suitable size separating sheet (see paragraph 4.2.2) that will cover the surface of the parts to be cured when placed on the platen press.

Step 4. Cover the part with a layer of parchment paper (see paragraph 4.1.1) or prepare the separating sheet according to PPS 10.22.

Step 5. Place the separating sheet over the parts.

Step 6. Raise the platen press bed until the separating sheet makes contact with the upper press surface.

Step 7. Determine the required manometer pressure according to Figure 1.

Step 8. Gradually apply pressure to within $\pm$ 5 Kg/cm^2 of the required manometer pressure.

Step 9. Once the pressure has stabilized, engage the heaters and raise the temperature of the parts to 260 $\pm$ 10°F at a rate of 2 to 5°F per minute (i.e., the heat-up rate for the lagging thermocouple shall be at least 2°F per minute while the heat-up rate for the leading thermocouple shall not exceed 5°F per minute), calculated over each 5 minute interval.

Step 10. Maintain the parts at the cure temperature (260 $\pm$ 10°F) for a minimum of 60 minutes. The part shall not remain at the cure temperature for more than 90 minutes.

Step 11. Upon completion of the temperature soak period, disengage the platen heaters and cool the parts at no more than 5°F per minute, calculated over each 5 minute interval.

Step 12. At 140°F or less, release the pressure and lower the platen press bed and remove the parts.

5.2.2 If at any time during the temperature soak period the pressure drops more than 5 Kg/cm^2 below the required manometer pressure or a temperature indication falls below 250°F, consider the cure cycle for that part to have stopped and restart only when the variance has been corrected. Extend the temperature soak period by the amount of time the cycle was out of tolerance.

5.2.2.1 Indicate on the recording chart any correction made during the cure cycle.

5.2.3 At any time during the temperature soak period, a pressure increase of 5 Kg/cm^2 above the required manometer pressure, or a temperature indication rises above 270°F, shall be cause for rejection and disposition of the parts.

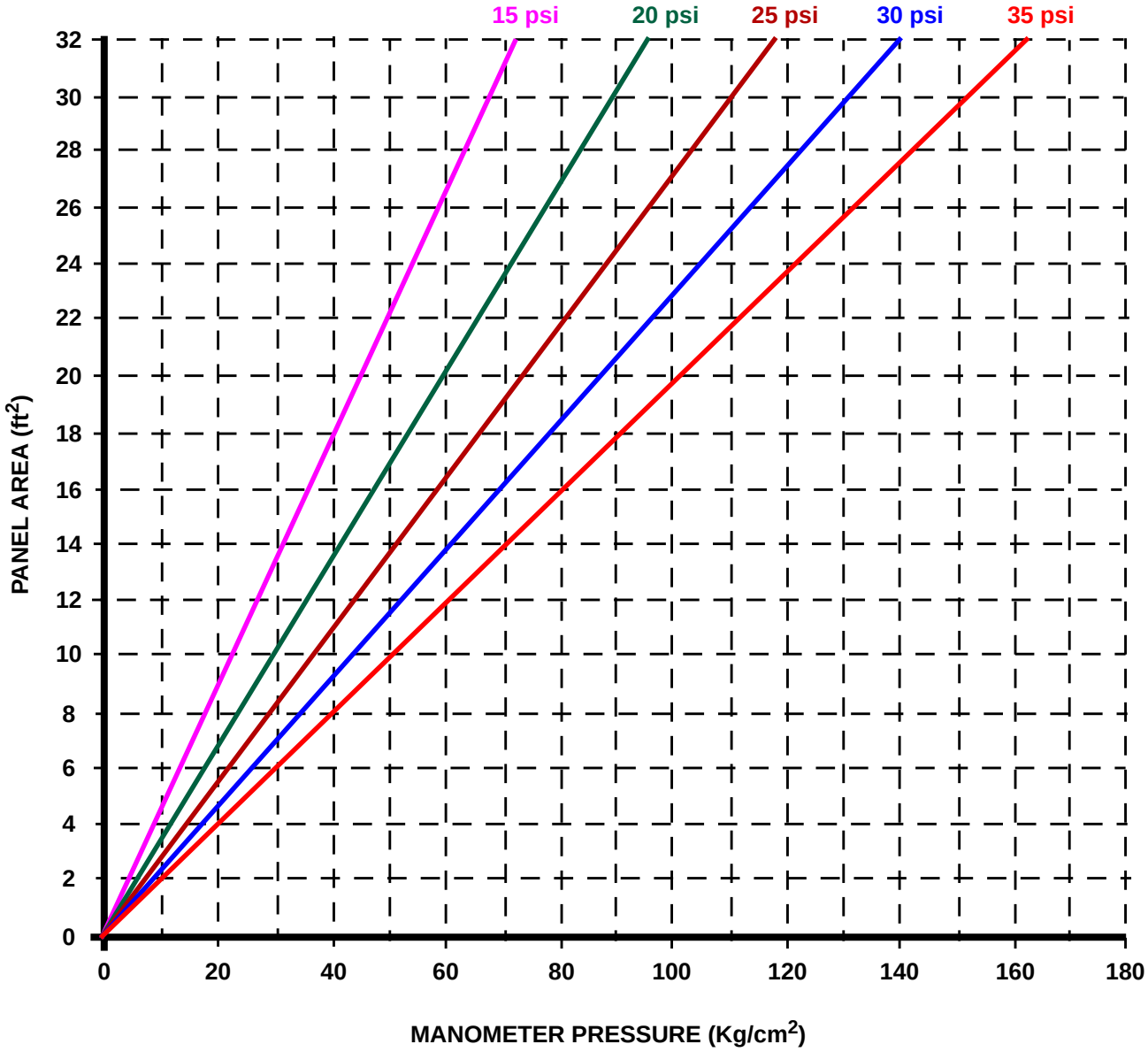

FIGURE 1 - MANOMETER PRESSURE GRAPH

5.3 Handling of Cured Composite Parts

5.3.1 Handle cured composite parts in such a manner as to minimize the possibility of damage.

5.3.2 Do not leave completed parts unprotected in the work area. Remove completed parts from the work area as soon as possible.

6 REQUIREMENTS

6.1 The temperature measurements from each thermocouple shall be recorded during the entire curing cycle. Multi-point recorders may be used, providing that each thermocouple is monitored at least once every 5 minutes.

6.2 The temperature chart shall be related to time so that heat-up and cure time may be checked and recorded.

6.3 Record pressure applied to the assemblies during curing.

6.4 The thermocouples and recorder shall be capable of recording the temperature to within ± 1°F. Calibration of recording equipment against equipment of known accuracy, traceable to the National Institute of Standards and Technology, National Research Council or equivalent shall be carried out periodically.

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 personnel requirements.

9 MAINTENANCE OF EQUIPMENT

9.1 Calibrate pressure gauges, temperature indicating/recording equipment, etc., according to Bombardier Quality requirements.

9.2 Perform temperature uniformity checks on a scheduled basis and the results shall be approved by Bombardier Quality.