**BOMBARDIER**
*Toronto Site*
**PROPRIETARY INFORMATION**

# PPS 25.31

**PRODUCTION PROCESS STANDARD**

# BONDING USING BOSTIK/BOSCODUR ADHESIVE

Issue 9
- This standard supersedes PPS 25.31, Issue 8.
- 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.

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|---|---|---|
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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 bonding aircraft parts and assemblies with Bostik/Boscodur adhesive.

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-018 - Engineering Requirements for Laboratories.

3.2 EHS-OP-005 - Hazardous Materials Management - *Bombardier Toronto internal operating procedure*.

3.3 PPS 10.46 - Application of Decorative Film.

3.4 PPS 13.13 - Personal Protective Respiratory Equipment.

3.5 PPS 13.26 - General Subcontractor Provisions.

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

3.7 PPS 13.39 - Bombardier Toronto Engineering Process Manual.

3.8 PPS 31.17 - Solvent Usage.

3.9 PPS 34.08 - Application of Epoxy-Polyamide Primer (F19 & F45).

## 4 MATERIALS, EQUIPMENT AND FACILITIES

### 4.1 Materials

4.1.1 Adhesive:

- Bostik 7132 (base) and Boscodur #22 (hardener); OR
- Bostik 7132 (base) and Boscodur #24T (hardener).

4.1.2 DSC 234-1 vacuum bagging film.

4.1.3 DSC 234-9 breather cloth.

4.1.4 DSC 234-17 vacuum bag sealant.

4.1.5 Abrasive paper, aluminum oxide, 50 - 80 grit size and 120 - 180 grit size.

### 4.2 Equipment

4.2.1 Disposable wax-free paperboard containers (e.g., MELO take-out containers).

4.2.2 Neoprene gloves (e.g., DSC 422-5).

4.2.3 Lint-free cotton gloves (e.g., DSC 422-1).

4.2.4 Cotton wiping cloths (e.g., DSC 378-2).

4.2.5 Tack cloths (e.g., DSC 375-1).

4.2.6 Hot air gun, 212°F (100°C) maximum.

### 4.3 Facilities

4.3.1 This PPS has been identified as a “Critical or Special” process according to PPS 13.39 and as such only facilities specifically approved according to PPS 13.39 are authorized to perform bonding aircraft parts and assemblies with Bostik/Boscodur adhesive according to this PPS.

4.3.2 Bombardier subcontractors shall direct requests for approval to Bombardier Supplier Quality Management. Bombardier 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 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 Bombardier Aerospace Supplier Quality Management.

4.3.3.1 Unless otherwise specified by Bombardier Aerospace Supplier Quality Management, for approval of subcontractor facilities to perform bonding aircraft parts and assemblies with Bostik/Boscodur adhesive according to this PPS, completion of a test program and submission of suitable test samples representative of production parts is required.

4.3.3.2 All testing and evaluation specified herein shall 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 Bostik/Boscodur adhesives specified herein are 2-part (base/hardener) adhesive systems.

5.1.2 Since Boscodur #22 and Boscodur #24T contains isocyanate, all operators working with these materials shall be familiar with the safety precautions given in section 7 before handling or use.

### 5.2 Preparation of Parts

5.2.1 Wear clean cotton gloves when handling bonding surfaces. Do not touch or contaminate prepared surfaces with bare hands or other foreign objects.

5.2.2 Ensure that bonding surfaces of aluminum alloy or cadmium plated parts are primed with F19 according to PPS 34.08.

5.2.3 Immediately before applying adhesive, prepare the bonding surfaces of each part according to Table I.

**TABLE I - PREPARATION OF PARTS FOR BONDING**

| MATERIAL | CLEANING PROCEDURE |
|---|---|
| Bare metal | Solvent clean according to PPS 31.17. |
| Primed parts | Solvent clean according to PPS 31.17. |
| Painted parts | Step 1. Lightly scuff the bond surfaces with 120-180 grit abrasive paper.<br>Step 2. Solvent clean according to PPS 31.17. |
| Thermoset plastics (Note 1) | Step 1. Lightly scuff the bond surfaces with 120-180 grit abrasive paper.<br>Step 2. Wipe with a clean dry cloth or blow with clean, oil-free, compressed air.<br>Step 3. Wipe with a tack rag. |
| Thermoplastics (Note 2) | Solvent clean according to PPS 31.17 (Note 3). |
| Wood | Step 1. Abrade the bond surface with 50-80 grit abrasive paper.<br>Step 2. Remove residual dust with clean, oil-free, compressed air. |

Note 1. Thermoset plastics: fibre-reinforced epoxy, polyester or phenolic composites.
Note 2. Thermoplastics: acrylic (Plexiglass), acrylic/PVC (Kydex), nylon (Zytel), polycarbonate (Lexan), PTFE (Teflon), PVC/PVF (Tedlar), vinyl films.
Note 3. Material which has been protected from contamination during storage does not require cleaning.

### 5.3 Preparation of Adhesive

5.3.1 Reject adhesive components that have expired or show signs of skinning, gelling, lumping, pigment separation or any other deterioration.

5.3.1.1 Dispose of any rejected Bostik 7132, Boscodur #22 and Boscodur #24T according to national legislation and local regulations. At Bombardier Toronto, dispose of adhesives according to EHS-OP-005.

5.3.2 Prepare the adhesive as follows:

Step 1. Thoroughly stir the base and hardener to a uniform consistency in their original separate containers.

Step 2. Mix the adhesive components together in a clean, wax-free container at a ratio of 20 to 1 by volume (i.e., 20 parts Boscodur #22 or Boscodur #24T to 1 part Bostik 7132).

Step 3. Stir the base/hardener mixture thoroughly to obtain a homogeneous air-free mix.

5.3.3 The adhesive may be reduced by mixing with the solvent specified in PPS 31.17. The reducing ratio (mixed adhesive to solvent) for spray application is 2 to 1 by volume. The reducing ratio for brush or roller application is 4 to 1 by volume.

5.3.4 The pot life is the time during which mixed adhesive remains suitable for application at a temperature of 75 ± 5°F and 50% relative humidity. The pot life of the mixed adhesive is 8 hours for a 100 gram mix. Higher humidity and temperature conditions will shorten the pot life.

5.3.5 Mix only sufficient material for the job on hand or which will be used up within the pot life of the material. Dispose of excess material upon expiration of the material pot life according to EHS-OP-005.

### 5.4 Application of Adhesive

5.4.1 Apply adhesive in a clean area as specified in section 6.2.

5.4.2 Apply the prepared adhesive to both bonding surfaces. It is not necessary to apply adhesive to surfaces which have been pre-coated with adhesive (i.e., DHMS P1.28 Class 2 decorative film).

5.4.3 The adhesive may be applied by brush, roller or spray. In general, spray application is preferred because it produces the most uniform coating.

5.4.4 Apply sufficient adhesive to achieve a dry film weight of 1 to 4 g/ft$^2$ (dry film thickness of 0.0003" - 0.0015") on each surface.

5.4.5 Allow the adhesive to air dry at room temperature for 1 to 8 hours before re-activating with heat and pressure. If re-activated within 1 hour, the solvents may not have fully flashed off and blistering may occur. After 8 hours, the catalyzed adhesive will have partially cured and poor adhesion will occur.

5.4.6 Except for decorative film, if the adhesive has air dried for more than 8 hours, strip the adhesive according to section 5.7. If the adhesive has air dried on decorative film for more than 8 hours, a second coating of adhesive may be applied rather than stripping the adhesive from the decorative film.

5.4.7 Assemble the parts to be bonded in the correct alignment and apply heat and pressure according to paragraph 5.5.

### 5.5 Application of Heat and Pressure

5.5.1 Except in the following cases, apply heat and pressure to the assembly using either the clamping method specified in section 5.5.2 or the vacuum bagging method specified in section 5.5.3:

- If support tooling is available, heat and pressure may be applied to the assembly by the vacuum press method specified in section 5.5.4.
- If application of pressure using the clamping method, vacuum bagging method or the vacuum press method is not possible, use the roller method specified in section 5.5.5.
- If using this adhesive to bond decorative film to interior components, refer to PPS 10.46 for the heat and pressure application procedure.

#### 5.5.2 Clamping Method

5.5.2.1 For the clamping method, apply heat and pressure to the assembly as follows:

Step 1. Using suitable clamps, clamp the assembly such that a pressure of approximately 5 psi is being exerted on the bond area.

Step 2. Place the clamped assembly in a suitable oven.

Step 3. Heat the bond line to the cure temperature (150°F to 175°F).

Step 4. Ensure that the bond line remains at the cure temperature for 2 to 4 minutes.

Step 5. Allow the part to cool to 115°F.

Step 6. Release the pressure applied by the clamps.

#### 5.5.3 Vacuum Bagging Method

5.5.3.1 For the vacuum bagging method, apply heat and pressure to the assembly as follows:

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

Step 2. Seal the assembly (including component, breather cloth and any support tool) with vacuum bagging film and vacuum bag sealant.

Step 3. Apply 2" to 5" Hg of vacuum.

Step 4. Place the vacuum bagged assembly in a suitable oven.

Step 5. Heat the vacuum bagged assembly to the cure temperature (150°F to 175°F) while maintaining a minimum applied vacuum of 10" Hg. Ensure that the bond line remains at the cure temperature for 2 to 4 minutes.

Step 6. Allow the part to cool to 115°F.

Step 7. Release the vacuum.

### 5.5.4 Vacuum Press Method

5.5.4.1 For the vacuum press method, apply heat and pressure to the assembly as follows:

Step 1. Position the assembly on the applicable support tool.

Step 2. Place the support tool with the assembly in the vacuum press.

Step 3. Cover the face of the component with breather cloth.

Step 4. Lower the vacuum diaphragm and lock it into position.

Step 5. Apply 2" - 5" Hg of vacuum and visually inspect the assembly to ensure that the vacuum diaphragm is properly forming over the part.

Step 6. Lower the heat lamps and heat the bond line to the cure temperature (150°F to 175°F) while maintaining a minimum applied vacuum of 10" Hg. Ensure that the bond line remains at the cure temperature for 2 to 4 minutes.

Step 7. Allow the part to cool to 115°F.

Step 8. Release the vacuum.

### 5.5.5 Roller Method

5.5.5.1 For the roller method, apply heat to the assembly as follows:

Step 1. Heat the bond line to the cure temperature (150°F to 175°F) using a hot air gun. If necessary, use remote temperature sensing equipment to verify that the bond line has been heated to the cure temperature.

Step 2. Using a rubber roller, roll the material down firmly while maintaining the bond line at the cure temperature for 2 to 4 minutes.

Step 3. Continue to roll down firmly until the bond line has cooled to 115°F.

### 5.6 Clean-Up and Disposal

5.6.1 Remove uncured adhesive from tools and equipment by solvent cleaning according to PPS 31.17.

5.6.2 Dispose of excess mixed adhesive and empty cans or containers, rags, wipers or paper contaminated with mixed adhesive, Boscodur #22 or Boscodur #24T according to national legislation and local regulations. At Bombardier Toronto, dispose of adhesives according to EHS-OP-005.

5.6.2.1 At Bombardier Toronto, dispose of adhesive contaminated work clothes, rags, etc., into Red Containers labelled “Waste Rags”.

5.6.3 Immediately clean up spilled Bostik 7132 with rags soaked in the solvent specified in PPS 31.17 and ventilate the area well to remove solvent fumes before resuming work. For spilled Boscodur #22, Boscodur #24T or mixed adhesive, clear the immediate area of all personnel and clean the spill according to EHS-OP-005.

### 5.7 Stripping of Adhesive

5.7.1 If necessary, remove the adhesive from the part by solvent cleaning according to PPS 31.17. If the part is of composite construction, heat it in an oven at 140°F for approximately one hour to dry any 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.

## 6 REQUIREMENTS

### 6.1 General

6.1.1 Bonded assemblies shall have intimate contact over the full bonding area.

6.1.2 Bonded parts shall show no indication of blistering, bridging, wrinkling or delamination.

### 6.2 Bonding Area Conditions

6.2.1 The cleanliness of the bonding area (e.g., tables, floors, equipment, walls, etc.) shall be inspected and cleaned as necessary to ensure that dust accumulation, dirt or other contamination will not be evident. Maintain records of dates of cleaning.

6.2.2 Maintain the temperature and relative humidity of the bonding areas within the range specified in Figure 1. Bonding when the relative humidity is below 30% will increase the chance of static discharge and worker discomfort, but will not affect part quality.

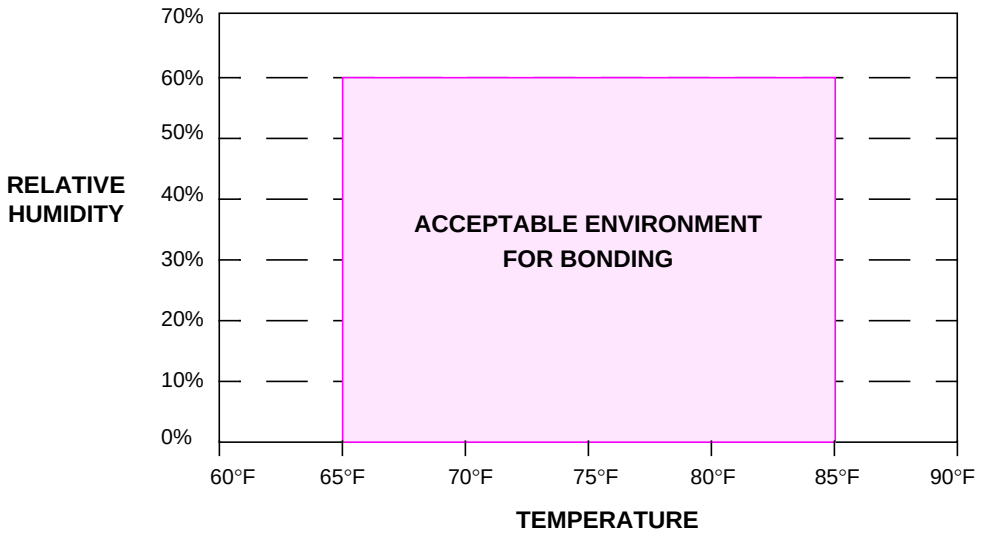


**FIGURE 1 - TEMPERATURE AND HUMIDITY LIMITS**

## *7 SAFETY PRECAUTIONS*

*7.1 Observe standard plant safety precautions when performing the procedure specified herein.*

*7.2 Keep adhesive away from fire and other sources of ignition.*

*7.3 Maintain sufficient ventilation at all times when mixing and applying adhesive. Wear protective respiratory equipment according to PPS 13.13 when working with Boscodur #22, Boscodur #24T or mixed adhesive to avoid inhalation of fumes or vapours.*

*7.4 Wear neoprene gloves at all times when mixing or handling mixed adhesive or its components. Avoid skin contact with mixed adhesive or its components. If contact occurs, wash contact area thoroughly with soap and water.*

*7.5 Avoid eye contact with adhesive components. If eye contact occurs, immediately flush eyes in a directed stream of water for at least 15 minutes while forcibly holding eyelids apart to ensure completed irrigation of all eye and lid tissue. Contact the Health Centre and a physician.*

*7.6 In the event of spillage of mixed adhesive, Boscodur #22 or Boscodur #24T, clear the immediate area of all personnel and clean up the spill according to EHS-OP-005.*

*7.7 Dispose of empty cans or containers, rags, wipers or paper contaminated with mixed adhesive, Boscodur #22 or Boscodur #24T according to EHS-OP-005.*

*7.8 Refer to PPS 31.17 for the safety precautions for handling and using solvents.*

## 8 PERSONNEL REQUIREMENTS

8.1 This PPS has been categorized as a “Critical or Special Process” according to PPS 13.39. Refer to PPS 13.39 for personnel requirements.

## 9 STORAGE

9.1 Store the containers of adhesive components at a temperature of 60°F to 80°F (16°C - 26°C) according to the precautions necessary for flammable materials.

9.2 Refer to PPS 13.28 for the storage life of the adhesive components.

9.3 Clearly mark the storage life expiry date on each adhesive component container.

9.4 Keep adhesive component containers tightly closed when not in use.