BOMBARDIER
Toronto (de Havilland)
PROPRIETARY INFORMATION

PPS 1.03

PRODUCTION PROCESS STANDARD

Hot Joggling of Aluminum Alloys

Issue 14
- This standard supersedes PPS 1.03, Issue 13.
- Vertical lines in the left hand margin indicate technical changes over the previous issue.
- Direct PPS related questions to PPS.Group@aero.bombardier.com or (416) 375-4365.
- This PPS is effective as of the distribution date.

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1 Scope

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for hot joggling of 2014, 2024 and 7000 series aluminum alloys.

1.1.1 This PPS complements the engineering drawings that specify its use as an authorized instruction. The procedure specified in this PPS must 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 Aerospace Toronto, all materials must be approved and assigned Material Safety Data Sheet (MSDS) numbers by the Bombardier Aerospace 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 Aerospace Toronto Environment, Health and Safety Department.

3 References

3.1 PPS 1.02 - Forming Aluminum Alloys.

3.2 PPS 13.26 - General Subcontractor Provisions.

3.3 PPS 13.39 - Bombardier Toronto Engineering Process Manual.

3.4 PPS 20.03 - Fluorescent Penetrant Inspection.

3.5 PPS 31.17 - Solvent Usage.

4 Materials, Equipment and Facilities

4.1 Materials

4.1.1 Aluminum alloy parts as specified on the engineering drawing.

4.2 Equipment

4.2.1 Universal joggle die (e.g., TS.211.40.00) and joggle die inserts: universal type (e.g., TS.211.41.XX) and solid type (e.g., TS.211.42.10).

4.2.2 Electric heating elements for use with die sets.

4.2.3 Electronically operated thermostatic switches capable of maintaining and controlling die temperatures within the limits specified in Table 1.

4.2.4 Tempilstiks, temperature indicating crayons for temperatures of 190°F (88°C), 270°F (132°C), and 350°F (177°C).

4.2.5 Mechanical press.

4.2.6 Leather gloves (e.g., DSC 422-3).

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 ot joggling of aluminum alloys according to this PPS.

4.3.2 Bombardier subcontractors must direct requests for approval to Bombardier Aerospace Supplier Quality Management. Bombardier Aerospace facilities must 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 must 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 must be detailed in the facility report. Based upon the facility report, Bombardier Toronto (de Havilland) Materials Technology may identify additional qualification and/or process control test requirements. During the facility survey, the facility requesting qualification must 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 hot joggling of aluminum alloys according to this PPS completion of a test program and submission of suitable test samples representative of production parts is required. Test samples must meet the requirements specified in section 6.

5 Procedure

5.1 General

5.1.1 Hot joggle all sheet metal (CS) shapes and extruded (CV) sections of 2014-T6 and 7000 series T6XXX/T7XXX aluminum alloys and tempers according to the procedure specified herein.

5.1.2 Joggle shapes and sections in softer tempers (e.g., T4/T42) at room temperature according to PPS 1.02. Joggle flat parts, in all heat treatment conditions at room temperature. Refer to Liaison Engineering for parts having a joggle transition length less than 5 times the depth of the joggle.

5.2 Preparation of parts

5.2.1 Before joggling, prepare the parts as follows:

Step 1. Solvent clean according to PPS 31.17 to remove grease, dirt and foreign particles.

Step 2. If necessary, it is acceptable to pre-heat parts to the hot joggling temperature provided that the cumulative time at the hot joggling temperature will not exceed the maximum allowable time specified in Table 1.

5.3 Heating of Dies and Parts

5.3.1 Carry out heating of dies and parts as follows:

Step 1. Secure the joggle die in the mechanical press. Take care to ensure that the joggle die inserts are correctly located.

Step 2. Install heating elements and temperature controlling and indicating equipment so that the temperature of the die set may be controlled.

Step 3. Heat the applicable die set to the temperature range specified in Table 1. Refer to TS.211.40.00, TS.211.41.XX and/or TS.211.42.10 for information regarding die sets used in-house at Bombardier Toronto (de Havilland).

Step 4. When the temperature indicator indicates that the die is operating within the required temperature range, insert the part and actuate the die set clamps to secure the part in the lower die insert.

Step 5. Using a Tempilstik corresponding to the joggling temperature specified in Table 1, repeatedly contact the part at a point within one transition length of the joggle until the part reaches the forming temperature as indicated by the melting of the tempilstik. Ensure that parts do not remain at the forming temperature longer than the maximum time (time of one continuous heating operation or the cumulative time of several heating operations) allowed in Table 1.

Table 1 - Hot Joggling Temperatures and Heating Data

MATERIAL	BASIC TEMPER	JOGGLING TEMPERATURE	CONTROLLED DIE TEMPERATURE RANGE	MAXIMUM ALLOWABLE TIME AT FORMING TEMPERATURE (Note 2)
2014	T4/T42 (Note 1)	190°F (88°C)	190°F - 210°F (88°C - 99°C)	120 Minutes
	T6	350°F (177°C)	350°F - 370°F (177°C - 188°C)	20 Minutes
2024	T4/T42 (Note 1)	190°F (88°C)	190°F - 210°F (88°C - 99°C)	120 Minutes
	T3XXX (Note 1)			
7000 series	T6XXX	270°F (132°C)	270°F - 290°F (132°C - 143°C)	20 minutes
	T7XXX			

Note 1. Only if authorized according to paragraph 5.1.2
2. Cumulative time of several heating operations or time of one continuous heating operation.

5.4 Joggling

5.4.1 Joggle parts as soon as the forming temperature is reached (as indicated by the applicable Tempilstik).

5.4.2 Remove parts from the die immediately after the joggling operation.

6 Requirements

6.1 **All** parts of every batch of hot joggled parts must be fluorescent penetrant inspected according to PPS 20.03. If possible, it is recommended that the first 2 joggled parts of each batch be fluorescent penetrant inspected before joggling and then fluorescent penetrant inspecting the remainder of the batch. If cracking of any parts is detected, contact Liaison Engineering. Cracked parts are not acceptable.

6.2 Dishing of joggled extrusions is acceptable within limits specified in Figure 1:

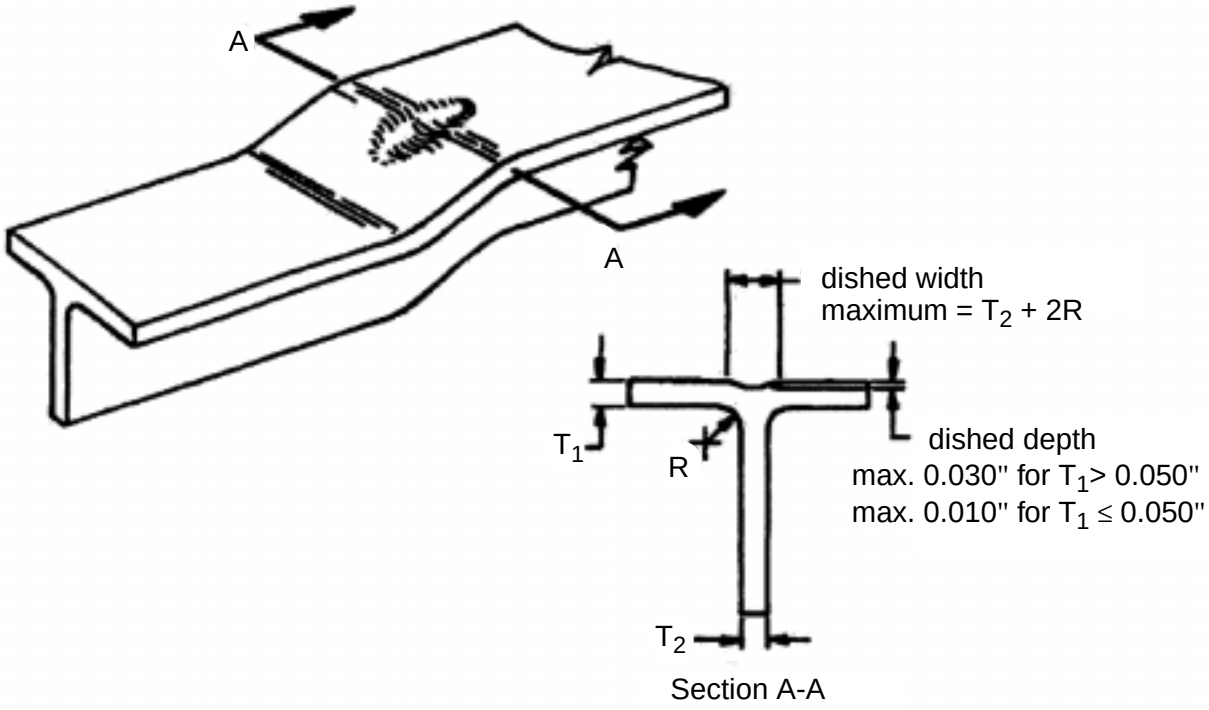

Figure 1 - Dishing Limits for Joggled Extrusions

7 Safety Precautions

7.1 Observe general shop safety precautions when performing the procedure specified herein.

7.2 Post suitable warning signs advising "HOT DIES" on the mechanical press at all times when hot joggling.

7.3 Wear heat resistant leather gloves when handling hot joggling parts.

8 Personnel Requirements

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

9 Maintenance

9.1 Ensure that temperature indicating and controlling equipment is operating properly (i.e., within the manufacturer's specifications) on at least a quarterly basis (i.e., at least once every 3 months).

9.2 A preventive maintenance program for hot joggling machines is recommended.