BOMBARDIER
Toronto (de Havilland)
PROPRIETARY INFORMATION

PPS 37.09

PRODUCTION PROCESS STANDARD

Special Welding Procedure

Issue 14
- This standard supersedes PPS 37.09, Issue 13.
- Vertical lines in the left hand margin indicate technical changes over the previous issue.
- Direct PPS 37.09 related questions to michael.wright@aero.bombardier.com.
- This PPS is effective as of the distribution date.

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	Production Process Standards (PPS)	
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	Quality	

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 fusion welding of Class A parts of the alloys specified herein. Such parts require special welding procedures, defined and approved as specified herein.

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 Toronto (de Havilland), all materials must be approved and assigned Material Safety Data Sheet (MSDS) numbers by the Bombardier Toronto (de Havilland) 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 (de Havilland) Environment, Health and Safety Department.

3 References

3.1 PPS 13.26 - General Subcontractor Provisions.

3.2 PPS 13.39 - Bombardier Toronto Engineering Process Manual.

3.3 PPS 16.01 - Application of Hard and Soft Film (F13) Corrosion Preventive Compound.

3.4 PPS 20.01 - Magnetic Particle Inspection.

3.5 PPS 24.01 - Aluminum Wire Spray Coating.

3.6 PPS 30.04 - Steel Heat Treatment - Carbon and Low Alloy Steels.

3.7 PPS 31.03 - Cleaning of Carbon and Low Alloy Steels.

3.8 PPS 31.07 - Cleaning and Stripping of Painted Surfaces.

3.9 PPS 31.17 - Solvent Usage.

3.10 PPS 33.02 - Removal of Metallic Coatings.

3.11 PPS 37.06 - Testing and Certification of Aircraft Fusion Welders.

3.12 PPS 37.10 - Requirements for Fusion Welds.

3.13 American Welding Society Standard Welding Symbols Wall Chart - AWS A2.1-WC.

4 Materials, Equipment and Facilities

4.1 Materials

4.1.1 Welding rods and wire as specified on the technique sheet.

4.2 Equipment

4.2.1 MIG and TIG welding equipment.

4.2.2 Tempilstiks, Tempilaq or surface pyrometers.

4.2.3 Welding jigs, fixtures and clamps.

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 fusion welding of Class A parts of the alloys specified herein 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 fusion welding of Class A parts of the alloys specified herein 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 Keep welding rods and wire dry, clean and free from grease and shop contamination.

5.1.2 Take precautions to prevent drafts from windows, cooling systems, electrical machinery or other sources reaching the weld during welding. Avoid rapid cooling of any weld.

5.1.3 It is recommended that a copy of AWS Standard Welding Symbols Wall Chart be posted wherever welding is being carried out.

5.1.4 Unless otherwise specified in the *Final Heat Treat* column of the engineering drawing, the heat treat condition of detail parts before welding must be as specified in Table 1.

Table 1 - Material Condition Prior to Welding

MATERIAL	ALLOY	HEAT TREAT CONDITION FOR WELDING (NOTE 1)
Low Alloy Steels	4340	Normalized and tempered or tempered to 90 - 120 ksi
	Hy-Tuf	Normalized and tempered
	300M	Normalized and tempered
Note 1. Carry out heat treatment, if necessary, according to PPS 30.04.		

5.2 Cleaning

5.2.1 Before welding, clean parts according to PPS 31.03. Suitably protect cleaned parts from contamination. Always wear clean cotton gloves if handling parts at the joining surfaces.

5.2.2 If fitting or deburring are required on assembly, solvent clean such areas according to PPS 31.17 immediately before welding.

5.3 Welding Procedure

5.3.1 Establish the welding procedure for each specific part as follows:

Step 1. Prepare a technique sheet for the part specifying the following information:

- Type and size range limitations on welding rod
- Type of shielding gas
- Maximum permissible joint gap
- Pre-heat and interpass temperatures
- Welding method
- Defluxing method (e.g., grit blasting or wire brushing)
- Post-weld stress relief requirements

Step 2. Using the information specified on the technique sheet, weld a part for testing or, in the case of large or expensive items, a simulated part.

Step 3. Submit the test part for evaluation according to PPS 37.10. If defects are found, modify the welding procedure technique sheet as necessary and weld and examine another part. Repeat this procedure until the test part proves to be acceptable.

Step 4. Once an established procedure has been adopted for a specific part no changes to the procedure as specified are permitted without testing as specified herein. Maintain technique sheets and test results on file.

5.4 Repairing Defective Welds and Defective Parts

5.4.1 Bombardier Toronto (de Havilland) MRB or Bombardier Toronto (de Havilland) delegated MRB approval must be obtained before repairing of welding defects in Class A welds (as found on weld verification) or defective parts (as found in service). Perform repair welding according to written MRB instructions.

5.4.2 Before repair welding, thoroughly clean the weld joint and adjacent areas in the repair region and remove any surface treatment such as aluminum metal spray, plating, paint, etc. according to PPS 24.01, PPS 31.07 or PPS 33.02, as applicable.

5.4.3 Reworking is governed by the following restrictions:

- Complete removal of the defect by grinding or filing is required. **DO NOT** use a welding or cutting torch to remove defects. **DO NOT** cover up defects with additional welds.
- Parts which have been heat treated after welding, other than stress relieved, may not be repair welded unless re-heat treatment is permitted by Liaison Engineering. Carry out re-heat treatment according to instructions from Liaison Engineering or Engineering Order, as applicable.

5.5 Straightening of Welded Parts

5.5.1 Straightening of welded parts is permitted before heat treatment (hardening).

5.5.2 Authorization and instructions must be obtained from Liaison Engineering before straightening welded parts after heat treatment to 150 - 170 ksi or above.

5.5.3 After straightening, magnetic particle inspect parts according to PPS 20.01.

5.6 Protective Treatment

5.6.1 Apply protective treatment, such as plating, priming and painting, after completion of all welding, weld verification, stress relieving, heat treatment, abrasive cleaning, machining, shot peening, magnetic particle inspection, etc.

5.6.2 If specified on the engineering drawing, apply internal corrosion preventive compound treatment according to PPS 16.01 to hollow parts after welding, weld verification, stress relieving, heat treatment, abrasive cleaning, machining, shot peening, plating, priming and painting.

6 Requirements

6.1 Ensure that the detailed procedure specified is rigidly adhered to.

6.2 Ensure all original welds and repair welds are checked according to PPS 37.10.

7 Safety Precautions

7.1 The safety precautions specified herein are specific to Bombardier Toronto to meet Canadian Federal and Provincial government environmental, health and safety regulations. It is recommended that other facilities consider these safety precautions; however, suppliers, subcontractors and partners are responsible for ensuring that their own environmental, health and safety precautions satisfy the appropriate local government regulations.

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

7.3 Refer to PPS 37.04 for safety precautions relating to the fusion welding of low alloy steels.

8 Personnel Requirements

8.1 Welding personnel must be certified according to PPS 37.06.

8.2 This PPS has been categorized as a “Controlled Critical Process” by PPS 13.39. Refer to PPS 13.39 for personnel requirements.

9 Maintenance of Equipment

9.1 Maintain all welding equipment, including lines and gauges, in good working order.

9.2 Return defective welding equipment for repair or replacement.

10 Additional Information

10.1 Refer to the engineering drawing for the following information:.

- Class and type of joint
- Final heat treat strength range
- Other pertinent data as required

10.1.1 Refer to Table 2 for the relationship between current and superseded weld classifications.

Table 2 - Cross Reference Between Weld Classifications

CURRENT	SUPERSEDED
Class A	Class 1, Type A
Class B	Class 1, Type B and Class 2
Class C	Class 1, Type C and Class 3