BOMBARDIER
Toronto (de Havilland)
PROPRIETARY INFORMATION

PPS 6.17

PRODUCTION PROCESS STANDARD

Repair of Hydraulic Lines using Externally Swaged (Permaswage Type) Fittings

Issue 10
- This standard supersedes PPS 6.17, Issue 9.
- 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.

Prepared By:	(Michael Wright) Production Process Standards (PPS)	December 10, 2013
Approved By:	(L.K. John) Materials Technology	December 11, 2013
	(Adam Gordon) Quality	December 11, 2013

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1 Scope

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for the repair of damaged or defective hydraulic lines using externally swaged (Permaswage type) fittings.

1.1.1 This PPS complements the engineering MRB disposition (e.g., RNC) specifying its use as an authorized instruction. The procedure specified in this PPS must be followed to ensure compliance with all applicable specifications. If this PPS conflicts with the engineering MRB disposition, follow the instructions of the engineering MRB disposition. 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 6.01 - Fabrication of Rigid Fluid Lines.

3.2 PPS 6.10 - Cleaning of Fluid System Components.

3.3 PPS 6.12 - Pressure Testing Hydraulic Components, Fuel and Bleed Air Lines.

3.4 PPS 6.13 - Installation of Externally Swaged (Permaswage Type) Fittings.

3.5 PPS 6.18 - Certification of Tooling used for Installation of Externally Swaged (Permaswage Type) Fittings.

3.6 PPS 13.39 - Bombardier Toronto Engineering Process Manual.

3.7 PPS 32.02 - Manual Application of Chemical Conversion Coatings.

3.8 PPS 34.08 - Application of Epoxy-Polyamide Primer.

4 Materials, Equipment and Facilities

4.1 Materials

4.1.1 Externally swaged (Permaswage type) fittings specified by Bombardier Toronto (de Havilland) MRB or Bombardier Toronto (de Havilland) delegated MRB. For DASH 8 aircraft and Learjet 45 wing assemblies, applicable B030XXXX externally swaged (Permaswage type) fittings shall be installed according to this PPS, even if the B030XXXX specification specifies installation according to BAPS 174-017.

4.2 Equipment

4.2.1 Equipment specified in PPS 6.13. All tooling used to perform work to this PPS must have been certified and/or re-certified according to PPS 6.18.

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 repair of hydraulic lines using externally swaged (Permaswage type) fittings 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 repair of hydraulic lines using externally swaged (Permaswage type) fittings 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 If authorized by Bombardier Toronto (de Havilland) MRB or Bombardier Toronto (de Havilland) delegated MRB, use externally swaged (Permaswage type) permanent type unions to repair defective or damaged tubing sections.

5.1.2 Maintain equipment and tools according to PPS 6.13 and PPS 6.18.

5.1.3 When installing externally swaged (Permaswage type) fittings it is imperative to leave a minimum straight section of tubing according to Table 1 (measured from the cut end) to allow the fitting to seat correctly. Ensure that cut tubing ends are square to within ±1°.

Table 1 - Minimum Straight Length Before Bends

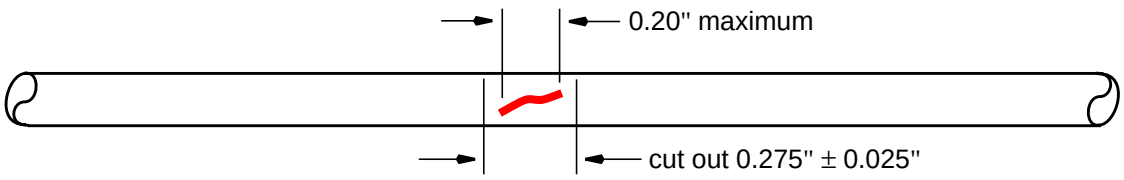
TUBE/FITTING SIZE	MINIMUM STRAIGHT LENGTH
-03 (3/16")	0.600"
-04 (1/4")	0.740"
-06 (3/8")	0.816"
-08 (1/2")	1.310"
-10 (5/8")	1.358"

TUBE/FITTING SIZE	MINIMUM STRAIGHT LENGTH
-12 (3/4")	1.428"
-16 (1")	1.573"
-20 (1 1/4")	1.675"
-24 (1 1/2")	1.800"

5.2 Hydraulic Line Repair

5.2.1 Repair small defects, contained within a section of line 0.20" long or less, as follows:

Step 1. Cut out a 0.275" ± 0.025" section of the line at the defect using a chipless tube cutter according to PPS 6.13.



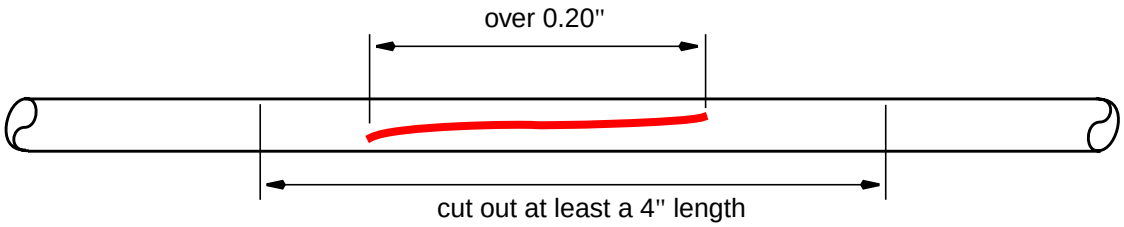
Step 2. Prepare and mark both cut ends of the tube according to PPS 6.13.

Step 3. Slide the externally swaged (Permaswage type) fitting fully onto one of the tubes and then slide the fitting back onto the second tube. Ensure that the fitting is centred over the two tube ends.

Step 4. Swage both fitting ends according to PPS 6.13.

5.2.2 Repair large defects, contained within a section of line over 0.20" long, as follows:

Step 1. Using a chipless tube cutter according to PPS 6.13, cut out at least a 4" length of line containing the defect.



Step 2. Prepare and mark both cut ends of the tube according to PPS 6.13.

Step 3. Using the cut-out section as a template, fabricate a replacement tube section to the required configuration according to PPS 6.01. Cut the new tube to size to provide a maximum gap of 0.300" between line ends to be rejoined.

Step 4. Brush apply chemical conversion coating according to PPS 32.02 to the replacement tube section, except for 2" at each end.

Step 5. Prepare and mark the replacement tube ends according to PPS 6.13.

Step 6. Slide the externally swaged (Permaswage type) fitting fully onto each of the tube ends and insert the replacement tube section.

Step 7. Slide each of the fittings back onto the original tube sections. Ensure that each fitting is centred over the two adjacent tube ends.

Step 8. Swage both fittings according to PPS 6.13.

5.3 Post-Swage Procedure

5.3.1 After swaging, process assemblies as follows:

Step 1. Examine externally swaged (Permaswage type) fittings visually and dimensionally to ensure they meet the requirements specified in PPS 6.13.

Step 2. Pressure test tube assemblies according to PPS 6.12. Pressure test assemblies that will be installed and swaged in place on the aircraft by isolating the applicable line section or, if this is not possible, during the aircraft functional test procedures.

Step 3. Apply F19 primer to any exposed (bare) tube surfaces on the replaced length of tubing according to PPS 34.08 except that it is neither necessary nor desirable to apply chemical conversion coating (e.g., alodine) to the bare tubing. Do not prime the fittings.

6 Requirements

6.1 After swaging, examine externally swaged (Permaswage type) fittings visually and dimensionally according to PPS 6.13.

7 Safety Precautions

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

7.2 Refer to PPS 6.13 and PPS 6.18 for safety precautions for installation of externally swaged (Permaswage type) fittings and pressure testing of tube assemblies.

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 Special Points to Note

9.1 Take care to ensure that hydraulic fluid lines and hydraulic system components used with MIL-H-5606 hydraulic fluid do not come into contact with solvent blends containing isopropyl alcohol, also known as isopropanol and 2-propanol. Hydraulic fluid lines and hydraulic system components used with MIL-H-5606 hydraulic fluid which have been contaminated with solvent blends containing isopropyl alcohol must be cleaned according to PPS 6.10.