BOMBARDIER
Toronto (de Havilland)
PROPRIETARY INFORMATION

PPS 13.21

PRODUCTION PROCESS STANDARD

APPLICATION OF SHIMS

Issue 7 - This standard supersedes PPS 13.21, Issue 6.
- Vertical lines in the left hand margin indicate 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 the application of shims.

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. 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 (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 21.20 - Mixing and Handling Two Part Sealants.

3.3 PPS 21.21 - General Sealing Practices.

3.4 PPS 25.30 - Bonding using DHMS A6.09 Epoxy Adhesive.

3.5 PPS 31.17 - Solvent Usage.

3.6 PPS 32.02 - Manual Application of Chemical Conversion Coatings.

3.7 PPS 34.08 - Application of Epoxy-Polyamide Primer.

4 Materials and Equipment

4.1 Materials

4.1.1 DHMS S3.06 fay sealant.

4.1.2 Flashbreaker tape to DSC 234-15.

4.1.3 Extrudable mouldable shim material, 2 part kit and Sem-Kit forms, to DHMS A6.09.

4.1.4 Pre-catalyzed mouldable shim material to DHMS A6.09-1.

4.1.5 Quick freeze spray (e.g., Miller-Stephenson Chemical Co. #MS-242N-AS).

4.1.6 Laminated shims to CSP 469A, CSP 470A or as specified by the engineering drawing (i.e., CSP XXX or drawing part number).

4.1.7 Half solid/half laminated shims to CSP 469B, CSP 470B or as specified by the engineering drawing (i.e., CSP XXX or drawing part number).

4.1.8 Tapered shims to CSP 471.

4.1.9 Release agent, Miller-Stephenson Chemical Co. MS-143DF or Valspar Corp. MR 225. Miller-Stephenson Chemical Co. MS-143N release agent is superseded by MS-143DF but may be used to the depletion of existing stock.

4.2 Equipment

4.2.1 Protective neoprene gloves (e.g., DSC 422-5).

4.2.2 Barcol Indentor (e.g., model 935).

5 Procedure

5.1 General

5.1.1 Only faces specifically identified on the engineering drawing as shimmable shall be shimmed as specified herein. Classify and shim gaps according to Table I.

5.1.2 Except as noted below, shim gaps using the shims specified by the engineering drawing.

- If the engineering drawing indicates that shimming is acceptable but does not specify a particular shim, use the shim specified in Table I.
- If, and only if, a **non-tapered aluminum** shim is specified and a tapered gap exists, it is acceptable to use a CSP 471 tapered shim in place of the shim specified on the engineering drawing.
- Gaps of less than 0.005" do not require shimming and shall be fay sealed with DHMS S3.06 sealant only.

TABLE I - CLASSIFICATION & SHIMMING OF GAPS

GAP THICKNESS RANGE	GAP CLASS	SHIM TYPE	SHIM MATERIAL		SECTION
			ALUMINUM STRUCTURE	CRES/STEEL STRUCTURE	
0.000" - 0.005" (all, including tapered gaps)	I	none (fay sealant only)	n/a		5.3.1
0.006" - 0.020" (except tapered gaps)	II	laminated shim	CSP 469A (Note 1)	CSP 470A (Note 1)	5.3.2
		DHMS A6.09 mouldable shim (Note 2)	n/a		5.3.3
0.021" - 0.040" (except tapered gaps)	III	half solid/half laminated shim	CSP 469B (Note 1)	CSP 470B (Note 1)	5.3.4
greater than 0.040"	IV	as specified by de Havilland Engineering (Stress Office)			5.3.5
0.006" - 0.040" Tapered Gap (Note 3)	V	solid tapered shim	CSP 471	refer to Liaison Engineering	5.3.6

Note 1. Under no circumstances is it acceptable to modify the non-tapered laminated shims specified on the engineering drawing to produce a shim with a tapered thickness.

Note 2. If the engineering drawing (or Stress Office approved RNC) specifies the use of mouldable shim material and the size of the gap is between 0.006" - 0.020", shim according to section 5.3.3.

Note 3. Unless otherwise specified by the engineering drawing, the maximum shimmable tapered gap is 0.040" with the taper ratio not exceeding 0.020" per inch.

5.2 Preparation of Parts and Materials

5.2.1 Just before applying sealant, solvent clean the immediate and surrounding area to which sealant is to be applied according to PPS 31.17. Ensure that the cleaned surfaces are completely free from any chips, burrs, dirt, grease, etc., which would interfere with or prevent adequate sealing.

5.2.2 Check the primer coating in the area to be shimmed for evidence of scratches or other defects. Touch up damaged F21 Type I primer as follows:

Step 1. Solvent wash the affected area according to PPS 31.17.

Step 2. Brush apply chemical conversion coating to the exposed metal surface according to PPS 32.02.

Step 3. Brush apply F19 primer according to PPS 34.08 to the chemical conversion coated surface only.

Step 4. Allow the F19 primer to cure for 60 to 90 minutes before applying sealant.

5.2.3 Mix and handle DHMS S3.06 sealant according to PPS 21.20.

5.2.4 Prepare pre-catalyzed mouldable shim material as follows:

Step 1. Remove enough pre-catalyzed shim material from the freezer for the job at hand. Use pre-catalyzed sheet approximately 0.010" thicker than the gap. If necessary, it is acceptable to use two plies of pre-catalyzed sheet to obtain the required thickness.

Step 2. Remove the release paper from one side of the pre-catalyzed shim while the shim material is still cold.

Step 3. Allow the pre-catalyzed shim material to thaw to room temperature. The material will quickly become tacky and slight condensation, if any, will form and evaporate. The time for the material to thaw will vary with the thickness of the material and the ambient temperature. Two or three minutes thaw time is typical.

Step 4. Apply the shim by bringing one end of the strip into contact with the surface and gently rolling the strip onto the surface. The rolling motion minimizes air entrapment. Use very light pressure when applying the strip. It is sometimes helpful to attach a small piece of adhesive tape to one end of the release paper to act as a handle.

Step 5. Remove the second piece of release paper by quickly cooling the surface using quick freeze spray. As the surface of the material cools and loses its tackiness, the release paper can be removed easily. After the release paper has been removed, the pre-catalyzed shim material will quickly become tacky again and will be ready for assembly.

5.2.5 Prepare Sem-Kit mouldable shim material as follows:

Step 1. Remove enough Sem-Kit cartridges for the job at hand from the freezer.

Step 2. Allow the Sem-Kit cartridges to thaw to room temperature (15 - 20 minutes). To check that the material has thawed sufficiently, wipe the side of the storage container free of moisture; if condensation re-appears the material has not yet thawed.

Step 3. After the kit components have thawed, mix the components thoroughly according to the Sem-Kit instructions.

5.2.6 Prepare two part mouldable shim material according to PPS 25.30.

5.3 Shimming

5.3.1 Shimming of Class I Gaps (0.000" - 0.005")

5.3.1.1 Shimming of Class I gaps is not required. Apply DHMS S3.06 fay sealant in Class I gaps according to PPS 21.21. Before fay sealing, prepare the gap surfaces according to section 5.2.

5.3.2 Shimming of Class II Gaps (0.006" - 0.020") using Laminated Shims

5.3.2.1 Shim Class II gaps using laminated shims as follows:

Step 1. Prepare the surface to which the shim is to be applied according to section 5.2.

Step 2. Apply DHMS S3.06 sealant to the shim area according to PPS 21.21.

Step 3. Remove enough of the upper most layers of the laminated shim to leave a slight gap (0.005" maximum). If a layer is removed, the entire layer must be removed; under no circumstances is it acceptable to modify the shims to produce a shim with a tapered thickness.

Step 4. Apply the modified laminated shim.

Step 5. Fay seal to fill the remaining gap with DHMS S3.06 sealant according to PPS 21.21. Apply fay sealant even if no gap exists after applying the shim.

Step 6. Unless otherwise specified by the engineering drawing, record the shim CSP or drawing part number in the workbook or index sheet of the assembly manual, as applicable.

5.3.3 Shimming of Class II Gaps (0.006" - 0.020") using Mouldable Shim Material

5.3.3.1 If use of mouldable shim material is permitted by specific instruction on the engineering drawing or Stress Office approved RNC, it is acceptable to shim 0.006" - 0.020" gaps as follows:

Step 1. Prepare the surfaces of the gap to be shimmed according to section 5.2.

Step 2. Mask off around the perimeter of the area to be shimmed with flashbreaker tape.

Step 3. Unless otherwise specified on the engineering drawing, apply a single coat of MS-143DF or MR 225 release agent to one of the mating surfaces. Allow the coat of release agent to air dry for at least 2 minutes.

Step 4. Apply mouldable shim material, prepared according to section 5.2, to the shim area to a thickness 0.010" - 0.015" thicker than the measured gap.

Step 5. Assemble the mating part in position by means of the locating pins.

Step 6. Apply pressure to the mouldable shim by installing temporary fasteners at the “no gap” zones specified on the engineering drawing.

Step 7. Remove mouldable shim material that has been squeezed out by solvent wiping according to PPS 31.17.

Step 8. Check for evidence of gaps and touch up, using a plastic or wooden spatula, if necessary.

Step 9. Prepare a test sample of the mouldable shim material (3 - 4 square inches x 0.125" thick) for Barcol hardness testing.

Step 10. Allow the mouldable shim to cure until the test sample has cured to a minimum Barcol hardness of 65 (16 - 24 hours). Record the results of the hardness test in the workbook or assembly manual.

Step 11. Remove the flashbreaker tape, temporary fasteners and locating pins and check the unbonded surface of the shim for any cracks, blisters, voids or delaminations. If the mouldable shim has any of these defects, carefully remove the cured shim and re-shim as specified herein.

Step 12. Remove residual release agent from the mating surface and the unbonded surface of the shim by solvent washing according to PPS 31.17.

Step 13. Apply DHMS S3.06 fay sealant to the cleaned surface according to PPS 21.21.

Step 14. Re-assemble the mating parts with the permanent fasteners specified on the engineering drawing

5.3.4 Shimming of Class III Gaps (0.021" - 0.040")

5.3.4.1 Shim Class III gaps as follows:

Step 1. Prepare the surface to which the shim is to be applied according to section 5.2.

Step 2. Apply DHMS S3.06 sealant to the shim area according to PPS 21.21.

Step 3. Remove enough of the upper most layers of the half solid/half laminated shim to leave a slight gap (0.005" maximum). When a layer is removed, the entire layer must be removed; under no circumstances is it acceptable to modify the shims specified on the engineering drawing to produce a shim with a tapered thickness.

Step 4. Apply the modified half solid/half laminated shim.

Step 5. Fay seal to fill the remaining gap with DHMS S3.06 sealant according to PPS 21.21. Apply fay sealant even if no gap exists after applying the shim.

Step 6. Unless otherwise specified by the engineering drawing, record the shim CSP or drawing part number in the workbook or index sheet of the assembly manual, as applicable.

5.3.5 Shimming of Class IV Gaps (greater than 0.040")

5.3.5.1 If the engineering drawing allows shimming of Class IV gaps and the size of the gap falls within the limit specified on the engineering drawing, shim the gap using the same procedure as that for shimming Class III gaps.

5.3.5.2 If the engineering drawing does not specify explicit instructions for shimming of gaps exceeding 0.040", refer to Liaison Engineering for disposition of Class IV gaps.

5.3.6 Shimming of Class V Gaps (Tapered)

5.3.6.1 Shim Class V gaps as follows:

Step 1. Prepare the surface to which the shim is to be applied according to section 5.2.

Step 2. Apply DHMS S3.06 sealant to the shim area according to PPS 21.21.

Step 3. Apply the appropriate tapered solid shim to leave a slight gap (0.005" maximum).

Step 4. Fay seal to fill the remaining gap with DHMS S3.06 sealant according to PPS 21.21. Apply fay sealant even if no gap exists after applying the shim.

Step 5. Unless otherwise specified by the engineering drawing, record the shim CSP or drawing part number in the workbook or index sheet of the assembly manual, as applicable.

6 Requirements

6.1 Gaps of up to 0.005" shall be fay sealed with DHMS S3.06 sealant. If the engineering drawing specifies shimming, gaps greater than 0.005" shall be shimmed using the shims specified on the engineering drawing or Table I.

6.2 Mouldable shims shall only be used if the engineering drawing or Stress Office approved RNC specifically allows their use. Whenever mouldable shims are used, a test sample of the mouldable shim material used shall be Barcol hardness tested. The Barcol hardness of the cured test sample must be 65 - 90 and recorded in the workbook, RNC or assembly manual. Cured mouldable shims shall be checked before the application of fay sealant for evidence of defects such as cracks, blisters, voids or delaminations. If the shim shows evidence of defects, the shim must be removed and the gap re-shimmed.

6.3 Unless the engineering drawing specifically states that recording of the shim number is not required, the shim CSP or drawing part number must be recorded in the workbook or assembly manual.

7 Safety Precautions

7.1 Avoid skin contact with DHMS A6.09 mouldable shim material. Wear protective neoprene gloves when mixing, handling or applying DHMS A6.09 mouldable shim material.

7.2 If skin contact with DHMS A6.09 mouldable shim material occurs, wash thoroughly with soap and water. Should accidental eye contact occur, flush eyes with large quantities of water at an eye wash station and report to the health centre. If any DHMS A6.09 mouldable shim material is accidentally swallowed, obtain medical attention immediately.

7.3 Do not mix or apply DHMS A6.09 mouldable shim material in confined spaces without ensuring that adequate ventilation is supplied.

8 Personnel Requirements

8.1 Personnel responsible for the application of shims must have a good working knowledge of the procedure and requirements as specified herein and shall have exhibited their familiarity to their supervisor.