BOMBARDIER Toronto (de Havilland) PROPRIETARY INFORMATION	**PPS 19.02** PRODUCTION PROCESS STANDARD

Use of Anaerobic Sealant/Adhesive

Issue 25
- This standard supersedes PPS 19.02, Issue 24.
- Vertical lines in the left hand margin indicate technical changes over the previous issue.
- This PPS is effective as of the distribution date.
- Validation of issue status is the responsibility of the user.

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Issue 25 - Summary of Changes (over the previous issue)

The following summaries are not detailed and are intended only to assist in alerting PPS users to changes which may affect them; refer to the applicable sections of this PPS for detailed procedure and requirements.

- Revised activator to be used with Loctite 222 sealant to specify use of Loctite 7471 'Primer T' only.
- Added procedure and requirements for use of Loctite 243 sealant with Loctite SF7088 activator, to be used when specified by the engineering drawing.
- Clarified part preparation procedure.
- Clarified that if, during subsequent processing or assembly, coloured dots used to identify secured bearings/bushings and proof loaded bearings are covered (e.g., by priming or painting), are obliterated or are obscured by incorporation into the next higher assembly, re-identification is not necessary.
- Added a general safety precaution indicating that the safety precautions specified in this PPS are specific to Bombardier Toronto (de Havilland) and that suppliers, subcontractors and partners are responsible for ensuring that their own environmental, health and safety precautions satisfy the appropriate local government regulations.

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1 Scope

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for securing threaded fasteners or fittings and retaining bearings or bushings using anaerobic sealant/adhesives.

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 General

3.1.1 Unless a specific issue is indicated, the issue of the reference documents specified in this section in effect at the time of manufacture shall form a part of this specification to the extent indicated herein.

3.2 Bombardier Toronto (de Havilland) Process Specifications

3.2.1 PPS 12.02 - Lubricating and Storing of Aircraft Bearings.

3.2.2 PPS 13.26 - General Subcontractor Provisions.

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

3.2.4 PPS 31.07 - Cleaning and Stripping of Painted Surfaces.

3.2.5 PPS 31.17 - Solvent Usage.

3.2.6 PPS 34.08 - Application of Epoxy-Polyamide Primer (F19 and F45).

4 Materials and Equipment

4.1 Materials

4.1.1 Unless otherwise specified in this section, use only the materials specified; use of superseding or alternative materials is not allowed.

4.1.2 Anaerobic sealants as specified by the engineering drawing or as specified in Table 1.

4.1.2.1 Each batch of Loctite 222 must be torque tested according to ASTM D5363 before use. Maintain a record of batch/torque testing results on file.

4.1.3 Primer/Activators as specified in Table 2.

4.1.4 Boelube, solid, 70200.

4.2 Equipment

4.2.1 SD 2978 proof load tester and adaptors. In place of the SD 2978 proof load tester it is acceptable to use equivalent proof load testers (e.g., tensile tester FM-10 with proof load adaptors). Maintain and/or certify equivalent proof load testers according to the equipment manufacturers instructions.

4.2.2 Dalo metal markers, medium tip, red and yellow (e.g., Mark-Tex Corp. 50210.02 (red), Mark-Tex Corp. 50210.06 (yellow), Dykem #26023 (red), Dykem #26063 (yellow), etc.).

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

5 Procedure

5.1 General

5.1.1 For the purposes of this PPS, when the term sealants is used it is intended to include the anaerobic sealants/adhesives referenced in Table 1 (unless specific reference is made to a particular sealant or adhesive).

5.1.2 Anaerobic sealants and adhesives are single component acrylic-type resins, which self-harden into tough structural solids when confined between close-fitting metal parts. The hardening action of these sealants is caused by a chemical reaction known as an “anaerobic” (without air) cure. When these materials are confined between metal parts which exclude air the chemical reaction begins, aided by catalytic action of the metal surfaces, causing the liquid to harden. A film or bead of sealant on an exposed metal surface stays liquid as long as air is present.

5.1.3 In order to speed up cure of the sealant the metal bonding surfaces are treated with primer/activator before applying the sealant. The primer/activator is mostly organic

solvent with a percentage of a catalytic agent. When applied, the solvent evaporates leaving a thin film of curing agent on the surface of the part.

5.1.4 If the engineering drawing or process specification specifies the use of Loctite Grade H sealant, use MIL-S-46163 Grade M or ASTM D5363 AN0311 (e.g., Loctite 222MS) sealant.

5.1.5 Unless otherwise specified on the engineering drawing, use the sealant specified in Table 1.

5.1.6 If possible, complete all riveting operations before applying sealant, as the rivet gun vibrations may shatter the adhesive bond.

Table 1 - Sealant Selection (Note 1)

Application	Sealant
Securing threaded fasteners	MIL-S-46163 Grade M (e.g., Loctite 222MS), ASTM D5363 AN0311 or Loctite 222 (Note 2)
Securing bushings and bearings	MIL-S-22473 Grade AA or ASTM D5363 AN0111 (e.g., Loctite Grade AA)
Securing fittings	MIL-R-46082 Type III or ASTM D5363 AN0421 (e.g., Loctite 635)

Note 1. Do not use Loctite 243 or Loctite 638 unless specified by the engineering drawing or PPS.

Note 2. Torque test each batch of Loctite 222 according to ASTM D5363 before use. Maintain a record of batch/torque testing results on file.

5.2 Preparation of Parts

5.2.1 Prepare parts as follows and as applicable:

Step 1. If F19 primer has entered the housing bore, remove the F19 primer by chemical stripping according to PPS 31.07; **do not** attempt to remove F19 primer by mechanical means. Take care not to remove the primer from the area surrounding the bore.

Step 2. For bearings which have lubricating holes in their outer race, plug the lubricating holes with Boelube 70200 solid lubricant. After plugging the holes, take care to ensure that all traces of Boelube are removed from the bearing race.

Step 3. Solvent clean the mating surfaces of housing bores, bearings, shafts and bushings to be secured using anaerobic sealant according to PPS 31.17; if cleaning sealed, grease lubricated bearings, it is imperative to ensure that solvent does not enter the bearings and contaminate the lubricant. For fasteners are to be secured using anaerobic sealant, solvent clean the mating threads using a bristle brush and the solvent specified in PPS 31.17, to remove all traces of dirt, grease, oil, etc.

Step 4. Except as follows, apply the primer/activator specified in Table 2 to both mating surfaces using a thin brush. When use of Loctite SF7088 stick type activator is specified by Table 2, apply the activator to only one of the mating surfaces/threads, with sealant to be applied to the other mating surface/threads.

Step 5. Allow the coating of primer/activator to air dry for a minimum of 5 minutes.

5.2.2 Always handle cleaned parts with clean, white, cotton gloves.

Table 2 - Primer/Activator Selection

Sealant	Primer/Activator
Loctite 222	Loctite 7471 'Primer T'
Loctite 243	Loctite SF7088 activator (also known as Loctite 7088 activator)
Loctite 638	Loctite 7471 'Primer T'
MIL-S-22473 Grade AA or ASTM D5363 AN0111 (e.g., Loctite Grade AA)	MIL-S-22473 Grade N or ASTM D5363 Grade N (e.g., Loctite 7649 'Primer N')
MIL-R-46082 Type III or ASTM D5363 AN0421 (e.g., Loctite 635)	MIL-S-22473 Grade T or ASTM D5363 Grade T (e.g., Loctite 7471 'Primer T')
MIL-S-46163 Grade M or ASTM D5363 AN0311 (e.g., Loctite 222MS)	

5.3 Sealant Application/Assembly

5.3.1 Apply sealant and assemble parts as follows:

Step 1. Except when using Loctite 243 sealant, apply a thin, even coat of the required sealant to the primed mating surfaces; when using Loctite 243 sealant, apply a thin, even coat of the sealant to the mating surface to which Loctite SF7088 activator was not applied. If applying sealant to bearings, take care to ensure that sealant does not enter the bearing race. If sealant does enter the bearing race, remove the sealant by thoroughly solvent rinsing according to PPS 31.17 or, for roller and ball bearings, clean according to PPS 12.02.

Step 2. Immediately (within no more than 5 minutes) assemble the parts in their correct position and alignment. If installing bearings with integral seals, take care to ensure that the sealant does not contact the seals.

Step 3. If possible, rotate bearings or bushings to ensure complete distribution of sealant. Sufficient sealant has been applied when a fillet is visible at the edge of the joint.

Step 4. Support clearance-fit bearings with a suitable support until the sealant has completely cured as specified in section 5.4.

Step 5. Ensure that a small fillet of sealant is evident at the parting line. For Garlock DU bushings only, thoroughly solvent clean the bore split line using the solvent specified in PPS 31.17 so that no sealant is evident in the bore.

Step 6. Except for Garlock DU bushings, after assembly of bearings and bushings into bores, ensure that a small fillet of sealant is evident at the parting line. Do not remove this fillet until it has fully cured as specified in section 5.4. For Garlock DU bushings, thoroughly solvent clean the bore split line immediately using the solvent specified in PPS 31.17 so that no sealant is evident in the bore.

5.4 Curing

5.4.1 Allow parts to cure to handle according to Table 3 before further handling.

5.4.2 Cure all parts according to Table 3 before further working, installing or proof load testing of the assembly.

Table 3 - Sealant Cure Schedules

Sealant	Cure to Handle	Full Cure
MIL-S-22473 Grade AA or ASTM D5363 AN0111 (e.g., Loctite Grade AA)	30 minutes at room temperature	2 hours at room temperature followed by 30 minutes at 120° - 180°F (49° - 82°C) or 24 hours at room temperature
MIL-R-46082 Type III or ASTM D5363 AN0421 (e.g., Loctite 635)	4 hours at room temperature	1 hour at room temperature followed by 20 minutes at 190° - 210°F (88° - 99°C) or 24 hours at room temperature
MIL-S-46163 Grade M or ASTM D5363 AN0311 (e.g., Loctite 222MS)	30 minutes at room temperature	24 hours at room temperature
Loctite 222		
Loctite 638		
Loctite 243	30 minutes at room temperature	

Note 1. For the purposes of this PPS, room temperature is defined as 61° - 90°F (16° - 32°C).

Note 2. After high temperature curing, allow the assembly to cool before further working, installing or proof load testing.

5.5 Post Assembly Procedure

5.5.1 General

5.5.1.1 After allowing the assembly to cure to handle, process parts as follows:

- Except for Garlock DU bushings, remove the extruded fillet of sealant at the parting line by solvent wiping according to PPS 31.17. Take care to ensure that solvent does not enter grease lubricated bearings.
- If F19 primer has been removed, re-finish edges and other areas according to PPS 34.08.

5.5.2 Proof Loading

5.5.2.1 After full cure according to Table 3, proof load all **bearings** assembled using MIL-S-22473 Grade AA or ASTM D5363 AN0111 sealant to the nominal proof load specified in Table 4 (e.g., as shown in Figure 1).

5.5.2.2 Proof loading of bushings is **not** required.

5.5.2.3 If it is not possible to proof load bearings on the outer race, proof load on the inner race by slowly rotating the bearing while applying the proof load.

5.5.2.4 Maintain the nominal proof load on the bearing for a period of 3 - 5 seconds.

5.5.2.5 Identify each successfully proof loaded assembly according to section 5.5.3.

Table 4 - Nominal Proof Loads for Bearing Assemblies

Bearing Outside Diameter	Bearing Race Width				
	up to 0.250"	0.251" - 0.375"	0.376" - 0.500"	0.501" - 0.625"	0.626" & larger
up to 0.625"	36 lbs	68 lbs	94 lbs	118 lbs	250 lbs
0.626" - 0.875"	52 lbs	96 lbs	132 lbs	166 lbs	250 lbs
0.876" - 1.125"	68 lbs	124 lbs	169 lbs	214 lbs	250 lbs
1.126" - 1.375"	83 lbs	152 lbs	206 lbs	250 lbs	250 lbs
1.376" - 1.625"	98 lbs	179 lbs	244 lbs	250 lbs	250 lbs
1.626" & larger	120 lbs	220 lbs	250 lbs	250 lbs	250 lbs

Note 1. Proof load using an SD 2978 proof load tester as shown in Figure 1. Use equivalent alternative proof loading equipment (ref. para. 4.2.1) according to the equipment manufacturers instructions.

Note 2. For the purposes of this PPS the term “nominal proof load” is intended to refer to the proof load setting to which proof load testing equipment be set or the weight (or combination of weights) used when performing proof loading as specified herein.

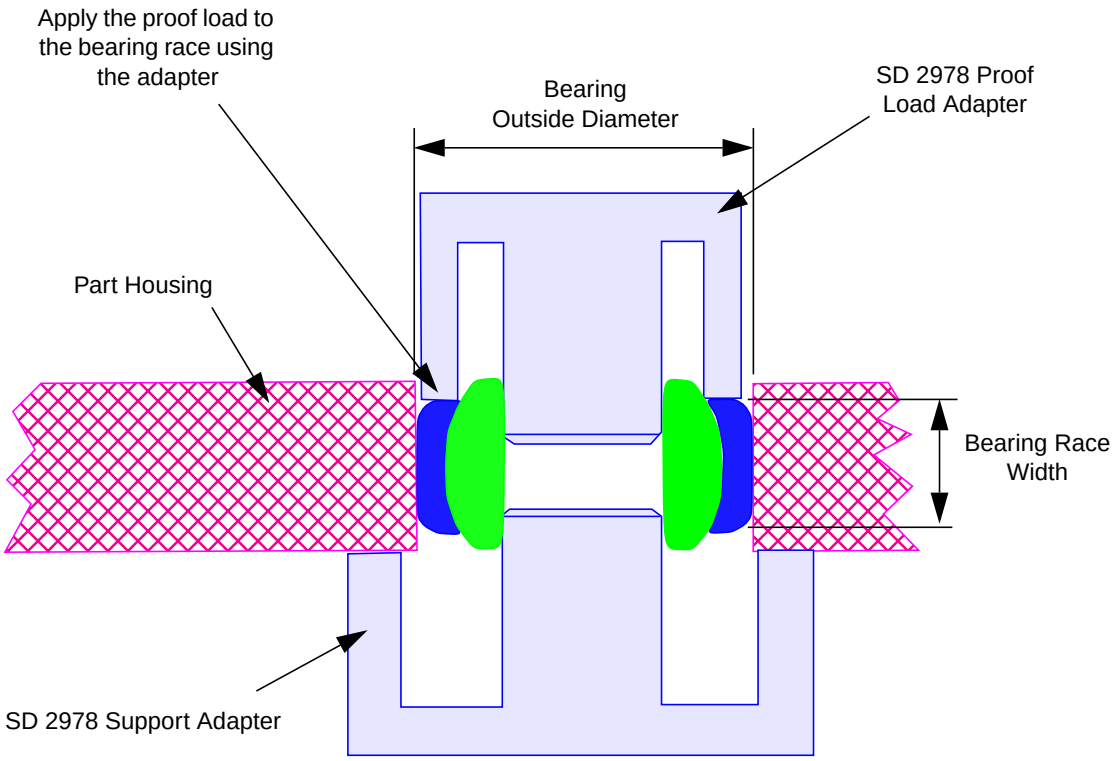

Figure 1 - Proof Loading

5.5.3 Identification of Secured and Proof Loaded Assemblies

5.5.3.1 Identify all bearings and bushings secured with sealant with a small red dot, applied adjacent to the sealed part using a Dalo marker.

5.5.3.2 Identify each proof loaded bearing with a small yellow dot, applied to the part surface adjacent to the bearing using a Dalo marker.

5.5.3.3 If, during subsequent processing or assembly, the identification dots applied as specified above are covered (e.g., by priming or painting), are obliterated, or are obscured by incorporation into the next higher assembly, re-identification is not necessary.

6 Requirements

6.1 Unless otherwise specified, threaded fasteners shall be secured using MIL-S-46163 Grade M (e.g., Loctite 222MS), ASTM D5363 AN0311 or Loctite 222 sealant as specified herein.

6.2 Unless otherwise specified, bushings and bearings shall be secured using MIL-S-22473 Grade AA or ASTM D5363 AN0111 (e.g., Loctite Grade AA) sealant as specified herein, including proof loading of secured bearings as specified in section 5.5.2 after full cure.

6.3 Unless otherwise specified, fittings shall be secured using MIL-R-46082 Type III or ASTM D5363 AN0421 (e.g., Loctite 635) as specified herein.

6.4 Ensure that the surface of the assembly is free of excess sealant.

6.5 Seized bearings are not acceptable.

7 Safety Precautions

7.1 The safety precautions specified herein are specific to Bombardier Toronto (de Havilland) 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 Apply sealants and primer/activator in well ventilated areas only.

7.4 Avoid skin contact with sealants or primer/activator. Wear protective neoprene gloves when applying sealant or primer/activator. If skin contact with sealant occurs, remove the material immediately by solvent cleaning the affected area with a clean cloth dampened in the solvent specified in PPS 31.17 and thoroughly washing with soap and water. If skin irritation persists after washing with soap and water report to the health centre.

7.5 Avoid ingestion of any materials specified herein. Always wash hands before eating or smoking. In cases of ingestion, obtain medical attention immediately.

7.6 Allow high temperature cured assemblies to cool before further working, installing or proof load testing.

7.7 Primer/activator is highly flammable. Do not smoke when applying primer/activator and take care to prevent ignition.

8 Personnel Requirements

8.1 Personnel must have a good working knowledge of the applicable procedure and requirements as specified herein and must have exhibited their competency to their supervisor.

9 Storage

9.1 Store sealants and primer/activator at room temperature.

9.2 Refer to PPS 13.28 for the storage life of sealants and primer/activator. Clearly mark the sealant and primer/activator containers with the storage life expiry date. Sealant or primer/activator which has exceeded its shelf life shall be submitted to the laboratory for shelf life extension testing and action according to PPS 13.28.

9.3 When not in use, keep containers of sealant and primer/activator tightly closed.

9.4 Primer/activators are highly flammable as well as light sensitive and, therefore, must be stored in flammable material cabinets away from oxidizing agents or combustible materials when not in use.