BOMBARDIER
Toronto (de Havilland)
PROPRIETARY INFORMATION

PPS 12.08

PRODUCTION PROCESS STANDARD

Installation of Shrink Fit Bushings into DASH 8 Series 300 Main Landing Gear Undercarriage Frame

Issue 3
- This standard supersedes PPS 12.08, Issue 2.
- 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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	Quality	

Signed original on file. Validation of paper prints is the responsibility of the user.

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1 Scope

1.1 This standard specifies the procedure and requirements for installation of shrink fit bushings into Dash 8 Series 300 Main Landing Gear Undercarriage Frame (de Havilland part no. 85411500) after cold expansion of applicable holes using the Fatigue Technology Inc. (FTI) split sleeve cold expansion process.

1.1.1 This PPS complements the engineering drawings that specify its use as an authorized instruction and the procedure specified 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 12.04 - Installation of Interference-Fit Bushings Using Liquid Nitrogen.

3.2 PPS 13.26 - General Subcontractor Provisions.

3.3 PPS 21.16 - Aircraft Weather/Pressure Sealing.

3.4 PPS 32.02 - Manual Application of Chemical Conversion Coatings.

4 Materials, Equipment and Facilities

4.1 Materials

4.1.1 Interference-Fit, flanged bushings, Bombardier Toronto (de Havilland) part number 85411552-101 & -103.

4.2 Equipment

4.2.1 FTI cold expansion tools as follows (see Figure 1):

powerpack: FT-200
puller unit: ..... BB-30 (Big Brute)
chuck assembly: BB-CA-20
nosecap: FMC-119-50010-A (3002-003)
jaw: CXCE-34s-1.700F
mandrel: ..... CXM-1.6950 / 1.6575-3-25-VI
mandrel gauge: CMX-1.6941
go/no-go gauge: FCG-119-65030-A
straight split sleeves: CXS-1.614/18-16S
flared split sleeves: CXS-1.614/18-16F

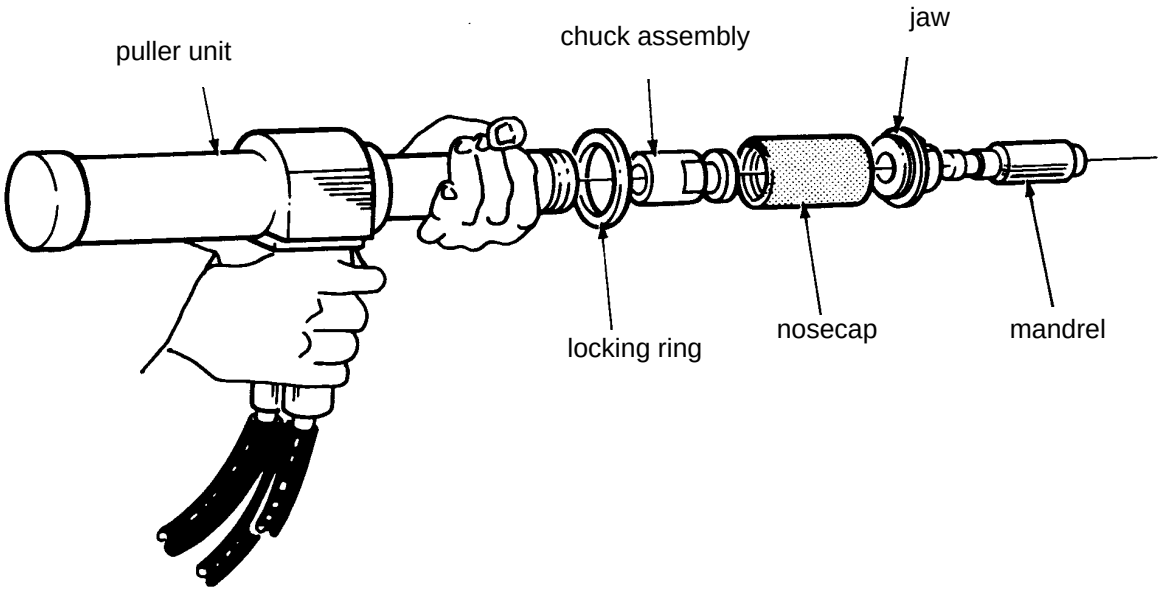

Figure 1 - Preparation of Puller Unit

4.3 Facilities

4.3.1 This PPS is **not** considered one of those identified as a “controlled” specification and as such any supplier facility listed on the Bombardier Aerospace approved supplier listing may perform the procedure specified herein (unless the listing includes limitations specifying otherwise).

4.3.1.1 For the purposes of this PPS, a “controlled” specification is one which requires specific Bombardier Aerospace approval of particular facilities to perform the particular process or procedure specified by that specification; this PPS is not considered a “controlled” specification.

4.3.1.2 The Bombardier Aerospace approved supplier listing may be accessed via the internet through www.Bombardier.com and selecting the appropriate links.

5 Procedure

5.1 General

5.1.1 The purpose of cold expansion of bushing holes is to improve the fatigue life of the component in which the bushings are located. Cold expansion of holes consists of producing a close tolerance hole in the component, expanding the hole using the FTI split sleeve process and then reaming or boring the hole to the required final diameter. The FTI split sleeve expansion process consists of mounting a prelubricated split sleeve on a mandrel, inserting the mandrel/sleeve combination into a close tolerance hole and then pulling the mandrel back through the sleeve. The action of drawing the mandrel through the split sleeve causes a radial plastic flow of material which produces an annular zone of residual compressive stresses that extends approximately one radius beyond the periphery of the hole. Residual compressive stresses provide an improvement in fatigue life of the component.

5.2 Preparation of Tooling (see Figure 1)

5.2.1 Prepare FTI tooling to expand the bushing hole as follows. Refer to paragraph 4.2.1 for the FTI tooling required (i.e., puller unit, chuck assembly, etc.) to cold expand the bushing hole.

Step 1. Thread the locking ring onto the puller unit.

Step 2. Thread the chuck assembly onto the piston of the puller unit and hand tighten.

Step 3. Thread the nosecap onto puller unit, hand tighten and then lock with the locking ring.

Step 4. Thread the jaw into the nosecap and hand tighten.

Step 5. Check the mandrel major diameter for excessive wear using the mandrel check fixture (see Figure 2). The gauge consists of a steel plate with a NO-GO hole in the center. If the mandrel major diameter passes through the NO-GO hole, the mandrel is worn beyond the specification limit and must be replaced.

Step 6. Place the tang of the mandrel into the chuck assembly. The mandrel will be ‘loose’ in the chuck as it will only be gripped when the puller unit is activated.

Step 7. Connect the main hydraulic and the two pneumatic trigger control lines of the puller unit to the FT-200 powerpack.

Step 8. Connect the shop airline to the powerpack and activate the puller unit to verify proper operation. The puller unit is activated by depressing its trigger. Continue depressing the trigger until the end of the mandrel has retracted completely below the face of the jaw, then release the trigger; the mandrel should now return to its fully extended position.

Step 9. Disconnect the shop air line temporarily.

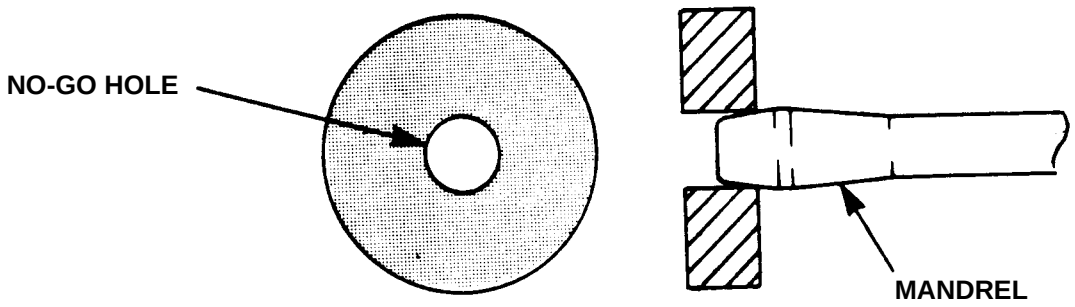

Figure 2 - Mandrel Check Fixture

5.3 Cold Expansion Procedure

5.3.1 Perform the cold hole expansion procedure on the main landing gear attachment lugs to first stage diameter as follows:

Step 1. Check the starting hole diameter using the combination GO/NO-GO gauge (FCG-119-65030-A) according to section 5.5.

Step 2. Assemble a flared sleeve (CXS-1.614/18-16F) and a straight sleeve (CXS-1.614/18-16S), onto the mandrel as shown in Figure 3. Place the flared sleeve at the base of the mandrel with the flare locking into the jaw and push the mandrel into the puller unit jaw to engage the chuck assembly. Butt the sleeves together and align them so that the sleeve splits are on opposite sides (180° apart) of the mandrel and so that the split on the flared sleeve will be towards the base of the lug during cold expansion of the hole.

Step 3. Connect the shop air line to the powerpack.

Step 4. Insert the mandrel/sleeves combination into the hole of the lug so that the jaw bottoms against the face of the lug (see Figure 3). When swaging the larger lug (i.e., for the -103 bushing) ensure that the jaw is correctly aligned to clear the boss on the side of the lug.

Step 5. Actuate the puller unit to pull the mandrel through the lug.

Step 6. Discard the used split sleeves; cold expansion sleeves are not reuseable.

Step 7. Visually check the hole for evidence of a small ridge (resultant from the gap in the split sleeves) to verify that the hole was cold expanded.

Step 8. Bore the cold expanded hole to the finish size specified by the engineering drawing.

Step 9. Deburr and break the edges of the hole according to the engineering drawing.

Step 10. Check that the finished hole diameter meets the requirements of the engineering drawing.

Step 11. Brush apply chemical conversion coating to the bore of the hole according to PPS 32.02.

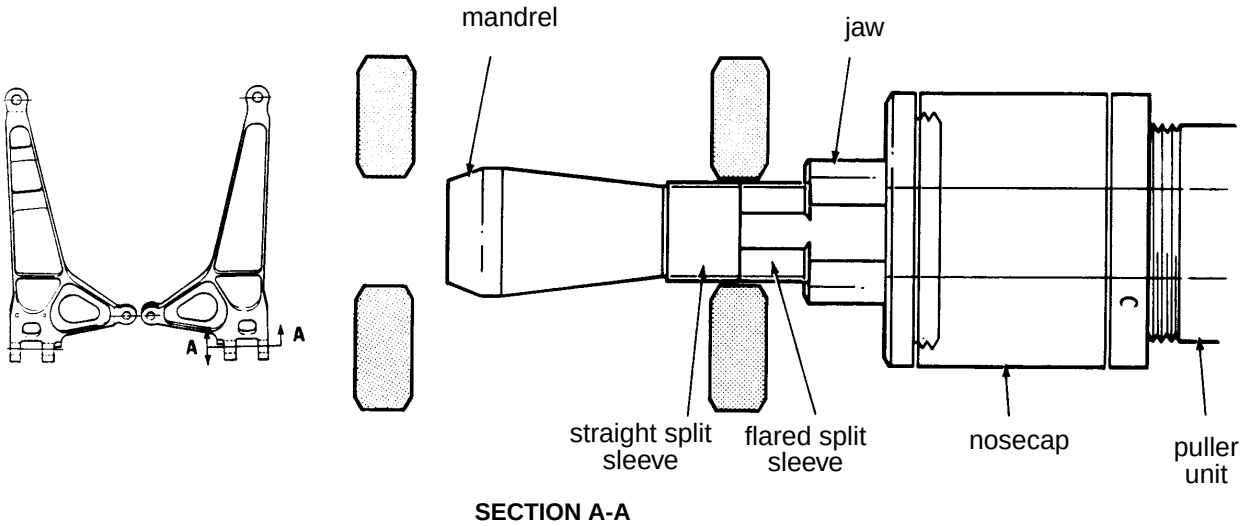

Figure 3 - General Description of Cold Expansion Process

5.4 Installation of Bushings

5.4.1 Install bushings as follows:

Step 1. Shrink fit the interference-fit bushings in place using liquid nitrogen according to PPS 12.04.

Step 2. After installation, seal the periphery of the bushings with a bead of DHMS S3.01/B2 sealant according to PPS 21.16.

Step 3. Bore the bushing to the final diameter specified by the engineering drawing and check the diameter using the combination GO/NO-GO gauge according to section 5.5.

5.5 Use of the Combination GO/NO-GO Gauge

5.5.1 The combination GO/NO-GO gauge (see Figure 4) is a dual purpose gauge used to check the final hole diameter in the forging lug as well as the final hole diameter in the bushing. The end with the larger diameters is used for testing the initial hole diameter and the end with the smaller diameters is used for checking the final bushing hole.

5.5.2 The applicable GO portion of the gauge must fit into the hole; if it does not, the hole is too small (see Figure 5) and must be rebored to the correct size and re-checked using the combination GO/NO-GO gauge. The NO-GO portion of the gauge must not fit into the hole; if it does, the hole is too large (see Figure 5) and must be referred to Bombardier Toronto (de Havilland) MRB or Bombardier Toronto (de Havilland) delegated MRB for disposition.

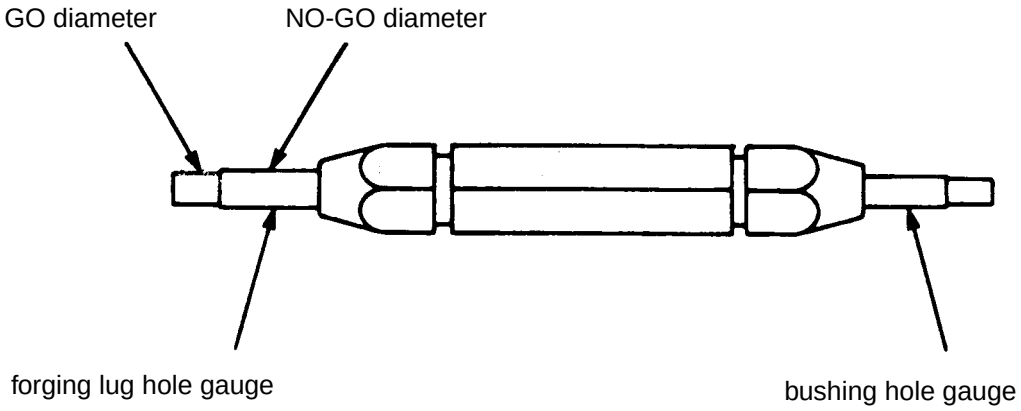

Figure 4 - Combination GO/NO-GO Gauge

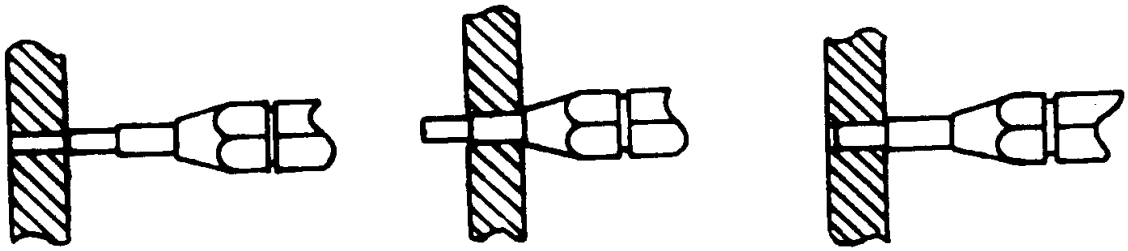

Figure 5 - Using the GO/NO-GO Gauge

6 Requirements

6.1 Ensure that the finished hole diameter of the installed bushings meet the requirements of the engineering drawing.

6.2 The maximum permissible gap between the installed bushing flange and the face of the attachment lug is 0.002". If the gap between the installed bushing flange and the face of the attachment lug is greater than 0.002", refer the installation to Bombardier Toronto (de Havilland) MRB or Bombardier Toronto (de Havilland) delegated MRB for disposition.

6.3 Ensure that the periphery of the bushings have been sealed with a bead of DHMS S3.01/B2 sealant according to PPS 21.16.

7 Safety Precautions

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

7.2 After setting up the FTI tooling, temporarily disconnect the shop air line; do not re-connect the shop air line until after split sleeves have been assembled to the mandrel as specified in Step 2 of paragraph 5.3.1.

8 Personnel Requirements

8.1 Personnel responsible for installation of shrink fit bushings into the DASH 8 Series 300 main landing gear undercarriage frame must have a good working knowledge of the procedure and requirements as specified herein and must have exhibited their competency to their supervisor.

9 Maintenance of Equipment

9.1 Ensure that all hydraulic and air connector mating surfaces are free of dirt, metal filings, etc.

9.2 Check the mandrel major diameter as specified in section 5.2 before cold expanding each batch of parts.

9.3 This process is tooling critical. The use of nonconforming or worn tools can result in a significant reduction in the expected fatigue life improvement.