BOMBARDIER
Toronto (de Havilland)
PROPRIETARY INFORMATION

PPS 2.26

PRODUCTION PROCESS STANDARD

Removal and Replacement of Jacketed (Pastushin) Rivets

Issue 12
- This standard supersedes PPS 2.26, Issue 11.
- 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 removal and replacement of jacketed (Pastushin) rivets previously installed in aircraft structure (i.e., rework). If the engineering drawing specifies the installation of jacketed rivets according to this PPS and the fastener holes have not already been drilled, install the solid rivets specified below according to PPS 2.38 in place of the jacketed rivets specified by the engineering drawing.

- If installation of a flush head jacketed rivet is specified (e.g., CSP 320), install a B0205017 solid rivet.
- If installation of a reduced flush head jacketed rivet is specified (e.g., CSP 372), install a B0205018 solid rivet.
- If installation of a universal head jacketed rivet is specified (e.g., CSP 374), install a B0205016 solid rivet.
- If installation of a 2024 alloy (i.e., DD) jacketed rivet is specified, for automatic installation it is acceptable to substitute the appropriate 7050 alloy (i.e., KE) solid rivet; for manual installation, it is acceptable to substitute the appropriate 2017 alloy (i.e., DN) solid rivet. For example, if the engineering drawing specifies installation of a CSP372DD jacketed rivet and the fastener hole has not already been drilled, for manual installation a B0205018DN solid rivet should be installed.
- If installation of a 2117 alloy (i.e., AD) jacketed rivet is specified, install the appropriate 2117 alloy (i.e., AD) solid rivet.

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 1.09 - Drilling and Reaming.

3.2 PPS 1.12 - Use of Rivet Squeezers (Portable and Stationary).

3.3 PPS 1.14 - Use of Pneumatic Rivet Guns.

3.4 PPS 1.48 - Set-Up and Operation of Rivet Shavers.

3.5 PPS 2.38 - Fluid Tight Installation of Solid Rivets

3.6 PPS 30.03 - Heat Treatment and Control of Aluminum Alloy Rivets.

4 Materials

4.1 Jacketed rivets of the type and size being replaced. Refer to Figure 1 for a breakdown of the jacketed rivet code number. Refer to Figure 2 for a general description of jacketed rivets.

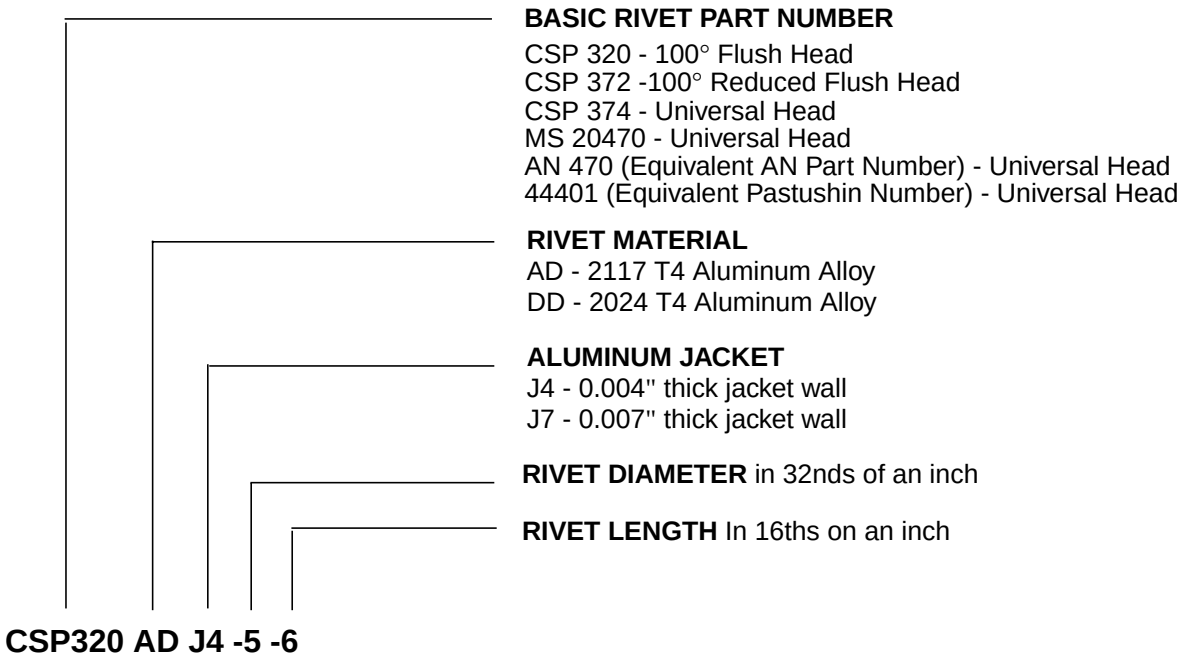


Figure 1 - Breakdown of Rivet Part Numbers

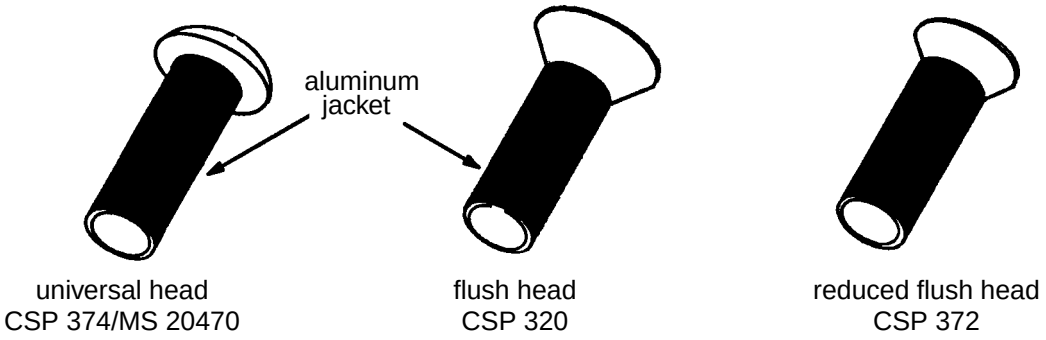


Figure 2 - General Description of Jacketed Rivet

5 Procedure

5.1 General

5.1.1 Jacketed rivets consist of a standard MS rivet with an aluminum jacket fitted over the entire shank of the rivet and are designed to be fluid tight in installations such as integral fuel tanks by the expansion of the rivet shank during forming of the shop head, forcing the aluminum jacket to fill and completely seal the hole. As the effectiveness of the fastener is dependant on correct installation, it is essential that the procedure specified herein is strictly adhered to.

5.1.2 Heat treat jacketed rivets of 2024 alloy (DD rivets) and maintain in refrigerated storage according to PPS 30.03 until installation. Ensure DD rivets are driven within 30 minutes of removal from the rivet storage freezer.

5.1.3 Type J4 rivets are used in normal installations. Type J7 rivets are only used as salvage for type J4, if the hole has been drilled oversize or has become damaged.

5.2 Removal of installed Rivets and Hole Evaluation

5.2.1 Remove and replace installed rivets as follows (see Figure 3):

Step 1. Using a centre punch, mark the centre of the rivet stem.

Step 2. Drill completely through the rivet head using a drill corresponding to the nominal shank diameter of the rivet, so as to break off the rivet head.

Step 3. Drive out the rivet shank using a suitable drift punch. In order to prevent damage to thin gauge material it may be necessary to support the structure from the reverse side with a suitable support block while driving out the rivet shank.

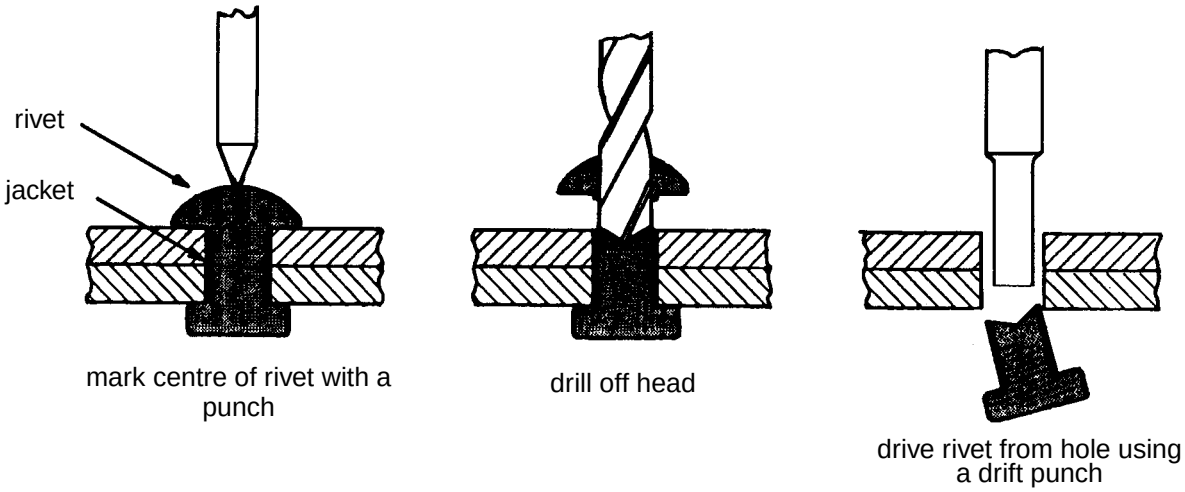


Figure 3 - Removal of Installed Rivets

Step 4. After the removal of a rivet or rivets, check for the following:

- Particles of the aluminum jacket remaining around the wall of the hole and between the faying surfaces around the hole. Remove such particles.
- Holes and countersinks out of tolerances specified in Table 1 or Table 2, as applicable.
- Scores and other damage to the wall of the hole and countersink.
- General deformity of the hole or countersink.

If the hole and countersink are found to be acceptable, a rivet of the same type and size as the one removed may be installed. If the hole has been damaged during removal of a rivet or is not within the specified tolerance for a J4 jacketed rivet, but is within the tolerance specified in Table 3 for a J7 jacketed rivet, a J7 replacement jacketed rivet of the same type and size may be installed. If the hole damage or oversize exceeds the tolerances for a J7 rivet of the same size, refer to Bombardier Toronto (de Havilland) MRB or Bombardier Toronto (de Havilland) delegated MRB for disposition.

Step 5. If installing a J7 replacement rivet, drill out the hole to the size specified in Table 3 according to PPS 1.09.

Step 6. Install the replacement rivet according to section 5.3.

Table 1 - Hole Size Data for Universal Head Rivets

FASTENER		FINAL HOLE SIZE
JACKET	NOMINAL DIAMETER	
J4	-4 (1/8")	0.141" - 0.144"
	-5 (5/32")	0.171" - 0.174"
	-6 (3/16")	0.200" - 0.204"
	-8 (1/4")	0.264" - 0.268"

Table 2 - Hole Size Data for Flush Rivets

FASTENER			COUNTERSINK DIAMETER	FINAL HOLE SIZE
JACKET	NOMINAL DIAMETER	TYPE		
J4	-4 (1/8")	CSP 372	0.191" - 0.196"	0.141" - 0.144"
		CSP 320	0.211" - 0.221"	
	-5 (5/32")	CSP 372	0.242" - 0.247"	0.171" - 0.174"
		CSP 320	0.272" - 0.282"	
	-6 (3/16")	CSP 372	0.297" - 0.302"	0.200" - 0.205"
		CSP 320	0.339" - 0.349"	
	-8 (1/4")	CSP 372	0.390" - 0.395"	0.264" - 0.268"
		CSP 320	0.462" - 0.472"	

Table 3 - Hole Preparation Data for J7 Type Jacketed Rivets

FASTENER		FINAL DRILL DATA	
JACKET	NOMINAL DIAMETER	RECOMMENDED DRILL SIZE	FINAL HOLE SIZE
J7	-4 (1/8")	#27	0.145" - 0.148"
	-5 (5/32")	#16	0.176" - 0.179"
	-6 (3/16")	#5	0.206" - 0.209"
	-8 (1/4")	I	0.271" - 0.274"

5.3 Installation of Replacement Rivets

5.3.1 Install replacement rivets as follows:

Step 1. If the engineering drawing does not specify the rivet length or if the specified length does not form satisfactory shop heads, use a rivet length which forms a shop head meeting the requirements of this PPS. As a general rule, the length of the undriven rivet must be 1 1/2 times the nominal shank diameter plus the thickness of the material in which the rivet is to be installed (see Figure 4).

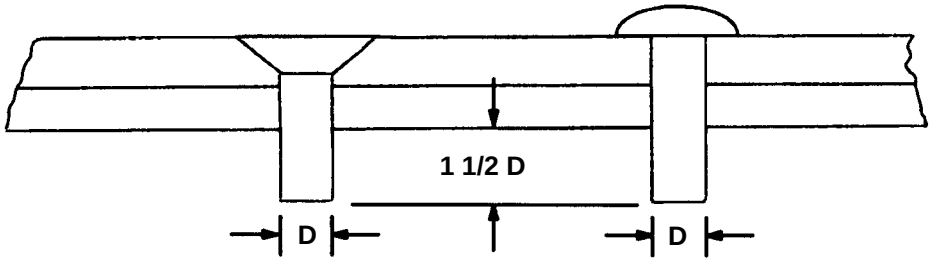


Figure 4 - Determining Suitable Rivet Length

Step 2. Ensure parts to be riveted are properly positioned and curved parts mate without excessive gaps. If necessary, clamp the assembly in every 4th to 6th rivet hole with Cleco type fasteners.

Step 3. If possible, use squeeze riveting equipment according to PPS 1.12 to install rivets. Alternatively, it is also acceptable to install rivets using percussion riveting equipment according to PPS 1.14. Start riveting at the centre of the skin and work outwards in all directions to the edges of the skin, so that the tendency of the skin to stretch does not result in warping or oil-canning. On extremely long riveted joints, start in the centre and step rivet every other 4 inches (approximately), working towards the ends of the joint, then install rivets in remaining holes. Drawing up before forming the shop head is necessary if the faying surfaces of the work in the area surrounding the rivet are not in close contact with each other. In order to prevent cracks in rivet heads, it is recommended to aim to form shop heads of rivets as close to permissible maximum height and minimum diameter as possible (see Table 4). Draw up the sheets before forming the shop head if the faying surfaces of the work in the area surrounding the rivet are not in close contact with each other.

5.4 Shaving of Installed Flush Head Rivets

5.4.1 Except as noted in paragraph 5.4.1.1 or paragraph 5.4.1.2, flush head rivets that protrude **0.0005" - 0.005"** do **not** require shaving. Shave CSP320 flush head rivets which protrude 0.005" - 0.010" to a protrusion of 0.000" - 0.0035" using a depth controlled rivet shaver according to PPS 1.48. Rivets which protrude over 0.010" are not acceptable and must be replaced (check the countersink diameter before installing another rivet).

5.4.1.1 Flush head rivets (including CSP372 reduced flush head rivets) installed in visibility areas (i.e., part surfaces which will be readily visible to passengers and/or crew) must protrude no more than 0.0035" above the part surface. Shave CSP320 flush head rivets that protrude more than 0.0035" above the part surface to a protrusion of 0.000" - 0.0035" using a depth controlled rivet shaver according to PPS 1.48.

5.4.1.2 **Do not** shave CSP372 reduced flush head rivets. Reduced flush head rivets that protrude more than specified above are **not** acceptable and must be replaced (check the countersink diameter before installing another rivet).

6 Requirements

6.1 The height and diameter of shop formed rivet heads must meet the requirements of Table 4.

Table 4 - Requirements for Shop Formed Heads

NOMINAL RIVET DIAMETER	SHOP HEAD	
	DIAMETER	HEIGHT
-4 (1/8")	0.173" - 0.203"	0.056" - 0.112"
-5 (5/32")	0.229" - 0.259"	0.066" - 0.132"
-6 (3/16")	0.266" - 0.316"	0.077" - 0.154"
-8 (1/4")	0.325" - 0.375"	0.083" - 0.166"

6.2 Refer to Table 5 for the limitations on flush head rivet protrusion above the surface of the part as shown below, before and after shaving, as applicable.

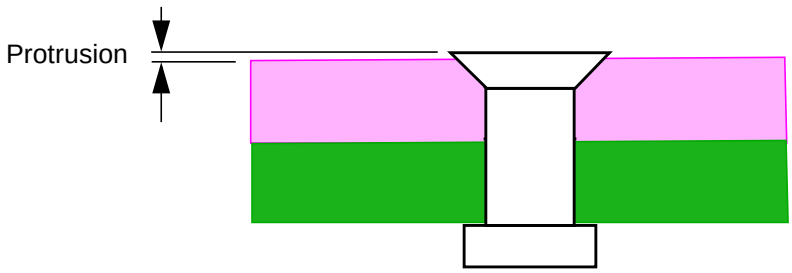


Table 5 - Flush Head Rivet Protrusion Limits

RIVET TYPE	INSTALLATION AREA (Note 1)	PROTRUSION LIMITS	
		PROTRUSION AT INSTALLATION (Note 2)	FINAL PROTRUSION (Note 3)
CSP372 Reduced Flush Head Rivets	Visibility area	0.0005" - 0.0035"	Shaving of CSP372 reduced flush head rivets is not permitted. If the rivet protrusion is excessive, the rivet must be removed and replaced.
	Not a visibility area	0.0005" - 0.005"	
CSP 320 Flush Head Rivets	Visibility area	0.0005" - 0.010"	0.0005" - 0.0035"
	Not a visibility area	0.0005" - 0.010"	0.0005" - 0.005"

Note 1. Visibility areas include part surfaces which will be readily visible to passengers and/or crew.
Note 2. The “Protrusion at Installation” dimensions are the limits on the flush rivet head above the part surface as installed before any shaving.
Note 3. The “Final Protrusion” dimensions are the limits on the flush head above the part surface after shaving, if necessary or permitted.

6.3 Visually check all installed rivets according to Table 6.

Table 6 - Visual Examination of Installed Rivets

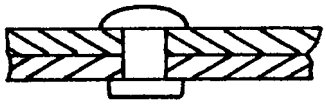
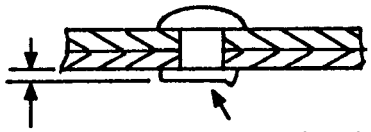
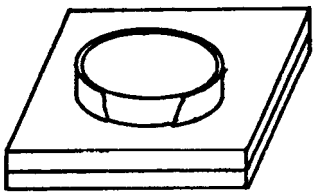
VISUAL APPEARANCE	DESCRIPTION	CORRECTIVE ACTION
	**ACCEPT** - Good installation - Sheets drawn up tightly - Shop head dimensions according to Table 4.	None required
	**ACCEPT** - Stepped portions of the shop head are within the height limits specified in Table 4.	None required
	UNACCEPTABLE - Height of a stepped portion is outside the head height limits specified in Table 4.	Replace rivet
	**ACCEPT** - Cracks in jacket in area of the shop head are acceptable, provided any loose pieces or pieces which may break away are removed.	None required

Table 6 - Visual Examination of Installed Rivets

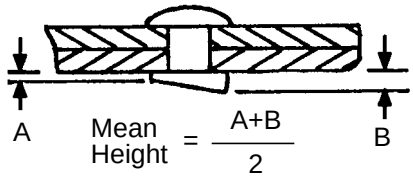
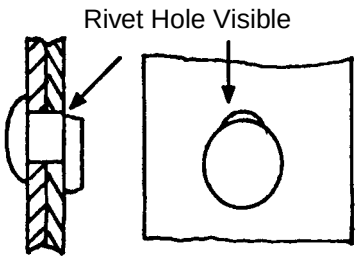
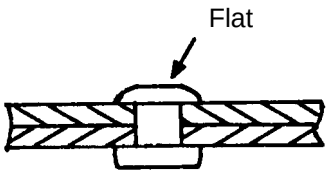
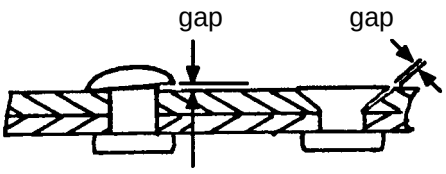
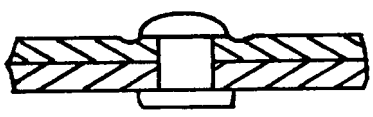
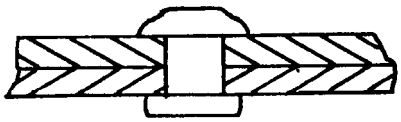
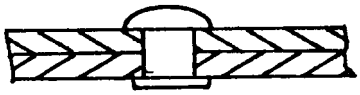
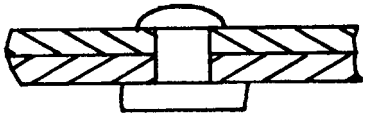
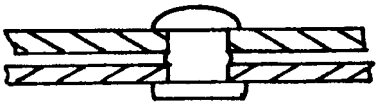
VISUAL APPEARANCE	DESCRIPTION	CORRECTIVE ACTION
	**ACCEPT** - The mean height of a sloped shop head is within the head height limits specified in Table 4.	None required
	UNACCEPTABLE - Mean height of a sloped shop head is outside the head height limits specified in Table 4.	Replace rivet
	**UNACCEPTABLE** - Rivet hole visible beyond periphery of eccentric shop head.	Replace rivet
	**ACCEPT** - The height of a flattened universal head is not less than the minimum shop head height specified in Table 4.	None required
	UNACCEPTABLE - The height of a flattened universal head is less than the minimum shop head height specified in Table 4.	Replace rivet
	**ACCEPT** - No gap under rivet head.	None required
	UNACCEPTABLE - Gap under rivet head.	- If gap is less than 0.002" re-strike head once. If gap remains, replace rivet - If gap is greater than 0.002", replace rivet - Check countersink diameter or dimple for flush head rivets.
	**UNACCEPTABLE** - Sheet damage caused by using too large a snap.	Refer to Bombardier Toronto (de Havilland) MRB or Bombardier Toronto (de Havilland) delegated MRB.

Table 6 - Visual Examination of Installed Rivets

VISUAL APPEARANCE	DESCRIPTION	CORRECTIVE ACTION
	**UNACCEPTABLE** - Manufactured head damaged by using too small a snap.	- Replace rivet - Use correct rivet snap
	**UNACCEPTABLE** - Shop head too small according to Table 4.	- Replace rivet - Check hole diameter - Replace with correct length rivet
	**UNACCEPTABLE** - Shop head too large according to Table 4.	- Remove rivet - Replace with correct length rivet
	**UNACCEPTABLE** - Bulge in sheets between rivets.	- Refer to Bombardier Toronto (de Havilland) MRB or Bombardier Toronto (de Havilland) delegated MRB.
	**UNACCEPTABLE** - Sheets not drawn up tightly.	- Remove rivets - Draw up sheets before installing rivets

7 Safety Precautions

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

8 Personnel Requirements

8.1 Personnel responsible for removal and replacement of jacketed rivets must have a good working knowledge of the procedure and requirements as specified herein and must have exhibited their competency to their supervisor.