

PROCESS SPECIFICATION DEPARTURE	Originator: T. Nguyen Supervisor: B. Grant Manufacturing: W. Plagemann Quality: A. Cooper Materiel: A. Cooper Engineering: M. Reddy	PSD NUMBER 6-6 Page 1 of 8	PROCESS SPEC NO. BAC5058
Implementation of this departure is: <input type="checkbox"/> OPTIONAL - May be implemented at discretion of affected organization. <input checked="" type="checkbox"/> MANDATORY - Must be implemented as noted below.		PROCESS SPEC TITLE RIVETING IN TITANIUM	
REASON: CHANGE 'ON MODEL' BLOCK. SEE REASON BELOW.		RELEASE DATE 28-JUN-2008	
SUBCONTRACTOR(S) AFFECTED ALL	ON MODELS ALL COMMERCIAL AIRPLANES AND DERIVATIVES THEREOF	MFG DEPTS OF DIV BELOW AFFECTED ALL BCA AND SUPPORTING	

THIS PSD SUPERSEDES 6-4

This PSD must be implemented upon release.

REASON: BAC5058 Process Spec. Compliancy Issues & Resolutions for all BCA Aft Pylon Heat Shields. Revise Table I, Hole Diameter, for size 3/8 from 0.279 to 0.379. Revise Table II to add 7/32 inch and 9/32 inch oversize rivets, FL 1 and FL 2 to Table II. Change rework requirements to allow select use of oversize rivets without Engineering approval.

8 MANUFACTURING CONTROL

Revise Section 8 to add the second paragraph as follows:

Installation of aluminum rivets is not allowed in titanium structure. If aluminum rivets are specified on the Engineering drawing, report this condition to Liaison Engineering.

8.1 HOLE SIZE

Revise Section 8.1.

- a. Hole sizes for titanium rivets shall conform to Table I.
- b. Hole radii for 6Al-4V titanium rivets shall conform to Table I. For other rivets, the holes may have a radius in accordance with Table I or a chamfer in accordance with Table V when necessary to allow head seating or to remove burrs at the hole entrance or exit. When radiusing the hole exit as shown in Table I, R, Section A, emphasis on a smooth transition rather than a true radius is intended. The transition shall be smooth with no sharp corners or edges.

CAUTION

Sharp edges will cause the rivet to crack.

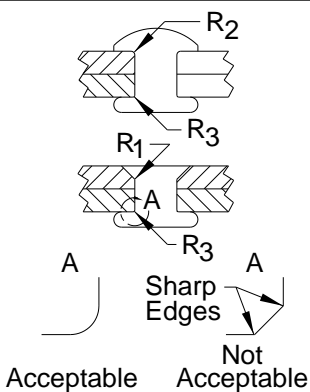
- c. No radius or chamfer shall be permitted at the sheet interface.
- d. Holes sizes for A-286 and nickel-copper alloy rivets used in titanium structure shall conform to Table II or fit-up between rivet and hole shall not exceed 0.006 inch.

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8.1 HOLE SIZE (Continued)

- e. Hole sizes for tubular rivets shall be in accordance with Table IV.
 - f. Hole sizes for Cherrybuck rivets ([NASM83459](#)) shall be in accordance with Table III.
 - g. Fastener holes shall be prependedicular within 2 degrees to the surface against which the manufactured fastener head will bear. All holes prepared for the installation of fasteners in accordance with this specification shall be inspected for non-conformities in accordance with [BAC5004](#).
 - h. Hole sizes for rivets to attach nutplates shall be in accordance with Table A.
- Revise Table I.

TABLE I - HOLE SIZES FOR TITANIUM RIVETS

NOMINAL RIVET DIAMETER	HOLE DIAMETER (INCH)		R ₁ ± 0.005 (INCH)	R ₂ R ₃ ± 0.005 (INCH)	
	MINIMUM	MAXIMUM			
3/32	0.096	0.100	0.005	0.010	
1/8	0.126	0.130	0.005	0.010	
5/32	0.164	0.168	0.030	0.015	
3/16	0.190	0.194	0.035	0.015	
7/32 FL 1	0.219	0.223	0.035	0.015	
1/4	0.250	0.254	0.035	0.020	
9/32 FL 1	0.281	0.285	0.035	0.020	
5/16	0.313	0.317	0.045	0.020	
11/32 FL 1	0.344	0.348	0.045	0.020	
3/8	0.375	0.379	0.045	0.025	
13/32 FL 1	0.406	0.410	0.045	0.025	

FL 1 Oversize - for rework only.

Revise Table II.

TABLE II - HOLE SIZE (INCHES) FOR NICKEL-COPPER ALLOY AND A-286 RIVETS

NOMINAL RIVET DIAMETER	BACR15DX BACR15DY BACR15GT		MS20615 MS20427		NAS1200		BACR15CE ()M FL 2	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
3/32	0.095	0.099	0.098	0.099	0.097	0.098	---	---
1/8	0.126	0.129	0.129	0.130	0.129	0.130	0.128	0.130
5/32	0.164	0.167	0.161	0.162	0.161	0.162	0.159	0.161
3/16	0.190	0.194	0.192	0.193	0.192	0.193	0.190	0.192
7/32 FL 1	0.219	0.223	---	---	---	---	0.223	0.225
1/4	0.250	0.254	0.255	0.256	0.255	0.256	0.253	0.255
9/32 FL 1	0.281	0.285	---	---	0.284	0.285	0.285	0.287

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8.1 HOLE SIZE (Continued)

FL 1 Oversize - for rework only.

FL 2 For Oversize of 7/32 and 9/32 use [BACR15DS](#) ()M

Add Table A.

TABLE A - HOLE SIZES (INCHES) FOR RIVETS TO ATTACH NUTPLATES

NOMINAL RIVET DIAMETER	MS20615 MS20427 NAS1198 NAS1200		BACR15CE ()M	
	MIN	MAX	MIN	MAX
3/32	0.098	0.103	0.096	0.101
1/8	0.129	0.134	0.128	0.133
5/32	0.161	0.166	0.159	0.164
3/16	0.192	0.198	0.190	0.196

Revise Table III.

TABLE III - HOLE SIZES (INCHES) FOR [NASM83459](#) RIVETS

NOMINAL RIVET DIAMETER	RECOMMENDED PILOT DRILL SIZE	NASM83459 RIVETS HOLE DIAMETER LIMITS	
		MINIMUM	MAXIMUM
1/16	---	---	---
3/32	---	---	---
1/8	3/32	---	---
5/32	1/8	0.1600	0.1630
3/16	1/8	0.1855	0.1885
1/4	1/8	0.2455	0.2485
5/16	1/8	0.3080	0.3110
3/8	1/8	0.3705	0.3735

Table IV is unchanged, but included for convenience of the user.

TABLE IV - HOLE SIZES (INCHES) FOR TUBULAR RIVETS

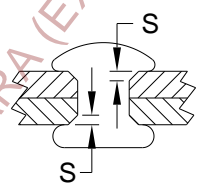
NOMINAL RIVET DIAMETER	RECOMMENDED DRILL SIZE	HOLE DIAMETER LIMITS	
		MINIMUM	MAXIMUM
3/32	40	0.098	0.103
1/8	1/8	0.125	0.129
5/32	26	0.147	0.151
3/16	12	0.188	0.192

Table V is unchanged, but included for the convenience of the user.

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8.1 HOLE SIZE (Continued)

TABLE V - OPTIONAL CHAMFER FOR RIVETS OTHER THAN 6AL-4V TITANIUM

NOMINAL RIVET DIAMETER	CHAMFER 45 DEGREES X S MAX (INCHES)	
3/32	0.005	
1/8	0.005	
5/32	0.005	
3/16	0.010	
7/32 FL 1	0.010	
1/4	0.010	
9/32 FL 1	0.010	
5/16	0.015	
11/32 FL 1	0.015	
3/8	0.015	

FL 1 Oversize - for rework only.

8.2 HOLE LOCATION

Revise Section 8.2.

Edge margin is the distance from the center of the hole to the nearest edge of the part to be riveted. Edge margin requirements are established by Engineering and are called out on Engineering drawing.

8.3 RIVET LENGTHS

Revise Section 8.3.

- a. Rivet length shall be selected to allow sufficient material to form the correct size driven button. Table VI shows the nominal shank projection before driving the rivets. Inspection of shank projection before driving is not a Quality Assurance requirement.

CAUTION

Titanium rivet protrusion lengths longer than those shown in Table VI may result in cracked rivets.

- b. Required protrusion before driving tubular rivets shall be in accordance with Table VII.

Table VI is unchanged, but included for the convenience of the user.

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8.3 RIVET LENGTHS (Continued)

TABLE VI - NOMINAL PROTRUSION P PRIOR TO DRIVING (INCHES)

RIVET DIAMETER	RIVET LENGTH - INCLUSIVE (INCH)	MATERIAL	
		6Al-4V	ALL OTHERS
		P	
3/32	3/16 to 1/2	0.093	0.093
1/8	3/16 to 3/8	0.105	0.125
	13/32	0.125	
5/32	7/32 to 3/8	0.135	0.164
	13/32 to 5/8	0.145	
	21/32 and longer	0.155	
3/16	9/32 to 3/8	0.165	0.190
	13/32 to 5/8	0.175	
	21/32 and longer	0.185	
1/4	11/32 to 5/8	0.220	0.250
	21/32 to 7/8	0.230	
	29/32 and longer	0.240	
5/16	7/16 to 5/8	0.250	0.312
	21/32 to 31/32	0.260	
	1 to 1-1/4	0.270	
3/8	9/16 to 31/32	0.348	0.375
	1 to 1-3/8	0.358	

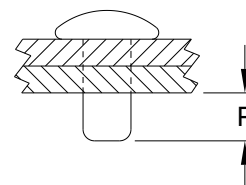


Table VII is unchanged, but included for the convenience of the user.

TABLE VII - REQUIRED PROTRUSIONS FOR TUBULAR RIVETS

RIVET DIAMETER (INCHES)	C (INCHES)	
	MAXIMUM	MINIMUM
3/32	0.07	0.04
1/8	0.09	0.06
5/32	0.11	0.08
3/16	0.14	0.11

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8.4 FLUSH RIVETING

8.4.2 HEAD FLUSHNESS

Revise Section 8.4.2.

- a. Flush head rivets shall be set in accordance with Figure 1 before driving.

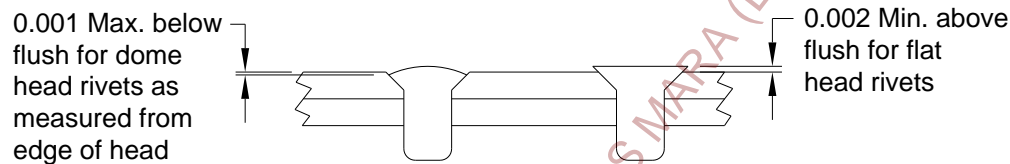


FIGURE 1 - HEAD FLUSHNESS PRIOR TO DRIVING

- b. Unless otherwise specified by the drawing, flushness limits after driving shall be in accordance with Table VIII. The rivet head shall not be below flush except for dome head rivets as noted in Figure 1.
- c. When shaving 100 degree countersunk head rivets, surface flushness requirements shall be in accordance with Table VIII.
- (1) Head protrusion shall not exceed H in Table VIII after driving and prior to shaving.
- (2) Head diameter shall not be less than D in Table VIII after shaving.
- d. The manufactured heads of [BACR15CE](#), [BACR15DS](#) and [NAS1097](#) rivets shall not be shaved or modified (e.g., sanding, grinding, etc.) to meet the flushness requirements without Engineering approval. For double flush riveting applications, driven (formed) buttons of these rivets may be shaved. The driven buttons for double flush riveting shall meet the conditions described in Figure X.

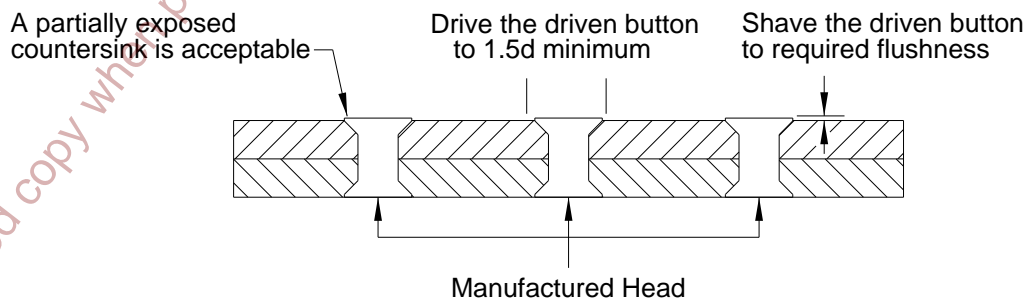


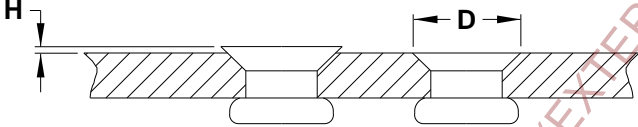
FIGURE X - DRIVEN BUTTON REQUIREMENTS FOR DOUBLE FLUSH RIVETING

Table VIII is unchanged, but included for the convenience of the user.

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8.4.2 HEAD FLUSHNESS (Continued)

**TABLE VIII - HEAD FLUSHNESS DIMENSIONS BEFORE AND AFTER SHAVING (EXCEPT
[BACR15CE](#), [BACR15DS](#) AND [NAS1097](#))**

				
NOMINAL RIVET DIAMETER	H MAX. HEAD PROTRUSION PRIOR TO SHAVING (INCH)		D MIN. HEAD DIAMETER AFTER SHAVING (INCH)	
	FL 1	FL 2	FL 1	FL 2
3/32	0.002	0.004	0.127	0.158
1/8	0.003	0.006	0.175	0.204
5/32	0.004	0.008	0.223	0.262
3/16	0.005	0.010	0.281	0.326
7/32 FL 3	0.005	0.011	0.304	0.326
1/4	0.006	0.012	0.372	0.443
9/32 FL 3	0.006	0.013	0.388	0.443
5/16	0.007	0.014	0.445	0.526
11/32 FL 3	0.007	0.015	0.477	0.526
3/8	0.008	0.016	0.531	0.660
13/32 FL 3	0.008	0.016	0.563	0.660

FL 1 Reduced shear flush head rivet

FL 2 [MS20426](#) style flush head rivet

FL 3 Oversize - for rework only

8.5 DRIVEN BUTTONS

Add item x.

- x. When a flush head rivet is driven double flush, the countersink depth setting for the driven button shall be the same for the manufactured head. The minimum driven button diameter shall be 1.5d as note in Section 8.4.2, Figure X.

8.7 REWORK

Solid rivets in sizes 3/32 inch diameter through 1/4 inch diameter may be replaced with 1/32 inch diameter larger rivets to accomplish rework provided the replacement rivet meets the centerline tolerance of the original rivet. Engineering approval and Quality Assurance verification are required if edge margin is less than two times the diameter; whereas only Quality Assurance verification is required if the edge margin is two times the diameter of the original fastener or greater.

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8.7	<u>REWORK (Continued)</u> EXCEPTION: Engineering approval and QA verification are required for 1/32 oversize rework where the rework countersink depth is greater than two thirds of the sheet thickness. <div>CAUTION</div> An increase in countersink depth to oversize may result in an unacceptable knife-edge condition in structure. Hole sizes for rivets 1/32 inch diameter larger than the original rivet callout are shown in Table II.		
11	REQUIREMENTS		
11.3	<u>FLUSHNESS</u>		
11.3.1	HEAD FLUSHNESS Revise Item c. c. The manufactured head of NAS1097 , BACR15DS and BACR15CE , rivet heads shall not be shaved or modified to meet flushness requirements without Design Engineering approval. Shaving of the driven (formed) buttons, for double flush applications is acceptable provided it is conducted in accordance with Section 8.4.2. Figure X. and Section 8.5x. Delete Item e.		