AIPS
Airbus Process Specification

Installation of Solid Rivets (For applications in the programs WB, SA, LR, A380 and A400M that are under design responsibility of A-E)

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Contents

1 Scope

This Airbus Process Specification defines the requirement for Installation of Solid Rivets (For applications in the programs WB, SA, LR, A380 and A400M that are under design responsibility of A-E) .
The purpose of this specification is to give design and quality requirements to manufacturers. Although the essential requirements of a process are defined, the specification does not give complete in house process instructions, these shall be given in the manufacturers detailed process instruction and supporting work instructions.

This specification shall not be used as an inspection document unless parts or assemblies have been manufactured according to this specification.

It shall be applied when mentioned in the relevant standard, material specification or drawing.

2 Normative references

This Airbus specification incorporates by dated or undated reference provisions from other publications. All normative references cited at the appropriate places in the text are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this Airbus specification only when incorporated in it by amendment of revision. For undated references, the latest issue of the publication referred to shall be applied.

National standards should be applied if Airbus standards are not available.

AIPS01-02-003	Preparation of Holes in Metallic Materials for Fastening
AIPS01-02-005	Preparation of Holes in FRP and Hybrids for Fastening
AIPS01-02-012	Machining and Assembly of Glare (R) Parts/Components
AIPS01-02-017	General Assembly and Installation of Fasteners
AIPS03-11-004	Milling of Fastener Heads
AIPS04-01-002	Heat Treatment of Rivets
AIPS05-05-001	Sealing of Aircraft Structures Inside and Outside Fuel Tank
AIPS05-05-004	Wet Installation of Fasteners
AMS4982	Titanium Alloy wire 44.5Cb
ASTM B565	Shear testing of Aluminium and Aluminium alloy Rivets and cold heading.
ASTM E112	Standard test methods for determining average grain size
EN6069	Rivet 100° reduced flush head
EN6080	Rivet 100° normal flush head
EN6081	Rivet Universal head
EN6101	Rivet 100° medium flush head
I+D-P-034	Dimpling for fasteners
I+D-P-202	Chemical conversion films on Aluminium and its alloys
I+D-P-213	Anodising of Aluminium and Aluminium alloys
I+D-P-220	Heat treatment of Aluminium alloys
MIL-A-8625	Anodic coatings for Aluminium and Aluminium alloys
MIL-C-5541	Chemical conversion coatings on Aluminium and Aluminium alloy
MIL-STD-1312	Fastener test methods
NAS1097	Rivet Solid 100° Flush shear head Aluminium alloy, Titanium columbium alloy
NFL21207	Fasteners, Identification and marking of standardised rivets

3 Definition, applicability and limitations

3.1 Definition

EMR	Electro magnetic riveting. Forming the upset tail of the rivet by an ultrafast single blow
Installed as received	Rivets being installed as shipped from the manufacturer, without former heat treatment
Allowance	Additional material on the shank side being formed to a flat or countersunk upset tail
Grip	Total sheet thickness in a stack-up
Rivet length	For universal head rivets the shank length and for rivets with countersunk heads the shank length inclusive the height of the countersunk head.
Protrusion	Countersunk head surface being above sheet surface
Seating	Bringing a preformed countersunk/universal head into contact with the countersunk/sheet surface before starting to form the upset head, only applicable for tapered shank rivets.
Riveting	Forming the rivet by squeezing or hitting
Direct riveting	When installing rivets with a rivet gun the rivet gun is located on the upset tail side
Upset tail	Flattened shank end formed by hitting or squeezing
Delamination	Separation of bonded fibres from the basic material
FRP	Fiber Reinforced Plastic inclusive CFRP
CFRP	Carbon Fiber Reinforced Plastic
FML	Fiber Metal Laminate (GLARE ®)

3.2 Applicability

This Airbus specification is applicable when invoked by the drawing directly or through another document for the purpose given in the scope. When processing to AIPS01-01-008 is required, it shall be invoked on the drawing by the words “Installation of Solid Rivets according to AIPS01-01-008”. Process instructions shall not be called on drawing.

The AIPS01-01-008 is applicable for the components of all Airbus programs before A350 that are under design responsablity of Airbus Spain

This specification is applicable to solid shank rivets manufactured in the following aluminium alloys:

L-3002	L-3120	L-3180	L-3767	AMS 4982(Ti45Cb)
L-3051	L-3140	L-3320	L-3191	----------

Unless otherwise specified, the aluminium alloy solid shank rivets will be used for the following applications:

- L-3120-T4: On aluminium alloy parts requiring high shear strength and moderate corrosion resistance.
- L-3140-T4: On aluminium alloy parts requiring high fastening strength and high service temperature.
- L-3002-H14 ó L-3051-H14: On aluminium alloy parts with hardly any mechanical requirements.
- L-3180-T4: On aluminium alloy parts requiring moderate fastening strength.
- L-3320-H32: On magnesium alloy parts or in assemblies in which these alloys are present, in order to reduce galvanic corrosion.
- L-3767-T73: On aluminium alloy parts requiring high shear strength and high shear strength and high service temperature. This alloy is intended to replace L-3140-T4.
- L-3191: On parts requiring high strength and high service temperature.

- AMS 4982: On aluminium or titanium alloy parts, or a combination of both, that is to say, where material, compatibility or a cold forming is required. They are suitable for high strength and service temperature applications.Limitations of the process.

3.3 Limitations of the process

The process shall not be applied to rivet and component materials other than specified in 3.2.

Any rivets remaining incorporated shall be indicated on the Engineering drawing. Any change during the manufacturing shall be cause for rejection

The rivets shall be preferably stored in their containers to avoid damages or contaminations due to water, grease, dirt, etc. These shall be clearly identified and shall be sent to the workshop in packages labelled with the standard designation of the product, reception control number and quantity of the parts.

4 Requirements

4.1 Reception of rivets

Prior to supplying the rivets to the workshop, Reception Quality Control shall perform the following inspections and tests:

Visual inspections

- Identification
- Surface protection
- Dimensions
- Discontinuities

Tests

- Shear tests
- Metallographic tests.

4.1.1 Visual inspections

Except contrary indication by the quality assurance department, the size of the sample to be taken shall be selected and inspected in compliance with specification AM2132-E.

4.1.2 Identification

The rivets shall be marked according to the corresponding material code (see Table-1). If due to marking deficiencies the identification is doubtful, proceed to a quantitative analysis of the material.

4.1.3 Surface protection

When specific requirements on the surface protection is not established, they shall be taken to be those called in Table-1.

4.1.4 Dimensions

Verify the most significant dimensions of the rivets, bearing in mind the tolerances established by the product's standard.

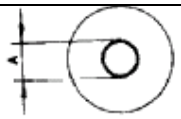
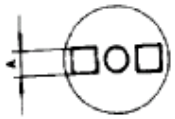
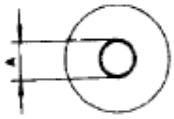
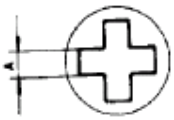
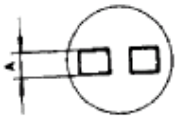
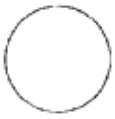
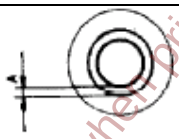
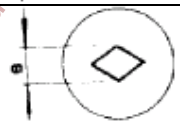
These dimensions are:

- Shank diameter
- Angle, diameter and height of the countersunk head
- Length of rivets

4.1.5 Stored Conditions

The rivets shall be preferably stored in their containers to avoid damages or contaminations due to water, grease, dirt, etc. These shall be clearly identified and shall be sent to the workshop in packages labelled with the satndard designation of the product, reception control number and quantity of the parts.

Table 1: Rivet identification and surface protection

SYMBOL OF THE MATERIAL IN THE HEAD OF THE RIVET	OBSERVATIONS ON THE MARKS	MATERIAL UNE/CASA	SYMBOL	SURFACE PROTECTION (to the reception)	COLOURS IDENTIFICATION
	Point in relief, height 0,1 ÷ 0,2 mm	L-3120 (2017)	D	Anodized or Cromated	Yellow packing
 (1)	Dashes and point in relief, height 0,1 ÷ 0,2 mm	L-3120 (3.1324)	C	Without protection	---
		L-3120 (A-U4G)	--	(2)	Uncoloured
	Engraved point 0,1 ÷ 0,2 mm	L-3180 (2117)	AD	Anodized o Chromated	Orange packing
		L-3180 (3.1124)	B	Without protection	---
			E	Chromated	
		L-3180 (A-U2G)	--	(2)	Violet dyed
	Cross in relief, height 0,1 ÷ 0,2 mm	L-3320 (5056)	B	Anodized or Chromated	Blue packing
		L-3320 (3.3354)	D	Without protection	---
			G	Chromated	
		L-3320 (A-G5M)	--	(2)	Green dyed
	Dashes in relief, height 0,1 ÷ 0,2 mm	L-3140 (2024)	DD	Anodized	Red packing
	Without marking	L-3002 (11009	A	Anodized or Chromated	White packing
		L-3051 (3.0255)	B	Without protection	---
		L-3051 (AS)	--	(2)	Red dyed
	Engraved circle (The diameter and max. depth are funciton of the diameter and head)	L-3767 (7050)	E or KE	Anodized or Chromated	Green packing
	Engraved square	L-3191 (2219)	K	Anodized or Chromated	Violet packing
	Engraved diamond	AMS 4982 (T145Cb)	U or T	(2)	Grey packing

NOTES:

(1) As opposed to establishments in document ISO/TC 20 (1973), the milled head rivets, manufatured in A-U4G (L-3120) carry no identification mark on the head. In order to avoid confusions with those of pure aluminium, it is necessary to “specify” on the orders made under French Standards that the marking be performed on the opposite end, on the shan; this option is established in document NF/L 21-207.

(2) Without specific protection requirement. The surface protection shall be the one established by the order.

REMARKS:

Dimensions:

- A < 0,8 mm / B < 1,3 mm /C < 2,5 mm.
- Anodic protection per I+D-P-213 (MIL-A-8625).
- Chromate: conversion coating; chemical conversion film, per I+D-P-202 (MIL-C-5541). This protection shall be coloured or colourless, as established in the applicable documentation.
- The anodizing is preferable to the chromate for rivets manufactured in L-3120, in order to avoid the repetition of the surface protection process (see NOTE of step 4.3.1).

4.1.6 Discontinuities

Determine the anomalies or maufacturing imperfections shall be determined, such as cracks, laps, nicks, pittings, burrs, die marks, intergranular corrosion attacks, etc. They shall be considered rejectable when the following circunstances concur:

a) Localized defects in the shank and head seating base:

- Those with deeper depths than 0,10 mm, puntual or presenting continuous character, concentric with the shank diameter.
- Those with deeper depths than 0,05 mm, of continuous character, not concentric with the shank diameter.

b) Defects situated on the peripheric edge of the head:

- Nicks and detachments or lack of material.
- Smooth irregularities which penetrate or extend towards the inside of the head's minimum diameter.

c) Defects situated on the head:

- Within the 6,4 mm diameter, if they exceed the 0,10 mm depth.
- Between diameters 6,4 and 8 mm, if they exceed the 0,15 mm depth.
- From 8 mm diameter onwards, if they exceed the 0,17 mm depth.

4.2 Tests

Except contrary indication by the quality assurance department, the side of the sample to be taken shall be selected and inspected according to specification AM2132-E.

4.2.1 Shear test (per ASTM-B565, per MIL-STD-1312)

In order to determine whether the shear strength values are the specific ones for the material, the suitable sample shall be tested.

Shear strength values ara called out in Table-2.

Table 2: Shear strength values

MATERIAL AND METALLURGIC CONDITION	L-3002-H14 or L-3051-H14	L-3320-H32	L-3180-T4	L-3120-T4	L-3140-T4	L-3767-T73	L-3191-T81	T145Cb (Annealed)
MINIMUM STRENGTH MPa (kgf/mm^2)	Without requirements	166(17)	179(18)	228(23)	255(26)	282(27)	221(25)	346(35)
MAXIMUM STRENGTH MPa (kgf/mm^2)	Without requiremens	---	---	270(25)	---	317(32)	---	386(39)

REMARKS:

- The determination of the minimum shear strength value, is not applicable to rivets with nominal diameter below 2,4 mm.
- Rivets with shank below 2,5 times its own diameter shall only be single shear tested, for the other shank lengths, the test may be either single or double shear, indistintly.

4.2.2 Metallographic test

It will be performed on the rivet's transversal sections with homogeneous grain and sizes not greater than nº 5 of standard ASTM-E-112.

NOTE: For n^{os}. 4,5 and 4,0 grain sizes, it is of utmost importance to resort to a practical test of assembly of five rivets, considering them acceptable if the locking head surpasses the crack requirements specifically establishing for each alloy (points 4.3.12 and 4.3.13).

4.3 Conditions for use

4.3.1 Metallurgic conditions

The rivets shall be received and installed in the metallurgic condition called out in Table-3 (as per I+D-M-180).

Table 3 : Metallurgic conditions

MATERIAL	RECEPCIÓN	INSTALLATION
L-3120	T-4	T-4 (*) or W/30d./-23ºC
L-3140	T-4	W/30d./-23ºC
L-3180	T-4	
L-3002 L-3051	H-14	
L-3320	H-32	
L-3767	T-73	
L-3191	T-81	
AMS 4982 (Ti45Cb)	Annealed	

REMARKS:

(*) This metallurgical condition is usually used to install rivets manufactured in 2017 and is never used of those manufactured in A-U4G or 3.1324 (Ref. 2017A). (See Table-1, rivet identification and surface protection).

In order to be installed before maturing in W condition, the hardening of the rivets shall be performed per I+D-P-220, bearing in mind Table-4 call outs.

Table 4: Hardening conditions

MATERIAL	HARDENING				
	Temperature ºC	Soaking time (minutes)		Quenching	
		Air furnace	Salt Furnace	Max. water temperature	Quench delay
L-3120	495 ± 5	40 - 60	30 - 45	Initial 30ºC Final 38ºC	15 s. (max.)
L-3140	490 ± 5	60 - 75	45 - 60		

NOTE: When the surface protection of the rivets is a chromate conversion coating (protective coating resistant up to 95ºC), this protection must be removed before proceeding to the solubilization treatment.

After the quenching, and before 30 minutes elapse, proceed to the chromate conversion coating of the rivets at room temperature, in the same heat treatment section, with the exception of those previously protected by anodic oxidation.

4.3.2 Refrigeration treatment

The rivets manufactured in L-3140 and L-3120 (Table-3) which are not going to be installed immediately after hardening, shall be subjected to refrigeration, so as to stop the natural aging process.

The time elapsed for the L-3140 rivets from commencement of the quenching up to its refrigeration in a refrigerator shall be a maximum of 5 minutes .

The time elapsed for the L-3120 rivets from commencement of the quenching up to its refrigeration in a refrigerator shall be a maximum of 30 minutes.

After quenching, or chromate conversion coating, if applicable (4.3.1.), the rivets shall be inserted in isopropyl alcohol or pure ethyl alcohol, previously cooled in dry ice down to a temperature of -40±10ºC keeping them immersed until a temperature of <18ºC is reached.

The soaking time in cooled alcohol shall not exceed 5 minutes.

The cold rivets, coming from the alcohol bath, shall be immediately stored in the refrigerator for a maximum period of 7 days at –12ºC or 30 days at –23ºC.

NOTE: The refrigerators for the storage of L-3140 and L-3120 rivets shall be of the class and type established I+D-P-220.

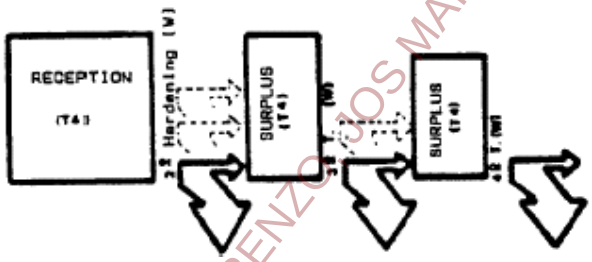
4.3.3 Distribution

In order to prolong the maximum soak time of the rivets in W condition, once hardened or brought out of the refrigerator, the distribution shall be made in porotable refrigerators supplying them in metallic cans totally surrounded by dry ice.

4.3.4 Number of hardenings

The person performing the distribution shall have available a sufficient number of partitioned boxes classifying the rivet, with clear labels indicating the number of hardenings they have been subjected to.

Rivets which have lost W condition (surplus rivets), shall be classified in group depending on their heat treatments, proceeding to their new hardening when a sufficient number exists within each group for one day's work and in compliance with the following sketch:



NOTE: Rivets shall not be subjected to more than three heat treatments.

The surplus rivets of third treatment shall be assigned for non-aeronautical uses.

4.3.5 Installation

Parts to be riveted and which need heat treatment shall be treated before riveting.

The exposure time of W condition rivets to room temperature shall not exceed the following values, from quenching up to installing:

a) L-3140 rivets "20 minutes maximum".

b) L-3120 rivets " 2 hours maximum".

NOTE: In summer (t>25ºC) the exposure times to room temperature shall be reduced to the minimum.

The W condition rivets shall be held as short a time as possible in the hand. Any other manipulation irrelevant to the placing (cutting, deburring,…) shall be performed before their heat treatment.

At the beginning of the working day personnell having used hardenable rivets (L-3120 and L-3140) the previous day shall hand over to the person responsible for the refrigeration, the unconsumed rivets, so that be may proceed to classify them by the number of heat treatments.

4.3.6 Location of the riveting

The location of the riveting shall be performed as called out in the parts drawing (Figure-1).

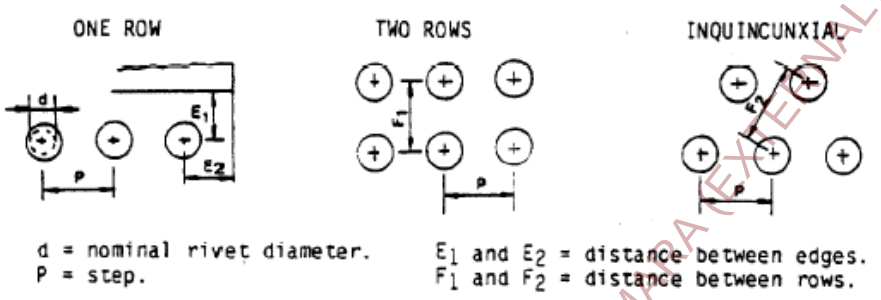


Figure 1: Riveting localitation

When the drawing does not call put any of the dimensions indicated in Figure-1, these shall be taken from Table-5.

Table 5: Riveting dimension

Shape of rivet head	STEPS (P)			DISTANCE BETWEEN ROWS (F1 and F2)			DISTANCE TO EDGE OF SHEET		
	Preferent	Minimum		Maximum (1)	Minimum		ELEMENTAL PARTS		ASSEM-BLIES
		Cylindrical counter-sinking	Dimpling		Cylindrical counter-sinking	Dimpling	E1 and E2 Nominal	Tolerance	E1 and E2 Min..
PROTRU-DING	6d to 7d	3d	5d	10d	3d	5d	2d+ 1,5mm	±1mm	2d
COUNTER SUNK							2d+ 2,5mm		2d+1mm

(1) Not valid for clamping holes.

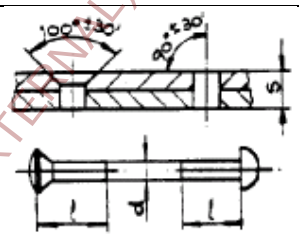
Before housing in compliance with the applicable drawings, determine the following characteristics of the riveting:

- Type, material and diameter of the rivet to be assembled.
- Situation of the original head in the parts to be mounted.
- The necessity or not of performing pilot holes. In the affirmative case, determine whether they have to be performed only on one part or the assembly of sheets positioned to be riveted.
- Drilling of the final hole and countersunking when applicable, on the detail parts, or it has to be performed positioning the sheets forming the assembly to be riveted.

4.3.7 Rivet length

In order to avoid the formation of cracks in the closing head, the suitable rivet in shank length shall be chosen in each case, for the sheet thickness to be rivetted. When this length is not called out in the drawing, it will be taken from Table-6.

Table 6: Rivet length calculation

Total thickness of the sheets to be riveted (S)	Nominal length of the rivets	REMARKS
Up to 1,58 mm (1/16")	l = S + d	
Greater than 1,58 mm (1/16") and less than 12,7 mm (1/2")	l = S + 3/2 d or S+d+2,4 mm which ever is smaller	
Greater than 12,7 mm (1/2")	l = 1,07 S + 3/2 d or 1,07 S+d+2,4 mm whichever is smaller	

If the cutting operation is inevitable due to lack of stock with the desired length, the cutting operation shall be performed prior to instalaltion, considering the following:

a) The cut shall be parallel to the preformed head of the rivet.

b) Remove burrs with very fine alumina abrasive paper, as well as any possible cracks which might have occurred by the cut.

c) Finish the shank end according to whether the rivet specified in the drawing is flat beleved (chamfered or rounded).

NOTE: For closing heads, countersunk at 100º, see table 10, dimensión Z.

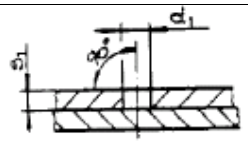
4.3.8 Holes

Hole diameters shall comply with types F and FF of AEN40027 and their dimensions shall be those called out in table 8.

The pilot holes shall be through holes when made on the assembly of sheets to be riveted. When due to drawing requirements one the outer parts have previously performed holes to guide the finishing bore, the S_1 min dimension called out in Table-7 shall be considered.

Should the pilot hole diameter not be dimensioned in the drawing, it should be in accordance with Table-7.

Table 7: Pilot hole diameter

NOMINAL RIVET DIAMETER	1,6	2,4	3,2	4,0	4,8	5,6	6,4	8,0	REMARKS
d_1	---	2,0	2,5						
S_1 (minimum)	0,4	0,5	0,6	0,8	1,0	1,2	1,6	1,8	

REMARKS:

- S_1 minimum is established in such a way that the finishing borer end, seats on the lower sheet, when the cutting edges contact with the pilot hole wall.

- Dimensions in millimeters.

Bores used for drilling the final hole depending on the rivet diameter shall be selected in compliance wirh table 8.

Holes shall be cylindrical, without rough edges, and without radial or circumferencial cracks. Surface roughness of hole shall be: Ra ≤ 6,3 μm (250 R.H.).

Table 8: Sizes of bore

Type of hole as per AEN40027	Nominal diameter of rivet	NOMINAL RIVETS					RIVETS NAS1097				
		Size of bore (inches)	HOLE DIAMETER				Size of bore (inches)	HOLE DIAMETER			
			MINIUM		MAXIMUM			MINIUM		MAXIMUM	
			mm	inches	mm	mm		mm	inches	mm	pulgadas
F	2,4	#40(.098)	2,49	.098	2,61	.103	#40(.098)	2,48	.098	2,61	.103
	3,2	#30(.128)	3,25	.128	3,43	.135	#30(.128)	3,25	.128	3,43	.135
	4,0	#20(.161)	4,04	.159	4,34	.171	#21(.159)	4,03	.159	4,24	.167
	4,8	#10(.194)	4,85	.191	5,16	.202	#11(.191)	4,82	.190	5,03	.198
	5,6	#1(.228)	5,65	.222	5,89	.232	NOT APPLICABLE				
	6,4	F(.257)	6,45	.254	6,73	.265	F(.257)	6,47	.255	6,63	.261
FF	3,2	#30(.128)	3,25	.128	3,40	.134	#30(.128)	3,23	.127	3,38	.133
	4,0	#21(.159)	4,04	.159	4,19	.165	#21(.159)	4,02	.158	4,17	.164
	4,8	#11(.191)	4,83	.190	4,98	.196	#12(.189)	4,81	.190	4,96	.195
	5,6	#2(.221)	5,64	.222	5,79	.228	NOT APPLICABLE				
	6,4	#1/4(.250)	6,43	.253	6,58	.259	#1/4(.250)	6,41	.252	6,56	.258

The perpendicularity of the holes as regards the rivet's original head housing surface, shall be 90 ± 1º.

Remove burrs. Fillets are not necessary at the very edge of the hole.

4.3.9 Millings

When performing millings for installation of rivets countersunk at 100º, they shall be performed by means of a stop support, assuring the correct seating of the head, without gaps (step 4.3.11) and with the required aerodynamic cleanliness (step 4.3.18). For this purpose, it will be necessary to use mills with the characteristics indicated in Figure-2.

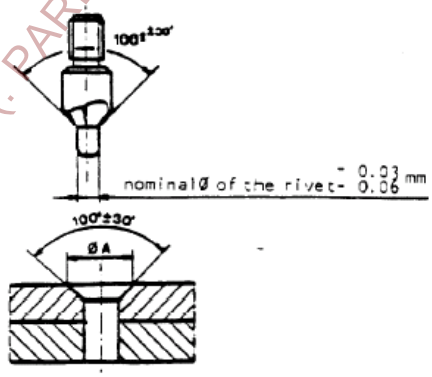


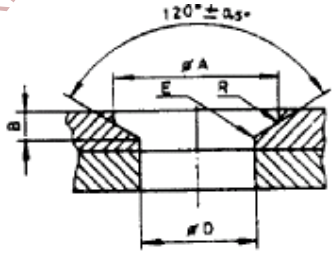
Figure 2: Milling at 100º

REMARKS:

– The milling diameter "A" will be, at the most, equal to the minimum theorical diameter of the countersunk head, and at least 0,15 mm below this.

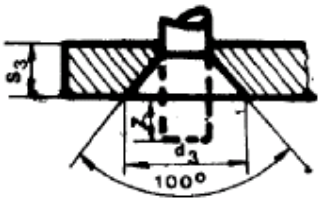
In case of rivets manufactured in L-3767-T73, with 120º flush head for shear stresses, the milling dimensions shall be those called out in Table-9.

Table 9: Milling dimensions

Nominal Diameter of Rivet	Milling			Hole			Transitions		Remarks
	Diameter A (mm)		Height B (mm)	Dimater D (mm)		Size of bore (inches)	Radii E (mm)	R (mm)	
	mín.	máx.	máx.	mín.	máx.				
3,2	4,13	4,20	0,71	3,25	3,43	#30(.128)	0,10 - ,30	0,08-0,25	 Use special tools for countersinking/counterboring
4,0	5,35	5,43	0,89	4,04	4,24	#21(.159)	0,13-0,33		
4,8	6,57	6,66	1,12	4,83	5,08	#11(.191)	0,20-0,40		
5,6	7,94	8,05	1,35	5,79	5,97	#1(.228)	0,28-0,48		
6,4	9,11	9,24	1,55	6,48	6,63	F(.257)	0,36-0,56		
7,2	10,30	10,44	1,75	7,37	7,57	L(.290)	0,41-0,61		
8,0	11,55	11,68	1,98	8,03	8,31	O(.316)	0,46-0,66		

If the closing heads have to be countersunk at 100º, these may not be used in the outer side of coatings. The countersinking dimensions being those in Table 10. The closing head thus obtained, which is not level with the sheet, must be brushed with a tolerance of $^{+\,0,1}_{-\,0,\,0}$.

Table 10: Countersinking dimensions

NOMINAL DIAMETER OF THE RIVET	2,4	3,2	4,0	4,8	
d_3	4 + 0,1 - 0	5 + 0,1 - 0	6,5 + 0,1 - 0	8 + 0,1 - 0	
S_3 (minimum)	0,8	1,0	1,2	1,5	
Z	1,6	1,7	1,9	2,6	

Dimensions in mm.

NOTE: When using NAS1097 rivets and the thickness of the sheet on which the closing head must be performed does not allow the standard countersinking, resort also to the same countersinking type as that of the entry head (NAS 1097).

When determine by the applicable drawings, and in general whenever possible, except in areas where electric continuity is required, the holes shall be protected throughout their whole surface, using products Z-12.101 (epoxy polyamide primer), Z-12.102 (zink chromate alkid primer) or Z-16.107 (polysulfide sealant), according to specification I+D-P-081, step 3.2.

NOTE: The riveting shall be perfomed while the interface products are still wet ("wet installation").

When riveting dihedral surfaces, the maximum possible angles, according to the nominal ϕ of the rivet, shall be called out in Table-11.

Table 11: Maximum angles

NOMINAL DIAMETER OF THE RIVET (mm)	1,6	2,4	3,2	4,0	4,8	5,6	6,4	8,0	FORMED HEAD
MAXIMUM ANGLE (α)	10º				7.5º		5º	2,5º	

Unless otherwise indicated in the Engineering drawings, the distance from the symmetry axis of the rivet to the profile web (Figure-3) shall be the shortest possible, according to the following equation.

$a_{min.} = r + d + l$ mm

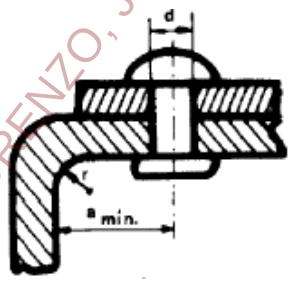
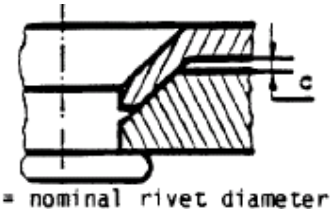


Figure 3: Distance from the symmetry axis of the rivet to the profile web

NOTE: If (a) is equal or less than 8,5 mm and there is no free access for the tool, they may be installed at 9 mm.

The dimpling shall be performed per I+D-P-034, not allowing “C” dimension gaps which exceed the limits established in Table-12, for this type of joints.

Table 12: “C” dimensions gaps

NOMINAL RIVET DIAMETER	DIMENSION “C”		
	MAXIMUM	MINIMUM	
d ≤ 3,2	0,15	0,02	
4 y 4,8	0,20		
d > 4,8	0,30		

Dimensions in millimeters.

4.3.10 Quality requirements

For the acceptability or rejection of the placed rivet, the following must be considered:

- Its seating.
- Possible cracks in the closing head.
- Dimensional finish of the closing head.
- Buckling in the rivet axis.
- Bulging of the sheets.
- Excentricity of the heads.
- Crevices.
- Intrusion or Protrusion of the flush head.

4.3.11 Seating of the placed rivets

The gaps under the rivet heads shall be evaluated considering the following limitations:

a) Rivets, countersunk at 100º and universal

- The gaps of the original heads of the rivets installed on flat surfaces, shall not exceed one third of the rivet contour (see maximum angle in Figure 4), at the same time that they will not allow insertion of a gage of 0,05 mm up to the rivet shank.
- The gaps of any kind or dimension in closing heads of rivets installed on flat surfaces are not acceptable
- The rivets installed on flat surfaces with allowable gaps shall be distributed regularity in such a way that no two continuous rivets with gaps shall exists, nor will the assembly show more than 5% of the rivets with allowable gaps.
-

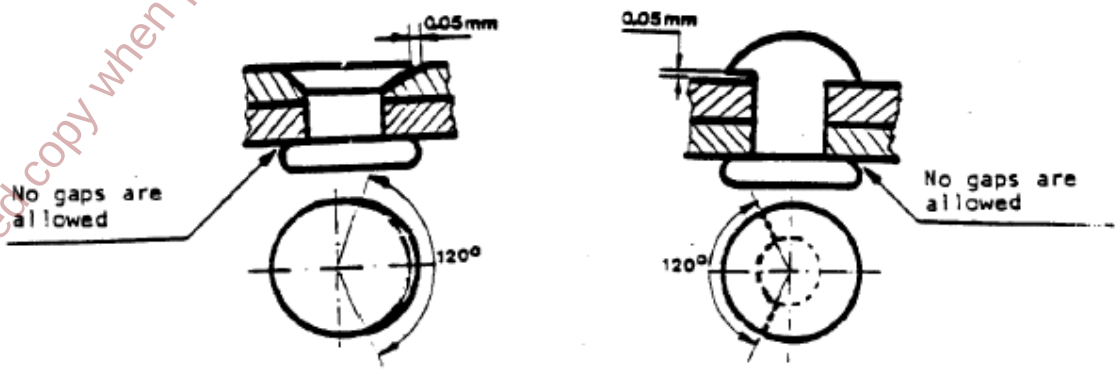


Figure 4: Rivets, countersunk at 100º and universal, showing seating gaps

The gaps of the rivets installed on curved surfaces shall be evaluated on the contact line, applying on it the same limitations as established for the riveted ones on flat surfaces (Figure-5).

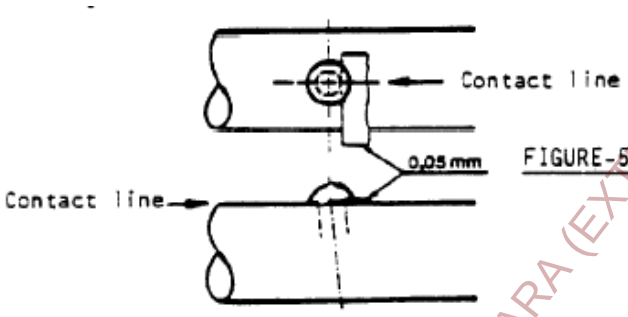


Figure 5: Universal rivet showing a unallowed seating gap

b) Rivets manufactured in L-3767-T73 with 120º countersunk head

- No kind of gap is allowed, either on the original head or on the closing one (Figure-6).

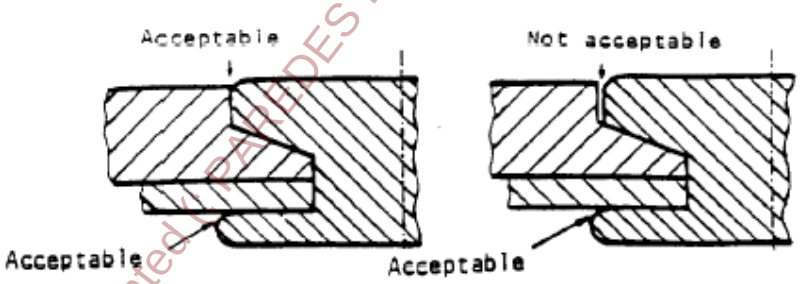


Figure 6: 120º countersunk head rivets, with and without seating gap

4.3.12 Cracks in the closing head

Determine by visual inspection the possible fissures or cracks of the closing heads. They are not acceptable in any type or dimension in the L-3002, L-3051, L-3180, L-3320, L-3767 or AMS 4982 (Ti45Cb). For L-3120, L-3140 and L-3191, they are not acceptable either, if they present the following characteristics:

- Cracks of any kind and dimensions, reaching the critical diametral area. This area is equal to 1.1 times the nominal rivet diameter.

- Fissures or cracks whose radial penetration is greater than 1/8 of the nominal rivet diameter or else reaches a peripheral width greater than 1/16 of the nominal rivet diameter.

- Ramified cracks, whatever their size may be.

- Parallel and diametral cracks, whether orientated at 45º or not.

- An intrusion or dishing in the peripheral area of the closing head shall be also cause for rejection.

NOTE: No crack of fissure shall be accepted in the original rivet head.

4.3.13 Dimensional finish of the closing head

The dimensional finish of the flat closing head will be:

- Diameter “D” =1,5 x nominal reivet ϕ, except for L-3767 (7050) alloy which will be 1,6 x nominal rivet ϕ
- Heigh “H” = 0,5 x nominal rivet ϕ

the tolerance dimensions being those called out below:

Table 13: Tolerances closing head dimensions

NOMINAL RIVET DIAMETER (mm)		**1,6**	**2,4**	**3,2**	**4,0**	**4,8**	**5,6**	**6,4**	**8,0**
Head height H (mm)	**Minimum**	0,6	1,0	1,3	1,6	1,9	2,2	2,6	3,1
	Maximum	1,1	1,6	2,0	2,4	2,9	3,2	3,8	4,6
Head diameter **D (mm)**	**Minimum (1)**	2,2	3,4	4,5	5,6	6,7	8,0	9,0	11,0
	Maximum	3,3	4,6	5,9	7,0	8,3	9,4	10,7	13,0

(1)The minium closing head diameter for AMS 4982 (Ti45Cb) niobium titanium alloy rivets will be 1,3 x the rivet ϕ and for L-3767 (7050) aluminium alloy rivets installed with automatic machine (DRIVEMATIC), it will be 1,5 x the rivet ϕ.

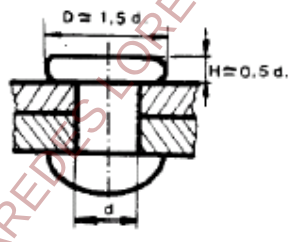


Figure 7: Flat closing head

NOTE: If the flat closing heads show an oblique shape, their central height must not be less than 1/3 of nominal rivet ϕ and the lateral minimum, 1/4 of it.

4.3.14 Buckling of the rivet shank

Deformations below 0.05 mm are allowable on the rivet shank, provided that the separation between the sheets does not exceed 0,35 mm at the edge of the structure. In this case, no gap opened under the rivet heads is allowable.

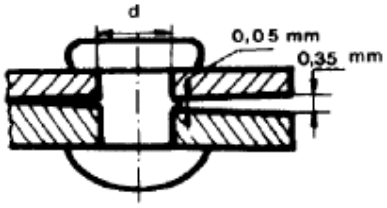


Figure 8: Rivet with buckling in the axis

4.3.15 Bulging of the sheets

Bulgings of the sheets greater than 0,3 mm between two consecutive rivets shall not be allowed.

Figure 9: Bulgings of the sheets

4.3.16 Excentricity of the heads

The excentric closing heads are allowable, provided that the head periphery does not reach the critical diameter ($d_{critical}$ = 1,1 d).

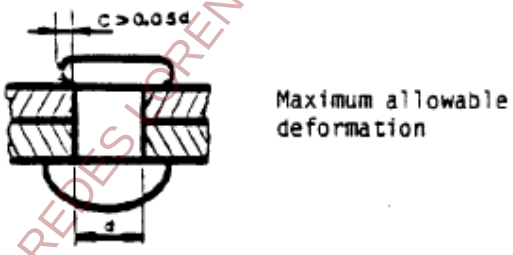


Figure 10: Excentricity of the heads

4.3.17 Crevises

The rivets showing a crevised head portion not greater than the dimension in Figure-11 are allowable, provided that they do not reach the critical diameter ($d_{critical}$ = 1,1 d).

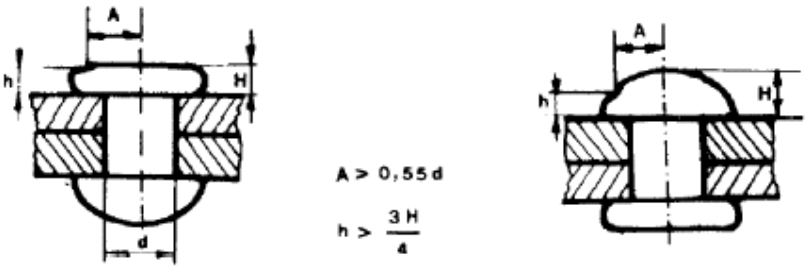


Figure 11: Crevised head portion

4.3.18 Maximum Intrusion or Protrusion of the countersunk

Unless otherwise expressly specified in the drawings or applicable documentation (TDD´s, etc.), the flush heads have the following maximum deviations, as regards the surface of the riveted joint:

(+) Protusion

(-) Intrusion

a) All rivets, except those of flush shear head

- AERODYNAMIC SURFACES: $0{,}00\ ^{+0{,}15}_{+0{,}00}$ mm, a 10% exceptional tolerance of $^{+0{,}20}_{+0{,}00}$ mm being allowable, provided that no two correlative rivets exist under these conditions.
- NON-AERODYNAMIC SURFACES: $0{,}00\ ^{+0{,}20}_{+0{,}00}$ mm.

b) 100º flush shear rivets (NAS 1097)

- They shall be installed leveled within $^{+0{,}127}_{+0{,}000}$ mm, taking as a reference the edge of the rivet head (flat area).

c) 120º flush shear head rivets (step 5.8.2)

- They shall be installed leveled within $^{+0{,}150}_{+0{,}025}$ mm, taking as a reference the highest point of the rivet head.

NOTE: It is not allowed to undercut or to shim any head or countersinking in order to comply with the leveling requirements.

If it should be necessary to undercut or shim the countersunk head of the rivet, Engineering approval shall be required. Unless otherwise indicated, the reworked area shall be immediately protected using Z-23.401, subsequently restoring surface protections according to the applicable documentation.

4.3.19 Personnel

All personnel shall be suitably trained to carry out the process of installing solid rivets.

4.3.20 Approved materials /rivets

All materials used during installation and the solid rivets shall be qualified and shall be obtained from Airbus approved sources.

All solid rivets shall be qualified and shall be obtained from Airbus approved sources.

4.3.21 Tooling/Equipment

All tooling and equipment shall be obtained from controlled sources and shall be certified as suitable for intended use and conforming to the requirements of this specification.

The calibration frequency of setting tools and calibration equipment shall be sufficient to suit the tooling usage and environment as required by the Quality Assurance Authority

4.3.22 Manufacturing shop

The manufacturing shop shall be approved to the requirements of the Airbus Quality Assurance function for the production and supply of parts assembled to this process.

5 Process qualification

The qualification procedure for the manufacturing process has to be performed according to Airbus rules.

6 Appendix (EN rivets)

6.1 Applicability

This appendix covers the requirements for the installation of solid rivets made from aluminum, aluminum alloys, titanium niobium (44.5Cb) and Monel (NiCu31) with a preformed head. The rivets have a plain or radiused/chamfered shank end. The rivets are to be installed manually or by automatic riveting machines using a multi-stroke rivet gun, EMR rivet tool or squeeze. The rivets are used for joining components of aluminum alloy, titanium alloy, CRES, FML and FRP.

The Appendix is applicable for the final assembly line of all AIRBUS programs previous to the A350 that are under design responsibility of Airbus Spain.
The rivets per following standards are installed according to this appendix:

EN6069.
EN6080.
EN6081.
EN6101.

6.2 Limitations of the process

The size and shape of installation equipment may limit the applications of solid rivets. Inaccessible applications shall always be referred to the relevant Design Authority.

Installation of rivets by using a hand hammer is only applicable for rivets from aluminium 1050A-H14.

Single stroke riveting except EMR rivet process shall not be used for solid rivets.

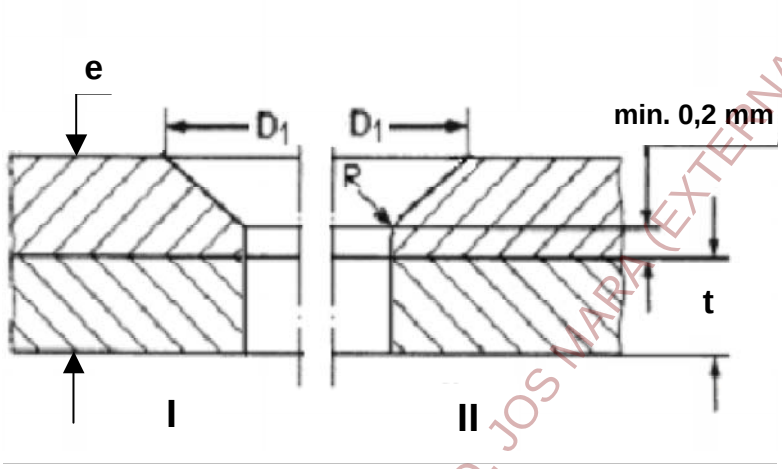
For joining FRP riveting shall be performed only by squeezing and EMR.

Aluminium solid rivets shall not be used in CFRP or in stack-ups containing CFRP.

Monel solid rivets shall only be used in high temperature applications up to an operating temperature of 427°C.

Solid rivets shall not be used in parts having a low elongation (example: castings or compression molded parts) or which are prone to stress corrosion (example: ST-direction of plate from 2024-T3 or -T351, 7075-T6, 2014-T6).

On countersunk holes the remaining cylindrical part in the countersunk sheet shall be min 0,2 mm measured to the edge in the hole, respectively on chamfered/radiused holes to the point where the tangents of hole and countersunk meet each other.



I: countersink with sharp edge,
II: countersink with radius in the transition area, R_{max} = 0,25 mm

Figure 12: Countersink and sheet thickness requirements

The min. sheet thickness on the upset tail side shall meet the values of Table 15, if not otherwise specified on the drawing.

Table 15: Minimum sheet thickness on the upset tail side

Rivet material	**Al-alloy**[1) 2)]	**44.5Cb**[2)]	**Monel**[3)]
Nominal rivet diameter d_1[mm]	**t_{min} [mm]**	**t_{min} [mm]**	**t_{min} [mm]**
1,6	-	-	0,8
2,4	0,8	0,8	0,8
3,2	1,0	1,0	1,2
3,6	1,2	1,2	1,4
4,0	1,4 (1,0 [4])	1,4	1,6
4,4	1,4	1,4	1,6
4,8	1,8 (1,4 [4])	1,8	2,0
5,6	2,3	2,3	2,4

[1)] applicable for rivets when installed as received
[2)] al-alloy part on the upset tail side
[3)] al-alloy, steel , titanium, Inconel etc. on the upset tail side
[4)] values in brackets are thicknesses for rivets from 2017A installed by squeezing

6.3 Requirements

6.3.1 Hole and countersink requirements

The rivet hole diameter shall meet the requirements defined in Table 16, if not otherwise specified on the drawing.

Table 16: Hole diameter for rivets from aluminium, aluminium alloy, titanium niobium (44.5Cb) and Monel (NiCu31)

Nominal Rivet Diameter d_1	Aluminium and Aluminium Alloy Rivets: EN6069 EN6080 EN6081 EN6101		Monel Rivets: EN6069 EN6080 EN6081 EN6101
	Applicable for riveting by EMR and riveting by rivet gun and squeeze	Applicable for automatic riveting by squeezing	44.5Cb Rivets: EN6069 EN6080 EN6081 EN6101
1,6	1,620 – 1,720	–	–
2,4	2,420 – 2,520	2,420 – 2,495	2,460 – 2,560
2,8	2,820 – 2,920	–	2,850 – 2,950
3,2	3,220 – 3,320	3,220 – 3,295	3,250 – 3,350
3,6	3,620 – 3,720	–	3,650 – 3,750
4,0	4,010 –4,110	4,010 – 4,085	4,050 – 4,150
4,4	4,410 – 4,510	–	4,450 – 4,550
4,8	4,800 – 4,900	4,800 – 4,875	4,850 – 4,950
5,2	5,200 – 5,300	–	5,250 – 5,350
5,6	5,600 – 5,700	5,600 – 5,675	5,650 – 5,750
6,0	6,000 – 6,100	–	–
6,4	6,400 – 6,500	6,400 – 6,475	–
7,2	–	7,180 – 7,255	–
8,0	–	7,970 – 8,045	–
9,6	–	9,570 – 9,645	–

All values in mm

The diameter of the countersink shall assure that after riveting the countersunk head meets the requirements of Table 17 for the min countersunk head protrusion. The max protrusion has to be in accordance with drawing requirements.

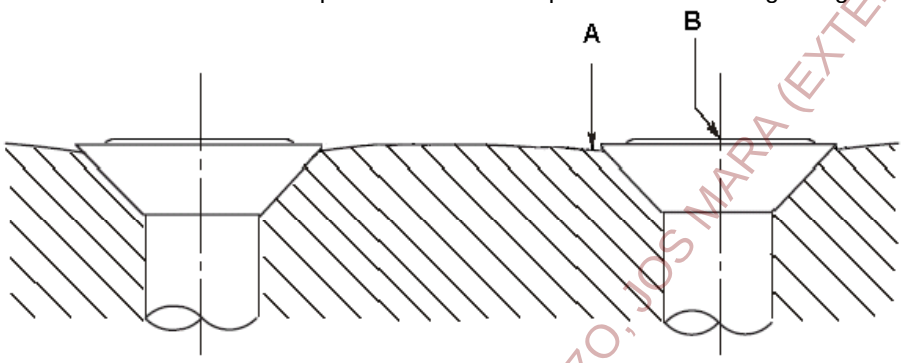
Table 17: Countersunk head protrusion after riveting

Rivet material	**Countersunk head protrusion after riveting**
	min

Aluminium and Aluminium alloy, rivets installed as received	+ 0,05 mm
Aluminium alloy 2017A-T4 , rivets installed in solution heat treated condition[1)]	+ 0,01 mm
Titanium niobium (44.5Cb) and Monel (NiCu31)	+ 0,01 mm

1) Solution heat treatment of rivets from material 2017A –T4 as per AIPS04-01-002.

Measurement of the countersunk head protrusion has to be performed according to Figure 13.



A: reference point on component surface, adjacent to rivet head
B: measurement point on the manufactured head

Figure 13: Measurement points to determine the countersunk head protrusion after rivet installation

When the countersunk head excceds the max protrusion specified on the drawing then on 100° normal flush head rivets made from aluminium or aluminium alloy 10% of the countersunk head height can be milled off to meet flushness requirements. On domed countersunk rivets the dome height shall not be considered for the calculation.

On rivets with a 100° medium flush head 5% can be milled off.

For repair rivets and for rivets with a 100° reduced flush head milling of the countersunk head is not allowed.

For rivets which require a countersunk upset tail the countersunk diameter shall be as defined in Figure 14 and Table 18, when not otherwise specified on the drawing. The transition area between countersink and cylindrical hole may have a sharp edge.

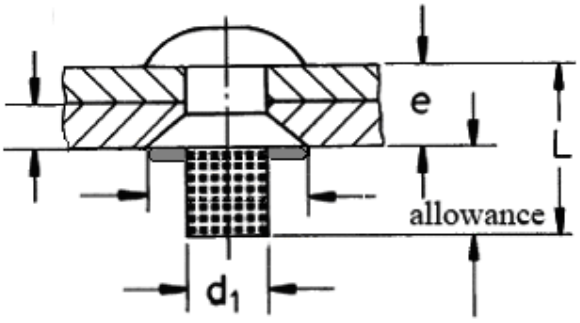


Figure 14: Allowance for a countersunk upset tail

Table 18: Allowance for a countersunk upset tail (not applicable for rivets from Monel)

Nominal rivet diameter d_1 [mm]	2,4	3,2	4,0	4,8
Min sheet thickness t_{min} [mm]	0,8	1,0	1,2	1,5
Countersink diameter D_2 [mm]	4,0	5,2	6,5	8,0
	4,1	5,3	6,6	8,1

6.3.2 Rivet length

The rivet length for joining a stack up of sheets is calculated according to the part thickess e plus an allowance to form the upset tail.

6.3.3 Flat or tapered upset tail

When rivets are installed with an flat or tapered upset tail, Figure 15, the rivet length shall be determined under the rules of Table 19.

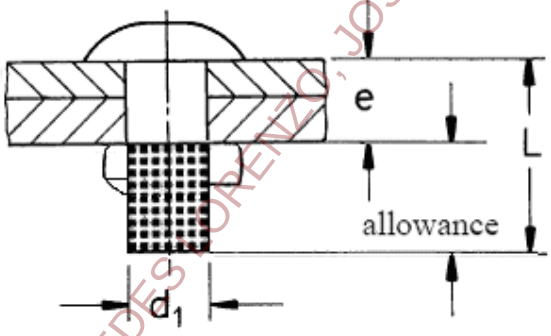


Figure 15: Allowance for a flat or tapered upset tail

Table 19: Determination of rivet length for a flat or tapered upset tail

Rivet material	Calculation of theoretic rivet length	Conversion from calculated length L to the length per rivet standard
Al and al-alloys	$L = e + 1{,}3 \times d_1$ [mm]	L has to be rounded to the next higher or lower length per applicable rivet standard, whichever is closer to the calculated value.
Titanium niobium (44.5Cb)	$L = e + 1{,}25 \times d_1$ [mm]	
Monel (NiCu31)	$L = e + 0{,}8 \times d_1$ [mm] For installation in steel, titanium, inconel etc.	L has to be rounded to the next higher length per applicable rivet standard

6.3.4. Countersunk upset tail

The installation of rivets with a 100° countersunk upset tail is only applicable for rivets made from aluminium, aluminium alloys and titanium niobium 44.5Cb.

The rivet length a the countersunk upset tail per Figure 14 and Table 18 is calculated by the formula

$$L = e + 0{,}7 \times d_1.$$

The length L thus obtained has to be rounded to the next higher or lower length per applicable rivet standard whichever is closer to the calculated value. The countersunk upset tail after riveting has to fill the countersunk completely. Excess material that protrudes can be milled off when flushness is required. Grinding shall not be used.

6.3.5 Cutting the rivet to length

When the required rivet length is not available it is acceptable to shorten the rivet shank. For rivets from aluminium and aluminium alloy can cut by shearing. Rivets from titanium niobium (44.5Cb) and Monel (NiCu31) shall not be cut by shearing, only by sawing or milling. IVD plated rivets shall not be shortened. The obtained length shall be inside the length range requested by the rivet standard. The cut shall be at 90° to the shank. The rivet shall have a plane shank end or a chamfer or radius when requested by the standard. Burrs have to be removed by filing.The grinding of rivets to length is forbidden for all materials.

6.3.6. Riveting

Rivet standards shall be as defined on the drawing.

Rivets from al-alloy 2017A-T4 can be installed in the as received or in the solution heat treated condition. Heat treatment shall be performed per AIPS04-01-002.

When rivets are squeezed the upset tail shall be formed in a single continuous action.

When Monel rivets are installed by rivet gun the direct riveting is the preferred method.

When riveting FRP on the upset tail side shall be a metallic part or metallic washer of min. 0,8 mm thickness as delamination or any kind of deformation in the FRP are not allowed.

The upset tail dimensions for solid rivets Figure 16 and Table 20 shall meet the requirements of Table 5.

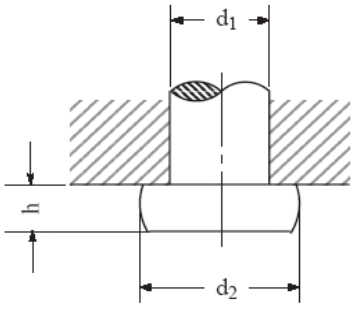


Figure 16: Upset tail dimensions

Table 20: Overview of rivet parameters and related tables for the dimensions of the upset tails

Rivet material and installation condition	Dimensions for upset tails
For all aluminium and aluminium alloy rivets	Table 21
For rivets from titanium niobium (44.5Cb)	
For rivets from Monel (NiCu31) to be installed in steel, titanium, Inconel etc.	Table 22

Table 21: Upset tail dimensions for rivets from aluminium, aluminium alloy and 44.5Cb with a flat upset tail. The dimensions are also valid for rivets from aluminium alloy with a tapered upset tail.

Diameter Code	Nominal rivet diameter d_1 [mm]	d_2 [mm]		h [mm]	
		min	max	min	max
-2	1,6	2,3	3,3	0,6	1,1
-3	2,4	3,6	4,8	0,8	1,4
3X	2,8				
-4	3,2	5,0	6,0	1,1	1,8
-4X	3,6				
-5	4,0	6,2	7,5	1,3	2,3
-5X	4,4				
-6	4,8	7,3	8,7	1,5	2,5
-6X	5,2				
-7	5,6	8,5	10,0	1,7	3,1
-7X	6,0				
-8	6,4	9,5	11,0	1,9	3,5
-10	8,0	11,8	13,5	2,6	4,4
-12	9,6	14,0	16,0	3,2	5,2

Table 22: Upset tail dimensions for rivets from Monel (NiCu31) for installation in steel, titanium, Inconel etc.

Diameter Code	Nominal rivet diameter d_1 [mm]	d_2 [mm]		h [mm]	
		min	max	min	max
-3	2,4	3,2	3,6	0,65	0,90
3X	2,8	3,7	4,2	0,75	1,10
-4	3,2	4,3	4,8	0,85	1,25
-4X	3,6	4,8	5,4	0,95	1,50
-5	4,0	5,3	5,9	1,10	1,70
-5X	4,4	5,8	6,5	1,20	1,85
-6	4,8	6,4	7,1	1,30	2,00
-7	5,6	7,4	8,2	1,50	2,30

No cracks are allowed on preformed heads on rivets. The requirements for the installed rivet and surface integrity are defined inTable 23:

Table 23: Overview of acceptable and non accepatable deviations and related tables

Faults on upset tails	Figure 17 to 22
Gaps under preformed heads and countersunk upset tails	Figure 23

Damages on universal heads	Figure 24 and 25
Sheet damage on the manufactured head side	Figure 26

An upset tail with a sloped surface is acceptable provided the min and max height are within the limits of the allowed tolerance band.

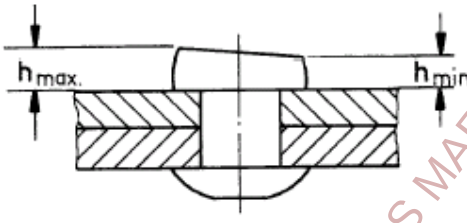


Figure 17: Upset tail with a sloped surface

Rivets having an upset tail height which is on one side less than the min allowed height are permitted on 10% of the rivets in one row provided their mean height is not below 1/3 d_1. This defect shall not occur on the rivet located at either end of a rivet row. In between not more than two effected rivets may be adjacent to one other.

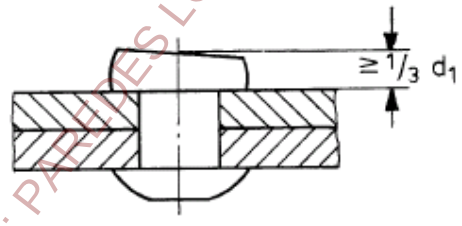


Figure 18: An upset tail, which is on one side below h_{min}

The upset tail may be displaced with respect to the shank provided it dimensions is within the tolerance. The fault is not permitted and the rivet shall be replaced if the upset tail touches the perimeter of the shank and the edge of the rivet hole is visible.
In the case of fuel tanks, a displaced upset tail which is recognizable by its ovality shall be replaced.

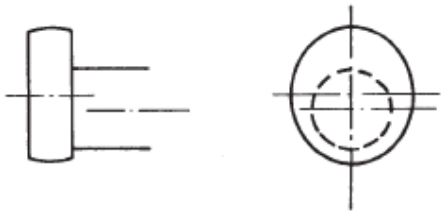


Figure 19: Acceptance criteria for a displaced formed upset tail

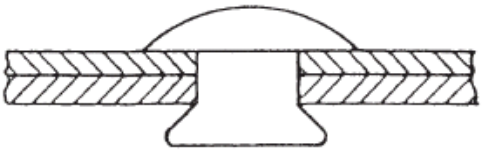


Figure 20: A bell shaped upset tail resulting from installation tools which is not permitted (back up bar of insufficient weight or rivet gun with too low capacity for forming)

On upset tails the location and depth of cracks are of primary importance. The cracks shall not continue into the shank area. Two or more cracks shall not overlap or be positioned in such a way that they might overlap after a time and thus cause rupture of the upset tail.
Cracked upset tails are permitted only on 10% of the rivets in one row. This defect shall not occur on the rivet located at either end of a rivet row. In between not more than two cracked rivets may be adjacent to one other.

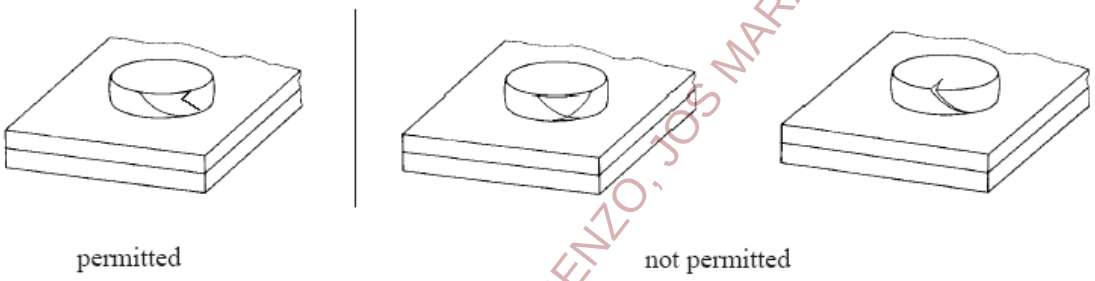


**Figure 21: Spiral cracks on upset tails of aluminum rivets from alloy 2017A.
No cracks are acceptable on rivets made from other al-alloys, 44.5Cb and Monel.**

These defects are due to incorrect hat treatment which causes the rivets to become too hard, or they are due to flaws in the surface of the rivet. These defects are not caused by faulty riveting.

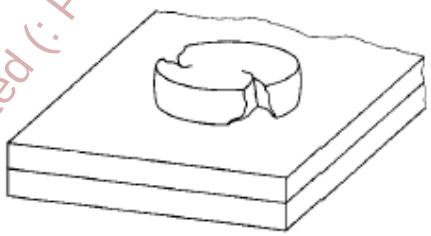


Figure 22: Longitudinal cracks (clefts) on formed heads are not permitted

A gap smaller than 0,1mm between the component and the manufactured universal or countersunk head is permitted, see Figure 13. On 10% of the rivets the gap may be 0,1 mm (a 0,1mm feeler gauge begins to clamp in the gap just at the entry, when the gap is equal 0,1 mm) and no two adjacent rivets have the same fault. An "apparent" circumferential gap at the countersunk head at the level of the countersunk head chamfer is permitted.

On wet installed rivets has to be ensured that any gaps resulting from measuring are sealed afterwards.

Gaps are not permitted at integral fuel tanks and pressure cells and not at countersunk formed upset tails.
The gap for universal head rivets may exceed 0,1 mm when installed on a curved surface (> 0,1mm in direction to the curve).

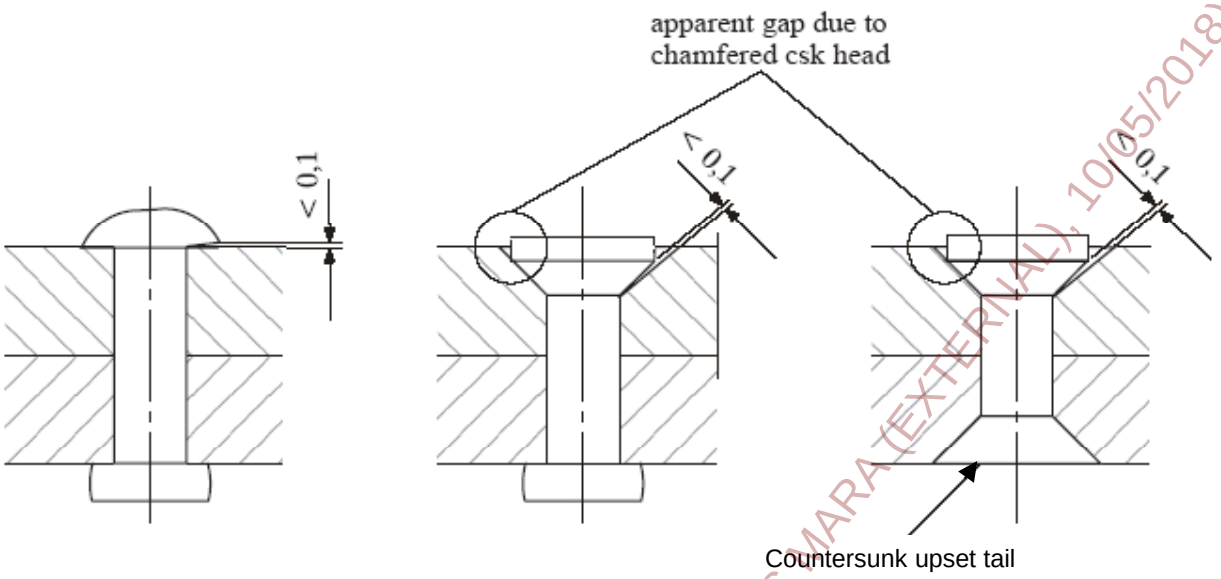


Figure 23: Gaps

A notch in the universal head is permitted when not exceeding ¼ of head height B

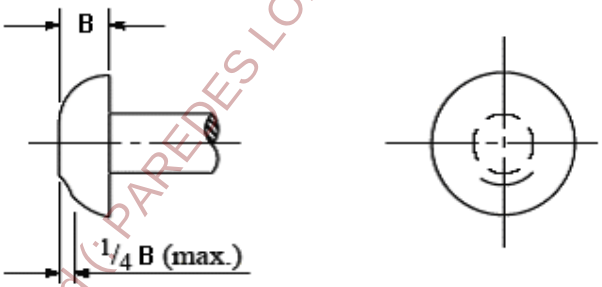
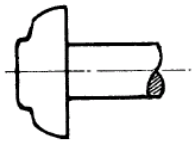


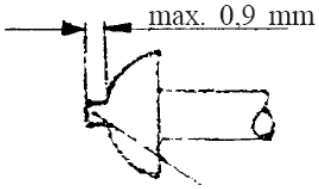
Figure 24: Notched manufactured head

This fault is caused by a too small rivet die



not permitted

This fault can occur when the rivet is held by vaccum in the riveting die



max. diameter 2.1 mm

permitted only on rivets from aluminium alloy

Figure 25: Manufactured head having with a concentric ring after installation

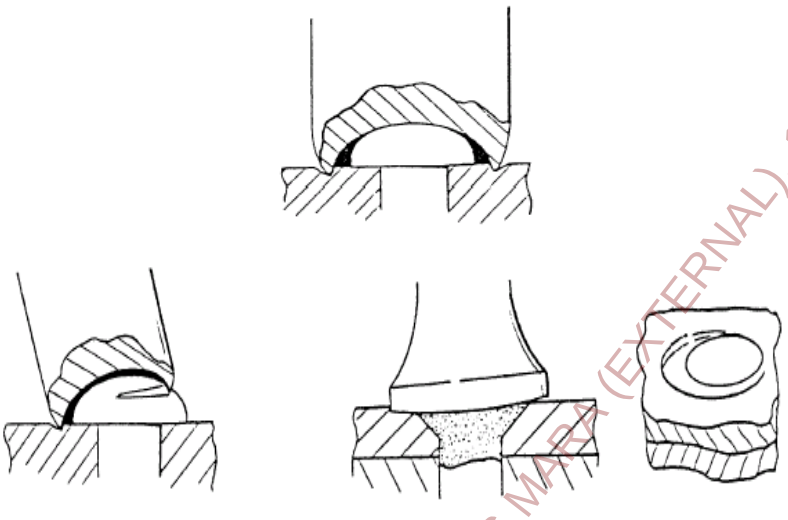


Figure 26: Non acceptable structural damage induced by riveting dies

Quilting of parts shall be avoided. Waviness of the sheets at joints have to be in accordance with the drawing requirements. Interface gaps between the rivets and gaps at the edges shall exceed the requirements of Figure 27.

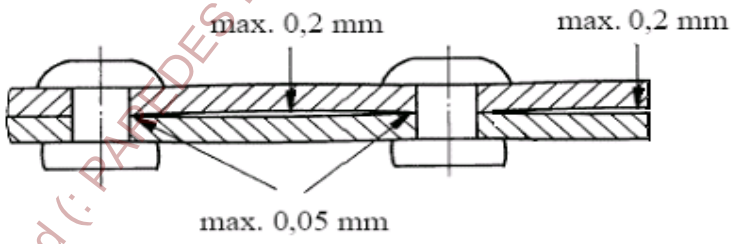


Figure 27: Gaps in the faying surface and at the edge

6.4 Quality requirements

6.4.1 Personnel

All personnel shall be suitably trained to carry out the process of installing solid rivets.

6.4.2 Process

All processes shall be qualified in accordance with section 6.5.

Installation processes shall be controlled within the limitations of this specification and parts/assemblies inspected to ensure they meet the requirements shown in section 6.3.

On automatic riveting machines a periodical quality check has to be done by riveting a control specimen to verify that the requirements of this AIPS will be met. The specimen to be used and the frequency of tests have to be defined in the local process specification.

Controls shall be in place to ensure oversize repairs are carried out under non-conformance documentation as agreed by the Airbus Quality Assurance Authority.

6.4.3 Approved materials /rivets

All materials used during installation and the solid rivets shall be qualified and shall be obtained from Airbus approved sources.

All solid rivets shall be qualified and shall be obtained from Airbus approved sources.

6.4.4 Tooling/Equipment

All tooling and equipment shall be obtained from controlled sources and shall be certified as suitable for intended use and conforming to the requirements of this specification.

The calibration frequency of setting tools and calibration equipment shall be sufficient to suit the tooling usage and environment as required by the Quality Assurance Authority

6.4.5 Manufacturing shop

The manufacturing shop shall be approved to the requirements of the Airbus Quality Assurance function for the production and supply of parts assembled to this process.

6.5 Process qualification

The qualification procedure for the manufacturing process has to be performed according to Airbus rules.

RECORD OF REVISIONS

Issue	Clause modified	Description of modification
1 11/07		New standard