Airbus Product Standard

Hole Geometries for use with Protruding and Countersunk Head Fasteners and Specific Nuts

Export Control – Not technical

Contents

1 Scope

This standard specifies the geometry and a coded means of calling up required hole diameters for use with protruding and countersunk head fasteners and specific nuts when used in applications involving metallic / metallic, Composite / Composite and Composite / metallic assemblies.

2 Normative References

This Airbus Standard 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 these publications apply to this Airbus Standard only when incorporated in it by amendment of revision. For undated references, the latest issue of the publication referred to shall be applied.

ABS0056	Rivet, countersunk
ABS0094	Pin - Titanium alloy 100° countersunk head break stem: Tension head
ABS0112	Rivet, blind 100° CSK
ABS0546	Rivet, blind 100° CSK
ABS0547	Rivet, blind, universal head
ABS0548	Pin, swage locking, pull-type 100° countersink, intermediate head
ABS0813	Nut, Hexagon, Self-Locking counter bored, self-sealing, Aluminum
ABS0889	Tapered shank bolt Protruding head short thread
ABS1295	Nut-plate, Rivetless, floating, variable counterbore, replaceable nut element
ABS1521	Nut, anchor, high float
ABS1605	Blind bolt, threaded type, 100° reduced head
ABS1621	Nut, anchor, one lug, high float
ABS1741	Radial Expansion Bolt (Protruding Shear Head)
ABS1742	Tapered Sleeve Bolt (100° Intermediate Countersunk Head)
ABS1743	Tapered Sleeve Bolt (Protruding Shear Head)
ABS1745	Radial Expansion Lock Bolt (Protruding Shear Head)
ABS1754	Sleeve Protruding Head
ABS1770	Sleeve, 100° Countersunk Head
ABS1771	Rework and Repair of Holes and Fasteners
ABS1774	Bolt - 12 Point Tension head
ABS1776	Radial Expansion Bolt (100° Intermediate Countersunk Head)
ABS1778	Radial Expansion Lock Bolt (100° Intermediate Countersunk Head)
ABS1807	Bolt, Sleeved, Countersunk head, Short thread Inch series
ABS1820	Bolt, Sleeved, 100° Countersunk intermediate head
ABS1830	Bolt, 12 point socket head Tension and shear application
ABS2322	Bolt, Blind, 100º Countersunk Head
ABS2323	Bolt, Blind, Protruding Head, High strength
AIPI01-03-009	Installation of Cold Expanded Sleeves
AIPS01-01-004	Installation of solid rivets

AIPS01-02-002	Installation of Taper Shank Bolts
AIPS01-02-003	Preparation of Holes in Metallic Materials for Fastening
AIPS01-02-005	Preparation of Holes in Plastic and Mixed (Plastic/Metal) Assemblies for Fastening
AIPS01-02-013	Installation of Blind Bolts and Blind Rivets - Pull-type
AIPS01-02-015	Installation of Blind Bolts Threaded type
AIPS01-02-016	Installation of Rivetless nut-plates
AIPS01-02-027	Installation of blind rivet nuts
AIPS01-03-006	Installation of tapered sleeved fasteners
AIPS01-03-008	Installation of Parallel Shank Sleeved Fasteners
AIPS01-03-009	Installation of Cold Expanded Sleeves
ASNA0029	Huck MLSP blind rivets - round head - Aluminum alloy
ASNA0077	Rivets, blind, countersunk 100° head
ASNA0078	Rivets, blind flattened round head
ASNA0079	Blind rivets with shank locking 100° countersunk head
ASNA0081	Blind bolt, self-locking, 100° countersunk head
ASNA0082	Blind bolt, self-locking, hexagonal head
ASNA0093	Bolt twelve point Inconel 718
ASNA2040	Tensile rivets 100° countersunk head
ASNA2041	Rivet, countersunk, lock-bolt
ASNA2065	Nut – crimped, self-locking or non-self-locking
ASNA2657	Bolt – Reduced countersunk head, shear coupling, short thread
EN6050	Aerospace series pins, swage locking, 100° countersink, reduced head, shear type in Aluminum
EN6069	Aerospace series, Solid rivet, 100° reduced flush head, close tolerance, Inch series
EN6081	Aerospace series, Solid rivet, universal head, close tolerance Inch series
EN6101	Aerospace series, Solid rivet,100° Medium flush head, close tolerance Inch series
EN6114	Bolt - Countersunk head, Short thread Inch series
EN6115	Bolt, Protruding head, Short thread Inch series
EN6122	Blind bolt 130° flush head high strength, preferable in composite application
EN6127	Blind bolt, 100° reduced flush head, high strength
EN6128	Blind bolt, 100° flush head, high strength
EN6129	Blind bolt, Protruding head, high strength
EN6131	Composite clip nut, self-locking
MBBN4481	Lockbolt, close tolerance with 100° flush head, Titanium alloy
NAS1329	Nut, blind rivet, flat head, internal thread, non-locking (free running) and self-locking (prevailing torque)
NAS1330	Nut, blind rivet – countersunk head, internal thread, non-locking (free running) and self-locking (prevailing torque)
NAS1581	Bolt, shear, 100º flush reduced head, offset cruciform, offset cruciform ribbed and dovetail slot, 95 KSI FSU
NAS1734	Nut, self-locking, blind rivet, elliptical head, 450 degrees F

NAS1735	Nut, self-locking, blind rivet, elliptical head, closed end, 450 ºF
NAS1919	Rivet, blind, general purpose, bulbed, protruding head, mechanically-locked-spindle
NAS1921	Rivet, blind, general purpose, bulbed, 100º flush head, mechanically-locked-spindle
NASM21250	Bolt, tension, steel, external wrenching, flanged, 12 – point, 180 KSI Ftu, 450 ºF
NASM21069	Nut, Self-locking, Plate, Two-Lug, reduced rivet spacing, low height, steel, 125 KSI Ftu, 450 °F
NSA5067	Nut - Clip Self-locking floating quick installation of dismantling
NSA5378	Bolt-12-point socket head, in Inconel 718, R= 1 510 MPa

3 Definitions

Hard metals: all metals with a higher density than Aluminum, except Cu alloys.

Blind bolt: Blind fastener without shank expansion during installation.

Blind rivet: Blind fastener with shank expansion during installation.

4 Requirements

4.1 Countersink Requirements

4.1.1 Countersink configuration and geometries for holes used with countersunk head fasteners are defined in AIPS01-02-003 & AIPS01-02-005. To ensure the countersink head sits correctly within the hole a chamfer or radius shall be machined at the transition between the hole countersink and bore as defined in AIPS01-02-003 & AIPS01-02-005. Generally recommended and reduced chamfer and radius dimensions are defined in Figure 1 and Table 1.

4.1.2 Reduced transition radii or chamfer dimensions shall not be used on wing applications without the prior agreement of the Design Authority. For 100° countersink head fasteners installed in metallic & composite elements less than 3,0mm thickness a reduced chamfer & radius shall be used to avoid knife edging.

4.1.3 For countersunk holes, the countersink profile shall fall within the tolerances given for angle and alignment as defined in AIPS01-02-003 & AIPS01-02-005, and shall conform to specific restrictions in regard to countersink depth and minimum stack thickness as defined on the drawing or in related design principles documentation. Mandatory dimensional requirements for countersinks are not defined here. It is the responsibility of the manufacturing function to ensure that the countersink dimensions are in accordance with the specific fastener requirements and that the countersink depth is controlled to ensure conformance with aerodynamic flushness requirements and with fastener seating requirements as defined in AIPS documentation governing fastener installation.

4.1.4 For countersunk fasteners, there is a minimum cylindrical thickness (t_{cyl}) to leave in the part where the head is housed as defined in Figure 2.

On composites, this minimum cylindrical thickness (t_{cyl}) depends on the fastener head height (h, taken from the fastener standard), the loads in the area, fastener type and diameter (Ø) and whether it is a primary or secondary structure. These values can be decreased under Stress agreement.

$$t_{cyl} > \text{Max of } [h/3, 0.4] *$$

* “Max of [h/3, 0.4] means h/3 or 0.4mm, whichever is the maximum”.

For the calculation. CFRP plies thickness as well as non-CFRP plies laid on external face (like ECF or glass fiber) should be considered, as indicated in Figure 1.

4.1.5 For solid rivets, the radii at the transition between the hole countersink and bore shall be 0,25mm at maximum.

4.1.6 For blind fasteners, the radii and chamfers at the transition between the hole countersink and bore are given in the AIPS01-02-013 for “pull type” blind fasteners and in the AIPS01-02-015 for “threaded type” blind fasteners.

4.1.7 For countersunk sleeved fastener configurations including GromEx (Geometry Codes S1, S4 and G2), the transition radii are defined in Section 4.3.9 for the respective fastener system. Chamfers are not permissible for these applications.

4.1.8 For countersunk tapered shank fasteners, transition radii are defined in Section 4.3.1.3.6.

4.2 Protruding Head requirements

4.2.1 Holes for use with protruding head fasteners shall conform to the geometry requirements defined in Figure 3. A chamfer or radius with dimensions as defined in Table 2 shall be machined on the head side to accommodate the fastener underhead radius. If universal head blind fasteners are used, chamfering of the hole is not necessary if the transition between underside of the manufactured head and stem has an undercut.

4.2.2 For solid rivets, there is no radius or chamfer under head.

4.2.3 For blind fasteners, the radius and chamfers under head are given in the AIPS01-02-013 for “pull type” blind fasteners and in the AIPS01-02-015 for “threaded type” blind fasteners.

4.2.4 Underhead radii for use with protruding head sleeved fastener configurations including GromEx (Geometry Codes S2, S5, G1 and G3) are defined in Section 4.3.9 for the respective fastener system. Chamfers are not permissible for these applications.

4.3 Hole Diameter requirements

4.3.1 Shear fasteners (bolt / Lockbolt)

4.3.1.1 Composite/Composite, Composite/Metallic or Metallic/Composite/Metallic Assemblies (including hard metals).

4.3.1.1.1 Hole diameter ‘D’ requirements presented in Table 3 (hole tolerance code ‘V1’) and Table 4 (hole code ‘V2’) are for high clearance fit assemblies involving low load transfer designated applications. Depending on the fastener diameter, these dimensions will result in a clearance between the fastener shank and the hole wall ranging from a minimum 0,002mm up to a maximum of 0,133mm.

4.3.1.1.2 Hole diameter ‘D’ requirements presented in Table 5 (hole tolerance code ‘V3’) and Table 6 (hole code ‘V4’) will result in a reduced level of clearance and are for use in high load transfer designated applications. Depending on the fastener diameter, these dimensions will result in a clearance between the fastener shank and the hole wall ranging from a minimum 0,002mm up to a maximum of 0,095mm.

4.3.1.2 Aluminum/Composite/Aluminum Assemblies

4.3.1.2.1 Hole diameter ‘D’ requirements presented in Table 7 (hole tolerance code ‘V5’) are for transition fit installation of shear bolts in Aluminum / Composite / Aluminum sandwich structures. Depending on the fastener diameter the fit will range from a minimum -0,025mm (interference) to a maximum of 0,085mm (clearance). These dimensions shall not be applied to Composite /

Composite or to Composite / metallic assemblies (i.e. where the Composite member is not fully supported on both sides by a metallic structure).

4.3.1.2.2 Hole diameter ‘D’ requirements presented in Table 8 (hole tolerance code ‘V6’) are for moderate interference fit installation of shear bolts in Aluminum / Composite / Aluminum sandwich structures. Depending on the fastener diameter the interference achieved will range from a minimum -0,025mm to a maximum of -0,121mm. These dimensions shall not be applied to Composite / Composite or to Composite / metallic assemblies (i.e. where the Composite member is not fully supported on both sides by a metallic structure).

4.3.1.3 Aluminum/Aluminum assemblies

4.3.1.3.1 Hole diameter ‘D’ requirements presented in Table 9 are for moderate clearance fit assemblies (hole tolerance code ‘M1’). Depending on the diameter, the clearance of the fit will range from a minimum of 0,002mm up to a maximum of 0,099mm.

4.3.1.3.2 Hole diameter ‘D’ requirements presented in Table 10 are for standard transition fit assemblies (hole tolerance code ‘M2’). Depending on the diameter, the fit will range from a minimum of -0,028mm (interference) up to a maximum of 0,055mm (clearance).

4.3.1.3.3 Hole diameter ‘D’ requirements presented in Table 11 are for reduced transition fit assemblies (hole tolerance code ‘M3’). Depending on the diameter, the fit will range from a minimum of -0,083mm (interference) up to a maximum of 0,015mm (clearance).

4.3.1.3.4 Hole diameter ‘D’ requirements presented in Table 12 are for shear bolts and Lockbolts in moderate interference fit assemblies (hole tolerance code ‘M4’) after cold working or without cold working to avoid rotation during tightening. Depending on the diameter, the interference of the fit will range from a minimum of -0,010mm up to a maximum of -0,121mm.

4.3.1.3.5 Hole diameter ‘D’ requirements presented in Table 13 are for pull in, pull stem and Lockbolts in high interference fit assemblies (hole tolerance code ‘M5’). Depending on the diameter, the interference of the fit will range from a minimum of -0,030mm up to a maximum of -0,204mm.

4.3.1.3.6 Hole diameters, countersink transition and underhead radii for use with countersunk tapered shank fasteners installed in accordance with the AIPS01-02-002 are provided in Table 14 and Figure 4 (hole tolerance code M6).

4.3.1.3.7 Hole diameters and underhead radii for use with protruding tapered shank fasteners installed in accordance with the AIPS01-02-002 are provided in Table 15 and Figure 5 (hole tolerance code M7).

4.3.1.4 Fiber metal laminate (FML) assemblies

4.3.1.4.1 Hole diameter ‘D’ requirements presented in Table 16 are for non-coated (anodized) shear bolts and Lockbolts in reduced transition fit assemblies (hole tolerance code ‘U1’). Depending on the diameter, the fit will range from a minimum of -0,043mm (interference) up to a maximum of 0,036mm (clearance).

4.3.1.5 Hard Metal/Hard Metal or Hard Metal/Aluminum assemblies

4.3.1.5.1 Hole diameter ‘D’ requirements presented in Table 17 are for clearance fit assemblies (hole tolerance code ‘H1’). Depending on the diameter, the clearance of the fit will range from a minimum of 0,010mm up to a maximum of 0,080mm.

Hole diameter ‘D’ requirements presented in Table 18 are for transition fit assemblies (hole tolerance code ‘H2’). Depending on the diameter, the fit will range from a minimum of -0,003mm (interference) up to a maximum of 0,121mm (clearance).

4.3.2 Solid rivets

4.3.2.1 For solid rivets from Aluminum, Aluminum alloy, Titanium Niobium (44.5Cb) and Monel (NiCu31). Hole diameter ‘D’ requirements presented in Table 19 are for clearance (interference only after squeezing) fit assemblies (hole tolerance code ‘R’).

4.3.2.2 For Aluminum alloy solid rivet installation in FML and FML / Aluminum material, hole diameter ‘D’ requirements presented in Table 19 shall be applied (hole tolerance code ‘R’).

4.3.3 Tension Fasteners

4.3.3.1 Hole diameter ‘D’ requirements presented in Table 20 are for high clearance fit assemblies for pure tension applications (hole tolerance code ‘T1’). Depending on the diameter, the clearance of the fit will range from a minimum of 0,200mm up to a maximum of 0,500mm.

4.3.3.2 Hole diameter ‘D’ requirements presented in Table 21 are for low clearance fit assemblies for tension & shear applications (hole tolerance code ‘T2’). Depending on the diameter, the clearance will range from a minimum of 0,002mm up to a maximum of 0,099mm.

4.3.3.3 Hole diameter ‘D’ requirements presented in Table 22 are for low clearance fit hard metal / hard metal assemblies for tension & shear applications (hole tolerance code ‘T4’). Depending on the diameter, the clearance will range from a minimum of 0,010mm up to a maximum of 0,080mm.

4.3.4 Blind fasteners

4.3.4.1 “Pull type” blind bolts and blind rivets

4.3.4.1.1 For standard “Pull type” blind bolts, hole tolerance Type A according to AIPS01-02-013, hole diameter requirements are presented in Table 23 (hole tolerance code ’B1’).

4.3.4.1.2 For standard “Pull type” blind bolts, hole tolerance Type B according to AIPS01-02-013, hole diameter requirements are presented in Table 24 (hole tolerance code ’B2’).

4.3.4.1.3 For blind rivets (except for ABS0112 and ASNA0079/0080) installed in metallic assemblies, hole diameters requirements are presented in Table 25 (hole tolerance code ‘B3’).

4.3.4.1.4 For ABS0112 blind rivets, hole diameter requirements are presented in Table 26 (hole tolerance code ‘B4’).

4.3.4.1.5 For ASNA0079/80 blind rivets, hole diameter requirements are presented in Table 27 (hole tolerance code ‘B5’).

4.3.4.1.6 For NAS1919 and NAS1921 installed in composite assemblies, hole diameter requirements are presented in Table 28 (hole tolerance code ‘K1’)

4.3.4.1.7 For ABS2322 and ABS2323 blind bolt, hole diameter requirements are presented in Table 9 (hole tolerance code ‘M1’).

4.3.4.2 “Threaded type” blind bolts

4.3.4.2.1 Hole diameter requirements for “threaded type” Type A (hole tolerance code ‘B6’) and Type B (hole tolerance code ‘B7’) blind bolts (except for ASNA0081/0082) installed according to AIPS01-02-015 are presented in Table 29.

4.3.4.2.2 Hole diameter requirements for ASNA0081/0082, “threaded type” Type A (hole tolerance code ‘B8’) and Type B (hole tolerance code ‘B9’) blind bolts installed according to AIPS01-02-015 are presented in Table 30.

4.3.4.3 Blind Rivet Nuts

4.3.4.3.1 Hole geometries (Geometry Code R3) and dimensions (hole tolerance code F1) for NAS1329/1330 round head blind rivet nuts per AIPS01-02-027 are presented in Figure 6 and Table 31.

4.3.4.3.2 Hole geometries (Geometry Code R4) and dimensions (hole tolerance code F2) for use with NAS1734 and NAS1735 oval countersink head blind rivet nuts installed to AIPS01-02-027 are defined in Figure 7 and Table 32.

4.3.4.3.3 Hole geometries (Geometry Code R5) and dimensions (hole tolerance code F3) for use with ASNA2065 crimped nuts installed to AIPS01-02-027 are defined in Figure 8 and Table 33.

4.3.5 Head tightened bolts

4.3.5.1 Hole diameters ‘D’ requirements presented in Table 34 are for low clearance fit assemblies for head tightened bolts with floating or fixed anchor nuts or free-running nuts applications (hole tolerance code ‘T3’).

4.3.6 Floating, fixed nuts

4.3.6.1 Hole diameters ’D’ requirements presented in Table 35 are for non-floating anchor nuts assemblies in primary structures, secondary structures and equipment (hole tolerance code ‘N1’).

4.3.6.2 Hole diameters ’D’ requirements presented in Table 35 are for floating anchor nuts assemblies in primary structures, secondary structures and equipment (hole tolerance code ‘N2’).

4.3.6.3 Hole diameters ’D’ requirements presented in Table 35 are for high floating anchor nuts assemblies in primary structures, secondary structures and equipment (hole tolerance code ‘N3’).

4.3.6.4 Hole diameters ’D’ requirements presented in Table 35 are for low floating anchor nuts assemblies in primary structures, secondary structures and equipment (hole tolerance code ‘N10’).

4.3.7 Rivet-less Nut-plates

4.3.7.1 Hole diameters ‘D’ requirements presented in Table 36 are for Rivet-less nut-plates with normal float A (hole tolerance code ‘N4’) and in Table 37 are for Rivet-less nut-plates with large float B (hole tolerance code ‘N5’) installed in Aluminum materials (the ABS1295 shall not be used on all Al alloys, refer to AIPS01-02-016).

4.3.7.2 Hole diameters ‘D’ requirements presented in Table 38 are for Rivet-less nut-plates with normal float A (hole tolerance code ‘N8’) and in Table 39 are for Rivet-less nut-plates with large float B (hole tolerance code ‘N9’) installed in Titanium materials (the ABS1295 shall not be used on all Ti alloys, refer to AIPS01-02-016).

4.3.8 Clip nuts

4.3.8.1 Hole diameters ‘D’ requirements presented in Figure 9 and Table 40 are for clip nuts installed inside the panel (hole tolerance code ‘N6’).

4.3.8.2 Hole diameters ‘D’ requirements presented in Figure 10 and Table 41 are for clip nuts installed on panel edge (hole code ‘N7’).

4.3.9 Sleeved Fasteners and Sleeves for Lightning Strike Protection in Composite/Composite, Composite/Metallic or Metallic/Composite/Metallic Assemblies

4.3.9.1 Hole diameters, countersink transition and underhead radii for use with ABS1776, ABS1778 and ABS1820 Titanium sleeved countersunk head (geometry code S1) and ABS1741 and ABS1745 CRES sleeved protruding head (geometry code S2) radial expansion bolts and lock bolts are provided in Table 42 (hole tolerance code L1) and Table 43 (hole tolerance code L2). These dimensions are applicable to fasteners installed in fuel tank structures and will result in an interference fit on installation (these fasteners shall not be used on all type of assemblies, refer to AIPS01-03-008).

4.3.9.2 Hole diameters, countersink transition and underhead radii for use with countersunk (geometry code S4) and protruding head (geometry code S5) tapered sleeve bolts (ABS1742 and ABS1743) are provided in Table 44 (hole tolerance code L3). These dimensions are applicable to fasteners installed in fuel tank structures and will result in an interference fit on installation (these fasteners shall not be used on all type of assemblies, refer to AIPS01-03-006).

4.3.9.3 Hole diameters, countersink transition and underhead radii for use with protruding (geometry code G1) and 100° countersunk head (geometry code G2) ABS1754 and ABS1770 GromEx sleeves are provided in Table 45. (hole tolerance code L4).

4.3.9.4 Hole Dimensions for use with ABS1754 protruding head sleeves and pull-in interference fit ABS1774 tension bolts (hole tolerance code L5, geometry code G3). are provided in Table 46. (it is no longer applicable for use in design or manufacturing).

4.3.9.5 Hole diameters, countersink transition and under head radii for use with 100° countersunk head (geometry code G4) ABS1807 GromEx sleeves are provided in Table 47. (hole tolerance code L6).

When used with non-coated sulphuric acid anodized fasteners (e.g. EN6114, EN6115) these diameters will provide for a close tolerance clearance fit between the installed fastener and GromEx sleeve. These dimensions should not be applied to multi-element stacks subject to shear and fatigue loading (these GromEx sleeves shall not be used on all type of assemblies, refer to AIPS01-03-009).

4.3.10 Snap & Click brackets

4.3.10.1 Hole geometry and dimensions for Snap & Click brackets (hole tolerance code reference W1) installed only in Aluminum and Titanium parts are provided in Table 48.

4.4 Spot face Requirements

4.4.1 Spot facing is not permitted in Composite materials. For metallic materials spot facing shall only be used when required on the drawing and where a spot face code is used in the call up (refer to paragraph 5). Spot face geometry and dimensions shall conform to the requirements of Figure 11 and Table 49.

4.5 General Requirements

4.5.1 Unless otherwise stated, hole quality shall be conform to AIPS01-02-003 (metallic materials) and AIPS01-02-005 (composite material and mixed assemblies).

4.5.2 This standard shall not be used unless called for on the drawing.

4.5.3 Any variance from the information in this standard shall be recorded on the drawing.

4.5.4 Drawings shall state: (a) call-up required (refer to paragraph 4); and (b) face on which the bolt head seats (i.e. face to be countersunk or chamfered).

4.5.5 Oversize values shall only be applied in case of rework or repair as defined in ABS1771.

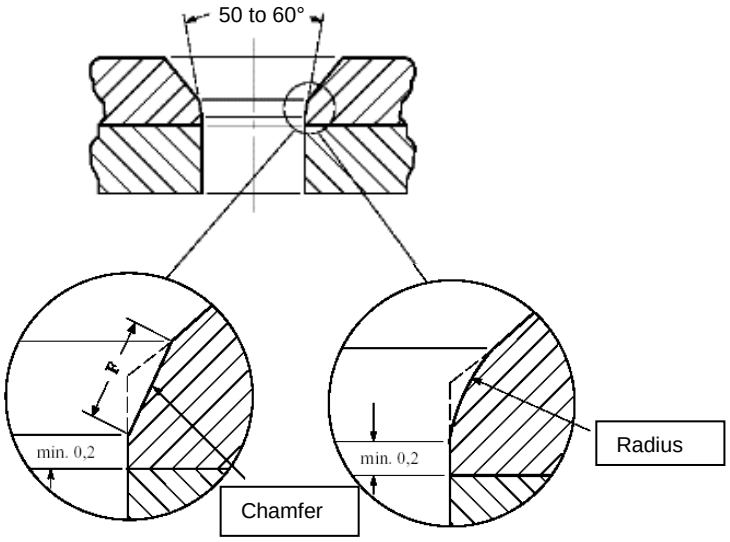


Figure 1: Transition radius / chamfer at the intersection between the hole countersink and bore and cylindrical thickness.

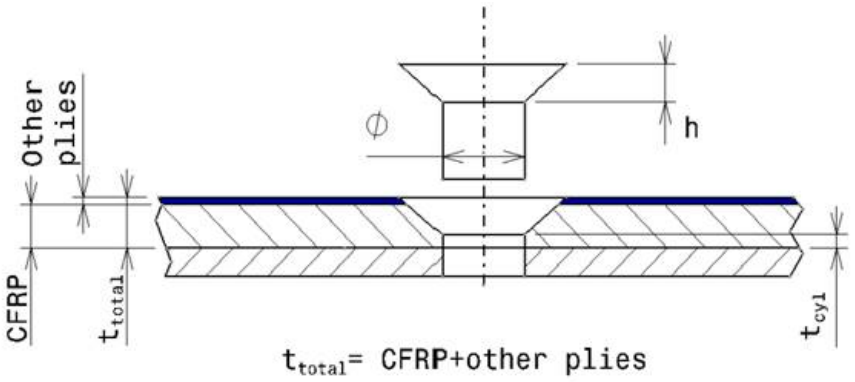


Figure 2: Minimum cylindrical thickness

Table 1: Transition radius / chamfer dimensions for use with 100° & 130° countersink fasteners (not applicable for solid rivets, blind fasteners, sleeve fasteners and tapered shank fasteners)

Dimensions in mm

Diameter code	Nominal Diameter	Recommended Chamfer / Radius				Reduced Chamfer / Radius[1,2,3]			
		R[4]		F[4]		R		F	
		Min	Max	Min	Max	Min	Max	Min	Max
2	4,17	0,8	1,0	0,7	0,9	0,5	0,7	0,4	0,6
3	4,76	0,8	1,0	0,7	0,9	0,5	0,7	0,4	0,6
3A	5,56	0,8	1,0	0,7	0,9	0,5	0,7	0,4	0,6
4	6,35	0,8	1,0	0,7	0,9	0,5	0,7	0,4	0,6
5	7,94	1,0	1,3	0,9	1,1	0,8	1,0	0,7	0,9
6	9,53	1,0	1,3	0,9	1,1	0,8	1,0	0,7	0,9
7	11,11	1,3	1,5	1,1	1,3	1,1	1,3	0,9	1,1
8	12,70	1,3	1,5	1,1	1,3	1,1	1,3	0,9	1,1
9	14,29	1,3	1,5	1,1	1,3	1,1	1,3	0,9	1,1
10	15,88	1,3	1,5	1,1	1,3	1,1	1,3	0,9	1,1
12	19,05	1,5	1,8	1,3	1,5	1,1	1,3	0,9	1,1
14	22,23	1,5	1,8	1,3	1,5	1,1	1,3	0,9	1,1
16	25,40	1,5	1,8	1,3	1,5	1,1	1,3	0,9	1,1
18	28,58	1,8	2,0	-	-	-	-	-	-
19	30,16	1,8	2,0	-	-	-	-	-	-
20	31,75	1,8	2,0	-	-	-	-	-	-
22	34,93	1,8	2,0	-	-	-	-	-	-

1. Not to be used on wing applications without the prior approval of the Design Authority.
2. Use of reduced radius mandatory for EN6050, MBBN4481 and ABS0548 fasteners installed in Al.
3. Use of reduced chamfer / radius is mandatory for 130° countersunk head fasteners and Lockbolts in Composite and metallic materials.
4. Inadmissible to be used in thin part (≤ 3 mm). Reduced chamfer & radius shall be used instead.

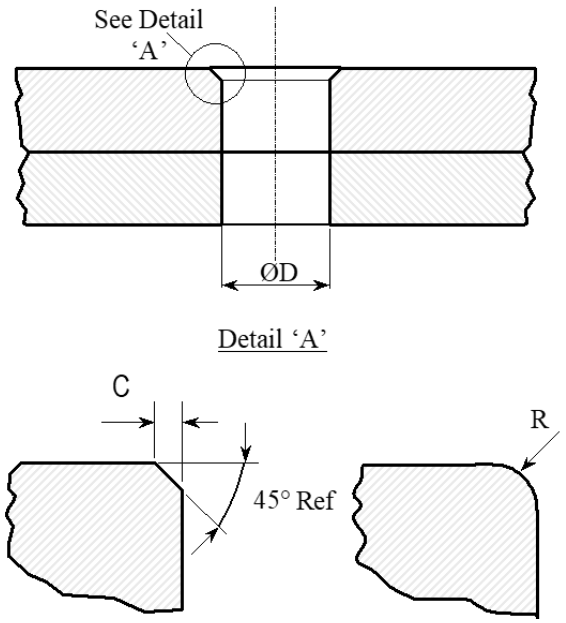


Figure 3: Hole Configuration for use with Protruding Head Bolts

Table 2: Head-side chamfer / radius dimensions for use with protruding head fasteners (Not applicable for use with countersunk head fasteners, solid rivets, blind fasteners and sleeve fasteners)

Dimensions in mm

Diameter Code	Nominal Diameter	Shear Bolts								Tension Bolts (Code P3)[2]			
		Recommended (Code P1)				Reduced (Code P2)[1]							
		Radius (R)		Chamfer (C)		Radius (R)		Chamfer (C)		Radius (R)		Chamfer (C)	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
2	4,17	0,6	0,9	0,6	0,9	0,6	0,7	0,40	0,50	-	-	-	-
3	4,76	0,6	0,9	0,6	0,9	0,6	0,7	0,40	0,50	1,0	1,3	1,05	1,15
3A	5,56	0,6	0,9	0,6	0,9	0,6	0,7	0,40	0,50	-	-	-	-
4	6,35	0,6	0,9	0,6	0,9	0,6	0,7	0,40	0,50	1,0	1,3	1,05	1,15
5	7,94	0,8	1,0	0,8	1,0	0,7	0,8	0,50	0,60	1,0	1,3	1,05	1,15
6	9,53	0,8	1,0	0,8	1,0	0,7	0,8	0,50	0,60	1,4	1,7	1,45	1,55
7	11,11	0,8	1,0	0,8	1,0	0,7	0,8	0,50	0,60	1,4	1,7	1,45	1,55
8	12,70	0,8	1,0	0,8	1,0	0,7	0,8	0,50	0,60	1,4	1,7	1,55	1,65
9	14,29	1,0	1,3	1,0	1,3	0,8	0,9	0,65	0,75	1,4	1,7	1,9	2,0
10	15,88	1,0	1,3	1,0	1,3	0,8	0,9	0,65	0,75	1,9	2,2	1,9	2,0
12	19,05	1,1	1,4	1,1	1,4	-	-	-	-	1,9	2,2	1,9	2,0
14	22,23	1,3	1,5	1,3	1,5	-	-	-	-	1,9	2,2	1,9	2,0
16	25,40	1,5	1,8	1,5	1,8	-	-	-	-	1,9	2,2	1,9	2,0
18	28,58	1,8	2,0	1,8	2,0	-	-	-	-	1,9	2,2	1,9	2,0
19	30,16	N/A	N/A	N/A	N/A	-	-	-	-	2,3	2,5	2,3	2,4
20	31,75	1,95	2,20	1,95	2,20	-	-	-	-	2,3	2,5	2,3	2,4
22	34,93	2,25	2,40	2,25	2,40	-	-	-	-	2,3	2,5	2,3	2,4

1) Geometry Code P2 not to be used on wing applications without the prior authorization of the Design Authority.

2) For use with tension bolts (e.g. NSA5378, ABS1830, MS21250) and ASNA0093.

Table 3: Hole diameters for use high clearance fit assemblies with non-coated (anodized) shear bolts in low load transfer applications (hole tolerance code 'V1') for Composite / Composite, Composite / Metallic or Metallic/Composite/Metallic assemblies. Also applicable for assemblies of Composite and hard metal parts.

Dimensions in mm

Diameter Code	Nominal Diameter	Clearance (+)		Hole Diameter 'D'							
				Standard		1st Oversize (Code X)		2nd Oversize (Code Y)		3rd Oversize (Code Z)	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
2	4,17	0,002	0,075	4,155	4,215	-	-	-	-	-	-
3	4,76	0,002	0,075	4,815	4,875	5,148	5,209	-	-	-	-
3A	5,56	0,002	0,075	5,544	5,604	5,941	6,002	-	-	-	-
4	6,35	0,002	0,085	6,339	6,410	6,736	6,807	7,132	7,203	-	-
5	7,94	0,002	0,085	7,927	7,998	8,323	8,394	8,719	8,790	-	-
6	9,53	0,002	0,085	9,514	9,585	9,911	9,982	10,307	10,378	-	-
7	11,11	0,005	0,100	11,105	11,187	11,501	11,584	11,897	11,980	-	-
8	12,70	0,005	0,100	12,692	12,774	13,089	13,172	13,485	13,568	-	-
9	14,29	0,005	0,100	14,267	14,349	14,663	14,746	15,060	15,143	-	-
10	15,88	0,005	0,100	15,854	15,936	16,251	16,334	16,647	16,730	17,442	17,525
12	19,05	0,008	0,118	19,032	19,129	19,429	19,527	19,825	19,923	20,620	20,718
14	22,23	0,008	0,118	22,208	22,305	22,604	22,702	23,000	23,098	23,795	23,893
16	25,40	0,008	0,118	25,383	25,480	25,779	25,877	26,175	26,273	26,970	27,068
18	28,58	0,008	0,118	28,557	28,654	28,953	29,050	29,350	29,415	-	-
19	30,16	0,012	0,133	30,149	30,245	30,545	30,641	30,941	31,037	-	-
20	31,75	0,012	0,133	31,733	31,846	32,129	32,242	32,526	32,639	-	-
22	34,93	0,012	0,133	34,908	35,021	35,304	35,417	35,701	35,814	-	-

Table 4: Hole diameters for high clearance fit assemblies with coated shear bolts in low load transfer applications (hole tolerance code 'V2') for Composite / Composite, Composite / Metallic or Metallic/Composite/Metallic assemblies. Also applicable for assemblies of Composite and hard metal parts.

Dimensions in mm

Diameter Code	Nominal Diameter	Clearance (+)		Hole Diameter 'D'							
				Standard		1st Oversize (Code X)		2nd Oversize (Code Y)		3rd Oversize (Code Z)	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
2	4,17	0,002	0,075	4,155	4,203	-	-	-	-	-	-
3	4,76	0,002	0,075	4,815	4,863	5,148	5,196	-	-	-	-
3A	5,56	0,002	0,075	5,544	5,592	5,941	5,989	-	-	-	-
4	6,35	0,002	0,085	6,339	6,397	6,736	6,793	7,132	7,189	-	-
5	7,94	0,002	0,085	7,927	7,984	8,323	8,381	8,719	8,777	-	-
6	9,53	0,002	0,085	9,514	9,572	9,911	9,968	10,307	10,364	-	-
7	11,11	0,005	0,100	11,104	11,17	11,501	11,571	11,897	11,967	-	-
8	12,70	0,005	0,100	12,692	12,76	13,089	13,158	13,485	13,554	-	-
9	14,29	0,005	0,100	14,267	14,33	14,663	14,733	15,060	15,129	-	-
10	15,88	0,005	0,100	15,854	15,92	16,251	16,32	16,647	16,717	17,442	17,512
12	19,05	0,008	0,118	19,032	19,11	19,429	19,514	19,825	19,910	20,620	20,705
14	22,23	0,008	0,118	22,208	22,29	22,604	22,689	23,000	23,085	23,795	23,880
16	25,40	0,008	0,118	25,383	25,46	25,779	25,864	26,175	26,260	26,970	27,055
18	28,58	0,008	0,118	28,557	28,64	28,953	29,037	29,350	29,402	-	-
19	30,16	0,012	0,133	30,149	30,23	30,545	30,628	30,941	31,024	-	-
20	31,75	0,012	0,133	31,733	31,83	32,129	32,229	32,526	32,626	-	-
22	34,93	0,012	0,133	34,908	35,00	35,304	35,404	35,701	35,801	-	-

Table 5: Hole diameters for use in low clearance fit assemblies with non-coated (anodized) shear bolts in high load transfer applications (hole tolerance code 'V3') for Composite /Composite, Composite / Metallic or Metallic/Composite/Metallic assemblies. Also applicable for assemblies of Composite and hard metal parts.

Dimensions in mm

Diameter Code	Nominal Diameter	Clearance (+)		Hole Diameter 'D'							
				Standard		1st Oversize (Code X)		2nd Oversize (Code Y)		3rd Oversize (Code Z)	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
2	4,17	0,002	0,057	4,155	4,197	-	-	-	-	-	-
3	4,76	0,002	0,057	4,815	4,858	5,148	5,191	-	-	-	-
3A	5,56	0,002	0,057	5,544	5,586	5,941	5,984	-	-	-	-
4	6,35	0,002	0,065	6,339	6,390	6,736	6,787	7,132	7,183	-	-
5	7,94	0,002	0,065	7,927	7,978	8,323	8,374	8,719	8,770	-	-
6	9,53	0,002	0,065	9,514	9,565	9,911	9,962	10,307	10,358	-	-
7	11,11	0,005	0,073	11,105	11,160	11,501	11,557	11,897	11,953	-	-
8	12,70	0,005	0,073	12,692	12,748	13,089	13,145	13,485	13,541	-	-
9	14,29	0,005	0,073	14,267	14,322	14,663	14,719	15,060	15,116	-	-
10	15,88	0,005	0,073	15,854	15,909	16,251	16,307	16,647	16,703	17,442	17,498
12	19,05	0,008	0,085	19,032	19,097	19,429	19,494	19,825	19,890	20,620	20,685
14	22,23	0,008	0,085	22,208	22,272	22,604	22,669	23,000	23,065	23,795	23,860
16	25,40	0,008	0,085	25,383	25,447	25,779	25,844	26,175	26,240	26,970	27,035
18	28,58	0,008	0,085	28,557	28,622	28,954	29,019	29,351	29,416	-	-
19	30,16	0,012	0,095	30,149	30,207	30,545	30,603	30,941	30,999	-	-
20	31,75	0,012	0,095	31,733	31,808	32,130	32,205	32,527	32,602	-	-
22	34,93	0,012	0,095	34,908	34,983	35,305	35,380	35,702	35,777	-	-

Table 6: Hole diameters for low clearance fit assemblies with coated shear bolts in high load transfer applications (hole tolerance code 'V4') for Composite / Composite, Composite / Metallic or Metallic/Composite/Metallic assemblies. Also applicable for assemblies of Composite and hard metal parts.

Dimensions in mm

Diameter Code	Nominal Diameter	Clearance (+)		Hole Diameter 'D'							
				Standard		1st Oversize (Code X)		2nd Oversize (Code Y)		3rd Oversize (Code Z)	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
2	4,17	0,002	0,057	4,155	4,185	-	-	-	-	-	-
3	4,76	0,002	0,057	4,815	4,845	5,148	5,178	-	-	-	-
3A	5,56	0,002	0,057	5,544	5,574	5,941	5,971	-	-	-	-
4	6,35	0,002	0,065	6,339	6,377	6,736	6,773	7,132	7,169	-	-
5	7,94	0,002	0,065	7,927	7,964	8,323	8,361	8,719	8,757	-	-
6	9,53	0,002	0,065	9,514	9,552	9,911	9,948	10,307	10,344	-	-
7	11,11	0,005	0,073	11,104	11,147	11,501	11,544	11,897	11,94	-	-
8	12,70	0,005	0,073	12,692	12,735	13,089	13,131	13,485	13,527	-	-
9	14,29	0,005	0,073	14,267	14,310	14,663	14,706	15,060	15,102	-	-
10	15,88	0,005	0,073	15,854	15,897	16,251	16,293	16,647	16,690	17,442	17,485
12	19,05	0,008	0,085	19,032	19,084	19,429	19,481	19,825	19,877	20,620	20,672
14	22,23	0,008	0,085	22,208	22,259	22,604	22,656	23,000	23,052	23,795	23,847
16	25,40	0,008	0,085	25,383	25,434	25,779	25,831	26,175	26,227	26,970	27,022
18	28,58	0,008	0,085	28,557	28,609	28,954	29,006	29,351	29,403	-	-
19	30,16	0,012	0,095	30,149	30,194	30,545	30,590	30,941	30,986	-	-
20	31,75	0,012	0,095	31,733	31,795	32,130	32,192	32,527	32,589	-	-
22	34,93	0,012	0,095	34,908	34,970	35,305	35,367	35,702	35,764	-	-

Table 7: Hole diameters for use for transition fit assemblies (hole tolerance code 'V5') for Aluminum / Composite / Aluminum assemblies.

Dimensions in mm

Diameter Code	Nominal Diameter	Transition (±)		Hole Diameter 'D'							
				Standard		1st Oversize (Code X)		2nd Oversize (Code Y)		3nd Oversize (Code Z)	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
3	4,76	-0,016	0,057	4,797	4,845	5,130	5,178	-	-	-	-
3A	5,56	-0,016	0,057	5,526	5,574	5,923	5,971	-	-	-	-
4	6,35	-0,018	0,065	6,319	6,377	6,716	6,774	7,112	7,169	-	-
5	7,94	-0,018	0,065	7,907	7,965	8,303	8,361	8,699	8,757	-	-
6	9,53	-0,018	0,065	9,494	9,552	9,891	9,948	10,283	10,352	-	-
7	11,11	-0,022	0,073	11,078	11,148	11,474	11,544	11,870	11,940	-	-
8	12,70	-0,022	0,073	12,665	12,735	13,062	13,131	13,458	13,527	-	-
9	14,29	-0,022	0,073	14,240	14,310	14,636	14,706	15,033	15,102	-	-
10	15,88	-0,022	0,073	15,827	15,897	16,224	16,293	16,620	16,690	17,415	17,485
12	19,05	-0,025	0,085	18,999	19,084	19,396	19,481	19,792	19,877	20,587	20,672
14	22,23	-0,025	0,085	22,174	22,259	22,571	22,656	22,967	23,052	23,762	23,847
16	25,40	-0,025	0,085	25,350	25,434	25,746	25,831	26,142	26,227	26,937	27,022

Table 8: Hole diameters for moderate interference fit assemblies (hole tolerance code 'V6') for Aluminum / Composite / Aluminum assemblies.

Dimensions in mm

Diameter Code	Nominal Diameter	Interference (-)		Hole Diameter 'D'							
				Standard		1st Oversize (Code X)		2nd Oversize (Code Y)		3nd Oversize (Code Z)	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
6	9,53	-0,020	-0,085	9,427	9,467	9,824	9,863	10,217	10,259	-	-
7	11,11	-0,026	-0,093	11,007	11,049	11,403	11,446	11,799	11,842	-	-
8	12,70	-0,026	-0,093	12,594	12,637	12,991	13,033	13,387	13,429	-	-
9	14,29	-0,030	-0,098	14,164	14,207	14,560	14,603	14,957	14,999	-	-
10	15,88	-0,030	-0,098	15,752	15,794	16,148	16,190	16,544	16,587	17,339	17,382
12	19,05	-0,035	-0,112	18,912	18,964	19,309	19,361	19,705	19,757	20,500	20,552
14	22,23	-0,040	-0,116	22,083	22,134	22,480	22,531	22,876	22,927	23,671	23,722
16	25,40	-0,045	-0,121	25,253	25,304	25,650	25,701	26,046	26,097	26,841	26,892

Table 9: Hole diameters for clearance fit assemblies with shear bolts (Hole Tolerance Code 'M1') and Blind bolts ABS2322 and ABS2323 for Aluminum / Aluminum assemblies.

Dimensions in mm

Diameter Code	Diameter code ABS2322 ABS2323	Nominal Diameter	Clearance (+)		Hole Diameter 'D'							
					Standard		1st Oversize (Code X)		2nd Oversize (Code Y)		3rd Oversize (Code Z)	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
2	5	4,17	0,002	0,062	4,155	4,190	-	-	-	-	-	-
3	6	4,76	0,002	0,067	4,815	4,855	5,148	5,188	-	-	-	-
3A	-	5,56	0,002	0,067	5,544	5,584	5,941	5,981	-	-	-	-
4	8	6,35	0,002	0,067	6,339	6,379	6,736	6,776	7,132	7,171	-	-
5	10	7,94	0,002	0,067	7,927	7,967	8,323	8,363	8,719	8,759	-	-
6	-	9,53	0,002	0,067	9,514	9,554	9,911	9,950	10,310	10,352	-	-
7	-	11,11	0,005	0,073	11,105	11,148	11,501	11,544	11,897	11,940	-	-
8	-	12,70	0,005	0,073	12,692	12,735	13,089	13,131	13,485	13,527	-	-
9	-	14,29	0,005	0,073	14,267	14,310	14,663	14,706	15,060	15,102	-	-
10	-	15,88	0,005	0,073	15,854	15,897	16,251	16,293	16,647	16,690	17,442	17,485
12	-	19,05	0,008	0,085	19,032	19,084	19,429	19,481	19,825	19,877	20,620	20,672
14	-	22,23	0,008	0,085	22,207	22,259	22,604	22,656	23,000	23,052	23,795	23,847
16	-	25,40	0,008	0,085	25,382	25,434	25,779	25,831	26,175	26,227	26,970	27,022
18	-	28,58	0,008	0,085	28,558	28,610	28,955	29,007	29,351	29,403	30,146	30,198
19	-	30,16	0,012	0,099	30,149	30,198	30,545	30,594	30,941	30,990	31,337	31,386
20	-	31,75	0,012	0,099	31,737	31,799	32,134	32,196	32,530	32,592	33,325	33,387
22	-	34,93	0,012	0,099	34,912	34,974	35,309	35,371	35,705	35,767	36,500	36,562

Table 10: Hole diameters for standard transition fit assemblies with shear bolts (Hole tolerance Code 'M2') for Aluminum / Aluminum assemblies.

Dimensions in mm

Diameter Code	Nominal Diameter	Interference (-) to clearance (+)		Hole Diameter 'D'							
				Standard		1st Oversize (Code X)		2nd Oversize (Code Y)		3rd Oversize (Code Z)	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
2	4,17	-0,028	0,032	4,125	4,160	-	-	-	-	-	-
3	4,76	-0,033	0,032	4,780	4,820	5,113	5,153	-	-	-	-
3A	5,56	-0,030	0,035	5,512	5,552	5,909	5,949	-	-	-	-
4	6,35	-0,027	0,038	6,310	6,350	6,707	6,747	7,103	7,142	-	-
5	7,94	-0,025	0,040	7,900	7,940	8,296	8,336	8,692	8,732	-	-
6	9,53	-0,022	0,043	9,490	9,530	9,887	9,926	10,283	10,322	-	-
7	11,11	-0,020	0,045	11,080	11,120	11,476	11,516	11,872	11,912	-	-
8	12,70	-0,017	0,048	12,670	12,710	13,067	13,106	13,463	13,502	-	-
9	14,29	-0,015	0,050	14,247	14,287	14,643	14,683	15,040	15,079	-	-
10	15,88	-0,013	0,052	15,836	15,876	16,233	16,272	16,629	16,669	17,424	17,464
12	19,05	-0,011	0,054	19,013	19,053	19,410	19,450	19,806	19,846	20,601	20,641
14	22,23	-0,010	0,055	22,189	22,229	22,586	22,626	22,982	23,022	23,777	23,817
16	25,40	-0,010	0,055	25,364	25,404	25,761	25,801	26,157	26,197	26,952	26,992

Table 11: Hole diameters for reduced transition fit assemblies with anodized shear bolts and Lockbolts (Hole tolerance Code 'M3') for Aluminum / Aluminum assemblies (continued)

Dimensions in mm

Dia Code	Nom. Dia d	Interference (-) to clearance (+)*		Hole Diameter 'D'**							
				Standard				1st Oversize (Code X)			
		Min	Max	Min (t/d ≤ 3)	Min (t/d >3)	Max (t/d ≤ 3)	Max (t/d >3)	Min (t/d ≤ 3)	Min (t/d >3)	Max (t/d ≤ 3)	Max (t/d >3)
2	4,17	-0,073	0,015	4,080	4,120	4,155	4,150	-	-	-	-
3	4,76	-0,083	0,005	4,730	4,780	4,805	4,810	5,060	5,110	5,135	5,140
3A	5,56	-0,082	0,006	5,460	5,510	5,535	5,540	5,857	5,907	5,930	5,937
4	6,35	-0,077	-0,006	6,260	6,310	6,318	6,346	6,660	6,710	6,718	6,746
5	7,94	-0,075	-0,003	7,850	7,900	7,908	7,936	8,240	8,300	8,298	8,336
6	9,53	-0,062	0,008	9,450	9,490	9,508	9,526	9,840	9,880	9,898	9,916
7	11,11	-0,070	0,013	11,030	11,080	11,100	11,126	11,420	11,470	11,490	11,513

* Values only exact for standard diameters and t/d ≤ 3

** with t = joint material stack thickness

Table 11: Hole diameters for reduced transition fit assemblies with anodized shear bolts and Lockbolts (Hole tolerance Code 'M3') for Aluminum / Aluminum assemblies (concluded)

Dimensions in mm

Diameter Code	Nominal Diameter d	2nd Oversize (Code Y)			
		Min (t/d ≤ 3)	Min (t/d >3)	Max (t/d ≤ 3)	Max (t/d >3)
2	4,17	-	-	-	-
3	4,76	-	-	-	-
3A	5,56	-	-	-	-
4	6,35	7,060	7,100	7,118	7,136
5	7,94	8,650	8,690	8,708	8,726
6	9,53	10,240	10,280	10,310	10,323
7	11,11	11,830	11,870	11,900	11,913

Table 12: Hole diameters for moderate interference fit assemblies with shear bolts and Lockbolts (Hole tolerance Code 'M4') for Aluminum / Aluminum assemblies after cold working or without cold working to avoid rotation during tightening.

Dimensions in mm

Diameter Code	Nominal Diameter	Interference (-)		Hole Diameter 'D'							
				Standard		1st Oversize (Code X)		2nd Oversize (Code Y)		3nd Oversize (Code Z)	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
2	4,17	-0,010	-0,070	4,083	4,118	-	-	-	-	-	-
3	4,76	-0,010	-0,075	4,738	4,778	5,071	5,111	-	-	-	-
3A	5,56	-0,010	-0,075	5,467	5,507	5,864	5,904	-	-	-	-
4	6,35	-0,015	-0,080	6,257	6,297	6,654	6,694	7,050	7,089	-	-
5	7,94	-0,016	-0,081	7,844	7,884	8,240	8,280	8,636	8,676	-	-
6	9,53	-0,020	-0,085	9,427	9,467	9,824	9,863	10,217	10,259	-	-
7	11,11	-0,025	-0,093	11,007	11,049	11,403	11,446	11,799	11,842	-	-
8	12,70	-0,025	-0,093	12,594	12,637	12,991	13,033	13,387	13,429	-	-
9	14,29	-0,030	-0,098	14,164	14,207	14,560	14,603	14,957	14,999	-	-
10	15,88	-0,030	-0,097	15,752	15,794	16,148	16,190	16,544	16,587	17,339	17,382
12	19,05	-0,035	-0,112	18,912	18,964	19,309	19,361	19,705	19,757	20,500	20,552
14	22,23	-0,040	-0,116	22,083	22,134	22,480	22,531	22,876	22,927	23,671	23,722
16	25,40	-0,045	-0,121	25,253	25,304	25,650	25,701	26,046	26,097	26,841	26,892

Table 13: Hole diameters for high interference fit assemblies with pull-in, pull-stem and Lockbolts (Hole tolerance Code 'M5') for Aluminum / Aluminum assemblies.

Dimensions in mm

Diameter Code	Nominal Diameter	Interference (-)		Hole Diameter 'D'							
				Standard		1st Oversize (Code X)		2nd Oversize (Code Y)		3nd Oversize (Code Z)	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
2	4,17	-0,030	-0,090	4,063	4,098	-	-	-	-	-	-
3	4,76	-0,030	-0,095	4,718	4,758	5,051	5,091	-	-	-	-
3A	5,56	-0,035	-0,100	5,442	5,482	5,839	5,879	-	-	-	-
4	6,35	-0,050	-0,115	6,222	6,262	6,619	6,659	7,015	7,054	-	-
5	7,94	-0,051	-0,116	7,809	7,849	8,206	8,246	8,602	8,642	-	-
6	9,53	-0,060	-0,125	9,387	9,427	9,784	9,823	10,177	10,219	-	-
7	11,11	-0,067	-0,136	10,964	11,007	11,360	11,404	11,756	11,800	-	-
8	12,70	-0,077	-0,145	12,542	12,585	12,939	12,981	13,335	13,377	-	-
9	14,29	-0,087	-0,155	14,107	14,150	14,503	14,546	14,900	14,942	-	-
10	15,88	-0,087	-0,155	15,694	15,737	16,091	16,133	16,487	16,530	17,282	17,325
12	19,05	-0,095	-0,172	18,852	18,904	19,249	19,301	19,645	19,697	20,440	20,492
14	22,23	-0,111	-0,188	22,011	22,063	22,408	22,460	22,804	22,856	23,599	23,651
16	25,40	-0,127	-0,204	25,170	25,222	25,567	25,619	25,963	26,015	26,758	26,810

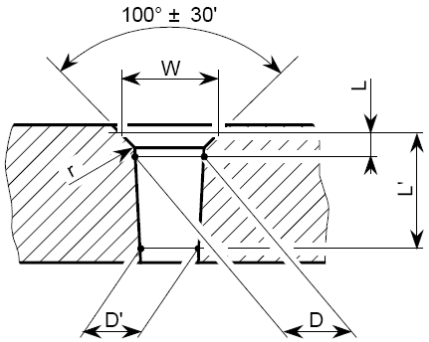


Figure 4: Hole Geometry (Geometry Code C9) and dimensional requirements for installation of Countersunk tapered shank bolt

Table 14: Hole Dimensions for countersunk tapered shank fasteners installed in accordance with AIPS01-02-002 in Aluminum/Aluminum assemblies (hole tolerance code M6)

Dimensions in mm

Diameter Code	Nominal Diameter	Group No.	Grip	L	Hole diameter D		L'	Hole diameter D'		W	Under head radius r	
					Min	Max		Min	Max		Min	Max
3	4,76	1 2 3	12,700 25,400 38,100	1,923 1,819 1,712	5,001 5,265 5,530	5,034 5,298 5,563	9,581 22,176 34,770	4,841	4,874	6,584	0,635	0,889
4	6,35	1 2 3	15,880 31,750 47,625	1,664 2,029 1,890	6,568 6,899 7,229	6,609 6,939 7,269	12,649 28,382 44,117	6,350	6,391	9,591	0,635	0,889
5	7,94	1 2 3	17,460 34,930 52,390	2,410 2,261 2,111	8,169 8,532 8,898	8,217 8,580 8,946	14,247 31,559 48,872	7,922	7,970	12,161	0,889	1,143
6	9,52	1 2 3	19,050 38,100 57,150	1,867 2,393 2,233	9,771 10,168 10,564	9,827 10,223 10,620	15,672 34,562 53,452	9,497	9,553	14,468	0,889	1,143
7	11,11	1 2 3	22,230 44,450 66,675	2,863 2,670 2,484	11,399 11,862 12,324	11,463 11,925 12,388	18,572 40,604 62,644	11,072	11,135	16,713	1,143	1,397
8	12,70	1 2 3	25,400 50,800 76,200	3,023 2,814 2,519	13,030 13,559 14,089	13,101 13,630 14,161	21,684 46,871 72,047	12,642	12,713	18,283	1,143	1,397
9	14,29	1 2 3	38,100 76,200 114,30	4,569 4,244 3,919	14,856 15,651 16,444	14,935 15,730 16,523	34,745 72,507 110,282	14,229	14,308	22,606	1,651	1,905
10	15,88	1 2 3	41,280 82,550 123,83	4,582 4,224 3,873	16,510 17,371 18,232	16,596 17,457 18,318	36,576 78,873 119,761	15,817	15,903	25,466	1,651	1,905
12	19,05	1 2 3	47,630 95,250 142,88	7,244 6,820 6,398	19,787 20,777 21,770	19,888 20,879 21,872	45,344 92,545 139,748	18,992	19,093	28,250	1,905	2,159
14	22,23	1 2 3	57,150 114,30 171,45	6,764 6,259 5,758	23,160 24,348 25,540	23,277 24,465 25,657	54,389 111,034 175,692	22,167	22,283	34,544	1,905	2,159
16	25,40	1	63,500	5,850	26,467	26,599	59,825	25,342	25,474	39,954	1,905	2,159

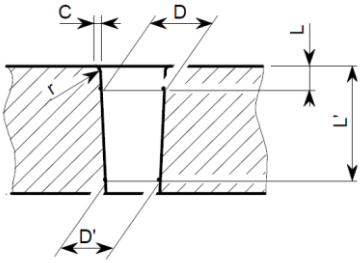


Figure 5: Hole Geometry (Geometry Code P4) and dimensional requirements for installation of Protruding tapered shank bolt

Table 15: Hole Dimensions for protruding tapered shank fasteners installed in accordance with AIPS01-02-002 in Aluminum/Aluminum assemblies (hole tolerance code M7)

Dimensions in mm

Dia Code	Nominal Dia	Group No.	Grip	L	Hole diameter D		L'	Hole diameter D'		C		Under head radius r	
					Min	Max		Min	Max	Min	Max	Min	Max
3	4,76	1 2 3	12,700 25,400 38,100	1,41	5,024 5,288 5,552	5,057 5,321 5,585	10,160 22,860 35,560	4,841	4,874	0,508	0,762	0.508	0,762
4	6,35	1 2 3	15,875 31,750 47,625	1,41	6,599 6,929 7,259	6,640 6,970 7,300	13,335 29,210 45,085	6,350	6,391	0,508	0,762	0.508	0,762
5	7,94	1 2 3	17,450 34,925 52,375	1,46	8,202 8,567 8,931	8,250 8,616 8,979	14,922 32,385 49,847	7,922	7,970	0,635	0,889	0,635	0,889
6	9,52	1 2 3	19,050 38,100 57,150	1,537	9,809 10,206 10,602	9,865 10,262 10,658	16,510 35,560 54,610	9,497	9,553	0,635	0,889	0,635	0,889
7	11,11	**1** **2** **3**	22,225 44,450 66,675	1,664	11,448 11,910 12,372	11,511 11,974 12,436	19,685 41,910 64,135	11,072	11,135	0,889	1,143	0,889	1,143
8	12,70	**1** **2** **3**	25,400 50,800 76,200	1,664	13,083 13,612 14,143	13,155 13,683 14,214	22,860 48,260 73,660	12,642	12,713	0,889	1,143	0,889	1,143
9	14,29	**1** **2** **3**	38,100 76,200 114,300	5,397	14,856 15,651 16,444	14,935 15,730 16,523	35,560 73,660 111,760	14,229	14,308	1,727	1,981	1,727	1,981
10	15,88	**1** **2** **3**	41,275 82,550 123,825	5,397	16,510 17,371 18,232	16,596 17,457 18,318	38,735 80,010 121,285	15,817	15,903	1,727	1,981	1,727	1,981
12	19,05	1 2 3	47,625 95,250 142,875	6,985	19,787 20,777 21,770	19,888 20,879 21,872	45,085 92,710 140,335	18,992	19,093	1,727	1,981	1,727	1,981
14	22,22	1 2 3	57,150 114,300 171,450	6,985	23,160 24,348 25,540	23,277 24,465 25,657	54,610 111,760 168,910	22,167	22,283	1,727	1,981	1,727	1,981
16	25,40	1 2 3	63,500 127,000 190,500	6,985	26,467 27,790 29,111	26,599 27,922 29,243	60,960 124,460 187,960	25,342	25,374	1,727	1,981	1,727	1,981

Table 16: Hole diameters for transition fit assemblies with anodized shear bolts and Lockbolts (Hole tolerance Code 'U1') in fiber metal laminate (FML) and FML / Aluminum assemblies.

Dimensions in mm

Diameter Code	Nominal Diameter	Interference (-) to clearance (+)*		Hole Diameter 'D'					
				Standard		1st Oversize (Code X)		2nd Oversize (Code Y)	
		Min	Max	Min	Max	Min	Max	Min	Max
2	4,17	-0,043	0,035	4,110	4,175	-	-	-	-
3	4,76	-0,043	0,035	4,770	4,835	5,105	5,170	-	-
3A	5,56	-0,042	0,036	5,500	5,565	5,900	5,960	-	-
4	6,35	-0,042	0,036	6,295	6,360	6,695	6,755	7,090	7,155

* Values only exact for standard diameters

Table 17: Hole diameters for clearance fit assemblies with shear bolts (Hole tolerance Code 'H1') for Hard metal/Hard metal or Aluminum / Hard metal assemblies.

Dimensions in mm

Diameter Code	Nominal Diameter	Clearance (+)		Hole Diameter 'D'							
				Standard		1st Oversize (Code X)		2nd Oversize (Code Y)		3nd Oversize (Code Z)	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
2	4,17	0,010	0,080	4,163	4,208	-	-	-	-	-	-
3	4,76	0,010	0,080	4,823	4,868	5,148*	5,193*	- **	- **	-	-
3A	5,56	0,010	0,080	5,552	5,597	5,941	5,986	-	-	-	-
4	6,35	0,010	0,080	6,347	6,392	6,736	6,781	7,132	7,176	-	-
5	7,94	0,010	0,080	7,935	7,980	8,323	8,368	8,719	8,764	-	-
6	9,53	0,010	0,080	9,522	9,567	9,911	9,955	10,310	10,354	-	-
7	11,11	0,010	0,080	11,109	11,154	11,501	11,546	11,897	11,942	-	-
8	12,70	0,010	0,080	12,697	12,742	13,089	13,133	13,485	13,529	-	-
9	14,29	0,010	0,080	14,272	14,317	14,663	14,708	15,060	15,104	-	-
10	15,88	0,010	0,080	15,859	15,904	16,251	16,295	16,647	16,692	-	-
12	19,05	0,010	0,080	19,034	19,079	19,429	19,481	19,825	19,877	-	-
14	22,23	0,010	0,080	22,209	22,254	22,604	22,656	23,001	23,053	-	-
16	25,40	0,010	0,080	25,384	25,429	25,779	25,831	26,176	26,228	-	-
18	28,58	0,010	0,080	28,560	28,592	28,955	28,987	29,350	29,382	-	-
19	30,16	0,010	0,080	30,147	30,179	30,542	30,574	30,937	30,969	-	-
20	31,75	0,010	0,080	31,735	31,780	32,130	32,175	32,525	32,570	-	-

* For ASNA0095 and ASNA0096: Min 5,212 - Max 5,257

** For ASNA0097 and ASNA0098: Min 5,608 - Max 5,652

Table 18: Hole diameters for transition fit assemblies with shear bolts (Hole tolerance Code 'H2') for Hard metal/Hard metal or Aluminum/Hard metal assemblies.

Dimensions in mm

Diameter Code	Nominal Diameter	Interference (-) to clearance (+)		Hole Diameter 'D'							
				Standard		1st Oversize (Code X)		2nd Oversize (Code Y)		3nd Oversize (Code Z)	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
2	4,17	-0,003	0,097	4,150	4,225	4,810	4,885	5,150	5,225	-	-
3	4,76	-0,003	0,097	4,810	4,885	5,150	5,225	5,540	5,615	-	-
3A	5,56	-0,002	0,098	5,540	5,615	5,937	6,010	-	-	-	-
4	6,35	-0,003	0,118	6,340	6,430	6,730	6,820	7,130	7,220	-	-
5	7,94	-0,005	0,121	7,930	8,020	8,320	8,410	8,720	8,810	-	-
6	9,53	-0,002	0,113	9,510	9,600	9,910	10,000	10,310	10,420	-	-
7	11,11	-0,001	0,116	11,100	11,190	11,500	11,610	11,900	12,000	-	-

Table 19: Hole diameters for solid rivets from Aluminum, Aluminum alloy, Titanium Niobium (44.5Cb) and Monel (NiCu31) (hole tolerance code 'R')

Dimensions in mm

Diameter Code	Nominal Diameter	Aluminum and Aluminum Alloy Rivets: EN6069 EN6081 EN6101				**Monel Rivets:** EN6069 EN6081 EN6101 **T40 rivets :** ABS0056 (1)	
		Applicable for riveting by EMR (Electromagnetic riveting) and riveting by rivet gun and squeeze		Applicable for automatic riveting by squeezing		**44.5Cb Rivets :** EN6069 EN6081 EN6101	
		Min	Max	Min	Max	Min	Max
02	1,6	1,620	1,720	-	-	-	-
03	2,4	2,420	2,520	2,420	2,495	2,460	2,560
3X	2,8	2,820	2,920	-	-	2,850	2,950
04	3,2	3,220	3,320	3,220	3,295	3,250	3,350
4X	3,6	3,620	3,720	-	-	3,650	3,750
05	4,0	4,010	4,110	4,010	4,085	4,050	4,150
5X	4,4	4,410	4,510	-	-	4,450	4,550
06	4,8	4,800	4,900	4,800	4,875	4,850	4,950
6X	5,2	5,200	5,300	-	-	5,250	5,350
07	5,6	5,600	5,700	5,600	5,675	5,650	5,750
7X	6,0	6,000	6,100	-	-	-	-
08	6,4	6,400	6,500	6,400	6,475	-	-
09	7,2	-	-	7,180	7,255	-	-
10	7,9	-	-	7,970	8,045	-	-
12	9,6	-	-	9,570	9,645	-	-

(1) Oversize diameters for ABS0056 solid rivets do not exist

Table 20: Hole diameters for high clearance fit assemblies with tension bolts in pure tension applications (hole tolerance code 'T1') for all assemblies.

Dimensions in mm

Diameter Code	Nominal Diameter	Clearance (+)		Hole Diameter 'D'					
				Standard		1st Oversize (Code X)		2nd Oversize (Code Y)	
		Min	Max	Min	Max	Min	Max	Min	Max
3	4,76	0,200	0,500	5,012	5,287	5,346	5,621	5,742	6,017
4	6,35	0,200	0,500	6,536	6,811	6,934	7,209	7,330	7,604
5	7,94	0,200	0,500	8,125	8,399	8,521	8,796	8,917	9,192
6	9,53	0,200	0,500	9,711	9,986	10,109	10,383	10,505	10,779
7	11,11	0,200	0,500	11,300	11,574	11,696	11,971	12,092	12,367
8	12,70	0,200	0,500	12,887	13,161	13,284	13,558	13,680	13,954
9	14,29	0,200	0,500	14,461	14,736	14,858	15,133	15,255	15,529
10	15,88	0,200	0,500	16,049	16,324	16,446	16,720	16,842	17,117
12	19,05	0,200	0,500	19,224	19,499	19,621	19,896	20,017	20,292
14	22,23	0,200	0,500	22,399	22,674	22,796	23,071	23,192	23,467
16	25,40	0,200	0,500	25,574	25,849	25,971	26,246	26,367	26,642
18	28,58	0,200	0,500	28,750	28,999	29,147	29,396	29,544	29,793
19	30,16	0,200	0,500	30,337	30,599	30,733	30,995	31,129	31,391
20	31,75	0,200	0,500	31,924	32,186	32,321	32,583	32,718	32,980
22	34,93	0,200	0,500	35,099	35,361	35,496	35,758	35,893	36,155

Table 21: Hole diameters for low clearance fit assemblies with tension bolts in tension & shear applications (hole tolerance code 'T2') for all assemblies

Dimensions in mm

Diameter Code	Nominal Diameter	Clearance (+)		Hole Diameter 'D'							
				Standard		1st Oversize (Code X)		2nd Oversize (Code Y)		3nd Oversize (Code Z)	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
3	4,76	0,002	0,067	4,815	4,855	5,148	5,188	5,544	5,584	-	-
4	6,35	0,002	0,067	6,339	6,379	6,736	6,776	7,132	7,171	-	-
5	7,94	0,002	0,067	7,927	7,967	8,323	8,363	8,719	8,759	-	-
6	9,53	0,002	0,067	9,514	9,554	9,911	9,950	10,310	10,352	-	-
7	11,11	0,005	0,073	11,105	11,148	11,501	11,544	11,897	11,940	-	-
8	12,70	0,005	0,073	12,692	12,735	13,089	13,131	13,485	13,527	-	-
9	14,29	0,005	0,073	14,267	14,310	14,663	14,706	15,060	15,102	-	-
10	15,88	0,005	0,073	15,854	15,897	16,251	16,293	16,647	16,690	17,442	17,485
12	19,05	0,008	0,085	19,032	19,084	19,429	19,481	19,825	19,877	20,620	20,672
14	22,23	0,008	0,085	22,207	22,259	22,604	22,656	23,000	23,052	23,795	23,847
16	25,40	0,008	0,085	25,382	25,434	25,779	25,831	26,175	26,227	26,970	27,022
18	28,58	0,008	0,085	28,558	28,610	28,955	29,007	29,351	29,403	30,146	30,198
19	30,16	0,012	0,099	30,149	30,198	30,545	30,594	30,941	30,990	31,337	31,386
20	31,75	0,012	0,099	31,737	31,799	32,134	32,196	32,530	32,592	33,325	33,387
22	34,93	0,012	0,099	34,912	34,974	35,309	35,371	35,705	35,767	36,500	36,562

Table 22: Hole diameters for low clearance fit assemblies with tension bolts in tension & shear applications (hole tolerance code 'T4') for hard metal/Hard metal assemblies.

Dimensions in mm

Diameter Code	Nominal Diameter	Clearance (+)		Hole Diameter 'D'							
				Standard		1st Oversize (Code X)		2nd Oversize (Code Y)		3nd Oversize (Code Z)	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
2	4,17	0,010	0,080	4,163	4,208	-	-	-	-	-	-
3	4,76	0,010	0,080	4,823	4,868	5,148	5,193	5,537	5,582	-	-
4	6,35	0,010	0,080	6,347	6,392	6,736	6,781	7,132	7,176	-	-
5	7,94	0,010	0,080	7,935	7,980	8,323	8,368	8,719	8,764	-	-
6	9,53	0,010	0,080	9,522	9,567	9,911	9,955	10,310	10,354	-	-
7	11,11	0,010	0,080	11,109	11,154	11,501	11,546	11,897	11,942	-	-
8	12,70	0,010	0,080	12,697	12,742	13,089	13,133	13,485	13,529	-	-
9	14,29	0,010	0,080	14,272	14,317	14,663	14,708	15,060	15,104	-	-
10	15,88	0,010	0,080	15,859	15,904	16,251	16,295	16,647	16,692	-	-
12	19,05	0,010	0,080	19,034	19,079	19,429	19,481	19,825	19,877	-	-
14	22,23	0,010	0,080	22,209	22,254	22,604	22,656	23,001	23,053	-	-
16	25,40	0,010	0,080	25,384	25,429	25,779	25,831	26,176	26,228	-	-
18	28,58	0,010	0,080	28,560	28,592	28,955	28,987	29,350	29,382	-	-
19	30,16	0,010	0,080	30,147	30,179	30,542	30,574	30,937	30,969	-	-
20	31,75	0,010	0,080	31,735	31,780	32,130	32,175	32,525	32,570	-	-

Table 23: Hole diameters for standard "pull type" blind bolts, hole tolerance Type A according to AIPS01-02-013 (hole tolerance code 'B1') for all assemblies.

Dimensions in mm

Diameter code	Nominal Diameter	Hole Diameter			
		Type A		1st Oversize (Code X)	
		Min.	Max.	Min.	Max.
04	3,25	3,277	3,353	-	-
05	4,14	4,166	4,183	4,570	4,650
06	5,03	5,055	5,073	5,460	5,540
08	6,58	6,604	6,627	7,010	7,090
10	7,90	7,925	7,947	-	-
12	9,47	9,500	9,527	-	-

Table 24: Hole diameters for standard "pull type" blind bolts, hole tolerance Type B according to AIPS01-02-013 (hole tolerance code 'B2') for all assemblies.

Dimensions in mm

Diameter code	Nominal Diameter	Hole Diameter			
		Type B		1st Oversize (Code X)	
		Min.	Max.	Min.	Max.
05	4,14	4,166	4,242	4,572	4,648
06	5,03	5,055	5,131	5,461	5,537
07	5,74	5,790	5,860	6,190	6,270
08	6,58	6,604	6,680	7,010	7,087
09	7,31	7,370	7,440	7,770	7,840
10	7,90	7,925	8,001	8,331	8,407
12	9,47	9,500	9,576	9,906	9,982
14	11,11	11,100	11,201	11,506	11,582
16	12,70	12,700	12,802	-	-

Table 25: Hole diameters for blind rivets (except for ABS0112 and ASNA0079/0080) (hole tolerance code 'B3') for metallic materials

Dimensions in mm

Diameter code	Nominal Diameter		Hole Diameter			
	Standard rivets	Rivets of large diameter	Standard rivets		Rivets of large diameter	
	ABS0546 ABS0547 ASNA0029 ASNA0077 ASNA0078 NAS1919 NAS1921 NAS9303	ASNA0077X ASNA0078X ASNA0129 ASNA0130	ABS0546 ABS0547 ASNA0029 ASNA0077 ASNA0078 NAS1919 NAS1921 NAS9303		ASNA0077X ASNA0078X ASNA0129 ASNA0130	
			min.	max.	min.	max.
04	3,18	3,56	3,277	3,353	3,632	3,708
05	3,97	4,39	4,064	4,166	4,470	4,572
06	4,76	5,11	4,877	4,978	5,207	5,309
08	6,35	6,76	6,502	6,629	6,883	6,985

Table 26: Hole diameters for ABS0112 Blind rivet (hole tolerance code 'B4') for all assemblies.

Dimensions in mm

Diameter code	Nominal Diameter	Hole Diameter	
		Min.	Max.
03	2,40	2,46	2,54
04	3,20	3,28	3,35

Table 27: Hole diameters for ASNA0079/0080 Blind rivet (hole tolerance code 'B5') for all assemblies.

Dimensions in mm

Diameter code	Nominal Diameter	Hole Diameter	
		Min.	Max.
04	3,2	3,25	3,37
05	4,0	4,05	4,17
06	4,8	4,85	4,97

Table 28: Hole diameters for NAS1919 and NAS1921 Blind rivet (hole tolerance code 'K1') for composite materials.

Dimensions in mm

Diameter code	Nominal Diameter	Hole Diameter	
		Min.	Max.
04	3,18	3,300	3,375
05	3,97	4,150	4,225
06	4,76	4,724	5,474

Table 29: Hole diameters for "threaded type" blind bolts (except for ASNA0081/0082) for all assemblies.

Dimensions in mm

Diameter code	Nominal Diameter	Hole Diameter					
		Type A (hole tolerance code 'B6')		Type B (hole tolerance code 'B7')		Type B (hole tolerance code 'B7') 1st Oversize (Code X)	
		Min.	Max.	Min.	Max.	Min.	Max.
05	4,14	4,183	4,205	4,192	4,267	4,570	4,650
06	5,03	5,055	5,077	5,055	5,130	5,460	5,540
07	5,77	5,791	5,813	5,792	5,867	-	-
08	6,59	6,604	6,627	6,604	6,680	7,010	7,080
09	7,35	7,366	7,388	7,366	7,442	-	-
10	7,90	7,925	7,947	7,925	8,001	-	-
11	8,70	-	-	8,738	8,814	-	-
12	9,50	9,525	9,547	9,525	9,601	-	-

Table 30: Hole diameters for ASNA 0081/82 "threaded type" blind bolts for all assemblies.

Dimensions in mm

Diameter code	Nominal Diameter	Hole Diameter			
		Type A (hole tolerance code 'B8')		Type B (hole tolerance code 'B9')	
		Min.	Max.	Min.	Max.
05	4,2	4,183	4,205	4,180	4,255
06	4,8	4,840	4,862	4,828	4,903
08	6,4	6,338	6,360	6,327	6,402
10	8,0	7,925	7,947	7,914	7,989
12	9,6	9,525	9,547	9,514	9,589

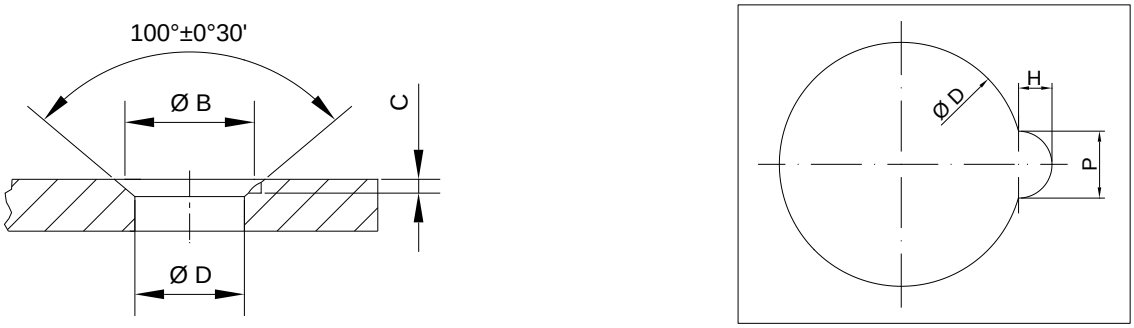


Figure 6: Hole geometry (Geometry Code R3) and dimensional requirements for NAS1329/1330 round headed blind rivet nuts installed to AIPS01-02-027 (Hole tolerance Code F1)

Table 31: Hole dimensional requirements for NAS1329/1330 round headed blind rivet nuts installed to AIPS01-02-027 (Hole tolerance Code F1)

Diameter Code	B diameter	C	D		Keyway Dimensions	
			Pilot hole diameter	Final hole diameter	P Ref	H Ref
	mm	mm	mm	mm	mm	mm
	Nominal	+0,40	+0,10	Max	+0,076	Max
		-0,00	-0,00	Min	-0,00	Min
08	9,02	1,20	5,00	5,74	1,57	1,42
				5,62		1,47
3	9,93	1,25	6,00	6,50		1,42
				6,35		1,47
4	13,44	1,86	8,00	8,58		1,42
				8,43		1,47

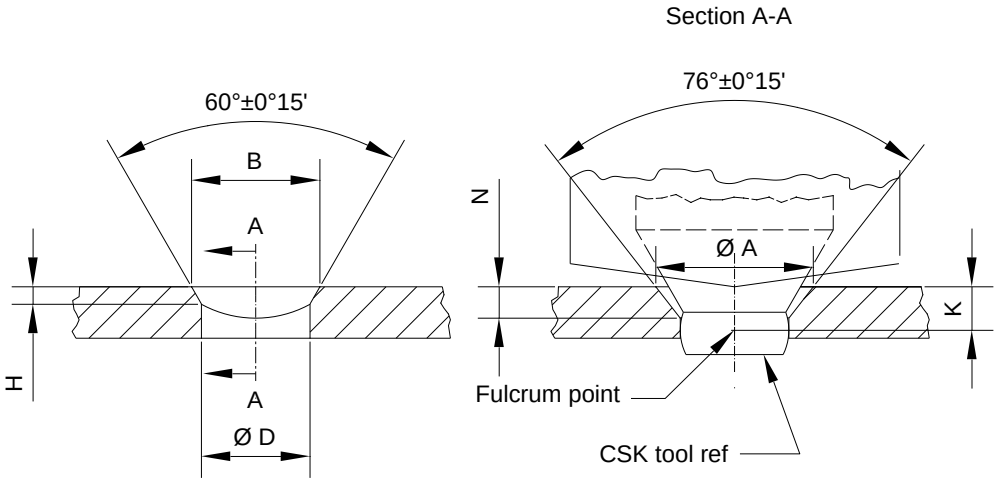


Figure 7: Hole Geometry (Geometry Code R4) and dimensional requirements for installation of NAS1734/1735 blind rivet nuts installed to AIPS01-02-027 (Hole tolerance Code F2)

Table 32: Hole dimensions for use with NAS1734/1735 blind rivet nuts installed to AIPS01-02-027 (Hole tolerance Code F2)

Diameter Code	A		B		D				H		N		K	
					Pilot hole		Final hole							
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
	±.005	±0,13	±.005	±0,13	+.003	+0,08	Max	Max	Ref		Ref		Ref	
					-.000	-0,00	Min	Min						
3	.331	8,41	.280	7,11	.191	4,85	.245	6,22	.034	0.86	.058	1,47	.080	2,03
							.242	6,15						
4	.438	11,13	.372	9,45	.250	6,35	.332	8,43	.040	1,02	.072	1,83	.100	2,54
							.328	8,33						
5	.520	13,21	.446	11,33	.312	7,92	.401	10,19	.044	1,12	.080	2,03	.100	2,54
							.397	10,08						
6	.623	15,82	.526	13,36	.375	9,53	.477	12,12	.048	1,22	.098	2,49	.160	4,06
							.472	11,99						
7	.706	17,93	.600	15,24	.437	11,10	.545	13,84	.054	1,37	.108	2,74	.160	4,06
							.540	13,72						
8	.794	20,17	.680	17,27	.500	12,70	.620	15,75	.058	1,47	.116	2,95	.160	4,06
							.615	15,62						
9	.882	22,40	.760	19,30	.562	14,27	.694	17,63	.063	1,60	.121	3,07	.160	4,06
							.689	17,50						
10	.978	24,84	.848	21,54	.625	15,88	.775	19,69	.069	1,75	.135	3,43	.160	4,06
							.770	19,56						
12	1.167	29,64	1.008	25,60	.750	19,05	.924	23,47	.079	2,01	.160	4,06	.220	5,59
							.919	23,34						

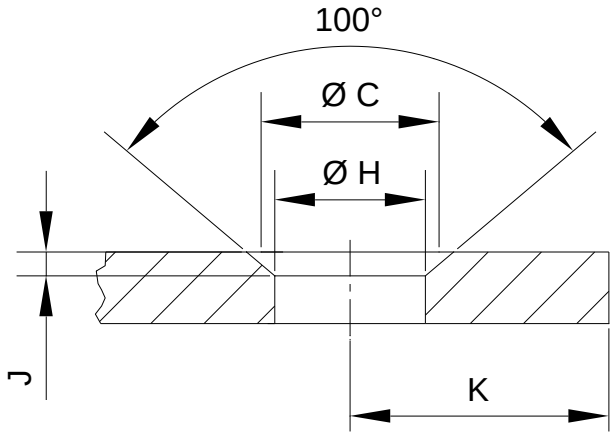


Figure 8: Hole geometry (Geometry Code R5) and dimensional requirements for installation of ASNA2065 crimped nuts to AIPS01-02-027 (Hole tolerance Code F3)

Table 33: Hole dimensions for use with ASNA2065 crimped nuts installed to AIPS01-02-027 (Hole tolerance Code F3)

Dia code	H	C	J	K
	mm	mm	mm	mm
	Max	+0,13	Ref	Min
	Min	-0,25		
1	4,90	5,69	0,36	0,86
	4,75			
2	5,61	6,58	0,41	1,02
	5,54			
3	6,63	7,59	0,41	1,12
	6,50			

Table 34: Hole diameters for low clearance fit assemblies for head tightened bolts with floating or fixed anchor nuts or free-running nuts applications (hole tolerance code 'T3') for all materials.

Dimensions in mm

Diameter Code	Thread size	Nominal Diameter	Hole Diameter 'D'	
			Min	Max
04	.1120-40	2,85	2,900	2,940
06	.1380-32	3,50	3,550	3,598
08	.1640-32	4,17	4,210	4,258
3	.1900-32	4,83	4,870	4,918
4	.2500-28	6,35	6,396	6,454
5	.3125-24	7,90	7,986	8,044
6	.3750-24	9,52	9,576	9,634
7	.4375-20	11,11	11,161	11,204
8	.5000-20	12,70	12,748	12,792

Table 35: Center hole diameters for anchor nuts in structures, secondary structures and equipment for all materials

Dimensions in mm

Diameter Code	Thread size	Nominal Diameter	Anchor nut type							
			Non-floating (MS21048; MS21069) (tolerance code 'N1')		Floating (NAS1791; NAS1792; MS21059) (tolerance code 'N2')		High floating (ABS1521; ABS1621) (tolerance code 'N3')		Low Floating (MS-type) (tolerance code 'N10')	
			Min	Max	Min	Max	Min	Max	Min	Max
04	.1120-40	2,85	3,0	3,1	4,6	4,7	-	-	3,6	3,7
06	.1380-32	3,50	3,7	3,8	5,1	5,2	-	-	4,2	4,3
08	.1640-32	4,17	4,3	4,4	5,8	5,9	-	-	4,9	5,0
3	.1900-32	4,83	5,0	5,1	6,5	6,6	8,0	8,1	5,6	5,7
4	.2500-28	6,35	6,5	6,6	8,1	8,2	-	-	7,1	7,2
5	.3125-24	7,90	8,1	8,2	9,6	9,7	-	-	8,7	8,8
6	.3750-24	9,52	9,7	9,8	11,1	11,2	-	-	10,3	10,4
7	.4375-20	11,11	11,3	11,4	12,7	12,8	-	-	11,8	11,9
8	.5000-20	12,70	12,9	13,0	14,3	14,4	-	-	13,4	13,5

Table 36: Hole diameters for Rivetless nutplates (ABS1295) with normal float A (hole tolerance code 'N4') installed in Aluminum alloys (list of Al alloys in given in AIPS01-02-016)

Dimensions in mm

Diameter code	Nominal Diameter	Hole Diameter			
		Normal float A		1st Oversize (Code X)	
		Min.	Max.	Min.	Max.
08	4,17	6,33	6,40	7,12	7,19
3	4,83	7,12	7,19	7,50	7,56
4	6,35	8,72	8,79	9,12	9,18

Table 37: Hole diameters for Rivetless nutplates (ABS1295) with large float B (hole tolerance code 'N5') installed in Aluminum alloys (list of Al alloys in given in AIPS01-02-016)

Dimensions in mm

Diameter code	Nominal Diameter	Hole Diameter			
		Normal float B		1st Oversize (Code X)	
		Min.	Max.	Min.	Max.
3	4,83	8,72	8,79	N/A	

Table 38: Hole diameters for Rivetless nutplates (ABS1295) with normal float A (hole tolerance code 'N8') installed in Titanium alloys (list of Ti alloys in given in AIPS01-02-016)

Dimensions in mm

Diameter code	Nominal Diameter	Hole Diameter			
		Normal float A		1st Oversize (Code X)	
		Min.	Max.	Min.	Max.
08	4,17	6,30	6,37	7,10	7,17
3	4,83	7,10	7,17	7,48	7,54
4	6,35	8,70	8,77	9,10	9,16

Table 39: Hole diameters for Rivetless nutplates (ABS1295) with large float B (hole tolerance code 'N9') installed in Titanium alloys (list of Ti alloys in given in AIPS01-02-016)

Dimensions in mm

Diameter code	Nominal Diameter	Hole Diameter			
		Normal float B		1st Oversize (Code X)	
		Min.	Max.	Min.	Max.
3	4,83	8,70	8,77	N/A	

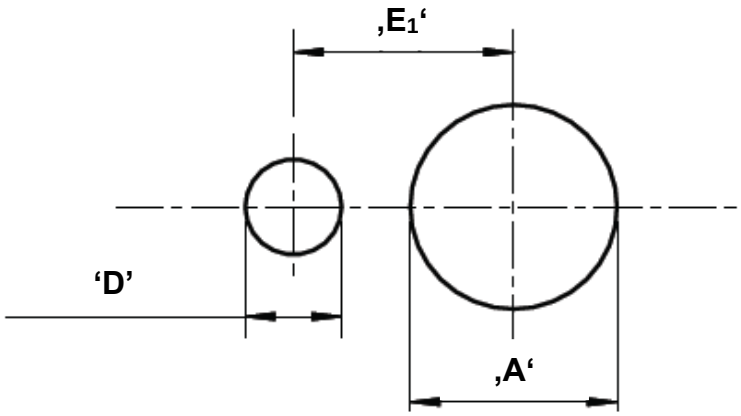


Figure 9: Installation dimensions for clip-nut installations in panels

Table 40: Installation dimensions for CLIP NUTS in panels (hole tolerance code ‘N6’)

Dimensions in mm

Diameter Code	Thread size	Nominal Diameter	EN6131 (hole tolerance code ‘K2’)					
			Installation hole Ø – ‘D’		Feed hole distance Ø - ‘E_1’		Feed hole Ø – ‘A’	
			Min	Max	Min	Max	Min	Max
08	.1640-32	4,17	7,29	7,49	15,4	15,6	15,0	15,1
3	.1900-32	4,83						

Diameter Code	Thread size	Nominal Diameter	NSA5067 (hole tolerance code ‘K3’)					
			Installation hole Ø – ‘D’		Feed hole distance Ø - ‘E_1’		Feed hole Ø – ‘A’	
			Min	Max	Min	Max	Min	Max
08	.1640-32	4,17	5,6	5,8	12,9	13,1	13,0	13,1
3	.1900-32	4,83	6,8	7,0				

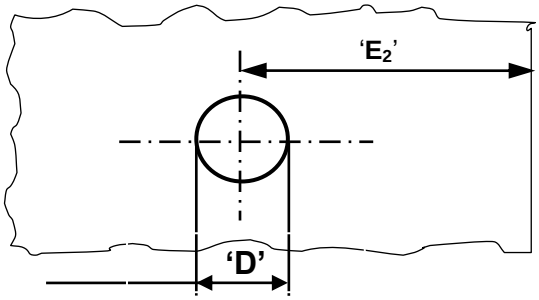


Figure 10: Installation dimensions for clip nut installations from panel edge

Table 41: Installation dimensions for CLIP NUTS on edges (hole tolerance code 'N7')

Dimensions in mm

Diameter Code	Thread size	Nominal Diameter	EN6131 (hole tolerance code 'K4')		
			Installation hole Ø – 'D'		Feed hole distance Ø – 'E_2'
			Min	Max	Max
08	.1640-32	4,17	7,29	7,49	12,7
3	.1900-32	4,83			

Diameter Code	Thread size	Nominal Diameter	NSA5067 (hole tolerance code 'K5')		
			Installation hole Ø – 'D'		Feed hole distance Ø – 'E_2'
			Min	Max	Max
04	.1120-40	2,85	5,6	5,8	9,525
06	.1380-32	3,50			
08	.1640-32	4,17			
3	.1900-32	4,83	6,8	7,0	

Table 42: Hole dimensions and chamfer requirements for Titanium sleeved ABS1776, ABS1778 and ABS1820 radial expansion bolts and Lockbolts (hole tolerance code L1, geometry codes S1)

Dimensions in mm

Diameter Code	Nominal Diameter	Hole Diameter 'D'						Countersink Transition Radius 'R'	
		Standard		1st Oversize (Code X)		2nd Oversize (Code Y)			
		Min	Max	Min	Max	Min	Max	Min	Max
3	4,76	5,393	5,436	5,633	5,833	6,187	6,230	0,51	0,61
4	6,35	6,960	7,011	7,357	7,408	7,754	7,805	0,51	0,61
5	7,94	8,586	8,637	8,982	9,033	9,379	9,430	0,89	0,99
6	9,53	10,237	10,288	10,633	10,684	11,030	11,081	0,89	0,99
7	11,11	11,888	11,939	12,284	12,335	12,681	12,732	0,89	0,99
8	12,70	13,509	13,564	13,906	13,961	14,303	14,358	0,89	0,99
9	14,29	15,135	15,190	15,532	15,587	15,929	15,984	0,99	1,09
10	15,88	16,786	16,841	17,183	17,238	17,580	17,635	0,99	1,09

Table 43: Hole dimensions and requirements for CRES sleeved protruding head ABS1741 and ABS1745 radial expansion bolts and Lockbolts (hole tolerance code L2, geometry code S2)

Dimensions in mm

Diameter Code	Nominal Diameter	Hole Diameter 'D'						Transition Under Head Radius 'R'	
		Standard		1st Oversize (Code X)		2nd Oversize (Code Y)			
		Min	Max	Min	Max	Min	Max	Min	Max
3	4,76	5,266	5,309	5,663	5,706	6,060	6,103	0,51	0,61
4	6,35	6,808	6,859	7,204	7,255	7,601	7,652	0,51	0,61
5	7,94	8,357	8,408	8,754	8,805	9,151	9,202	0,89	0,99
6	9,53	9,983	10,034	10,379	10,430	10,776	10,827	0,89	0,99
7	11,11	11,557	11,608	11,954	12,005	12,351	12,402	0,89	0,99
8	12,70	13,154	13,209	13,550	13,605	13,947	14,002	0,89	0,99
9	14,29	15,033	15,088	15,430	15,485	15,827	15,882	0,99	1,09
10	15,88	16,633	16,688	17,030	17,085	17,427	17,482	0,99	1,09

Table 44: Hole dimensions and chamfer requirements for ABS1742, and ABS1743 tapered sleeve bolts (hole tolerance code L3, geometry codes S4 and S5).

Dimensions in mm

Diameter Code	Nominal Diameter	Hole Diameter 'D'						Transition and Under Head Radius 'R'			
		Standard		1st Oversize (Code X)		2nd Oversize (Code Y)		Countersink head		Protruding head	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
4	6,35	8,339	8,390	8,735	8,786	9,132	9,183	1,45	1,65	1,45	1,65
5	7,94	9,937	9,988	10,333	10,384	10,730	10,781	1,90	2,10	1,90	2,10
6	9,53	11,939	11,990	12,336	12,387	12,734	12,785	1,90	2,10	1,90	2,10
7	11,11	13,922	13,973	14,319	14,370	14,715	14,766	1,90	2,10	1,90	2,10
8	12,70	15,516	15,571	15,913	15,968	16,310	16,365	2,15	2,35	2,15	2,35
9	14,29	17,112	17,167	17,509	17,564	17,906	17,961	2,15	2,35	2,15	2,35
10	15,88	18,722	18,777	19,119	19,174	19,516	19,571	2,25	2,45	2,25	2,45
12	19,05	22,305	22,370	22,701	22,766	23,097	23,162	2,30	2,50	2,30	2,50
14	22,23	25,899	25,964	26,295	26,360	26,692	26,757	2,55	2,75	2,55	2,75
16	25,40	29,093	29,158	29,490	29,555	29,887	29,952	2,90	3,10	2,90	3,10

Table 45: Hole dimensions for use with ABS1754 and ABS1770 GromEx sleeves and clearance fit bolts (hole tolerance code L4, geometry codes G1 and G2).

Dimensions in mm

Diameter Code	Nominal Diameter	Installed Sleeve Inner diameter (Standard &		Hole Diameter 'D' [1]						Transition and Under head			
				Standard		1st Oversize (Code X)		2nd Oversize (Code Y)		Countersink head		Protruding head	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
3	4,76	4,815	4,882	5,893	5,918	6,274	6,299	6,670	6,695	0,38	0,64	0,55	0,65
4	6,35	6,339	6,414	7,430	7,455	7,826	7,851	8,225	8,250	0,38	0,64	0,55	0,65
5	7,94	7,927	8,001	9,017	9,067	9,413	9,464	9,812	9,862	0,64	0,89	0,55	0,65
6	9,53	9,514	9,590	10,605	10,655	11,001	11,051	11,400	11,450	0,64	0,89	0,55	0,65

[1] Refer to AIPS/AIPI01-03-009 for engineering validated allowable deviations to these hole tolerances for -3 and -4 diameters.

Table 46 [1)]: Hole Dimensions for use with ABS1754 protruding head sleeves and pull-in interference fit ABS1774 tension bolts (hole tolerance code L5, geometry code G3).

Dimensions in mm

~~Diameter Code~~	~~Nominal Diameter~~	~~Installed Sleeve Inner diameter~~		~~Hole Diameter 'D'~~						~~Under head radius~~	
				~~Standard~~		~~1st Oversize (Code X)~~		~~2nd Oversize (Code Y)~~			
		~~Min~~	~~Max~~	~~Min~~	~~Max~~	~~Min~~	~~Max~~	~~Min~~	~~Max~~	~~Min~~	~~Max~~
~~16~~	~~25,40~~	~~25,245~~	~~25,316~~	~~27,178~~	~~27,254~~	~~27,574~~	~~27,650~~	~~27,973~~	~~28,049~~	~~0,89~~	~~1,14~~
~~19~~	~~30,16~~	~~30,005~~	~~30,076~~	~~31,902~~	~~31,979~~	~~32,299~~	~~32,375~~	~~32,697~~	~~32,774~~	~~0,89~~	~~1,14~~

1) Table 46 is no longer applicable for use in design or manufacturing

Table 47: Hole dimensions for use with ABS1807 Sleeve (hole tolerance code L6, geometry code G4).

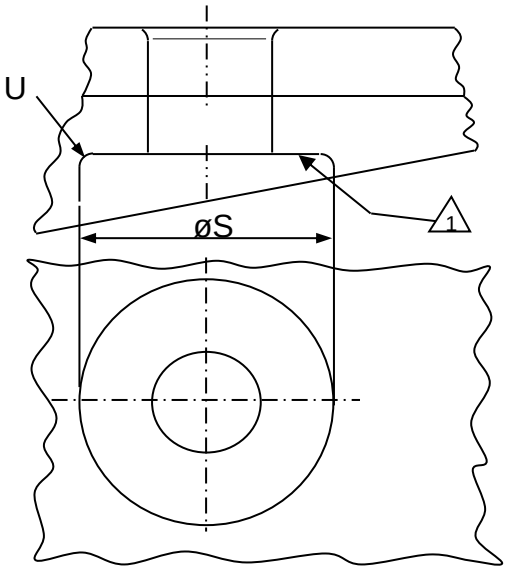
Dimensions in mm

Diameter Code	Nominal Diameter	Installed Sleeve Inner diameter (Standard)		Hole Diameter 'D' [1]						Transition and Under head			
				Standard		1st Oversize (Code X)		2nd Oversize (Code Y)		Countersink head		Protruding head	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
3	4,76	4,815	4,882	6,670	6,695	--	--	--	--	0,38	0,64	--	--
4	6,35	6,339	6,414	8,225	8,250	8,613	8,638	9,009	9,035	0,38	0,64	--	--
5	7,94	7,927	8,001	9,812	9,862	10,200	10,251	10,599	10,650	0,64	0,89	--	--
6	9,53	9,514	9,590	11,400	11,450	--	--	--	--	0,64	0,89	--	--

[1] Refer to AIPS/AIPI01-03-009 for engineering validated allowable deviations to these hole tolerances for -3 and -4 diameters.

Table 48: Hole Dimensions for Snap & Click brackets in only Aluminum and Titanium parts (hole tolerance code W1)

Diameter code	Nominal diameter	Hole diameter		Remark
		Min.	Max.	
3	5,0	5,1	5,3	Without surface protection
		5,0	5,2	With surface protection



1 All spot-facing surfaces machined on assembly shall have a surface finish equivalent to, or better than that required for the particular hole.

Figure 11: Spot face geometry requirements for holes machined in metallic materials. For 'S' and 'U' dimensions.

Table 49: Spot face codes and dimensions for use with metallic materials only

Note: Code 'A' indicates spot face not required.

Dimensions in mm

Diameter Code	Spot face Code					
	B		C		D	
	Diameter S	Radius U	Diameter S	Radius U	Diameter S	Radius U
2	14,3	1,5	17,5	3,0	23,8	6,4
3	14,3	1,5	17,5	3,0	23,8	6,4
3A	15,9	1,5	19,0	3,0	25,4	6,4
4	17,5	1,5	20,6	3,0	27,0	6,4
5	19,1	1,5	22,2	3,0	28,6	6,4
6	22,2	1,5	25,4	3,0	31,8	6,4
7	23,8	1,5	27,0	3,0	33,3	6,4
8	27,0[=]	1,5	30,2*	3,0	36,5[#]	6,4
9	31,8	1,5	34,9	3,0	41,3	6,4
10	34,9	1,5	38,1	3,0	44, 5	6,4
12	39,7	1,5	42,9	3,0	49,2	6,4
14	49,2	1,5	52,4	3,0	58,7	6,4
16	54,0	1,5	57,2	3,0	63,5	6,4
18	58,7	1,5	61,9	3,0	68,3	6,4
19	63,5	1,5	66,7	3,0	73,0	6,4
20	65,1	1,5	68,3	3,0	74,6	6,4
22	71,4	1,5	74,6	3,0	81,0	6,4

[=] For ABS0813-8C nuts, the spot face diameter shall be 28,6mm to avoid interference with the nut.

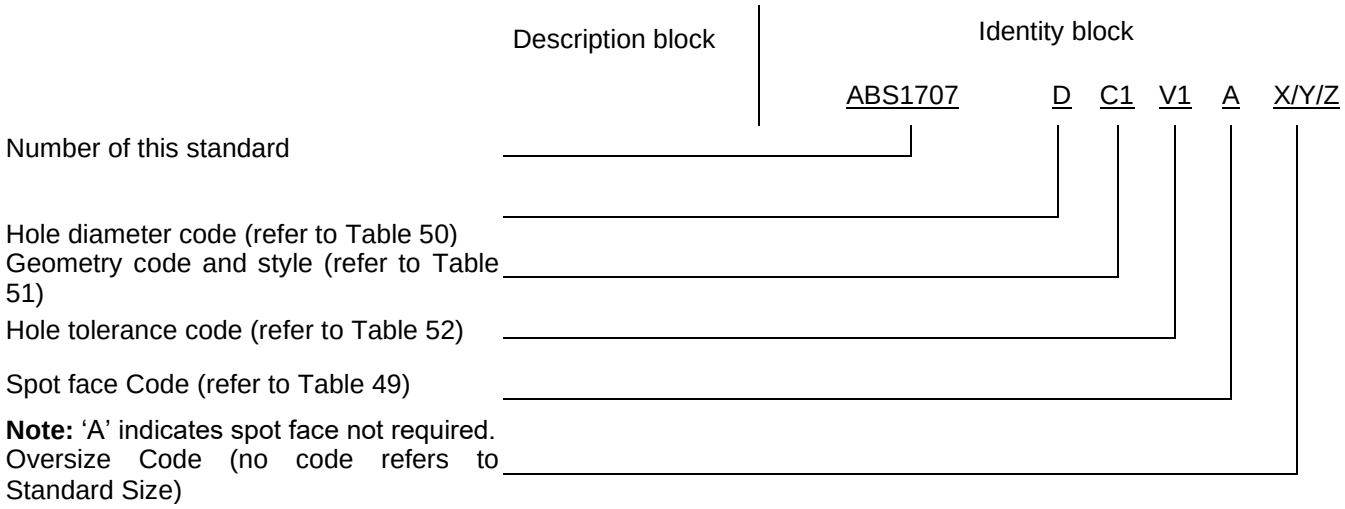
* For ABS0813-8C nuts, the spot face diameter shall be 31,8mm to avoid interference with the nut.

[#] For ABS0813-8C nuts, the spot face diameter shall be 38,1mm to avoid interference with the nut.

5 Designation

This type of standard shall be designated according to the philosophy of the following example:

Example 1: - nominal ¼" diameter hole for use with non-coated (e.g. sulphuric acid anodized Ti) countersunk head bolt in a LOW load transfer designated application in CFRP material. No spot face requirement.



Example 2: - nominal 1/2" diameter plain hole for use with protruding head bolt in a HIGH load transfer designated application in CFRP material, requiring a spot face.

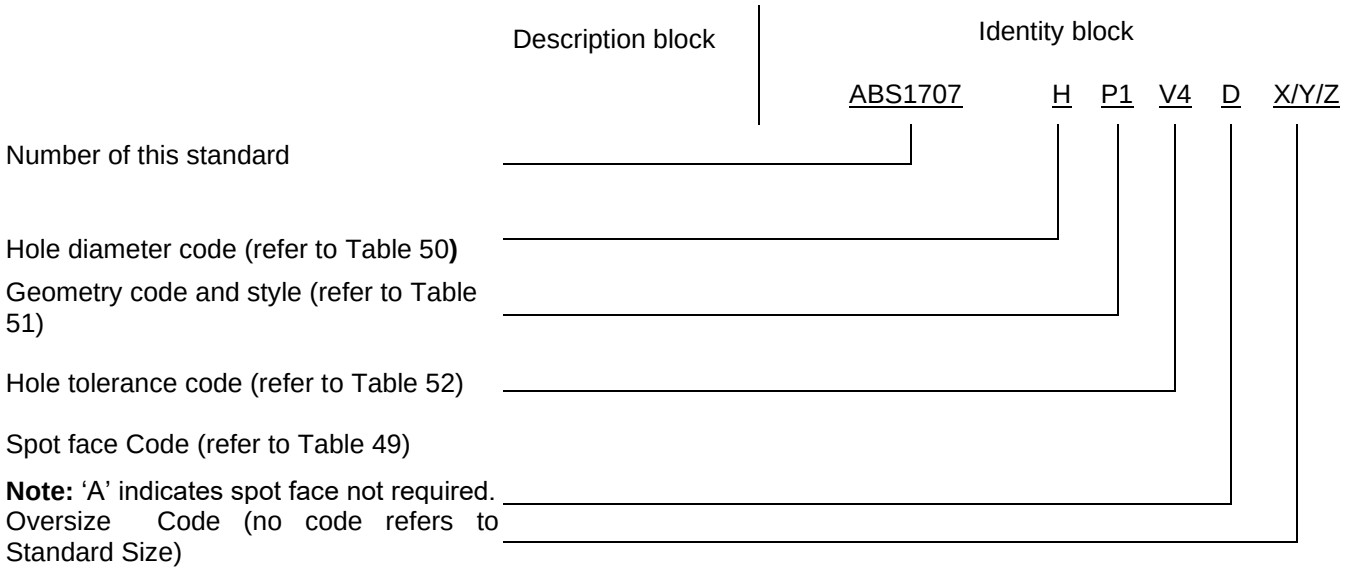


Table 50: Hole diameter codes

Dimensions in mm

Hole Diameter Code	Bolts / Lockbolts Diameter		Blind fasteners Diameter		Solid rivets Diameter		Head tightened bolts & Nuts Diameter	
	Code	Nominal	Code	Nominal	Code	Nominal	Code	Nominal
A1	-	-	-	-	02	1,6	-	-
A2	-	-	03	2,4	03	2,4	-	-
A3	-	-	-	-	3X	2,8	04	2,85
A4	-	-	04	3,2	04	3,2	-	-
A5	-	-	-	-	4X	3,6	06	3,50
A (=A6)	2	4,17	05	4,2	05	4,0	08	4,17
B0	-	-	-	-	5X	4,4	-	-
B	3	4,76	06	4,8 – 5,0	06	4,8	3	4,83
B1	-	-	-	-	6X	5,2	-	-
C	A	5,56	07	5,8	07	5,6	-	-
C1	-	-	-	-	7X	6,0	-	-
D	4	6,35	08	6,4 – 6,6	08	6,4	4	6,35
D1	-	-	09	7,2 – 7,4	09	7,3	-	-
E	5	7,94	10	7,9	10	7,9	5	7,90
E1	-	-	11	8,7	-	-	-	-
F	6	9,52	12	9,5	12	9,6	6	9,52
G	7	11,11	-	-	-	-	7	11,11
H	8	12,70	-	-	-	-	8	12,70
J	9	14,29	-	-	-	-	-	-
K	10	15,88	-	-	-	-	-	-
L	12	19,05	-	-	-	-	-	-
M	14	22,23	-	-	-	-	-	-
N	16	25,40	-	-	-	-	-	-
O	18	28,58	-	-	-	-	-	-
P	19	30,16	-	-	-	-	-	-
Q	20	31,75	-	-	-	-	-	-
R	22	34,93	-	-	-	-	-	-

Notes

1. The diameter of fasteners is as defined in product standards. This table is for reference only; for specific hole diameters refer to the applicable tables in section 4
2. Nominal diameter values are given as reference; this nominal dimension can vary (in general within a range of +/- 0,2 mm) depending on the specific product standard.
3. In some cases, the diameter of the product differ significantly (mainly for blind fasteners); this is the reason why for some cases, the nominal diameter is identified with a range of values instead of only one.
4. Depending on the product standard, the diameter code can be identified with the corresponding value directly or with this value preceded of a "zero" (example: 06 or 6).

Table 51: Hole geometry and style call-up codes and associated Table references

Code	Hole Geometry and Style	Reference
C1	100° Countersink – Intermediate Head(1) – recommended chamfer / transition radius (Not applicable for thin part ≤ 3mm in thickness)	Table 1
C2	100° Countersink – Intermediate Head(1) – reduced chamfer / transition radius	Table 1
C3	100° Countersink – Full Head(2) – recommended chamfer / transition radius	Table 1
C4	100° Countersink – Full Head(2) – reduced chamfer / transition radius	Table 1
C5	100° Countersink – Reduced Head(3) – recommended chamfer / transition radius (Not applicable for thin part ≤ 3mm in thickness)	Table 1
C6	100° Countersink – Reduced Head(3) – reduced chamfer / transition	Table 1
C8 (=C7)	130° Countersink – Reduced chamfer / transition radius	Table 1
C9	100° Countersink – Tapered shank bolts	Table 14
P1	Protruding Head – Recommended lead-in radius / chamfer.	Table 2
P2	Protruding Head – Reduced lead-in radius / chamfer	Table 2
P3	Protruding Head – Tension Bolts (NSA5378, ABS1830, MS21250)	Table 2
P4	Protruding Head – Tapered shank bolts	Table 15
R1	Countersink solid rivets and blind fasteners	§ 4.1
R2	Protruding solid rivets and blind fasteners	§ 4.2
R3	NAS1329 and NAS 1330 round headed blind rivet nuts to AIPS01-02-027	Figure 6 & Table 31
R4	NAS1734 and NAS1735 blind rivet nuts to AIPS01-02-027	Figure 7 & Table 32
R5	ASNA2065 crimped nuts to AIPS01-02-027	Figure 8 & Table 33
A0	Floating or Fixed Anchor nuts, Clips nuts, Rivetless nutplates, or other	NA
S1	Parallel sleeved fasteners, Ti sleeve, countersunk head – RXL & RXB (ABS1776, ABS1778 and ABS1820)	§ 4.3.9.1
S2	Parallel sleeved fasteners, CRES sleeve, protruding head – RXL & RXB (ABS1741 & ABS1745)	§ 4.3.9.1
S4	Tapered sleeve fasteners, countersunk head – STL (ABS1742)	§ 4.3.9.2
S5	Tapered sleeve fasteners, protruding head – STL (ABS1743)	§ 4.3.9.2
G1	GromEx Sleeve, protruding head (ABS1754) with clearance fit bolt	§ 4.3.9.3
G2	GromEx Sleeve, countersunk head (ABS1770) with clearance fit bolt	§ 4.3.9.3
G3	GromEx Sleeve (ABS1754) with interference fit bolt (ABS1774) (4)	§ 4.3.9.3
G4	Sleeve, 100° Countersunk Head (ABS1807)	§ 4.3.9.3

Note:

(1) Example of intermediary head fastener: EN6114, ABS1720…

(2) Example of full head fastener: ABS0094, ASNA2040…

(3) Example of reduced head fasteners: ASNA2657, NAS1581…

(4) Geometry code G3 for use with GromEx Sleeve (ABS1754) is inactive for design and manufacturing

Table 52: Hole tolerance codes, area of application and associated Table references

Code	Type of assembly	Application	Reference
V1	Composite & Mixed – High clearance fit, Low load transfer	Non-coated shear bolts	Table 3
V2	Composite & Mixed – High clearance fit, Low load transfer	Coated shear bolts	Table 4
V3	Composite & Mixed – Low clearance fit, High load transfer	Non-coated shear bolts	Table 5
V4	Composite & Mixed – Low clearance fit, High load transfer	Coated shear bolts	Table 6
V5	Low interference to clearance fit	Shear bolts, Composite in	Table 7
V6	Moderate interference fit	Shear bolts, Composite in	Table 8
M1	Aluminum – Moderate clearance fit	Shear bolts and Blind bolts	Table 9
M2	Aluminum – Standard transition fit	Shear bolts	Table 10
M3	Aluminum – Reduced transition fit	Shear bolts	Table 11
M4	Aluminum – Moderate interference fit	Pull in, Pull stem and Lockbolt	Table 12
M5	Aluminum – High interference fit	Pull in, Pull stem and Lockbolt	Table 13
M6	Aluminum – High interference fit	Countersunk tapered shank	Table 14
M7	Aluminum – High interference fit	Protruding tapered shank bolts	Table 15
U1	Fiber metal laminate – Reduced transition fit	Non-coated (anodized) shear	Table 16
H1	Hard metal – Clearance fit	Shear bolts	Table 17
H2	Hard metal – Transition fit	Shear bolts	Table 18
R	All materials	Shear load, solid rivets	Table 19
T1	All materials – High clearance fit	Tension bolts	Table 20
T2	All materials except with hard metals – Low clearance fit	Tension bolts	Table 21
T4	Hard metal – Low clearance fit	Tension bolts	Table 22
B1	All materials	“Pull-type” standard blind bolts	Table 23
B2	All materials	“Pull-type” standard blind bolts	Table 24
B3	Metallic materials	“Pull-type” Blind rivets (except for ABS0112 and	Table 25
K1	Composite	NAS1919/1921 “Pull-type”	Table 28
B4	All materials	ABS0112 “Pull-type” Blind rivet	Table 26
B5	All materials	ASNA0079/0080 “Pull-type”	Table 27
B6	All materials	“Threaded type” blind bolts	Table 29
B7	All materials	“Threaded type” blind bolts	Table 29
B8	All materials	“Threaded type” blind bolts	Table 30
B9	All materials	“Threaded type” blind bolts	Table 30
F1	All materials	Round headed blind rivet nuts	Table 31
F2	All materials	NAS1734 and NAS1735 blind	Table 32
F3	All materials	Crimped nuts to AIPS01-02-	Table 33
T3	All materials – Low clearance fit	Head tightened bolts with	Table 34
N1	All materials – Clearance fit	Non-floating anchor nuts	Table 35
N2	All materials – Clearance fit	High floating anchor nut	Table 35
N3	All materials – High clearance fit	Very high floating anchor nut	Table 35
N10	All materials – Low clearance fit	Low floating anchor nut	Table 35
N4	Aluminum alloys	Rivetless nutplates with normal	Table 36
N5	Aluminum alloys	Rivetless nutplates with large	Table 37
N6	All materials	Inside panel clip nuts	Table 40
K2	All materials	EN6131 Inside panel clip nuts	Table 41
K3	All materials	NSA5067 Inside panel clip nuts	Table 41
N7	All materials	On edge clip nuts	Table 41
K4	All materials	EN6131 On edge clip nuts	Table 41
K5	All materials	NSA5067 On edge clip nuts	Table 41

(Continued)

Table 52: Hole tolerance codes, area of application and associated Table references (concluded)

Code	Type of assembly	Application	Reference
N8	Titanium alloys	Rivetless nutplates with normal float A	Table 38
N9	Titanium alloys	Rivetless nutplates with large float B	Table 39
L1	Fuel tank penetrations for lightning strike protection – CFRP & Mixed	Parallel sleeved fasteners, Titanium sleeved, countersunk head – RXL (ABS1776 ,ABS1778 & ABS1820)	Table 42
L2	Fuel tank penetrations for lightning strike protection – CFRP & Mixed	Parallel sleeved fasteners, CRES sleeved, protruding head – RXL (ABS1741 & ABS1745)	Table 43
L3	Fuel tank penetrations for lightning strike protection (direct strike & conducted current) – CFRP & Mixed	Tapered sleeve fasteners, countersunk head – STL (ABS1742)	Table 44
		Tapered sleeve fasteners, protruding head – STL (ABS1743)	Table 44
L4	Fuel tank penetrations for lightning strike protection (conducted current) – single CFRP element and low shear	GromEx Sleeve, protruding head (ABS1754) with clearance fit bolt	Table 45
		GromEx Sleeve, countersunk head (ABS1770) with clearance fit bolt	Table 45
L5 [1)]	Fuel tank penetrations for lightning strike protection (direct strike & conducted current) – CFRP & Mixed	GromEx Sleeve (ABS1754) with interference fit bolt (ABS1774)	Table 46[1)]
L6	Fuel tank penetrations for lightning strike protection (conducted current) – single CFRP element and low shear	Sleeve, 100° Countersunk Head (ABS1807)	Table 47
W1	Only Aluminum and Titanium parts	Snap & Click brackets	Table 48

[1)] Table 46 is inactive for design and manufacture

6 Record of Revisions

Issue	Clause modified	Description of Modification
1 06/05		New standard
2 11/05	1.	Threaded bolts and lock bolts defined in scope.
	3.1.1	New Table 2 added to provide option to use a reduced transition radius / chamfer. All subsequent Tables renumbered accordingly.
	3.1.2	Figure 4 inserted to define geometry restrictions and countersink depth for Composites. All subsequent Figures renumbered accordingly.
	3.3.1 & 3.3.2	Bolt description for non-coated bolts extended to include clear reference to 'anodised' bolts. Shank tolerance added for coated bolts.
	Figure 3	'Note' extended to include reference to 3.1.2 and new Figure 4.
	Table 1	Dimensions added for diameter code 3A. Caption changed to include reference to 'standard transition radius / chamfer'.
	Table 2	New Table 2 added to include dimensions for holes with a 'reduced transition radius / chamfer'.
	Figure 4	New Figure 3 added to define geometry restrictions for countersinks in Composite structures.
	Table 3	Formerly Table 2. Reduced radius / chamfer dimensions added.
	Table 5	Formerly Table 4. Dimensions confirmed for coated fasteners.
	Table 7	Formerly Table 6. Dimensions confirmed for coated fasteners.
	Table 8	Formerly Table 7. Dimensions added for Diameter Code 3A.
	Table 10	Formerly Table 9. Table updated to include only defined head geometries / styles and to ensure appropriate cross reference to linked Tables.
	Table 11	Formerly Table 10. Table updated to ensure appropriate cross reference to linked Tables.
3 05/08	All	Table and Figure numbers updated to reflect changes.
	2	Reference to AIPS 01-02-005 updated to reflect changed title AIPS01-02-017 added
	3.1	Paragraphs redrafted to ensure appropriate referencing of AIPS and updated Table / Figure numbers. Reference to countersink dimensional requirements removed. Restrictions on countersink depth removed – reference AIPS and design principles documentation.
	3.2 – 3.4	Paragraphs reworded and reference figures and tables updated.
	3.5.1	Reference to AIPS 01-02-003 removed – not applicable.
	3.1.1 b f	Standard chamfer / radius re-defined as 'recommended' chamfer / radius. Use of reduced chamfer / radius restricted to metallic assemblies where there is a known risk of head dishing. Nota added for EN6050, MBBN4481, ABS0548, ASNA2041

Issue	Clause modified	Description of Modification
3 05/08	3.1.2 & Annex	Add a reference to RSDP and put all the information initially done in the Annex
	3.3.1.1 & Tables 3 to 6	Hole tolerances for installation in Composite/Composite or Composite/metallic assemblies for shear bolts
	3.3.1.2 & Tables 7 to 10	Hole tolerances for installation in Aluminum/Aluminum assemblies for shear bolts
	3.3.1.3 & Tables 11& 12	Hole tolerances for installation in hard metal/hard metal or hard metal/Aluminum assemblies for shear bolts
	3.3.2 & Tables 13 to 14	Hole tolerances for installation in pure tension or tension & shear applications for tension bolts
	Table 1	Figure of Hole Configuration for Use with Countersunk Head Bolts deleted and included in AIPS01-02-005
		Option for 130° countersink added.
		Reduced and 'recommended' chamfer / radius dimensions included in same table. Note added restricting use of 'reduced' chamfers / radii.
	Figure 1	Reference countersink dimensions included for use with 100° full and intermediate head countersink fasteners moved to Annex
	Figure 3	Original Figure 1 (countersink configuration and geometry) removed as requirement captured in AIPS. All other Figures re-numbered.
	Table 17	Tolerance (45°±1°) added on the angle for chamfer on protruding head
	Table 18	Hole geometry and style call-up codes added for use with 100° full & 100° reduced countersunk head and 130° countersunk head fasteners.
		Hole tolerance call-up codes added
4 10/08	1	Scope extended to include metallic assemblies
	3.1.1	Restrictions further defined for reduced chamfers.
	3.1.2	Head seating and requirements for conformance with governing fastener installation AIPS.
	3.3.1.2	Section added for transition and interference fit in metallic / Composite / metallic sandwich structures with reference to new Tables 7 & 8
	3.3.1.3	Section added for Al / Al assemblies with associated reference to new Tables 9 –12.
	3.3.1.4	New section added for hard metal / hard metal and hard metal / Al assemblies with reference to new Tables 13 and 14.
	3.3.2.	New section added for tension fasteners with reference to new Tables 15 and 16
	Tables 7 - 20	New Tables added according to referenced text and all tables and cross reference updated
		Annex was deleted no necessary information

Issue	Clause modified	Description of Modification
5 01/10	1	Scope extended to include all kinds of fasteners (rivets, blind bolts, clip nuts...)
	2	Normative references list updated to include standards
	3	Definition of hard metals, blind bolts and blind rivets added
	4	Limitation paragraph added
	5	Modification of requirement for 130° countersunk head fasteners
	5.1.3	Requirements updated to take into account rivet, blind bolts, clip nuts, and hole for fixed or floating anchor nuts
	5.1.4 & 5.2.2	Specification of radius for solid rivets
	5.3.2 & Table 15	Specification of radius/chamfer for blind fasteners
	5.3.4 & Tables 18 to 24	Hole tolerances for solid rivets added
	5.3.5 & Table 25	Hole tolerances for blind bolts (pull-type and threaded type) added
	5.3.6 & Table 26	Hole tolerances for head tightened bolts added
	5.3.7 & Table 27 to 30	Hole tolerances for floating or fixed nuts added
	5.3.8 & Table 31-32	Hole tolerances added for Rivetless nutplates
	Table 2	Chamfer for tension bolts added.
	Tables 15 to 32	Modification and creation of tables according to modification of requirements

Issue	Clause modified	Description of Modification
6 06/10	4	Deleted to avoid any issue regarding Resin based coating fasteners application
	4.2.2	Chamfer and radius requirement added for solid rivets
	4.3.1.3.3 & Table 11	Modification of the title to clarify the application.
	4.3.5.1 & Table 26	Modification of application perimeter
	Table 2	Chamfer dimension added for dash 19 to 22 tension bolts
	Table 3 to 6, 9, 16 and 17	Modification of hole tolerances of dash 19
	Table 8	Hole tolerances added for dash 6
	Table 9, 17	Modification of maximum standard hole tolerances for dash 3
	Table 13	Hole tolerances for dash 18 to 20 added
	Table 17	Hole tolerances for 2nd oversize of dash 3
	Table 18	Hole tolerances for tension & shear applications in assemblies with hard metal added (hole code ‘T4’)
	Table 3 to 6, 9, 16 and 17	Modification of hole tolerances of dash 19
	Table 8	Hole tolerances added for dash 6
	Table 9, 17	Modification of maximum standard hole tolerances for dash 3
	Table 13	Hole tolerances for dash 18 to 20 added
	Table 17	Hole tolerances for 2nd oversize of dash 3
	Table 18	Hole tolerances for tension & shear applications in assemblies with hard metal added (hole code ‘T4’)
	Table 15, 19 to 34	Codification modified according to the table 35
	Table 24	Hole tolerances for dash 11 added
	Table 27	Hole tolerances added for low floating anchor nuts (code ‘N10’)
	Table 28 to 31	ABS1295 added in titles
	Table 28 & 30	Hole tolerances for oversize of dash 08
	Table 29 & 31	No oversize applicable for dash 03 specified
	Table 35	Modification of the table in adding 2 columns for blind fasteners, solid rivets and nuts diameter codes to be in line with the fastener standards
	Table 36	Update of ‘R1’ code to refer to §5.1 and ‘R2’ code added for protruding head
	Table 37	‘T3’ & ‘N10’ hole tolerances code added

Issue	Clause modified	Description of Modification
7 01/11	2.	Normative references updated to include additional references.
	4.1.1 - 4.1.5	Paragraph updated to include chamfer recommendation countersunk fasteners in thin metallic stacks
	4.2.4	Paragraph added for countersunk head sleeved fasteners and GromEx.
	4.3.4.3	Paragraph added for protruding head sleeved fasteners and GromEx.
	4.3.9	Paragraph added for blind rivet nuts
	4.3.10	Requirements added for sleeved fasteners and GromEx sleeves
	Table 1	Paragraph added for snap and click brackets
	Figs 3-5	Footnote 4 added giving chamfer restrictions for thin stacks
	Table 21	Added to define geometry requirements for blind rivet nuts. Subsequent Figures renumbered
	Tables 26-28	NSA54216, 54217, 54219 blind rivets removed
	Tables 37-41	Added to define hole dimension requirements for blind rivet nuts. Subsequent Tables renumbered
	Table 42	Added to define hole dimension requirements for sleeved fasteners and GromEx. Subsequent Tables renumbered
		Added to define hole dimension requirements for snap and click brackets. Subsequent Tables renumbered
8 05/11	2	ABS0056, AIPS01-02-002, AIPS01-03-006, AIPS01-03-008, AIPS01-03-009 added in reference document list
	4.1.6	Paragraph added for countersunk head tapered shank fasteners.
	4.3.1.1 & Table 3, 4, 5 & 6	Title modification to include “Metallic/Composite/Metallic”
	4.3.1.3.5 & Table 44	Hole tolerances (code ‘M6’) added for countersunk tapered shank fasteners
	4.3.4.1.3 & Table 21	Restriction added as only applicable for metallic assemblies
	4.3.4.1.6 & Table 22	Hole tolerance (code ‘K1’) added for NAS1919 & NAS1921 in composite assemblies
	4.3.6.4	Paragraph added for low floating anchor nuts
	4.3.9	Precision on limitation on sleeved fasteners and GromEx sleeves applications (link with AIPS01-03-006, AIPS01-03-008 & AIPS01-03-009)
	4.5.5	Requirements added that oversize are only for rework and repair
	Table 1 & 2	Precision regarding applicability of Table 1 & 2
	Table 15	ABS0056 added to solid rivet hole tolerances
	Table 19	Hole tolerances added for blind bolts pull type 1st oversize

Issue	Clause modified	Description of Modification
8 05/11	Table 25	Hole tolerances added for threaded blind fasteners 1st oversize
	Table 36	Harmonization of hole tolerances whatever type of installation
	Table 41	Hole tolerances updated
	Table 43	Hole tolerances updated
	Table 46	Review of table to be clearer
	Table 47	Code C3 added for countersunk tapered shank fasteners and note added to clarify the intermediate, full and reduced head
	Table 48	Code M6 added for countersunk tapered shank bolts, Code K1 added for NAS1919 & NAS1921 in composite assemblies and code K2, K3, K4 & K5 for EN6131 and NSA5067. Precision on assembly type for code F1, F2 & F3
		Modification of Assembly type for L1, L2, L3, L4 & L5 to be in line with 4.3.9 title regarding applicability.
9 04/14	Figure 4 and corresponding table	Include dimensions H and P as referenced dimensions
	Table 1 to 18	Amended diameter code 2 values in tables 1 -18
	Table 16	Hole sizes amended to fall in line with other diameters
	Table 26	ASNA0081/0082 tolerance type "B" values amended
	Table 27	Remove hyphen from table 27 diameter codes
	Table 28	Remove hyphen codes
	Table 37	Diameter 5 2nd oversize values added
	Table 38	Replaced chamfer with radius in heading, 2nd oversize values inserted
	Table 39	Replaced chamfer with radius in heading, 2nd oversize values inserted
	Table 40	Replaced chamfer with radius in heading, 2nd oversize values inserted
	4.3.9.4 & Table 42	Marked as inactive for design and manufacturing
	Table 46	Hole diameter code A2 changed
	Table 47	Reference values amended, note for code G3 added.
	Table 48	Note for code L5 added
	Chapter 2	Added ABS1820 Bolt, Sleeved, 100° Countersunk intermediate head

Issue	Clause modified	Description of Modification
10 06/15	4.3.9.3 Table 2 Table 19 Table 41 Table 46 5 Table 47 Table 48 Table 49	Text “Hole diameters….ABS1807….” added. Values added for Code P2 in Columns Chamfer Min and Max from size 2 to 10. Diameter code 4 new. Text “(Standard & Oversizes)” in column “Installed…” added. New. In the designation a few links to the tables modified. Table 46 renamed in 47. Table 47 renamed in 48, Code G4 added. Table 48 renamed in 49, Code L6 added.
11 01/16	2 4.3.6.1, 4.3.6.2 And 4.3.6.3 Table 16 Table 31 Table 31 Table 38 Table 39	Term “Cres” changed as “CRES” (for NASM21048 in page 4) Term “equipment” changed as “equipment” Corrections of the 2nd Oversize dimensions for diameter 20 & 22 Term “equipment” changed as “equipment” MS21059 added for tolerance code ‘N2’ Term “lockbolts” changed as “Lockbolts” Term “lockbolts” changed as “Lockbolts”
12 06/18	4.3.4.1.7 Table 9 Table 20 Table 49	Paragraph added for blind bolts ABS2322 Addition of ABS2322 diameter codes Addition of hole diameters values for diameters code 07 and 09 according to values of the EN6122. Addition of ABS2322 for code M1 (table 9)

Issue	Clause modified	Description of Modification
13 06/21	All	Revision of typos, added designation (+) and (-) for clearance / interference
	2	Normative references updated
	4.1.3	Chapter created, subsequent chapters have been increased by one
	4.3.1.3.3	Chapter created for tolerance M3, subsequent chapter numbers increased by one
	4.3.1.4	Chapter and subchapters created for tolerance U1, subsequent chapter numbers increased by one
	4.3.4.2.1	Chapter name changed and text updated
	4.4.1	Spot face requirements link revised to Figure 10 / Table 47
	Figure 1	Reference to paragraph 5.1.1 deleted
	Figure 2	New drawing added, subsequent figure numbers increased by one
	Table 1	Designation of chamfer “F2” renamed to “C”
	Table 2	Note 2 updated
	Table 9	ABS2323 and related dia codes -8 and -10 added
	Table 11	Table 11, code M3 added, subsequent table numbers increased by one
	Table 14	Table 14, code U1 added, subsequent table numbers increased by one
	Table 24	Diameter code ‘06’ added and tolerances defined
	Table 27	Note 1 removed, ASNA0081/0082 excluded in title line
	0	Table title renamed to large float
	Table 28	Missing dimensions of type ‘A’ tolerance added
	Table 43	Maximum and Minimum hole diameter D and D’ amended
	Table 45	Updated with oversize hole diameters
	Table 49	Revision of blind fasteners’ nominal diameter values. Notes added
14 11/22	2	Normative references updated.
	4.1.7	Amended the countersunk tapered shank fasteners reference section as 4.3.1.3.6
	4.3.2.2	Paragraph added for Aluminum alloy solid rivet installation in FML and FML / Aluminum material.
	Table 5	Modification of the hole dimensions for Diameter code 19.
	Table 7	Revision of typos, amended Clearance (+) to Transition (±). Added “-“ (Negative) symbol for Interference / min values.
	Table 8	Revision of typos, amended Clearance (+) to Interference (-). Added “-“. (Negative) symbol for Interference values.
	Table 16	Note added for ASNA0095/96/97/98.

Issue	Clause modified	Description of Modification
15 02/24		Following modifications with reference to the CPPRs 26352, 26663 & 28191
	2	ABS0889, ABS1830 & NASM21069 added in reference document list
	4.3.1.3.7	Chapter created for tolerances ‘M7’
	Table 2	Maximum and Minimum Chamfer (C) dimension of Diameter code 8 amended Note 2 updated with ABS1830
	Figure 5	New drawing added for protruding tapered shank fasteners, subsequent figure numbers increased by one
	Table 15	Table 14, code ‘M7’ added, subsequent table numbers increased by one
	5	Reference table numbers updated
	Table 35	MS21069 added for tolerance code ‘N1’
	Table 51	ABS1830 added for the ‘P3’ code New code ‘P4’ added for Protruding Head – Tapered shank bolts. Reference figure and table numbers updated
	Table 52	Added Code ‘M7’ for Protruding tapered shank bolts. Reference figure and table numbers updated