

BS 3A 117:1962+A2:2016



BSI Standards Publication

AEROSPACE SERIES

Bolts, Pan Head, Slotted Drive, Unified Threads, Corrosion Resisting Steel, Strength Class 880 MPa, for Aircraft – Specification

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Summary of pages

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Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 May 2016. It was prepared by Technical Committee ACE/12, *Aerospace fasteners and fastening systems*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

BS 3A 117:1962+A2:2016 supersedes BS 3A 117:1962 (Incorporating Amendment No 1:1962), which is withdrawn.

Information about this document

Amendment No.2:2016 introduces the following principle changes:

- the addition of high expansion heat resisting steel conforming to BS HR 650, BS EN 2398 and BS EN 2399;
- to take account of the mechanical properties of these steels, the introduction of a part number code for bolts made from high expansion heat resisting steels (to be marked on the bolt surface), to distinguish them from bolts made from the BS S 80 material (see Clause 9).

The start and finish of text introduced or altered by Amendment No.2:2016 is indicated in the text by tags $\boxed{A_2}$ $\boxed{A_2}$. Minor editorial changes are not tagged. Previous amendments are not indicated.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

1 Scope

^{A2} This British Standard specifies the materials, dimensions and inspection requirements for corrosion resisting steel pan head bolts (Unified threads), Strength class 880 MPa, for aircraft. ^{A2}

2 Normative references

^{A2} The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS S 80, *High chromium-nickel corrosion resisting steel forging stock, bars, forgings and parts (880 to 1 080 MPa: limiting ruling section 100 mm)*

BS 4A 100:2003, *Aerospace series – Specification for general requirements for bolts and free running nuts of tensile strength not exceeding 1 249 MPa*

BS HR 650, *Aerospace series – Specification for high expansion heat-resisting steel bar and wire for the manufacture of bolts, studs, set screws and nuts (Ni 25.5, Cr 15, Ti 2, Mn 1.5, Mo 1.25, Si 0.7, V 0.3) (Limiting ruling section 50 mm)*

BS EN 2398, *Aerospace series – Heat resisting steel FE-PA2601 (X6NiCrTiMoV26-15) – Rm ≥ 900 MPa – Bars for machined bolts – D ≤ 25 mm*

BS EN 2399, *Aerospace series – Heat resisting steel FE-PA2601 (X4NiCrTiMoV26-15) – Rm ≥ 900 MPa – Bars for forged bolts – D ≤ 25 mm*

BS EN ISO 6506-1, *Metallic materials – Brinell hardness test – Part 1: Test method*

BS EN ISO 6507-1, *Metallic materials – Vickers hardness test – Part 1: Test method*

BS EN ISO 6508-1, *Metallic materials – Rockwell hardness test – Part 1: Test method* ^{A2}

3 General requirements

The bolts shall comply with the relevant requirements of ^{A2} BS 4A 100:2003 ^{A2} in respect of manufacture, screw threads, identification and marking.

4 Material and manufacture

- a) ^{A2} The bolts shall be manufactured by one of the following methods:
 - machined from bright drawn bars that conform to one of the British Standards specified in Table 1; or
 - forged from material that conforms to one of the British Standards specified in Table 1.
- b) The materials used for the manufacture of forged bolts shall have the following mechanical properties in the final heat-treated condition:
 - 0.2% proof stress (min): 590 MPa;
 - tensile strength (min): 880 MPa;
 - elongation (min): 12%;
 - izod impact (min): 55 J (40 ft·lbf). ¹⁾ ^{A2}

¹⁾ Not applicable to the materials given in BS HR 650, BS EN 2398 and BS EN 2399.

Table 1 – Materials for manufacture of bolts

BS No.	Material	Application
BS S 80	2½% nickel-chromium-molybdenum steel	For the manufacture of machined bolts
BS HR 650	High expansion heat-resisting steel	For the manufacture of forged bolts
BS EN 2398	High expansion heat-resisting steel	For the manufacture of machined bolts
BS EN 2399	High expansion heat-resisting steel	For the manufacture of forged bolts

5 Dimensions

- All finished bolts shall conform to the dimensions and tolerances given in Table 2 and Table 3, and Figure 1.
- The clamping length of the bolt shall conform to the dimensions and tolerances given in Table 3, and shall be such that when a standard nut without countersink or a ring gauge without countersink has been screwed on as far as possible by hand, its leading face is within the distance M from the underside of the bolt head. The runout of thread shall not exceed twice the pitch.
- The nominal length of the bolt shall be the minimum bearing length L , which is determined by the minimum clamping length M , less two thread pitches.

6 Screw threads

The bolts shall have Unified threads of the form and class of fit specified in the relevant requirements of BS 4A 100:2003.

7 Protective finish

A protective finish shall not be applied to the bolts.

8 Hardness values

The hardness values of finished bolts shall be as follows; in accordance with BS EN ISO 6506-1 (Brinell), BS EN ISO 6507-1 (Vickers) or BS EN ISO 6508-1 (Rockwell 'C'):

- for machined components:
255 to 321 HBW 1/30; 26 to 34 HRC; or
270 to 340 HV30.
- for forged components:
248 to 341 HBW 1/30; 26 to 34 HRC; or
260 to 360 HV30.

9 Identification and marking

9.1 Identification

The British Standard identifier and part number (in accordance with Table 3) shall not be applied on the bolts, but shall be clearly marked on the labels of parcels of bolts together with the batch identification code.

EXAMPLES

A117-11D is a bolt with thread size 10 32 UNF and bearing length of 1.1 inches manufactured in material conforming to BS S 80;

A117X11D is a bolt of the same size manufactured with materials conforming to BS HR 650, BS EN 2398, or BS EN 2399. A_2

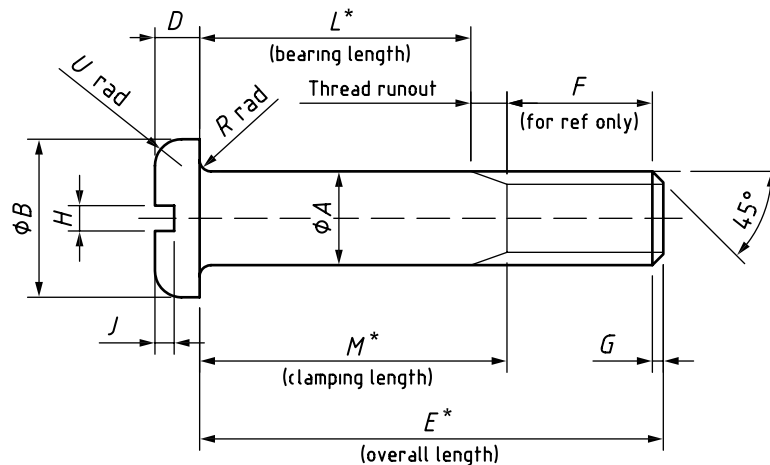
9.2 Marking

A_2 Bolts manufactured with materials conforming to BS HR 650, BS EN 2398, and BS EN 2399 shall be marked with an 'X' in accordance with BS 4A 100:2003, Clause 8. A_2

10 Inspection procedure

A_2 The bolts shall be inspected in accordance with the relevant requirements of BS 4A 100:2003. A_2

Figure 1 Dimensions



* For bearing length L , clamping length M and overall length E , see Table 3.

A2) Table 2 – Dimensions

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19		
Thread size (decimal equivalent)	Thread size	Shank dia		Thread runout length (2x pitch)		Head dia		Head thickness		Radius around head		Underhead radius		Chamfer depth		Slot Width		Depth		
		ϕA				$(F)^\dagger$	ϕB		D	U	R		G		H		J^\ddagger			
		min	max	max	min	min	max	min	max	nom	min	max	min	max	min	max	min	max	min	max
in.		in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
.112-40 UNC	4-40 UNC	0.1085	0.1115	0.050	0.300	0.184	0.194	0.058	0.068	0.042	0.005	0.015	0.015	0.020	0.031	0.039	0.030	0.040		
.138-32 UNC	6-32 UNC	0.1345	0.1375	0.063	0.277	0.242	0.252	0.072	0.082	0.046	0.005	0.015	0.020	0.030	0.039	0.048	0.037	0.050		
.164-32 UNC	8-32 UNC	0.1605	0.1635	0.063	0.327	0.273	0.283	0.085	0.096	0.052	0.010	0.020	0.020	0.030	0.045	0.054	0.045	0.058		
.190-32 UNF	10-32 UNF	0.1865	0.1895	0.063	0.377	0.309	0.319	0.099	0.110	0.061	0.010	0.020	0.020	0.030	0.050	0.060	0.053	0.068		
.250-28 UNF	1/4-28 UNF	0.2465	0.2495	0.071	0.459	0.420	0.440	0.130	0.144	0.087	0.015	0.030	0.030	0.040	0.064	0.075	0.070	0.087		
.3125-24 UNF	5/16-24 UNF	0.3090	0.3120	0.083	0.497	0.527	0.547	0.162	0.178	0.099	0.015	0.030	0.030	0.040	0.072	0.084	0.085	0.106		

[†] This dimension is an absolute minimum associated with maximum length M and minimum length E. It is not intended for use for manufacturing or inspection purposes

[‡] To be measured from the top of the head to the point at which the slot breaks through. **A2)**

Table 3 – Bearing length *L*, clamping length *M* and overall length *E*

No. 4-40 UNC			No. 6-32 UNC				No. 8-32 UNC				
Part No. Code	*L min	M 0 –0.030	E +0.040 0	Part No. Code	*L min	M 0 –0.030	E +0.040 0	Part No. Code	*L min	M 0 –0.030	E +0.040 0
	in.	in.	in.		in.	in.	in.		in.	in.	in.
½A	0.050	0.130	0.450	½B	0.050	0.143	0.450	½C	0.050	0.143	0.500
1A	0.100	0.180	0.500	1B	0.100	0.193	0.500	1C	0.100	0.193	0.550
2A	0.200	0.280	0.600	2B	0.200	0.293	0.600	2C	0.200	0.293	0.650
3A	0.300	0.380	0.700	3B	0.300	0.393	0.700	3C	0.300	0.393	0.750
4A	0.400	0.480	0.800	4B	0.400	0.493	0.800	4C	0.400	0.493	0.850
5A	0.500	0.580	0.900	5B	0.500	0.593	0.900	5C	0.500	0.593	0.950
6A	0.600	0.680	1.000	6B	0.600	0.693	1.000	6C	0.600	0.693	1.050
7A	0.700	0.780	1.100	7B	0.700	0.793	1.100	7C	0.700	0.793	1.150
8A	0.800	0.880	1.200	8B	0.800	0.893	1.200	8C	0.800	0.893	1.250
9A	0.900	0.980	1.300	9B	0.900	0.993	1.300	9C	0.900	0.993	1.350
10A	1.000	1.080	1.400	10B	1.000	1.093	1.400	10C	1.000	1.093	1.450
11A	1.100	1.180	1.500	11B	1.100	1.193	1.500	11C	1.100	1.193	1.550
12A	1.200	1.280	1.600	12B	1.200	1.293	1.600	12C	1.200	1.293	1.650
13A	1.300	1.380	1.700	13B	1.300	1.393	1.700	13C	1.300	1.393	1.750
14A	1.400	1.480	1.800	14B	1.400	1.493	1.800	14C	1.400	1.493	1.850
15A	1.500	1.580	1.900	15B	1.500	1.593	1.900	15C	1.500	1.593	1.950
16A	1.600	1.680	2.000	16B	1.600	1.693	2.000	16C	1.600	1.693	2.050
17A	1.700	1.780	2.100	17B	1.700	1.793	2.100	17C	1.700	1.793	2.150
18A	1.800	1.880	2.200	18B	1.800	1.893	2.200	18C	1.800	1.893	2.250
19A	1.900	1.980	2.300	19B	1.900	1.993	2.300	19C	1.900	1.993	2.350
20A	2.000	2.080	2.400	20B	2.000	2.093	2.400	20C	2.000	2.093	2.450
21A	2.100	2.180	2.500	21B	2.100	2.193	2.500	21C	2.100	2.193	2.550
22A	2.200	2.280	2.600	22B	2.200	2.293	2.600	22C	2.200	2.293	2.650
23A	2.300	2.380	2.700	23B	2.300	2.393	2.700	23C	2.300	2.393	2.750
24A	2.400	2.480	2.800	24B	2.400	2.493	2.800	24C	2.400	2.493	2.850
25A	2.500	2.580	2.900	25B	2.500	2.593	2.900	25C	2.500	2.593	2.950
26A	2.600	2.680	3.000	26B	2.600	2.693	3.000	26C	2.600	2.693	3.050
27A	2.700	2.780	3.100	27B	2.700	2.793	3.100	27C	2.700	2.793	3.150
28A	2.800	2.880	3.200	28B	2.800	2.893	3.200	28C	2.800	2.893	3.250
29A	2.900	2.980	3.300	29B	2.900	2.993	3.300	29C	2.900	2.993	3.350
30A	3.000	3.080	3.400	30B	3.000	3.093	3.400	30C	3.000	3.093	3.450
31A	3.100	3.180	3.500	31B	3.100	3.193	3.500	31C	3.100	3.193	3.550
32A	3.200	3.280	3.600	32B	3.200	3.293	3.600	32C	3.200	3.293	3.650
33A	3.300	3.380	3.700	33B	3.300	3.393	3.700	33C	3.300	3.393	3.750
34A	3.400	3.480	3.800	34B	3.400	3.493	3.800	34C	3.400	3.493	3.850
35A	3.500	3.580	3.900	35B	3.500	3.593	3.900	35C	3.500	3.593	3.950
36A	3.600	3.680	4.000	36B	3.600	3.693	4.000	36C	3.600	3.693	4.050
37A	3.700	3.780	4.100	37B	3.700	3.793	4.100	37C	3.700	3.793	4.150
38A	3.800	3.880	4.200	38B	3.800	3.893	4.200	38C	3.800	3.893	4.250

*See Clause 5c). ^{A2}

Table 3 – Bearing length *L*, clamping length *M* and overall length *E* (continued)

No. 10-32 UNF			¼ in. UNF				5/16 in. UNF				
Part No. Code	*L min	M 0 -0.030	E +0.040 0	Part No. Code	*L min	M 0 -0.030	E +0.040 0	Part No. Code	*L min	M 0 -0.030	E +0.040 0
	in.	in.	in.		in.	in.	in.		in.	in.	in.
½D	0.050	0.143	0.550	½E	0.050	0.151	0.650	½G	0.050	0.163	0.700
1D	0.100	0.193	0.600	1E	0.100	0.201	0.700	1G	0.100	0.213	0.750
2D	0.200	0.293	0.700	2E	0.200	0.301	0.800	2G	0.200	0.313	0.850
3D	0.300	0.393	0.800	3E	0.300	0.401	0.900	3G	0.300	0.413	0.950
4D	0.400	0.493	0.900	4E	0.400	0.501	1.000	4G	0.400	0.513	1.050
5D	0.500	0.593	1.000	5E	0.500	0.601	1.100	5G	0.500	0.613	1.150
6D	0.600	0.693	1.100	6E	0.600	0.701	1.200	6G	0.600	0.713	1.250
7D	0.700	0.793	1.200	7E	0.700	0.801	1.300	7G	0.700	0.813	1.350
8D	0.800	0.893	1.300	8E	0.800	0.901	1.400	8G	0.800	0.913	1.450
9D	0.900	0.993	1.400	9E	0.900	1.001	1.500	9G	0.900	1.013	1.550
10D	1.000	1.093	1.500	10E	1.000	1.101	1.600	10G	1.000	1.113	1.650
11D	1.100	1.193	1.600	11E	1.100	1.201	1.700	11G	1.100	1.213	1.750
12D	1.200	1.293	1.700	12E	1.200	1.301	1.800	12G	1.200	1.313	1.850
13D	1.300	1.393	1.800	13E	1.300	1.401	1.900	13G	1.300	1.413	1.950
14D	1.400	1.493	1.900	14E	1.400	1.501	2.000	14G	1.400	1.513	2.050
15D	1.500	1.593	2.000	15E	1.500	1.601	2.100	15G	1.500	1.613	2.150
16D	1.600	1.693	2.100	16E	1.600	1.701	2.200	16G	1.600	1.713	2.250
17D	1.700	1.793	2.200	17E	1.700	1.801	2.300	17G	1.700	1.813	2.350
18D	1.800	1.893	2.300	18E	1.800	1.901	2.400	18G	1.800	1.913	2.450
19D	1.900	1.993	2.400	19E	1.900	2.001	2.500	19G	1.900	2.013	2.550
20D	2.000	2.093	2.500	20E	2.000	2.101	2.600	20G	2.000	2.113	2.650
21D	2.100	2.193	2.600	21E	2.100	2.201	2.700	21G	2.100	2.213	2.750
22D	2.200	2.293	2.700	22E	2.200	2.301	2.800	22G	2.200	2.313	2.850
23D	2.300	2.393	2.800	23E	2.300	2.401	2.900	23G	2.300	2.413	2.950
24D	2.400	2.493	2.900	24E	2.400	2.501	3.000	24G	2.400	2.513	3.050
25D	2.500	2.593	3.000	25E	2.500	2.601	3.100	25G	2.500	2.613	3.100
26D	2.600	2.693	3.100	26E	2.600	2.701	3.200	26G	2.600	2.713	3.250
27D	2.700	2.793	3.200	27E	2.700	2.801	3.300	27G	2.700	2.813	3.350
28D	2.800	2.893	3.300	28E	2.800	2.901	3.400	28G	2.800	2.913	3.450
29D	2.900	2.993	3.400	29E	2.900	3.001	3.500	29G	2.900	3.013	3.550
30D	3.000	3.093	3.500	30E	3.000	3.101	3.600	30G	3.000	3.113	3.650
31D	3.100	3.193	3.600	31E	3.100	3.201	3.700	31G	3.100	3.213	3.750
32D	3.200	3.293	3.700	32E	3.200	3.301	3.800	32G	3.200	3.313	3.850
33D	3.300	3.393	3.800	33E	3.300	3.401	3.900	33G	3.300	3.413	3.950
34D	3.400	3.493	3.900	34E	3.400	3.501	4.000	34G	3.400	3.513	4.050
35D	3.500	3.593	4.000	35E	3.500	3.601	4.100	35G	3.500	3.613	4.150
36D	3.600	3.693	4.100	36E	3.600	3.701	4.200	36G	3.600	3.713	4.250
37D	3.700	3.793	4.200	37E	3.700	3.801	4.300	37G	3.700	3.813	4.350
38D	3.800	3.893	4.300	38E	3.800	3.901	4.400	38G	3.800	3.913	4.450

* See Clause 5c). 

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