

Specification for

**Cadmium-plated steel
bolts —
(Unified hexagons and
Unified threads) with
close tolerance shanks**

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Aerospace Systems Standards Policy Committee (ACE/-) to Technical Committee ACE/12, upon which the following bodies were represented:

The Association of Electronics, Telecommunications and Business Equipment Industries

British Industrial Fasteners Federation

Ministry of Defence

Society of British Aerospace Companies Ltd.

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Foreword

This edition of this British Standard has been prepared under the direction of the Aerospace Standards Policy Committee and supersedes BS 3A 111:1962 which is withdrawn.

This edition clarifies the maximum diameter of bolts after plating, but it does not reflect a full review or revision of the standard which will be undertaken in due course. The 0.0003 in plating allowance on the maximum diameter quoted in BS 3A 111 (and preceding editions) is now embodied in the maximum diameter after plating in Table 1, and separate reference to a plating allowance has been deleted. The maximum diameter of bolts before plating has been deleted and the thickness of plating is now controlled.

An equivalent range of bolts with unplated shanks is specified in BS 3A 108.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 4, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This British Standard specifies the materials, dimensions, finish and inspection requirements for steel bolts with Unified hexagons, Unified threads and close tolerance shanks cadmium plated to be suitable for insertion in aluminium alloy materials, for aircraft.

2 References

2.1 Normative references

This British Standard incorporates, by reference, provisions from specific editions of other publications. These normative references are cited at the appropriate points in the text and the publications are listed on the inside back cover. Subsequent amendments to, or revisions of, any of these publications apply to this standard only when incorporated in it by updating or revision.

2.2 Informative references

This British Standard refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on the inside back cover, but reference should be made to the latest editions.

3 Procurement

The bolts shall conform to the latest edition of BS A 100.

4 Materials and manufacture

4.1 The bolts shall be manufactured by one of the following methods:

a) machined from bright drawn bars which conform to the following British Standards:

BS 3S 95:1967

or BS 2S 114:1964

or BS 2S 116:1964 bolts up to and including $\frac{3}{8}$ in diameter;

or BS 2S 117:1964

or BS S 154:1976

NOTE BS S 96 material may be used until stocks are exhausted.

b) forged from material which conforms to the following British Standards:

BS 3S 102:1969

or BS 3S 105:1969

or BS 2S 147:1976

or BS S 148:1969

or BS 2S 149:1976

or BS S 158:1977

4.2 In the finally heat-treated condition, the mechanical properties of the material used for forged bolts shall be as follows:

0.1 % proof stress	not less than 664 MPa (43 tonf/in ²)
tensile strength	not less than 850 MPa (55 tonf/in ²) not more than 1 003 MPa (65 tonf/in ²)
elongation on 4 $\sqrt{\text{area}}$	not less than 18 %
Izod impact value:	not less than 54 J (40 ft lbf)

5 Anti-corrosion treatment

All finished bolts shall be coated with cadmium in accordance with DEF STAN 03-19[1].

6 Dimensions

6.1 All finished bolts, after the application of the cadmium coating, shall conform to the dimensions and tolerances given in Table 1 and Table 2.

6.2 The clamping length of the bolt shall conform to the dimensions and tolerances given in Table 2, and shall be such that when a standard nut without countersink or 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.

6.3 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.

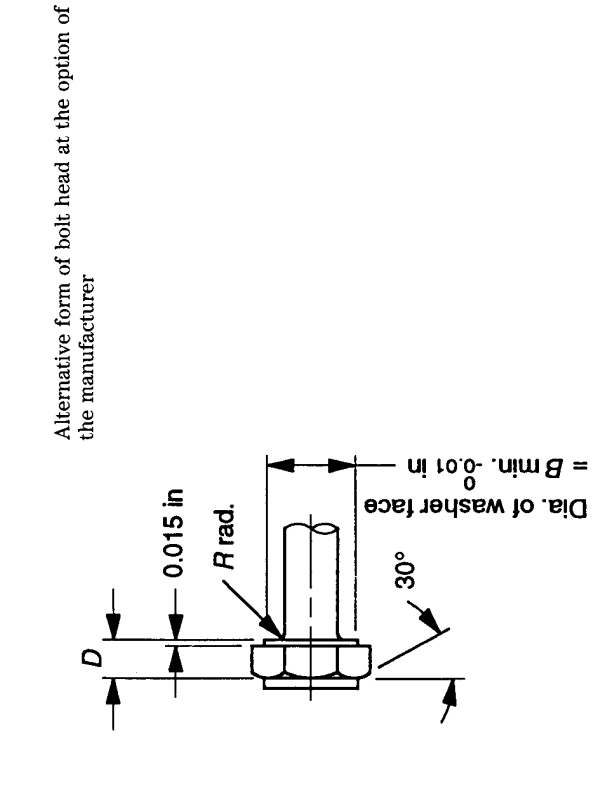
7 Screw threads

The bolts shall have Unified threads of the form and class of fit specified in the latest edition of BS A 100.

Table 1 — Dimensions

Dimensions in inches

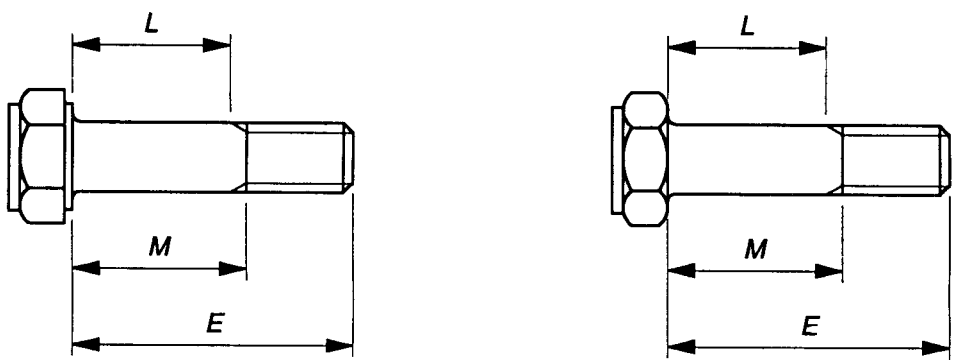
1	2	3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		
		Nominal size		Diameter of plain portion of shank		Diameter of plain portion of shank		2 x pitch		Minimum length of screwed portion of shank		Width across flats		Width across corners		Thickness of head		Radius under bolt head		Depth of chamfer		Identification disk		Diameter		Depth								
Diameter of plain portion of shank	Thread	A		B		C		D		E		F		G		H		I		J		K		L		M		N		O				
		Before plating	After plating	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.			
0.190	No. 10-32 UNF	0.1887	0.1899	0.1891	0.1891	0.063	0.377	0.344	0.339	0.397	0.115	0.105	0.020	0.010	0.030	0.020	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	
1/4	1/4 in UNF	0.2489	0.2501	0.2493	0.2493	0.071	0.459	0.438	0.431	0.505	0.150	0.140	0.030	0.015	0.040	0.030	0.040	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	
5/16	5/16 in UNF	0.3112	0.3126	0.3118	0.3118	0.083	0.497	0.500	0.493	0.577	0.180	0.170	0.030	0.015	0.040	0.030	0.040	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
3/8	3/8 in UNF	0.3737	0.3751	0.3743	0.3743	0.083	0.597	0.562	0.554	0.650	0.220	0.210	0.030	0.015	0.040	0.030	0.040	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
7/16	7/16 in UNF	0.4362	0.4376	0.4368	0.4368	0.100	0.670	0.688	0.679	0.794	0.270	0.260	0.030	0.015	0.040	0.030	0.040	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
1/2	1/2 in UNF	0.4987	0.5001	0.4993	0.4993	0.100	0.770	0.750	0.741	0.866	0.300	0.290	0.030	0.015	0.040	0.030	0.040	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030



¹⁾ For bearing length *L*, clamping length *M* and overall length *E* see Table 2.
²⁾ 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.

Table 2 — Bearing length L , clamping length M and overall length E

Dimensions in inches



No. 10-32 UNF				$\frac{1}{4}$ in UNF				$\frac{5}{16}$ in UNF			
Part No.	L^a min.	$M \begin{smallmatrix} 0 \\ -0.03 \end{smallmatrix}$	$E \begin{smallmatrix} +0.04 \\ 0 \end{smallmatrix}$	Part No.	L^a min.	$M \begin{smallmatrix} 0 \\ -0.03 \end{smallmatrix}$	$E \begin{smallmatrix} +0.04 \\ 0 \end{smallmatrix}$	Part No.	L^a min.	$M \begin{smallmatrix} 0 \\ -0.03 \end{smallmatrix}$	$E \begin{smallmatrix} +0.04 \\ 0 \end{smallmatrix}$
$\frac{1}{2}$ D	0.05	0.143	0.55	1E	0.1	0.201	0.70	1G	0.1	0.213	0.75
1D	0.1	0.193	0.60	2E	0.2	0.301	0.80	2G	0.2	0.313	0.85
2D	0.2	0.293	0.70	3E	0.3	0.401	0.90	3G	0.3	0.413	0.95
3D	0.3	0.393	0.80	4E	0.4	0.501	1.00	4G	0.4	0.513	1.05
4D	0.4	0.493	0.90	5E	0.5	0.601	1.10	5G	0.5	0.613	1.15
5D	0.5	0.593	1.00	6E	0.6	0.701	1.20	6G	0.6	0.713	1.25
6D	0.6	0.693	1.10	7E	0.7	0.801	1.30	7G	0.7	0.813	1.35
7D	0.7	0.793	1.20	8E	0.8	0.901	1.40	8G	0.8	0.913	1.45
8D	0.8	0.893	1.30	9E	0.9	1.001	1.50	9G	0.9	1.013	1.55
9D	0.9	0.993	1.40	10E	1.0	1.101	1.60	10G	1.0	1.113	1.65
10D	1.0	1.093	1.50	11E	1.1	1.201	1.70	11G	1.1	1.213	1.75
11D	1.1	1.193	1.60	12E	1.2	1.301	1.80	12G	1.2	1.313	1.85
12D	1.2	1.293	1.70	13E	1.3	1.401	1.90	13G	1.3	1.413	1.95
13D	1.3	1.393	1.80	14E	1.4	1.501	2.00	14G	1.4	1.513	2.05
14D	1.4	1.493	1.90	15E	1.5	1.601	2.10	15G	1.5	1.613	2.15
15D	1.5	1.593	2.00	16E	1.6	1.701	2.20	16G	1.6	1.713	2.25
16D	1.6	1.693	2.10	17E	1.7	1.801	2.30	17G	1.7	1.813	2.35
17D	1.7	1.793	2.20	18E	1.8	1.901	2.40	18G	1.8	1.913	2.45
18D	1.8	1.893	2.30	19E	1.9	2.001	2.50	19G	1.9	2.013	2.55
19D	1.9	1.993	2.40	20E	2.0	2.101	2.60	20G	2.0	2.113	2.65
20D	2.0	2.093	2.50	21E	2.1	2.201	2.70	21G	2.1	2.213	2.75
21D	2.1	2.193	2.60	22E	2.2	2.301	2.80	22G	2.2	2.313	2.85
22D	2.2	2.293	2.70	23E	2.3	2.401	2.90	23G	2.3	2.413	2.95
23D	2.3	2.393	2.80	24E	2.4	2.501	3.00	24G	2.4	2.513	3.05
24D	2.4	2.493	2.90	25E	2.5	2.601	3.10	25G	2.5	2.613	3.15
25D	2.5	2.593	3.00	26E	2.6	2.701	3.20	26G	2.6	2.713	3.25
				27E	2.7	2.801	3.30	27G	2.7	2.813	3.35
				28E	2.8	2.901	3.40	28G	2.8	2.913	3.45
				29E	2.9	3.001	3.50	29G	2.9	3.013	3.55
				30E	3.0	3.101	3.60	30G	3.0	3.113	3.65
								31G	3.1	3.213	3.75
								32G	3.2	3.313	3.85
								33G	3.3	3.413	3.95
								34G	3.4	3.513	4.05
								35G	3.5	3.613	4.15
								36G	3.6	3.713	4.25
								37G	3.7	3.813	4.35

NOTE Bolts below the heavy line may not be readily available in large quantities because of limitations in manufacture by forging.
^a See 6.3.

Table 2 — Bearing length L , clamping length M and overall length E

$\frac{3}{8}$ in UNF				$\frac{7}{16}$ in UNF				$\frac{1}{2}$ in UNF			
Part No.	L^b min.	$M \begin{smallmatrix} 0 \\ -0.03 \end{smallmatrix}$	$E \begin{smallmatrix} +0.04 \\ 0 \end{smallmatrix}$	Part No.	L^b min.	$M \begin{smallmatrix} 0 \\ -0.03 \end{smallmatrix}$	$E \begin{smallmatrix} +0.04 \\ 0 \end{smallmatrix}$	Part No.	L^b min.	$M \begin{smallmatrix} 0 \\ -0.03 \end{smallmatrix}$	$E \begin{smallmatrix} +0.04 \\ 0 \end{smallmatrix}$
1J	0.1	0.213	0.85	1L	0.1	0.230	0.95	1N	0.1	0.230	1.05
2J	0.2	0.313	0.95	2L	0.2	0.330	1.05	2N	0.2	0.330	1.15
3J	0.3	0.413	1.05	3L	0.3	0.430	1.15	3N	0.3	0.430	1.25
4J	0.4	0.513	1.15	4L	0.4	0.530	1.25	4N	0.4	0.530	1.35
5J	0.5	0.613	1.25	5L	0.5	0.630	1.35	5N	0.5	0.630	1.45
6J	0.6	0.713	1.35	6L	0.6	0.730	1.45	6N	0.6	0.730	1.55
7J	0.7	0.813	1.45	7L	0.7	0.830	1.55	7N	0.7	0.830	1.65
8J	0.8	0.913	1.55	8L	0.8	0.930	1.65	8N	0.8	0.930	1.75
9J	0.9	1.013	1.65	9L	0.9	1.030	1.75	9N	0.9	1.030	1.85
10J	1.0	1.113	1.75	10L	1.0	1.130	1.85	10N	1.0	1.130	1.95
11J	1.1	1.213	1.85	11L	1.1	1.230	1.95	11N	1.1	1.230	2.05
12J	1.2	1.313	1.95	12L	1.2	1.330	2.05	12N	1.2	1.330	2.15
13J	1.3	1.413	2.05	13L	1.3	1.430	2.15	13N	1.3	1.430	2.25
14J	1.4	1.513	2.15	14L	1.4	1.530	2.25	14N	1.4	1.530	2.35
15J	1.5	1.613	2.25	15L	1.5	1.630	2.35	15N	1.5	1.630	2.45
16J	1.6	1.713	2.35	16L	1.6	1.730	2.45	16N	1.6	1.730	2.55
17J	1.7	1.813	2.45	17L	1.7	1.830	2.55	17N	1.7	1.830	2.65
18J	1.8	1.913	2.55	18L	1.8	1.930	2.65	18N	1.8	1.930	2.75
19J	1.9	2.013	2.65	19L	1.9	2.030	2.75	19N	1.9	2.030	2.85
20J	2.0	2.113	2.75	20L	2.0	2.130	2.85	20N	2.0	2.130	2.95
21J	2.1	2.213	2.85	21L	2.1	2.230	2.95	21N	2.1	2.230	3.05
22J	2.2	2.313	2.95	22L	2.2	2.330	3.05	22N	2.2	2.330	3.15
23J	2.3	2.413	3.05	23L	2.3	2.430	3.15	23N	2.3	2.430	3.25
24J	2.4	2.513	3.15	24L	2.4	2.530	3.25	24N	2.4	2.530	3.35
25J	2.5	2.613	3.25	25L	2.5	2.630	3.35	25N	2.5	2.630	3.45
26J	2.6	2.713	3.35	26L	2.6	2.730	3.45	26N	2.6	2.730	3.55
27J	2.7	2.813	3.45	27L	2.7	2.830	3.55	27N	2.7	2.830	3.65
28J	2.8	2.913	3.55	28L	2.8	2.930	3.65	28N	2.8	2.930	3.75
29J	2.9	3.013	3.65	29L	2.9	3.030	3.75	29N	2.9	3.030	3.85
30J	3.0	3.113	3.75	30L	3.0	3.130	3.85	30N	3.0	3.130	3.95
31J	3.1	3.213	3.85	31L	3.1	3.230	3.95	31N	3.1	3.230	4.05
32J	3.2	3.313	3.95	32L	3.2	3.330	4.05	32N	3.2	3.330	4.15
33J	3.3	3.413	4.05	33L	3.3	3.430	4.15	33N	3.3	3.430	4.25
34J	3.4	3.513	4.15	34L	3.4	3.530	4.25	34N	3.4	3.530	4.35
35J	3.5	3.613	4.25	35L	3.5	3.630	4.35	35N	3.5	3.630	4.45
				36L	3.6	3.730	4.45	36N	3.6	3.730	4.55
				37L	3.7	3.830	4.55	37N	3.7	3.830	4.65
				38L	3.8	3.930	4.65	38N	3.8	3.930	4.75
				39L	3.9	4.030	4.75	39N	3.9	4.030	4.85
				40L	4.0	4.130	4.85	40N	4.0	4.130	4.95
								41N	4.1	4.230	5.05
								42N	4.2	4.330	5.15
								43N	4.3	4.430	5.25
								44N	4.4	4.530	5.35
								45N	4.5	4.630	5.45

NOTE Bolts below the heavy line may not be readily available in large quantities because of limitations in manufacture by forging.
^b See 6.3.

List of references (see clause 2)

Normative references

BSI standards publications

BRITISH STANDARDS INSTITUTION, London

- BS 3A 100:1991, *Specification for general requirements for bolts and free running nuts of tensile strength not exceeding 1 249 MPa*¹⁾.
- BS 3S 95:1967, *Specification for 1½ per cent nickel-chromium-molybdenum steel [90/110 kgf/mm² (57/70 tonf/in²): limiting ruling section 150 mm (6 in)]*.
- BS 3S 102:1969, *Specification for carbon-molybdenum steel (bar for the manufacture of forged bolts only)*.
- BS 3S 105:1969, *Specification for carbon steel (bar for the manufacture of forged bolts only)*.
- BS 2S 114:1964, *Specification for aircraft material. Manganese-molybdenum steel (55/65 tonf/sq in: limiting ruling section 2½ inches)*.
- BS 2S 116:1964, *Specification for aircraft material "40" carbon steel bright bars for machining (55-65 tonf/sq in: limiting ruling section ¾ inch) (primarily intended for the manufacture of machined bolts)*.
- BS 2S 117:1964, *Specification for aircraft material. 1 per cent chromium steel (55/65 tonf/sq in: limiting ruling section 1⅛ inch)*.
- BS 2S 147:1976, *Specification for 0.5 % nickel-chromium-molybdenum steel bars for the manufacture of forged bolts and forged nuts*.
- BS S 148:1969, *Specification for low nickel-chromium steel (bar for the manufacture of forged bolts only)*.
- BS 2S 149:1976, *Specification for 1.75 % nickel-chromium-molybdenum steel bars for the manufacture of forged bolts and forged nuts*.
- BS S 154:1976, *Specification. 2½ % nickel-chromium-molybdenum steel billets, bars, forgings and parts (880–1 080 MPa: limiting ruling section 150 mm)*.
- BS S 158:1977, *Specification for 1 % chromium-molybdenum steel bars for the manufacture of forged bolts and forged nuts*.

Other references

- [1] DEF STAN 03-19 *Electro-Deposition of Cadmium* available from Ministry of Defence (Procurement Executive), Directorate of Standardization, Kentigern House, 65 Brown St, Glasgow G2 8EX.

Informative references

BSI standards publications

BRITISH STANDARDS INSTITUTION, London

- BS 3A 108:1962, *Specification for steel bolts (Unified hexagons and Unified threads) with close tolerance shanks for aircraft*²⁾.
- BS 2S 96:1964, *Specification for 2½ per cent nickel-chromium-molybdenum steel (55/65 tonf/sq in: limiting ruling section 6 in)*³⁾.

¹⁾ Edition current at time of publication (see clauses 3 and 8).

²⁾ Referred to in the foreword only.

³⁾ Withdrawn.

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