BS 7371-12:2008

BRITISH STANDARD

Coatings on metal fasteners –

Part 12: Requirements for imperial fasteners

ICS 25.220.40; 21.060.10

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Contents

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 9 and a back cover.

Foreword

Publishing information

This British Standard is published by BSI and came into effect on 31 July 2008. It was prepared by Technical Committee FME/9/1, *Coatings on threaded components and accessories*. A list of organizations represented on this committee can be obtained on request to its secretary.

Information about this document

This standard supersedes all parts of BS 3382, which are withdrawn.

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

This standard gives thickness requirements for coatings on imperial metal fasteners and can be used in conjunction with all parts of BS 7371.

NOTE 1 For information on coating materials, see the relevant part of BS 7371.

This standard does not cover components such as self-tapping screws and wood screws.

This standard includes area tables (in square inch units) for imperial fasteners, and factors for thickness determination (see Table 2 to Table 8).

NOTE 2 Details concerning cadmium have not been included in this standard due to the restrictions placed on the marketing and use of cadmium and its compounds contained in national and international regulations.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 919-1:2007, *Screw gauge limits and tolerances – Part 1: Specification for gauges for screw threads of unified form*

BS 7371-1, *Coatings on metal fasteners – Specification for general requirements and selection guidelines*

BS 7371-3, *Coatings on metal fasteners – Part 3: Specification for electroplated zinc coatings*

BS 7371-4, *Coatings on metal fasteners – Part 4: Specification for electroplated nickel, nickel/chromium and copper/nickel/chromium coatings*

3 Terms and definitions

For the purposes of this British Standard, the terms and definitions given in BS 7371-1 apply.

4 Screw thread dimensions

Thread dimensions of components supplied for plating and after plating shall conform to the relevant screw thread standards.

NOTE See BS 919-1:2007, Annex D for the gauging procedure to be used.

After plating, thread dimensions of components shall be in accordance with the appropriate clauses of BS 919-1:2007, Annex D.

5 Coating thickness

The thickness to be applied to imperial fasteners made to standard dimensions shall be in accordance with Table 1, however, if the maximum batch average thickness exceeds that specified in Table 1, the parts can be accepted if they conform when tested with the appropriate GO gauge.

Table 1 **Plating thickness**

Basic major diameter of screw thread in		**Batch average thickness** µ	
Over	**Up to and including**	**Minimum**	**Maximum**
0.060	0.126	3.8	5.1
0.126	0.250	5.1	6.4
0.250	0.500	6.4	7.6
0.500	0.750	7.6	8.9

NOTE It is recommended that components with threads of basic major diameters greater than $\frac{3}{4}$ in be plated to the requirements of BS EN 12329.

6 Application and type of coating

Zinc electroplating shall be applied in accordance with BS 7371-3.

Nickel or nickel plus chromium on steel or copper alloy (including brass) components shall be applied in accordance with BS 7371-4.

NOTE 1 Thicker coatings are also dealt with in the above parts.

NOTE 2 For tin on steel, copper and copper alloy components, see BS 1872.

NOTE 3 For silver on steel, copper and copper alloy components, see BS 2816.

7 Measurement of coating thickness

Coating thickness shall be calculated in accordance with BS 7371-3 for zinc coatings, and BS 7371-4 for nickel and copper coatings.

NOTE 1 See Table 2 to Table 8 for surface areas of imperial fasteners with areas in square inches.

NOTE 2 The value of K for areas in square inches (K″) is as follows:

- *for zinc, K″ = 219, assuming a density of 7.1 g/cm^3;*
- *for nickel and copper, K″ = 174, assuming a density of 8.8 g/cm^3;*
- *for tin (see BS 1872:1984, **B.2.5**) K″ = 212, assuming a density of 7.3 g/cm^3.*

These values will give thickness in microns.

- *For silver, see BS 2816, but for average thickness use the strip and weigh method (see Annex A). To convert inch dimensions to microns, multiply by 2.54 × 10^3.*

Table 2 **Screws and bolts: B.S.W. and B.S.F. threads**

Nominal size in	Area per inch length of shank square inches — Threaded shank: Nominal diameter			Unthreaded shank: Rolling diameter		Area of head square inches — Countersunk head	Raised countersunk head	Round head	Pan head	Cheese head	Raised cheese head	Mushroom head	Hexagon head
B.S.W or B.S F.	**B.S.W.**	**B.S.F.**	**B.S W. or B.S.F.**	**B.S.W.**	**B.S.F.**	**BS 450**	**BS 450**	**BS 450**	**BS 450**	**BS 450**	**BS 450**	**BS 450**	**BS 450 (below $\frac{1}{4}$ in) and BS 1083**
$\frac{1}{8}$	0.579	—	0.390	0.339	—	0.099	0.108	0.118	0.151	0.117	0.144	0.166	0.138
$\frac{5}{32}$	0.725	—	0.487	0.425	—	0.155	0.169	0.184	0.238	0.183	0.237	—	0.183
$\frac{3}{16}$	0.857	0.894	0.584	0.502	0.523	0.224	0.242	0.265	0.351	0.265	0.339	0.390	0.301
$\frac{7}{32}$	—	1.046	0.682	—	0.612	0.306	0.331	0.362	0.451	0.362	0.452	—	0.472
$\frac{1}{4}$	1.164	1.205	0.782	0.682	0.705	0.402	0.436	0.474	0.605	0.473	0.599	0.646	0.625
$\frac{5}{16}$	1.480	1.516	0.977	0.867	0.887	0.629	0.698	0.741	0.949	0.742	0.924	0.960	0.863
$\frac{3}{8}$	1.792	1.835	1.175	1.049	1.074	0.905	0.989	1.067	1.348	1.067	1.343	1.332	1.166
$\frac{7}{16}$	2.096	2.151	1.370	1.228	1.259	1.235	—	1.455	1.851	1.456	1.431	—	1.659
$\frac{1}{2}$	2.391	2.463	1.565	1.400	1.442	1.614	—	1.901	2.414	1.905	1.922	—	2.211
$\frac{9}{16}$	2.726	2.798	1.762	1.596	1.638	2.043	—	2.406	2.703	2.414	—	—	2.828
$\frac{5}{8}$	3.035	3.103	1.957	1.778	1.817	2.522	—	2.970	3.239	2.982	—	—	3.433
$\frac{3}{4}$	3.675	3.732	2.350	2.152	2.185	3.634	—	4.276	4.113	4.295	—	—	4.922

Table 3 **Screws and bolts: UNC and UNF threads**

Nominal size	Area per inch length of shank, square inches					Area of head, square inches				
	Threaded shank		Unthreaded shank			Countersunk (flat) head	Raised countersunk (oval) head	Pan head	Raised cheese (fillister) head	Hexagon head
			Nominal diameter	Rolling diameter						
UNC or UNF	UNC	UNF	UNC or UNF	UNC	UNF	BS 1981	BS 1981	BS 1981	BS 1981	BS 1768
0	—	0.275	0.187	—	0.163	0.025	0.028	0.035	0.031	—
1	0.333	0.339	0.227	0.198	0.201	0.038	0.044	0.052	0.046	—
2	0.395	0.403	0.268	0.234	0.238	0.054	0.059	0.070	0.063	0.047
3	0.454	0.464	0.309	0.269	0.275	0.073	0.081	0.093	0.084	0.093
4	0.508	0.523	0.349	0.298	0.309	0.096	0.104	0.121	0.108	0.097
5	0.578	0.586	0.390	0.342	0.346	0.119	0.129	0.152	0.136	0.103
6	0.626	0.647	0.430	0.367	0.383	0.147	0.160	0.184	0.166	0.184
8	0.764	0.777	0.512	0.448	0.459	0.209	0.227	0.261	0.236	0.199
10	0.867	0.903	0.594	0.509	0.530	0.281	0.305	0.349	0.318	0.293
12	1.006	1.027	0.675	0.593	0.606	0.368	0.386	0.450	0.414	0.330
in										
$\frac{1}{4}$	1.158	1.209	0.782	0.680	0.709	0.489	0.531	0.605	0.558	0.563
$\frac{5}{16}$	1.473	1.522	0.977	0.865	0.893	0.772	0.841	0.952	0.875	0.783
$\frac{3}{8}$	1.783	1.856	1.175	1.047	1.090	1.113	1.215	1.355	1.265	0.999
$\frac{7}{16}$	2.086	2.161	1.370	1.226	1.269	1.236	—	1.855	1.333	1.284
$\frac{1}{2}$	2.401	2.495	1.565	1.411	1.466	1.409	—	2.423	1.816	1.778
$\frac{9}{16}$	2.712	2.810	1.762	1.594	1.651	1.851	—	—	2.182	2.152
$\frac{5}{8}$	3.020	3.144	1.957	1.775	1.847	2.383	—	3.252	2.583	2.780
$\frac{3}{4}$	3.657	3.789	2.350	2.149	2.226	3.629	—	4.132	3.428	4.005

Table 4 **Screws and bolts: B.A. threads**

	Area per inch length of shank square inches			**Area of head** square inches				
Nominal size B.A.	**Threaded shank**	**Unthreaded shank**		**Cheese head**	**Round head**	**Countersunk head**	**Raised countersunk head**	**Hexagon head**
		Nominal diameter	**Rolling diameter**	**BS 57**	**BS 57**	**BS 57**	**BS 57**	**BS 57**
0	1.114	0.738	0.665	0.534	0.423	0.339	0.367	0.539
1	0.981	0.650	0.586	0.418	0.332	0.268	0.288	0.420
2	0.868	0.578	0.518	0.318	0.253	0.205	0.220	0.331
3	0.754	0.503	0.450	0.248	0.197	0.163	0.181	0.251
4	0.659	0.443	0.393	0.197	0.157	0.131	0.139	0.193
5	0.585	0.393	0.349	0.150	0.120	0.101	0.110	0.152
6	0.509	0.342	0.303	0.116	0.093	0.078	0.085	0.117
7	0.453	0.305	0.270	0.092	0.073	0.063	0.070	0.093
8	0.397	0.267	0.237	0.075	0.060	0.051	0.056	0.072
9	0.340	0.232	0.203	0.050	0.040	0.034	0.037	0.053
10	0.303	0.207	0.181	0.038	0.031	0.026	0.029	0.042

Table 5 **Screws and bolts: B.S.C. and B.S.P. threads**
Dimensions in inches

	Area per inch length of shank					
Nominal size	**B.S.C. threads to BS 811**			**B.S.C. fastening threads to BS EN ISO 228**		
	Threaded shank	**Unthreaded shank**		**Threaded shank**	**Unthreaded shank**	
		Nominal diameter	**Rolling diameter**		**Nominal diameter**	**Rolling diameter**
$\frac{1}{8}$	0.537	0.390	0.348	1.929	1.197	1.128
$\frac{5}{32}$	0.672	0.487	0.436	—	—	—
$\frac{3}{16}$	0.824	0.584	0.534	—	—	—
$\frac{7}{32}$	0.957	0.682	0.620	—	—	—
$\frac{1}{4}$	1.108	0.782	0.718	2.596	1.621	1.518
$\frac{9}{32}$	1.260	0.880	0.816	—	—	—
$\frac{5}{16}$	1.411	0.977	0.914	—	—	—
$\frac{3}{8}$	1.714	1.175	1.111	3.337	2.055	1.952
$\frac{7}{16}$	2.017	1.370	1.307	—	—	—
$\frac{1}{2}$	2.320	1.565	1.503	—	—	—
$\frac{9}{16}$	2.623	1.762	1.700	—	—	—
$\frac{5}{8}$	2.926	1.957	1.896	—	—	—
$\frac{11}{16}$	3.229	2.152	2.092	—	—	—
$\frac{3}{4}$	3.533	2.350	2.289	—	—	—

Table 6 **Nuts: B.S.W. and B.S.F. threads**

	Area of nut square inches			
Nominal size B.S.W or B.S F. in	**Ordinary**	**Thin**	**Slotted**	**Castle**
	BS 450 (below $\frac{1}{4}$ in) and BS 1083	**BS 450 (below $\frac{1}{4}$ in) and BS 1083**	**BS 1083**	**BS 1083**
$\frac{1}{8}$	0.17	0.14	—	—
$\frac{5}{32}$	0.21	0.18	—	—
$\frac{3}{16}$	0.36	0.31	—	—
$\frac{7}{32}$	0.56	0.47	—	—
$\frac{1}{4}$	0.64	0.53	0.80	0.81
$\frac{5}{16}$	0.92	0.76	1.05	1.12
$\frac{3}{8}$	1.26	1.03	1.34	1.49
$\frac{7}{16}$	1.78	1.45	1.91	2.19
$\frac{1}{2}$	2.38	1.94	2.56	2.89
$\frac{9}{16}$	3.03	2.46	3.25	3.76
$\frac{5}{8}$	3.69	3.00	3.95	4.51
$\frac{3}{4}$	5.29	4.29	5.65	6.48

Table 7 **Nuts: B.A. threads**

	Area of nut square inches	
Nominal size, B.A.	**Ordinary**	**Thin**
	BS 57	**BS 57**
0	0.59	0.51
1	0.46	0.40
2	0.36	0.31
3	0.28	0.24
4	0.22	0.18
5	0.17	0.14
6	0.13	0.11
7	0.10	—
8	0.08	0.07
9	0.06	—
10	0.05	—

Table 8 **Nuts: UNC and UNF threads**

	Area of nut square inches					
Nominal size UNC or UNF	**Ordinary (precision)**	**Thin**	**Slotted**	**Thick slotted**	**Hexagon machine screw nut (pressed)**	**Square machine screw nut (pressed)**
	BS 1768	**BS 1768**	**BS 1768**	**BS 1768**	**BS 1981**	**BS 1981**
0	—	—	—	—	0.07	0.08
1	—	—	—	—	0.07	0.08
2	—	—	—	—	0.10	0.12
3	—	—	—	—	0.10	0.12
4	—	—	—	—	0.19	0.22
5	—	—	—	—	0.29	0.34
6	—	—	—	—	0.29	0.34
8	—	—	—	—	0.36	0.42
10	—	—	—	—	0.41	0.48
12	—	—	—	—	0.58	0.66
in						
$\frac{1}{4}$	0.66	0.56	0.72	0.81	0.62	0.72
$\frac{5}{16}$	0.89	0.74	0.95	1.05	0.99	1.14
$\frac{3}{8}$	1.18	0.95	1.24	1.39	1.23	1.42
$\frac{7}{16}$	1.71	1.40	1.82	2.01	—	—
$\frac{1}{2}$	2.10	1.76	2.21	2.55	—	—
$\frac{9}{16}$	2.78	2.33	2.96	3.35	—	—
$\frac{5}{8}$	3.27	2.69	3.45	4.04	—	—
$\frac{3}{4}$	4.72	3.81	4.97	5.59	—	—

Annex A (informative)

Strip and weigh method for the determination of group and sample average plating thickness of silver

A.1 Thoroughly clean and free each group of items from grease.

A.2 Thoroughly dry each group of items.

A.3 Weigh each group of items together or in such small groups as are appropriate to the maximum capacity of the balance to an accuracy of 1 mg on each weighing.

A.4 Totally immerse each group of items in the following stripping solution, and turn each item over in the solution to permit free access of the liquid to all surfaces:

a) sulphuric acid (d 1.84): 19 parts by volume;

b) nitric acid (d 1.42): 1 part by volume;

c) temperature: 60 °C–70 °C.

A.5 Remove items from the stripping solution immediately the coating is completely dissolved, then totally immerse in sulphuric acid (d 1.84) for a few seconds. This operation minimizes attack on the base metal during the early stages of the final rinsing.

A.6 Remove items from the sulphuric acid, wash well with cold running water, wipe and immerse in clean acetone to remove any trapped water. Dry each item, and reweigh each group exactly as before.

A.7 Deduce the weight of plating for each group by subtraction of the results of the weighings, or evaluate it from the stripping solutions by a normal method of chemical estimation (e.g. potentiometric titration with a standard sodium chloride solution).

A.8 Calculate the areas of coatings of the ten or more items in the group from the data given in Table 2 to Table 8.

A.9 Calculate the group average thickness (assuming a relative density of 10.5 for the silver deposit, i.e. 172 g/in^3) from:

Group average thickness =

$$\frac{\text{weight of coating (g)}}{\text{area of coating (in}^2) \times 172} \text{ in} = \frac{\text{weight of coating (g)}}{\text{area of coating (cm}^2) \times 10.5} \text{ cm.}$$

Bibliography

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 57, *Specification – B.A. screws bolts and nuts*

BS 450, *Specification for machine screws and machine screw nuts (B.S.W. & B.S.F. threads)*

BS 811, *Specification for cycle (B.S.C.) threads (formerly known as C.E.I. threads)*

BS 1083, *Specification for precision hexagon bolts, screws and nuts (B.S.W. & B.S.F. threads)*

BS 1768, *Specification for unified precision hexagon bolts, screws, & nuts (UNC & UNF threads) – Normal series*

BS 1872:1984, *Specification for electroplated coatings of tin*

BS 1981, *Specification for unified machine screws and machine screw nuts*

BS 2816, *Method for specifying electroplated coatings of silver and silver alloys for engineering purposes*

BS EN 12329, *Corrosion protection of metals – Electrodeposited coatings of zinc with supplementary treatment on iron or steel*

BS EN ISO 228, *Pipe threads where pressure-tight joints are not made on the threads*

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