BRITISH STANDARD

BS 7371 :
Part 4 : 1994

Coatings on metal fasteners

Part 4. Specification for electroplated nickel, nickel/chromium and copper/nickel/chromium coatings

BSI
STANDARDS

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the General Mechanical Engineering Standards Policy Committee (GME/-) to Technical Committee GME/9, upon which the following bodies were represented:

BEAMA Ltd.
British Constructional Steelwork Association Ltd.
British Industrial Fasteners Federation
British Steel Industry
British Steel Industry (Wire Section)
Gauge and Tool Makers' Association
Society of Motor Manufacturers and Traders Ltd.
Washer Manufacturers Association of Great Britain

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

British Turned-parts Manufacturers' Association
Institute of Metal Finishing
Metal Finishing Association
National Centre of Tribology
Stainless Steel Fabricators' Association of Great Britain

This British Standard, having been prepared under the direction of the General Mechanical Engineering Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 15 June 1994

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Contents

Foreword

This Part of BS 7371 has been prepared under the authority of the General Mechanical Engineering Standards Policy Committee to provide part of a series of standards on coatings on metal fasteners.

WARNING. This British Standard calls for the use of substances and/or procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and in no way absolves either the designer, the producer, the supplier or the user from statutory obligations relating to health and safety at any stage of manufacture or use.

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

Specification

0 Introduction

BS 7371 deals with the performance and selection of coatings on metal fasteners and accessories.

This Part of BS 7371 specifies the requirements for electroplated nickel, nickel/chromium and copper/nickel/chromium coatings.

Other published Parts of BS 7371 are as follows:

BS 7371 : Part 1 : 1991 *Specification for general requirements and selection guidelines*[1)]

BS 7371 : Part 2 : 1993 *Specification for torque/clamping force relationship*

BS 7371 : Part 3 : 1993 *Specification for electroplated zinc and cadmium coatings*

BS 7371 : Part 7 : 1994 *Specification for mechanically applied zinc coatings*

BS 7371 : Part 10 : 1994 *Specification for organic coatings*

BS 7371 : Part 11 : 1993 *Specification for zinc flake non-electrolytically applied cured coatings*

Further Parts of the series to incorporate the following are in preparation:

Specification for electroplated tin and tin/lead coatings

Specification for electroplated coatings for special purposes

Specification for mechanically applied coatings for special purposes

Specification for phosphate and oil coatings

Nickel, nickel/chromium and copper/nickel/chromium electroplated coatings covered by this Part of BS 7371 are for use on fasteners and accessories where the following apply:

a) a coating having a bright decorative appearance is required for ferrous (including stainless steel) and non-ferrous fasteners;

b) a barrier type of coating is acceptable on ferrous fasteners;

c) thin coatings give limited corrosion protection. Coatings that give improved protection will need thicker deposits than are customary for thread assembly and will need selective plating or thread undersizing;

d) the risk of hydrogen embrittlement of high tensile steel fasteners is acceptable.

A coating of nickel has a bright metallic appearance which is enhanced by an additional coating of chromium, which prevents tarnishing.

Copper plating prior to nickel plating can increase the corrosion protection provided by the complete coating.

The shape of certain parts and the thickness requirements may make processing in bulk impossible, especially in the case of chromium plating. Reference to the coater is recommended to enquire if a difficulty exists or if it can be overcome by the use of specialized processing methods such as selective plating or jigging.

Typical difficulties as outlined in BS 4479 : Part 1 : 1990 and BS 4479 : Part 2 : 1990 arise when bulk processing:

1) long thin parts;

2) parts with flat surfaces that may stick together during processing, e.g. flat washers;

3) parts with recesses which do not receive the full coating within the recess;

4) parts with shapes that induce nesting and interlocking;

5) the internal surfaces of hollow parts.

Only the lower classes of coatings are suitable for overall application to metal components such as:

i) parallel threaded fasteners and accessories;

ii) screws that cut or form their own threads, e.g. self tapping screws (see for example BS 4174 : 1972);

iii) woodscrews (see for example BS 1210 : 1963);

iv) pipe nuts and connectors with parallel or tapered threads without the use of selective plating or undersizing the threads.

The thickness and lack of ductility of thicker deposits may be unsatisfactory on springs and other very flexible components.

When these coatings are applied to non-ferrous fasteners, the only part of the specification that will apply will be the coating thickness requirements.

NOTE. The coating processes covered by this standard may induce hydrogen embrittlement in certain ferrous fasteners. Attention is drawn to the appropriate requirements in BS 7371 : Part 1 : 1991.

[1)] This is supplementary to all other Parts of BS 7371.

1 Scope

This Part of BS 7371 specifies requirements for coatings applied by the electrolysis of solutions of copper, nickel or chromium. The coatings consist principally of copper, nickel or chromium and are not usually lubricated.

NOTE 1. The corrosion resistance for higher grade coatings can be improved by using two layer (duplex) nickel coatings or special types of chromium deposit.

NOTE 2. The surface smoothness and brightness of the substrate will influence the appearance and corrosion protection after plating.

In addition to the requirements in this Part of BS 7371, the requirements in Part 1 of the standard which are applicable to copper, nickel and chromium electroplated coatings apply.

This Part of BS 7371 also specifies requirements for the following:

a) the coating thickness of component metals in the coating;

b) the type and thickness of chromium coating to be applied, if required;

c) quality assessment of the corrosion resistance of unused coated parts when subjected to neutral salt spray testing or copper acetic salt spray testing (see for example BS 7479 : 1991);

d) adhesion test.

Annexes include tables indicating suitable coating grades for standard screw threads and methods of determination of coating thickness.

2 References

2.1 Normative references

This Part of BS 7371 incorporates, by dated or undated reference, provisions from other publications. These normative references are made at the appropriate places in the text and the cited publications are listed on the inside back cover. For dated references, only the edition cited applies; any subsequent amendments to or revisions of the cited publication apply to this Part of BS 7371 only when incorporated in the reference by amendment or revision. For undated references, the latest edition of the cited publication applies, together with any amendments.

2.2 Informative references

This Part of BS 7371 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 Definitions

For the purposes of this Part of BS 7371, the definitions given in BS 7371 : Part 1 : 1991 apply.

4 Application and type of coating

4.1 Cleaning and pretreatment

Parts, fasteners and accessories shall be cleaned and pretreated in accordance with clauses **4** and **5** of BS 7371 : Part 1 : 1991.

NOTE. Restrictions applicable to the avoidance of embrittlement of high tensile parts should be observed.

4.2 Type of coating

The coating shall be bright and lustrous in appearance, the thicker coatings having a high degree of reflectivity, particularly when applied to a smooth or polished surface. The performance of the coating can be improved by using the following, either singly or in combination:

a) a copper undercoat on ferrous fasteners in accordance with BS 1224 : 1970;

b) a duplex nickel deposit in accordance with BS 1224 : 1970;

c) a modified chromium deposit (Cr) in accordance with BS 1224 : 1970.

To enable higher thicknesses to be used on significant surfaces of threaded fasteners, the procedure of selective electroplating shall be used, i.e. the heads of screws can receive a higher coating thickness than the threads, thereby enabling the threads to be plated without creating interference on assembly which would result if the higher thickness of coating were applied to the fastener as a whole.

4.3 Application

The coating of copper, nickel or chromium shall be applied by the electrolysis of an aqueous solution of a salt or salts of the appropriate metal.

NOTE. Stabilizers and brighteners may be added to the solution as necessary.

5 Coating

5.1 Surface condition

The coating shall be clean, dry and of uniform appearance. All surfaces of a component shall be coated unless otherwise agreed. The coating shall be free from blisters or loosely adhering material.

5.2 Coating thickness

The specified coating thickness of nickel or copper and nickel (see table 2) shall be applied using the relationships between nominal, local and batch average thicknesses shown in table 1.

Coating thicknesses for threaded parts shall conform to annex A. The coating thicknesses shall be measured by the methods described in annex B.

NOTE 1. If a coating thickness other than those given in table 1 is required, this should be agreed between the purchaser and the supplier.

The chromium top coat, if specified, (see table 2) shall show a continuous coating over all the component. If a modified chromium deposit is specified, (see item c) of **4.2**) the minimum thickness shall be in accordance with BS 1224 : 1970.

NOTE 2. Experience has shown that the use of selective plating to apply thicker coats to significant surfaces is to be preferred over the method of applying a thick coat to the fastener as a whole given in annex C. Reference to the coater is recommended to enquire which method would be preferred for a particular application.

Local thickness shall be measured on a significant surface (see figure B.1).

Exceeding the maximum batch average thickness shall not be a cause for rejection if the coated thread is still accepted by an appropriate 'go' gauge, 4h for external threads and 4H for internal threads.

Table 1. Nominal coating thicknesses

Thicknesses in µm

Nominal coating thickness [1]	Effective coating thickness		
	Minimum local thickness	Batch average thickness	
		min.	max.
3	3	3	5
5	5	4	6
3	8	7	10
10	10	9	12
12	12	11	15
15	15	14	18
20	20	18	23
25	25	23	28
30	30	27	35
40	40	36	46

[1] See annex A.

5.3 Corrosion resistance

Unless otherwise agreed, representative samples from a batch shall be selected in accordance with clause **7** of BS 7371 : Part 1 : 1991 and shall be tested for resistance to salt spray in accordance with BS 7479 : 1991.

Coatings shall be graded by their corrosion resistance as given in table 2. Surfaces which are not significant shall resist salt spray for 50 % of the

Table 2. Coating designation and corrosion resistance

Service condition number [1]	Coating designation [2] [3]					First appearance of rust	
	Copper or brass base material		Steel base material				
	Nickel coating	Nickel plus chromium coating	Nickel coating	Nickel plus chromium coating	Copper plus nickel plus chromium coating	5 % neutral [4] salt spray test	Copper acetic salt spray test
						h	h
0	Ni3b	Ni3bCr	Ni5b	Ni5bCr			
1	Ni5b	Ni5bCr	Ni10b	Ni10bCr	Cu10Ni5bCr	12	—
2[5]	Ni10b	Ni10bCr	Ni20b	Ni20bCr	Cu20Ni10bCr	48	—
3[5]	Ni20b	Ni20bCr	Ni30b	Ni30bCr	Cu20Ni20bCr	—	8
4	Not recommended	Ni30dCr	Not recommended	Ni40dCr	Cu20Ni30dCr	—	16

[1] See table 1 of BS 7371 : Part 1 : 1991.

[2] b indicates that a bright nickel coating is required (see BS 1224 : 1970).
d indicates that a duplex nickel coating is required (see BS 1224 : 1970).

[3] In the coating designation the number after each coating material represents the nominal thickness of that particular coating material in micrometres.

[4] It should be noted that neutral salt spray testing is not usually specified for nickel chromium coatings but times in the copper acetic salt spray test for low service condition numbers would be too short to be meaningful.

[5] If agreed between the purchaser and supplier the thickness of bright nickel coating can be reduced, for service conditions 2 and 3, provided that a duplex system or modified type of chromium deposit is used (see BS 1224 : 1970).

time given in table 2, unless selective plating is used when this shall not be a requirement.

NOTE. For routine quality control purposes, after the ability of the coating to conform to the corrosion test is established, evaluation of coating mass or thickness may be used, but for referee purposes the corrosion resistance requirements still apply.

5.4 Adhesion

When tested in accordance with **2.1** of BS 5411 : Part 10 : 1981 the metallic coating shall continue to adhere to the basic metal.

6 Suitability of coatings for components with parallel threads

NOTE 1. The suitability of the coatings specified in this Part of BS 7371 for parts with screw threads is limited by the clearance between external and internal threads.

Maximum electroplating thickness to be applied to parts incorporating standard thread forms shall be as specified in annex A, in order to minimize the risk of interference when both threaded elements of an assembly are similarly coated.

NOTE 2. Annex C gives guidance for modifying thread dimensions to accommodate thicker coatings.

NOTE 3. Modification of male thread dimensions from tolerance class 6g may influence the mechanical properties.

7 Information to be documented and supplied to the coater

The following information shall be fully documented and supplied to the coater:

a) the number and date of this British Standard, i.e. BS 7371 : Part 4 : 1994;

b) the coating designation (see table 2);

c) the base material to be coated (e.g. steel);

d) the hardness and property class of the component to be plated;

e) the significant surfaces if not as defined in BS 7371 : Part 1 : 1991;

f) any additional protection required for delivery (see clause **8** and appendix D of BS 7371 : Part 1 : 1991);

g) the requirements of any subsequent operations (e.g. the application of an adhesive);

h) any special requirements (e.g. selective plating; see annex C).

8 Identification

The coating shall be identified by the number and date of this British Standard, i.e. BS 7371 : Part 4 : 1994[2)] together with the coating designation in accordance with table 2.

Example

A nickel and chromium electroplated coating of 10 μm thickness would be identified as BS 7371 : Part 4 : 1994 Ni10bCr.

[2)] Marking BS 7371 : Part 4 : 1994 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is solely the claimant's responsibility. Such a declaration is not to be confused with third party certification of conformity, which may also be desirable.

Annexes

Annex A (normative)

Coating thickness for threaded parts

In order to reduce the risk of interference on assembly of threads with electroplated coatings, the nominal coating thickness shall not exceed one-quarter of the fundamental deviation of the thread as specified in table A.1.

The effective coating thicknesses measured according to one of the methods specified in annex B shall conform to the values specified in table 1.

If batch average thickness measurement is used for threaded parts having a nominal thread length > $5d$ then a smaller nominal thickness shall be applied (see table A.1).

Table A.1. Upper limits of nominal coating thickness

Pitch P	Nominal thread diameter [1] d	Internal thread		External thread						
		Tolerance position G [4]		Tolerance position g [4]					Tolerance position f [4]	
		Fundamental deviation	Nominal coating thickness max.	Fundamental deviation	Nominal coating thickness max.				Fundamental deviation	Nominal coa. max.
					[2]	[3]				[2]
					All nominal lengths	Nominal length l				All nominal lengths
						$l < 5d$	$5d < l < 10d$	$10d < l < 15d$		
	mm	µm	µm	µm	µm	µm	µm	µm	µm	µm
0.2		+ 17	3	– 17	3	3	3	3		
0.25	1; 1.2	+ 18	3	– 18	3	3	3	3		
0.3	1.4	+ 18	3	– 18	3	3	3	3		
0.35	1.6 (1.8)	+ 19	3	– 19	3	3	3	3	– 34	8
0.4	2	+ 19	3	– 19	3	3	3	3	– 34	8
0.45	2.5 (2.2)	+ 20	5	– 20	5	5	3	3	– 35	8
0.5	3	+ 20	5	– 20	5	5	3	3	– 36	8
0.6	3.5	+ 21	5	– 21	5	5	3	3	– 36	8
0.7	4	+ 22	5	– 22	5	5	3	3	– 38	8
0.75	4.5	+ 22	5	– 22	5	5	3	3	– 38	8
0.8	5	+ 24	5	– 24	5	5	3	3	– 38	8
1	6 (7)	+ 26	5	– 26	5	5	3	3	– 40	10
1.25	8	+ 28	5	– 28	5	5	5	3	– 42	10
1.5	10	+ 32	8	– 32	8	8	5	5	– 45	10
1.75	12	+ 34	8	– 34	8	8	5	5	– 48	12
2	16 (14)	+ 38	8	– 38	8	8	5	5	– 52	12
2.5	20 (18; 22)	+ 42	10	– 42	10	10	8	5	– 58	12
3	24 (27)	+ 48	12	– 48	12	12	8	8	– 63	15
3.5	30 (33)	+ 53	12	– 53	12	12	10	8	– 70	15
4	36 (39)	+ 60	15	– 60	15	15	12	10	– 75	15
4.5	42 (45)	+ 63	15	– 63	15	15	12	10	– 80	20
5	48 (52)	+ 71	15	– 71	15	15	12	10	– 85	20
5.5	56 (60)	+ 75	15	– 75	15	15	15	12	– 90	20
6	64	+ 80	20	– 80	20	20	15	12	– 95	20

[1] Information for coarse pitch threads is given for convenience only. The determining characteristic is the thread pitch.
[2] Maximum values of nominal coating thickness if local thickness measurement is agreed.
[3] Maximum values of nominal coating thickness if batch average thickness measurement is agreed.
[4] See BS 3643 : Part 1 and Part 2.
NOTE. The additional deviations that can be applied to threads specially manufactured to accommodate thick coatings are given in table C.1.

he
ead as

B shall

gth > 5*d*

	Tolerance position f [4]					Tolerance position e [4]				
	Fundamental deviation	Nominal coating thickness max.				Fundamental deviation	Nominal coating thickness max.			
		[2]	[3]				[2]	[3]		
		All nominal lengths	Nominal length *l*				All nominal lengths	Nominal length *l*		
$10d < l < 15d$			$l < 5d$	$5d < l < 10d$	$10d < l < 15d$			$l < 5d$	$5d < l < 10d$	$10d < l < 15d$
µm	µm	µm	µm	µm	µm	µm	µm	µm	µm	µm
3										
3										
3										
3	– 34	8	8	5	5					
3	– 34	8	8	5	5					
3	– 35	8	8	5	5					
3	– 36	8	8	5	5	– 50	12	12	10	8
3	– 36	8	8	5	5	– 53	12	12	10	8
3	– 38	8	8	5	5	– 56	12	12	10	8
3	– 38	8	8	5	5	– 56	12	12	10	8
3	– 38	8	8	5	5	– 60	15	15	12	10
3	– 40	10	10	8	5	– 60	15	15	12	10
3	– 42	10	10	8	5	– 63	15	15	12	10
5	– 45	10	10	8	5	– 67	15	15	12	10
5	– 48	12	12	8	8	– 71	15	15	12	10
5	– 52	12	12	10	8	– 71	15	15	12	10
5	– 58	12	12	10	8	– 80	20	20	15	12
8	– 63	15	15	12	10	– 85	20	20	15	12
8	– 70	15	15	12	10	– 90	20	20	15	15
10	– 75	15	15	15	12	– 95	20	20	15	15
10	– 80	20	20	15	12	– 100	25	25	20	15
10	– 85	20	20	15	12	– 106	25	25	20	15
12	– 90	20	20	15	15	– 112	25	25	20	15
12	– 95	20	20	15	15	– 118	25	25	20	15

th.

s are given in table C.1.

Annex B (normative)
Measurement of coating thickness

B.1 Local thickness

The local thickness shall be measured by one of the methods contained in the following British Standards.

BS 5411 : Part 2 : 1987
BS 5411 : Part 4 : 1986
BS 5411 : Part 5 : 1984
BS 5411 : Part 8 : 1991
BS 5411 : Part 9 : 1984

The thickness shall only be measured on the measuring area as shown in figure B.1.

B.2 Determination of group and batch average coating thickness for non-preferentially coated parts

B.2.1 *Reagents*

B.2.1.1 *For removal of chromium*

A stripping solution consisting of:

- antimony trioxide 20 g
- hydrochloric acid (density greater than 1.16 g/ml) 1 l

B.2.1.2 *For removal of nickel on steel*

A stripping solution consisting of:

- sodium meta-nitrobenzene sulfonate 65 g
- sodium hydroxide 10 g
- sodium cyanide 100 g

Make up to 1 l solution with water.

B.2.1.3 *For removal of nickel on copper or copper alloy*

A stripping solution consisting of:

- orthophosphoric acid (density 1.75 gm/l) approx. 90 % acid

B.2.1.4 *For the removal of copper on steel*

A stripping solution consisting of:

- sodium hydroxide 10 g
- sodium cyanide 100 g

Make up to 1 l solution with water.

NOTE. Proprietary chemical stripping solutions may be used provided they show negligible attack on the base metal.

B.2.2 *Procedure*

B.2.2.1 *General*

Degrease the group of components in an organic solvent and dry thoroughly.

If the group of components have been chromium plated then totally immerse them in the stripping solution specified in **B.2.1.1** which will dissolve the chromium in less than 2 min, after which there should be no appreciable gassing. Remove the components without delay, rinse in water and dry thoroughly.

NOTE. The chromium thickness is too low to be accurately measured by the procedure used in this clause. If the thickness of chromium is required it can be determined using BS 5411 : Part 4 : 1986.

Weigh the group of components to an accuracy of 0.01 % of their total mass.

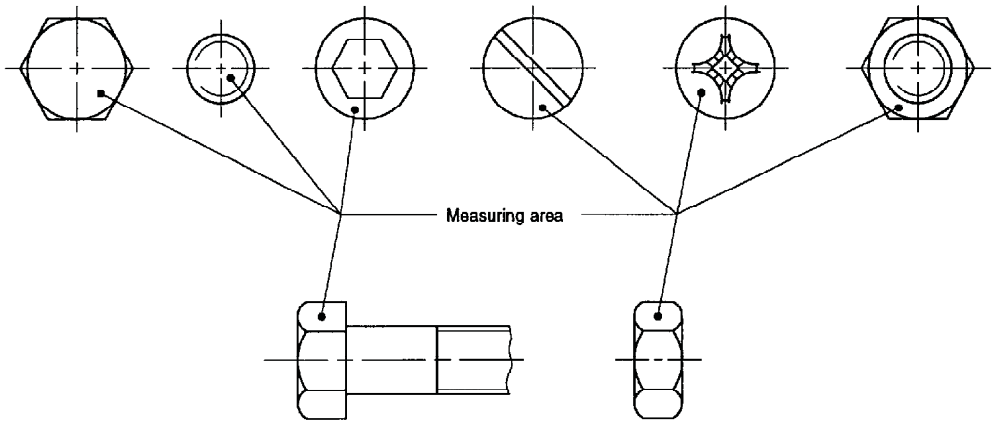

Figure B.1. Measuring area for local coating thickness measurement on fasteners

B.2.2.2 *Nickel on steel*

NOTE. This subclause applies also to nickel applied over a flash coating of copper on steel where the copper thickness is less than 0.5 μm.

Totally immerse the group of components in the stripping solution specified in **B.2.1.2** maintained at a temperature between 75 °C and 85 °C. The solution will completely strip 7.5 μm of nickel in about 30 min provided the components are turned over. The flash coating of copper will also be stripped and as a result will count as if it were nickel. After the coating has been totally stripped, remove the group of components, wash immediately in running water and wipe with a soft cloth to remove any loose deposits. Immerse in clean acetone, remove, dry thoroughly and reweigh.

B.2.2.3 *Nickel on copper or copper alloy*

NOTE 1. This subclause applies also to a nickel coating applied over a copper coating on steel where the thickness of the copper coating is at least 5 μm or more.

Totally immerse the group of components in the stripping solution specified in **B.2.1.3** maintained at a temperature between 180 °C and 190 °C. The solution will completely strip 2.5 μm of nickel in about 10 min and complete removal of the nickel will be indicated by the absence of further gassing.

NOTE 2. Components are usually suspended in the solution on thin copper wire.

After the coating has been totally stripped, remove the group of components, wash immediately in running water and wipe with a soft cloth to remove any loose deposits. Immerse in clean acetone, remove, dry thoroughly and reweigh.

NOTE 3. During use at high temperature the phosphoric acid solution tends to lose water rapidly. Loss of too much water will slow the stripping rate considerably. This water loss should be replaced but only after the stripping solution has cooled to room temperature.

B.2.2.4 *Copper on steel*

NOTE. This subclause applies only to copper coatings which have a thickness of at least 5 μm or more.

After the nickel coating has been removed, totally immerse the group of components in the stripping solution specified in **B.2.1.4** maintained at a temperature between 75 °C and 85 °C. Turn the components over to ensure complete removal of the copper. After all the copper has been stripped, remove the group of components, wash immediately in running water and wipe with a soft cloth to remove any loose deposits. Immerse in clean acetone, remove, dry thoroughly and reweigh.

B.2.3 ***Calculations***

B.2.3.1 *Nickel coating*

Calculate the group average thickness of coating (in μm) using the following formula:

$$\text{Thickness} = \frac{1120\,(m_0 - m_1)}{A}$$

where

m_0 is the mass of the group of components after the chromium coating if any has been stripped (in g);

m_1 is the mass of the group of components after the nickel coating has been stripped (in g);

A is the total surface area[3)] of the group of components (in cm^2).

B.2.3.2 *Copper coating*

Calculate the group average thickness of coating (in μm) using the following formula:

$$\text{Thickness} = \frac{1120\,(m_1 - m_2)}{A}$$

where

m_1 is the mass of the group of components after the nickel coating has been stripped (in g);

m_2 is the mass of the group of components after the copper coating has been stripped (in g);

A is the total surface area[3)] of the group of components (in cm^2).

B.2.3.3 *Batch average coating thickness*

Calculate the batch average coating thickness from the following formula:

$$\text{Batch average coating thickness} = \frac{\text{Sum of all group average coating thicknesses}}{\text{Number of groups}}$$

[3)] Surface areas of common metric components are given in appendix C of BS 7371 : Part 1 : 1991.

Annex C (informative)

Guidance on procedures that may be adopted to accommodate thick coatings

C.1 Modification of thread dimensions

When, in order to provide improved corrosion resistance, it is required to deposit coatings thicker than those that appear in table A.1 or alternatively, when it is required to apply coatings to components of pitches smaller than appear in table A.1, it is necessary to manufacture threads to special limits and tolerances.

The minimum pitch limits of applicability in table A.1 can be lowered if for any particular thread the normal tolerance is restricted at the maximum metal limits. This provides a greater fundamental deviation or, in the case of tolerance position H, it provides a deviation which does not otherwise exist. Alternatively, the whole tolerance zone can be displaced to provide a greater fundamental deviation.

The minimum fundamental deviation required for particular pitches and deposit thicknesses are given in table C.1.

C.2 Selective electroplating

Where a thick deposit is required on a portion of the fastener, for example the heads of bolts or blind nuts, it is often possible to use the procedure of selective electroplating. In such cases the thickness of the deposits applied to the different areas of the fastener will need to be specified by the purchaser.

Table C.1. Minimum fundamental deviation required to accommodate coatings too thick to be applied to standard threads. Metric threads

Dimensions in micrometres

Nominal coating thickness	Minimum fundamental deviation			
	If local thickness measurement is agreed	If batch average thickness measurement is agreed		
	All nominal lengths	$l < 5d$	$5d < l < 10d$	$10d < l < 15d$
3	12	12	15	18
5	20	20	25	30
8	32	32	40	48
10	40	40	50	60
12	48	48	60	72
15	60	60	75	90
20	80	80	100	120
25	100	100	125	150
30	120	120	150	180

NOTE 1. If the tolerance class already has a basic deviation (for example, G, g, f or e), that deviation is deducted from the relevant deviation in this table to give the minimum additional basic deviation.

NOTE 2. Since the modifications for the thicker deposits may significantly reduce the thread engagement, their application should be agreed between manufacturer and purchaser.

List of references (see clause 2)

Normative references

BSI standards publications

BRITISH STANDARDS INSTITUTION, London

BS 1224 : 1970	*Specification for electroplated coatings of nickel and chromium*
BS 5411 :	*Methods of test for metallic and related coatings*
BS 5411 : Part 2 : 1987	*Review of methods of measurement of thickness*
BS 5411 : Part 4 : 1986	*Coulometric method for the measurement of coating thickness*
BS 5411 : Part 5 : 1984	*Measurement of local thickness of metal and oxide coatings by the microscopical examination of cross-sections*
BS 5411 : Part 8 : 1991	*Measurement of coating thickness of metallic coatings: X-ray spectrometric methods*
BS 5411 : Part 9 : 1984	*Measurement of coating thickness of electrodeposited nickel coatings on magnetic and non-magnetic substrates: magnetic method*
BS 5411 : Part 10 : 1981	*Review of methods available for testing adhesion of electrodeposited and chemically deposited metallic coatings on metallic substrates*
BS 7371 :	*Coatings on metal fasteners*
BS 7371 : Part 1 : 1991	*Specification for general requirements and selection guidelines*
BS 7479 : 1991	*Method for salt spray corrosion tests in artificial atmospheres*

Informative references

BSI standards publications

BRITISH STANDARDS INSTITUTION, London

BS 1210 : 1963[4)]	*Specification for wood screws*
BS 3643 :	*ISO metric screw threads*
BS 3643 : Part 1 : 1981	*Principles and basic data*
BS 3643 : Part 2 : 1981	*Specification for selected limits of size*
BS 4174 : 1972[4)]	*Specification for self-tapping screws and metallic drive screws*
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[4)] Referred to in the introduction only.

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