BRITISH STANDARD

BS 7371 :
Part 10 : 1994

Coatings on metal fasteners

Part 10. Specification for organic coatings

UDC 621.88 : 667.622.3

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
Stainless Steel Fabricators' Association of Great Britain
National Centre of Tribology

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 March 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.

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 organic 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 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 nickel, nickel/chromium and copper/nickel/chromium coatings

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

Organic coatings covered by this Part of BS 7371 are for use on fasteners and accessories where the following apply:

a) a colour is required;

b) the risk of hydrogen embrittlement of high tensile steel fasteners is unacceptable;

c) a more even coverage of parts of complex shape than would be obtained by electroplated metallic coatings is advantageous.

The corrosion resistance of an organic coating is principally dependant upon the barrier effect such that when any base metal is exposed corrosion may occur. Organic coatings which are oiled will inhibit this effect by migration of the oil. The coatings may also inhibit electrical conductivity.

Organic coatings may be applied over other coatings such as phosphate or zinc in order to improve corrosion resistance or impart a colour.

The shape of certain parts may create difficulties in the application of these coatings and 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.

Typical difficulties arise when bulk processing:

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

2) parts with shapes that induce nesting and interlocking;

3) parts with recesses.

The coatings are suitable for application to metal components such as the following:

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) springs and spring components;

v) pipe nuts and connectors with parallel or tapered threads;

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 processing temperature of certain coatings complying with this standard may adversely affect the mechanical properties of some heat treated components.

1 Scope

This Part of BS 7371 specifies requirements for organic coatings. The coatings consist principally of pigments and other additives bonded by resins and can be lubricated to give controlled torque/clamping force properties when required (see for example BS 7371 : Part 2 : 1993).

In addition to the requirements in this Part of BS 7371, the requirements in Part 1 of the standard which are applicable to organic coatings apply.

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

a) four grades of coating;

b) colour;

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

d) adhesion test.

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

2 References

2.1 Normative references

This Part of BS 7371 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 Part of BS 7371 only when incorporated in it by updating or revision.

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 together with the following.

organic coating

A coating which consists of pigments and other additives bonded together by resins.

4 Applications 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. A phosphating pretreatment is permitted to improve adhesion or corrosion resistance, this may reduce the electrical conductivity and parts which have a phosphate pretreatment may require de-embrittlement if the curing temperature of the organic coating does not exceed 180 °C.

4.2 Type of coating

The coating shall consist primarily of resins incorporating additives and pigments to improve corrosion resistance or to impart colour or lubricity. Where specified by the purchaser (see item d) of clause 7) the lubricity of the coating shall be modified by the addition of a lubricant and the torque/clamping force performance of a coated fastener shall conform to BS 7371 : Part 2 : 1993.

NOTE. Unless otherwise specified oil impregnation may be used to improve corrosion resistance or to provide lubricity, resulting in coatings which are not completely dry.

4.3 Curing of coating

The coating shall be cured and the curing temperature shall not exceed 230 °C.

5 Coating

5.1 Surface condition

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

5.2 Colour

The colour of the coating on individual components shall be uniform in appearance and in the mid-range of the designated colour. Slight variations in colour between components shall not be cause for rejection unless otherwise agreed between the purchaser and supplier.

NOTE. Colour matching and gloss level may be specified by the purchaser on agreement with the supplier.

5.3 Corrosion resistance

Unless otherwise agreed, representative samples from a batch shall be tested in accordance with clause 7 of BS 7371 : Part 1 : 1991 and shall be tested for resistance to neutral salt spray in accordance with BS 7479 : 1991. Coatings shall be graded by their corrosion resistance as given in table 1. Significant surfaces shall resist neutral salt spray for the time given in table 1. Surfaces which are not significant shall resist neutral salt spray for 50 % of the time given in table 1.

NOTE. Coating weight and thickness are not reliable parameters for confirmation of the corrosion resistance of organic coatings since they give no indication of porosity. Therefore, for referee purposes the corrosion resistance requirements still apply.

5.4 Adhesion

When tested in accordance with annex A the exposure of more than 10 % of the base metal over the tested area shall constitute failure. Parts which do not have significant surfaces of sufficient size or shape to permit testing in accordance with annex A shall be assessed by testing parts coated by the same process in the same production run.

Oil impregnated parts shall be either tested prior to the application of the lubricant or after removal of the lubricant with a cold solvent that does not attack the organic coating.

NOTE. Pick up of some colouration on the tape is permissible.

Table 1. Corrosion resistance

Grade	Resistance of neutral salt spray, time for base metal corrosion (min.) h
OA	72
OB	120
OC	192
OD	240

NOTE. All grades are available with controlled lubricity.

6 Gauging after coating for threaded fastener components

After coating, the finished threaded fastener component shall conform to the following.

a) A coating, externally threaded component shall assemble into a similarly threaded nut with thread of tolerance class 6H in conformance with BS 3643 : Part 2 : 1981.

b) A coated internally threaded component shall assemble onto a similarly threaded bolt with thread of tolerance class 6g in conformance with of BS 3643 : Part 2 : 1981.

NOTE. For the suitability of organic coatings for threaded fasteners see annex B.

7 Information to be supplied

The following information shall be fully documented:

a) the number of this British Standard, i.e. BS 7371 : Part 10 : 1994;

b) the coating grade;

c) the colour;

d) the requirements of a coating lubricated to BS 7371 : Part 2 : 1993;

e) dry or oiled, if not defined either condition may be supplied;

f) any additional information regarding limitations of the process to be used, e.g. maximum acceptable coating thickness, any restrictions in coating material, metallurgical condition details if the curing temperature may have some effect on heat treated parts.

8 Identification

The coating shall be identified by the number and date of this British Standard, i.e. BS 7371 : Part 10 : 1994[2)] together with the grade.

The grade shall be selected from table 1.

A colour shall be identified by the colour name written after the grade identification.

NOTE 1. In the absence of a colour in the designation the colour black may be supplied.

A lubricated condition shall be identified by the letter L after the colour or grade identification as applicable (see **4.2**).

A requirement for the coating to be supplied dry or oiled shall be designated by either 1 for oiled or 2 for dry after the dry lubricant, colour or grade identification as applicable.

NOTE 2. In the absence of any designation either condition may be supplied.

For example a dry green organic coating of grade OA with controlled lubricity would be identified as BS 7371 : Part 10 : 1994 grade OA green L2.

[2)] Marking BS 7371 : Part 10 : 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)

Adhesion test

Using a sharp instrument, scribe lines through to the base metal approximately 2 mm apart across a significant surface of the component, then scribe further lines at approximately 90° to these. Apply a strip of clear tape conforming to BS 3887 : 1991 and rub down with finger pressure. Remove the tape within (90 ± 30) s of application by pulling it off rapidly and smoothly, back upon itself, as closely as possible to an angle of 180° to the coated surface.

Annex B (informative)

Suitability of organic coatings for threaded fasteners

B.1 General

The suitability of the specified coatings for threaded parts is limited by the clearance between external and internal threads.

Tables B.1, B.2 and B.3 give guidance on the grades of coating that can be applied to standard threads to limit the risk of interference.

B.2 Avoidance of thread interference for threads in conformance with Part 2 of BS 3643

Table B.1 shows grades of coating which may be safely applied to male threaded parts with thread tolerance classes g, f or e, before coating, which are to be mated after coating with uncoated female threads tolerance class H.

Table B.2 shows grades of coating which may be safely applied to female threaded parts with thread tolerance classes H or G, before coating, which are to be mated after coating with uncoated male threads tolerance class g.

Table B.3 shows grades of coatings which may be safely applied if both male and female threaded parts are to be coated.

NOTE. The fundamental deviations for each thread tolerance class are shown in BS 3643 : Part 2.

Table B.1 Organic coatings for male threaded fasteners to be used with tolerance class H threaded female fasteners

Thread pitch mm	Suitable coating grade		
	Male thread tolerance Class g	Male thread tolerance Class f	Male thread tolerance Class e
0.35 0.4	None	None	OA[1] or OB[1]
0.45 0.5		OA[1] or OB[1]	OA, OB, OC or OD
0.6		OA, OB or OC	
0.7 0.75 0.8	OA[1] or OB[1]		
1 1.25 1.5 1.75	OA, OB or OC	OA, OB, OC or OD	
2 2.5	OA, OB, OC or OD		

[1] Only if electrophoretically applied.

Table B.2 Organic coatings for female threaded fasteners to be used with tolerance class g threaded male fasteners

Thread pitch mm	Suitable coating grade	
	Female thread tolerance Class H	Female thread tolerance Class G
0.35 0.4	None	None
0.45 0.5 0.6 0.7 0.75 0.8		OA[1] or OB[1]
1 1.25 1.5	OA[1] or OB[1]	OA, OB or OC
1.75		OA, OB, OC or OD
2 2.5	OA, OB or OC	

[1] Only if electrophoretically applied.

Table B.3 Organic coatings for male/female thread combinations

<table>
<tr><th rowspan="2">Thread pitch
mm</th><th colspan="6">Suitable coating grade for male/female thread combinations</th></tr>
<tr><th>g/H</th><th>f/H</th><th>e/H</th><th>g/G</th><th>f/G</th><th>e/G</th></tr>
<tr><td>0.35
0.4
0.45
0.5</td><td rowspan="4">None</td><td rowspan="2">None</td><td>OA[1] or OB[1]</td><td>None</td><td rowspan="3">OA, OB or OC</td><td rowspan="2">OA, OB or OC</td></tr>
<tr><td>0.6
0.7
0.75
0.8
1</td><td rowspan="3">OA, OB or OC</td><td>OA[1] or OB[1]</td></tr>
<tr><td>1.25
1.5</td><td rowspan="2">OA[1] or OB[1]</td><td rowspan="2">OA, OB or OC</td><td rowspan="2">OA, OB, OC or OD</td></tr>
<tr><td>1.75
2
2.5</td><td>OA, OB, OC or OD</td></tr>
</table>

[1] Only if electrophoretically applied.

List of references (see clause 2)

Normative references

BSI standards publications

BRITISH STANDARDS INSTITUTION, London

BS 3643 :	*ISO metric screw threads*
BS 3643 : Part 2 : 1981	*Specification for selected limits of size*
BS 3887 : 1991	*Specification for pressure sensitive adhesive closing and sealing tapes*
BS 7371 :	*Coatings on metal fasteners*
BS 7371 : Part 1 : 1991	*Specification for general requirements and selection guidelines*
BS 7371 : Part 2 : 1993	*Specification for torque/clamping force relationship*
BS 7479 : 1991	*Method for salt spray corrosion tests in artificial atmospheres*

Informative references

BSI standards publications

BRITISH STANDARDS INSTITUTION, London

BS 1210 : 1963[3)]	*Specification for wood screws*
BS 4174 : 1972[3)]	*Specification for self-tapping screws and metallic drive screws*
BS 7371 :	*Coatings on metal fasteners*
BS 7371 : Part 3 : 1993[3)]	*Specification for electroplated zinc and cadmium coatings*
BS 7371 : Part 7 : 1994[3)]	*Specification for mechanically applied zinc coatings*
BS 7371 : Part 11 : 1993[3)]	*Specification for zinc flake non-electrolytically applied cured coatings*

[3)] Referred to in the introduction only.

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