BRITISH STANDARD

BS 7371 :
Part 6 : 1998

Coatings on metal fasteners

Part 6. Specification for hot dipped galvanized coatings

ICS 21.060.01; 25.220.40

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee FME/9, Bolts, nuts and accessories, 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
National Association of Fastener Stockholders
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

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The following BSI references relate to the work on this standard:
Committee reference FME/9
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Contents

Foreword

This British Standard has been prepared by Technical Committee FME/9 to provide Part of a series of standards on requirements for coatings on metals 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 the supplier or the user from statutory obligations relating to health and safety at any stage of manufacture or use.

Compliance with this 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.

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 hot dip galvanized 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 4 : 1994	*Specification for electroplated nickel, nickel/chromium and copper/nickel/chromium coatings*
BS 7371 : Part 7 : 1993	*Specification for mechanically applied zinc coatings*
BS 7371 : Part 8 : 1997	*Specification for sherardized coatings*
BS 7371 : Part 9 : 1996	*Specification for phosphate or phosphate and oil 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.

The hot dipped galvanized coating covered by this Part of BS 7371 is for use on fasteners and accessories where the following apply:

a) an alloyed coating where long-term galvanic corrosion protection is required, superior to that obtained with thinner coatings, (a service life in excess of 25 years is not uncommon in non-agressive environments);

b) a uniform coverage of parts of complex shape is required;

c) any risk of hydrogen embrittlement of high tensile steel fasteners is unacceptable;

d) compatibility is required with site structures and fittings which may also be galvanized;

e) a damage resistant coating would be advantageous, particularly for assembly and use in harsh environments.

Difficulties may arise during the processing of certain components and reference to the coater is recommended to enquire whether a difficulty exists and whether it can be overcome by the use of specialized processing methods. Typical difficulties may arise where:

1) the processing temperature, between 450 °C conventional temperature and 580 °C high temperature, affects the mechanical properties of some heat treated, shot peened or cold work hardened fasteners or components;

2) the application to threaded fasteners without additional thread allowance results in thread interference on assembly see clause 7;

3) very small or light gauge parts with recesses need special considerations.

The coatings specified in this British Standard are suitable for application to metal components such as the following:

i) parallel threaded fasteners and accessories;

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

iii) pipe nuts and connectors with parallel or tapered threads (see **7.2**);

iv) nails and staples;

v) parts with flat surfaces e.g. washers;

parts with recesses.

1 Scope

This Part of BS 7371 specifies requirements for hot dip galvanized coatings on metal fasteners and accessories applied by immersion in molten zinc.

NOTE 1. Hydrogen embrittlement is not induced as a result of this galvanizing process.

The coating consists of zinc and/or zinc/iron alloy layers which are metallurgically bonded to the base material, resulting in a dust free surface which when required can be lubricated to give controlled torque/clamping force properties (see BS 7371 : Part 2 : 1993).

NOTE 2. This Part of BS 7371 should be read in conjunction with the requirements for coatings of BS 7371 : Part 1 *General requirements and selection guidelines.*

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

a) the minimum thickness requirements for two grades of coating;

b) modification of internal threads to accept standard size galvanized external threads;

c) assessment of corrosion resistance of unused coated parts.

[1)] All other Parts of BS 7371 should be read in conjunction with this Part.

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 purpose of this Part of BS 7371 the following definitions apply together with those given in BS 7371 : Part 1.

3.1 hot dip galvanizing

The formation of a coating of zinc and/or zinc/iron alloys on ferrous products by dipping them into molten zinc.

3.2 hot dip galvanized coating

A coating consisting of zinc/iron alloys usually covered by a zinc topcoat obtained by hot dip galvanizing.

NOTE. The term hot dip galvanized coating is subsequently referred to as the 'coating'.

3.3 local coating thickness

An individual measurement of coating thickness taken on the significant surface of the component.

3.4 average local coating thickness

The mean value of the local coating thicknesses measured on one large component or on all the components in the control sample.

4 Application and type of coating

4.1 Cleaning and pre-treatment

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

4.2 Type of coating

The coating shall be matt to silver grey in appearance and consist primarily of zinc and iron.

The coating shall be electrically conductive, metallurgically bonded and galvanically protective to steel under most climatic conditions.

When specified by the purchaser (see **8f**) the lubricity of the coating shall be modified by the addition of a lubricant and the torque/clamping performance of the coated fastener shall conform to BS 7371 : Part 2 : 1993.

4.3 Application

The coating shall be applied to the product by dipping it into molten zinc.

Hot dipped galvanized coatings shall not be applied to parts with a surface hardness of 390 HV or over.

Hot dipped galvanized coatings shall not be applied to fasteners of property classes 12, 12.9 and over.

5 Coating

5.1 Surface condition

The coating shall be clean, dry and of a uniform appearance. All surfaces of a component shall be coated unless otherwise specified. When examined for appearance the significant surfaces shall be smooth, free from staining and defects such as an uncoated area.

5.2 Coating thickness

The minimum average local coating thickness shall be as shown in table 1 when measured in accordance with annex A.

In cases of dispute clause **A.2** shall be taken as the referee method.

NOTE. Other coating thicknesses may be applied but they are outside the scope of the standard and should be agreed between supplier and user.

Table 1. Minimum average local coating thickness

Component type	Minimum average local coating thickness µm
Threaded components	43
Other components	43

5.3 Corrosion resistance

NOTE. The life of any zinc coating is directly proportional to it's thickness. Hot dip galvanizing provides a tough metallurgically bonded coating suitable for long term environmental protection.

Galvanized coatings are protected under normal environmental weathering conditions by the formation of a naturally occurring surface zinc oxide patena. The testing of corrosion resistance shall not be carried out by the use of the salt spray test as the formation of the naturally occurring surface zinc oxide patena is prevented by the use of salt spray.

6 Post treatments

Where specified post treatments shall be applied to the coating they shall be fully documented (see **8**c).

NOTE. These treatments may be in the form of a chromate, passivation, lubricant, oil etc., however in the majority of uses the application of a post treatment will be unnecessary.

If a chromate or passivation post treatment is applied to hot dipped galvanized threaded components then they should be lubricated to aid assembly.

7 Thread gauging

7.1 Gauging after coating for threaded fasteners or components

Due to the thickness of coating applied during the galvanizing process it is not possible to gauge the threaded fasteners with standard thread gauges.

7.2 Additional clearances for threaded fasteners or components

When hot dipped galvanized threaded fasteners or components have to be assembled together an additional thread clearance shall be provided. Standard diameter bolts shall be coated from stock and standard nuts shall be tapped oversize after coating to provide the additional thread clearance required. This additional thread clearance is 0.40 mm.

NOTE 1. When assembled the uncoated nut thread is protected against corrosion by direct contact with the coating on the bolt.

NOTE 2. It is recommended that, wherever possible, threaded fasteners or components that have to be assembled together are sent for hot dip galvanizing at the same time to ensure that they are able to be assembled together after coating.

8 Information to be documented and supplied to the coater

The following information to be supplied by the purchaser shall be fully documented. Both the definitive requirements specified throughout the standard and the following documented items shall be satisfied before a claim of compliance with the standard can be made and verified:

a) the number and date of this British Standard i.e. BS 7371 : Part 6 : 1998;

b) if a special coating thickness is required;

c) the post treatment, if any is required;

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

e) any additional information regarding limitations of the process to be used;

f) if lubrication of the coating is required in accordance with BS 7371 : Part 2 : 1993;

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

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

9 Identification

The coating shall be identified by the number and date of this British Standard, i.e. BS 7371 : Part 6 : 1998[2)] ZnG.

A lubricated condition shall be designated by the letter L after the designation (see **4.2**).

Example

A hot dipped galvanized coating of average local thickness 43 μm with added lubricant shall be identified as BS 7371 : Part 6 : 1998 ZnGL.

[2)] Marking BS 7371 : Part 6 : 1998 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 certidication which may also be desired.

Annexes

Annex A (normative)

Measurement of coating thickness

A.1 Local thickness

NOTE. Where a local thickness is being determined, the relationship between local and average thickness should be noted.

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

- BS 5411 : Part 8 : 1991.
- BS EN ISO 1463 : 1995.
- BS EN ISO 2117 : 1995.
- BS EN ISO 3882 : 1995.

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

A.2 Referee test

In cases of dispute the gravimetric method described in BS 729 : 1971 shall be used.

A.3 Thicker coatings

Where agreed between the supplier and user, thicker coatings shall be achieved by either shotblasting prior to galvanizing or using silicon killed steels which increases the reactivity between the molten zinc and the base steel of the component to be coated.

Annex B (informative)

Hydrogen embrittlement

Hydrogen embrittlement may cause premature failure of parts which are heat treated or cold worked to a surface hardness of 320 HV and above or property class 9.8 and above. Most electrolytic and acidic processes are liable to produce hydrogen embrittlement and, although baking after pickling and before coating will minimize the risk of failure, the process cannot be guaranteed to be completely effective.

If the risk of failure is unacceptable, cleaning and pre-treatment specifications such as abrasive blasting should be used.

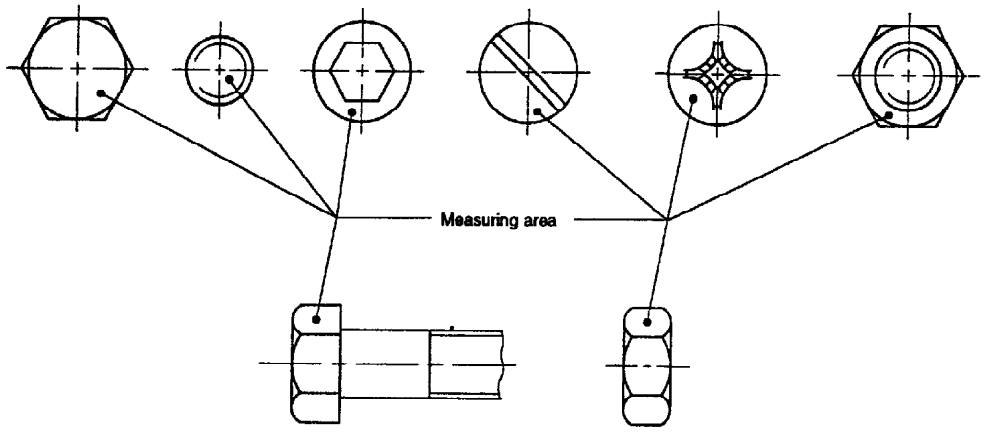

Figure A.1 Measuring area for local coating thickness measurement on fasteners

List of references (see clause 2)

Normative references

BSI publications

BRITISH STANDARDS INSTITUTION, London

BS 729 : 1971	*Specification for hot dip galvanized coatings on iron and steel articles*
BS 5411 :	*Method of test for metallic and related coatings*
BS 5411 : Part 8 : 1991	*Measurement of coating thickness of metallic coatings: X ray spectrometric methods*
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 EN ISO 1463 : 1995	*Metallic and oxide coatings. Measurement of coating thickness. Microscopical method*
BS EN ISO 2117 : 1995	*Metallic coatings. Measurement of coating thickness Coulometric method of anodic dissolution*
BS EN ISO 3882 : 1995	*Metallic and other non-organic coatings. Review of methods of measurement of thickness*

Informative references

BSI publications

BRITISH STANDARDS INSTITUTION, London

BS 1210 : 1963[3)]	*Specification for wood screws*

[3)] Referred to in the introduction only.

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