BRITISH STANDARD

BS EN ISO
1461:2009

Hot dip galvanized coatings on fabricated iron and steel articles — Specifications and test methods (ISO 1461:2009)

ICS 25.220.40

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW

sales@wm-scaffold.com

National foreword

This British Standard is the UK implementation of EN ISO 1461:2009. It supersedes BS EN ISO 1461:1999 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee STI/34, Hot dip galvanized coatings.

A list of organizations represented on this committee can be obtained on request to its secretary.

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.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 July 2009

© BSI 2009

ISBN 978 0 580 61088 2

Amendments/corrigenda issued since publication

Date	Comments

sales@wm-scaffold.com

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 1461

May 2009

ICS 25.220.40

Supersedes EN ISO 1461:1999

English Version

Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods (ISO 1461:2009)

Revêtements par galvanisation à chaud sur produits finis en fonte et en acier - Spécifications et méthodes d'essaii (ISO 1461:2009)

Durch Feuerverzinken auf Stahl aufgebrachte Zinküberzüge (Stückverzinken) - Anforderungen und Prüfungen (ISO 1461:2009)

This European Standard was approved by CEN on 30 April 2009.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

© 2009 CEN All rights of exploitation in any form and by any means reserved worldwide for CEN national Members.

Ref. No. EN ISO 1461:2009: E

Foreword

This document (EN ISO 1461:2009) has been prepared by Technical Committee ISO/TC 107 "Metallic and other inorganic coatings" in collaboration with Technical Committee CEN/TC 262 “Metallic and other inorganic coatings”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2009, and conflicting national standards shall be withdrawn at the latest by November 2009.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN ISO 1461:1999.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Endorsement notice

The text of ISO 1461:2009 has been approved by CEN as a EN ISO 1461:2009 without any modification.

Contents

Page

Foreword ... **iv**

1 Scope ... **1**

2 Normative references ... **1**

3 Terms and definitions ... **2**

4 General requirements ... **3**
4.1 General ... **3**
4.2 Hot dip galvanizing bath ... **3**
4.3 Information to be supplied by the purchaser ... **3**
4.4 Safety ... **4**

5 Acceptance inspection and sampling ... **4**

6 Coating properties ... **4**
6.1 Appearance ... **4**
6.2 Thickness ... **5**
6.3 Renovation ... **8**
6.4 Adhesion ... **8**
6.5 Acceptance criteria ... **8**

7 Certificate of compliance ... **9**

Annex A (normative) **Information to be supplied** ... **10**

Annex B (normative) **Safety and process requirements** ... **12**

Annex C (informative) **Renovation of uncoated or damaged areas** ... **13**

Annex D (informative) **Determination of thickness** ... **14**

Annex E (informative) **Corrosion resistance of hot dip galvanized coatings** ... **15**

Bibliography ... **16**

© ISO 2009 – All rights reserved

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 1461 was prepared by Technical Committee ISO/TC 107, *Metallic and other inorganic coatings*, Subcommittee SC 4, *Hot dip coatings (galvanized, etc.)*.

This third edition cancels and replaces the second edition (ISO 1461:1999), which has been technically revised. This revision reflects the experience gained in the use of ISO 1461 and includes a simplification of procedures and presentation.

Significant changes to the text include the following:

— further refining of the scope of application of the standard to exclude woven or welded mesh products that are continuously galvanized;

— adding a definition for weld seepage in Clause 3;

— adding references to the availability of secondary zinc supply;

— adding explanatory notes on coating finish;

— simplifying requirements for sampling and testing;

— adding references for the use of alternative renovation materials and for methods of adhesion testing;

— moving much informative information on the influence of the basis metal on the hot dip galvanized coatings produced and designed for galvanizing into the guidance document ISO 14713-2 [8].

© ISO 2009 – All rights reserved

INTERNATIONAL STANDARD **ISO 1461:2009(E)**

Hot dip galvanized coatings on fabricated iron and steel articles — Specifications and test methods

1 Scope

This International Standard specifies the general properties of coatings and test methods for coatings applied by dipping fabricated iron and steel articles (including certain castings) in a zinc melt (containing not more than 2 % of other metals). It does not apply to the following:

a) sheet, wire and woven or welded mesh products that are continuously hot dip galvanized;

b) tube and pipe that are hot dip galvanized in automatic plants;

c) hot dip galvanized products (e.g. fasteners) for which specific standards exist and which might include additional requirements or requirements which are different from those of this International Standard.

NOTE Individual product standards can incorporate this International Standard for the coating by quoting its number, or can incorporate it with modifications specific to the product. Different requirements can also be made for galvanized coatings on products intended to meet specific regulatory requirements.

After-treatment/over-coating of hot dip galvanized articles is not covered by this International Standard.

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.

ISO 752, *Zinc ingots*

ISO 1460, *Metallic coatings — Hot dip galvanized coatings on ferrous materials — Gravimetric determination of the mass per unit area*

ISO 2064, *Metallic and other inorganic coatings — Definitions and conventions concerning the measurement of thickness*

ISO 2178, *Non-magnetic coatings on magnetic substrates — Measurement of coating thickness — Magnetic method*

ISO 2808, *Paints and varnishes — Determination of film thickness*

ISO 2859-1, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 2859-2, *Sampling procedures for inspection by attributes — Part 2: Sampling plans indexed by limited quality (LQ) for isolated lot inspection*

ISO 2859-3, *Sampling procedures for inspection by attributes — Part 3: Skip-lot sampling procedures*

© ISO 2009 – All rights reserved

ISO 3549, *Zinc dust pigments for paints — Specifications and test methods*

ISO 3882, *Metallic and other inorganic coatings — Review of methods of measurement of thickness*

ISO 10474, *Steel and steel products — Inspection documents*

EN 1179, *Zinc and zinc alloys — Primary zinc*

EN 13283, *Zinc and zinc alloys — Secondary zinc*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 2064 and the following apply.

3.1
hot dip galvanizing
formation of a coating of zinc and/or zinc iron alloys on iron and steel products by dipping prepared steel or cast iron in a zinc melt

3.2
hot dip galvanized coating
coating obtained by hot dip galvanizing

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

3.3
coating mass
total mass of zinc and/or zinc alloys per area of surface

NOTE The coating mass is expressed in grams per square metre, g/m^2.

3.4
coating thickness
total thickness of zinc and/or zinc alloys

NOTE The thickness is expressed in micrometres, µm.

3.5
significant surface
part of the article covered or to be covered by the coating and for which the coating is essential for serviceability and/or appearance

3.6
control sample
article or group of articles from a lot that is selected for sampling

3.7
reference area
area within which a specific number of single measurements are made

3.8
local coating thickness
mean value of coating thickness obtained from the specific number of measurements within a reference area for a magnetic test or the single value from a gravimetric test

3.9
mean coating thickness
average value of the local thicknesses

© ISO 2009 – All rights reserved

3.10
local coating mass
value of coating mass obtained from a single gravimetric test

3.11
mean coating mass
average value of the coating masses determined either by using a control sample selected in accordance with Clause 5 using tests in accordance with ISO 1460 or by conversion of the **mean coating thickness** (3.9)

3.12
minimum value of the coating thickness
lowest single measurement in a gravimetric test or lowest mean obtained from the specified number of measurements in a magnetic test within a reference area

3.13
inspection lot
single order or single delivery load

3.14
acceptance inspection
inspection of an inspection lot at the hot dip galvanization works, unless otherwise specified

3.15
uncoated area
areas on the iron or steel articles that do not react with the molten zinc

3.16
zinc melt
molten mass containing primarily zinc

3.17
weld seepage
emission of previously retained pretreatment solutions from narrow spaces between two closely contacting surfaces that have been subject to intermittent welding or from very small cavities (pinholes) in the welds of a galvanized article

4 General requirements

4.1 General

This International Standard sets out requirements for the contents of the zinc melt used to apply a galvanized coating to articles (see 4.2). The chemical composition and the surface condition (finish and roughness) of the basis metal, the mass of the parts and the galvanizing conditions may affect the appearance, thickness, texture and physical/mechanical properties of the coating. This International Standard does not define any requirements regarding these points. Guidance on these parameters can be found in ISO 14713-2 [8].

4.2 Hot dip galvanizing bath

The hot dip galvanizing bath shall primarily contain molten zinc. The total of the other elements (as identified in ISO 752, EN 1179 or EN 13283, excluding tin and iron) in the molten zinc shall not exceed 1,5 % by mass.

4.3 Information to be supplied by the purchaser

The information listed in Annex A (Clauses A.1 and A.2) shall be supplied by the purchaser.

© ISO 2009 – All rights reserved

4.4 Safety

Venting and draining shall be provided for in accordance with Annex B.

5 Acceptance inspection and sampling

Acceptance inspection can be undertaken by, or on behalf of, the purchaser and shall be undertaken before the products leave the hot dip galvanizers custody, unless otherwise specified at the time of ordering by the purchaser. Acceptance inspection involves assessment of the appearance of the coated product and testing of the zinc coating thickness. Adhesion tests are normally not carried out and are only tested by agreement.

If the customer requires this, a control sample for thickness testing shall be taken randomly from each inspection lot (3.13) selected for testing. The minimum number of articles from each inspection lot that forms the control sample shall be in accordance with Table 1.

Table 1 — Control sample size related to lot size

Number of articles in lot	Minimum number of articles in the control sample
1 to 3	All
4 to 500	3
501 to 1 200	5
1 201 to 3 200	8
3 201 to 10 000	13
> 10 000	20

6 Coating properties

6.1 Appearance

At acceptance inspection, the significant surface(s) of all the hot dip galvanized article(s), when first examined by normal or corrected vision from a distance of not less than 1 m, shall be free from nodules, blisters (i.e. raised areas without solid metal beneath), roughness and sharp points (if either can cause injury) and uncoated areas.

The primary purpose of the galvanized coating is to protect the underlying iron or steelwork against corrosion. Considerations related to aesthetics or decorative features should be secondary. Where these secondary features are also of importance, it is highly recommended that the galvanizer and customer agree upon the standard of finish that is achievable on the iron or steelwork (in total or in part), given the range of materials used to form the article. This is of particular importance where the required standard of finish is beyond that set out in this subclause. It should be noted that “roughness” and “smoothness” are relative terms and the roughness of coatings on articles galvanized after fabrication differs from that of mechanically wiped products, such as galvanized sheet, tube and wire. In practice, it is not possible to establish a definition of appearance and finish covering all requirements.

The occurrence of darker or lighter areas (e.g. cellular pattern or dark grey areas) or some surface unevenness shall not be a cause for rejection. The development of wet storage staining, primarily basic zinc oxide (formed during storage in humid conditions after hot dip galvanizing), shall not be a cause for rejection, providing the coating thickness remains above the specified minimum value.

© ISO 2009 – All rights reserved

NOTE In certain circumstances, for example, where the galvanized article is to receive a further treatment or application of additional coatings, the purchaser might ask the galvanizer

a) not to quench the article, and/or

b) to take measures to prevent the formation of corrosion products on the surface of the galvanized coating during storage and transport.

Flux residues shall not be permitted. Lumps and zinc ash shall not be permitted where they might affect the intended use of the hot dip galvanized article or its corrosion resistance requirement (see ISO 14713-1 [7] for corrosion protection performance data).

Aesthetic effects (e.g. weld seepage) resulting from the use of intermittent welds around overlapping surfaces in the fabrication should not be a cause for rejection. Use of this type of welding pattern often results from consideration of health and safety issues. Further guidance is given in ISO 14713-2 [8].

Articles that fail visual inspection shall be renovated in accordance with 6.3. Otherwise, the articles shall be regalvanized and resubmitted for inspection.

When particular requirements exist (for example, when the galvanized coating is to be painted), a sample shall be produced [see A.2 f)] at the purchaser's request.

6.2 Thickness

6.2.1 General

Coatings applied by hot dip galvanizing are designed to protect the iron and steel products against corrosion (see Annex E). The length of time of corrosion protection by such coatings is approximately proportional to the coating thickness (see ISO 14713-1 [7]).

6.2.2 Test methods

In case of dispute regarding the test method, the method of calculating the coating thickness shall be by the determination of the mean mass of hot dip galvanized coating per unit area using the gravimetric method in accordance with ISO 1460, and the nominal density of the coating, 7,2 g/cm^3, shall be used for calculation purposes. Where less than 10 articles are involved, the purchaser shall not have to accept the gravimetric test if that would involve the destruction of articles and unacceptable remedial costs to the purchaser.

Tests (see Annex D) are most commonly carried out by one of the magnetic methods given in ISO 2808 and ISO 2178 (also specified in ISO 3882). Instruments for magnetic methods measure either the magnetic attraction between a permanent magnet and the base metal, as influenced by the presence of the coating, or the reluctance of the magnetic flux path passing through the coating and the base metal. Alternative methods include the gravimetric and the microscopic cross-section methods (see Annex D).

The test methods given in ISO 2808 and ISO 2178 (also reviewed in ISO 3882) are most appropriate within works and for routine quality control. Because the area on which each measurement is made in these methods is very small, individual figures may be lower than the values for the local or mean coating thickness. If a sufficient number of measurements is made within a reference area, effectively the same local thickness will be determined by magnetic as well as gravimetric methods.

6.2.3 Reference areas

The number and position of reference areas and their sizes for the magnetic or gravimetric test shall be chosen with regard to the shapes and sizes of the article(s) in order to obtain a result as representative as possible of mean coating thickness or mass per unit area, as applicable. On a long article in the control sample, the reference areas shall be cut approximately 100 mm from the edges and 100 mm from each end and the approximate centre, and shall comprise the whole cross-section of the article.

© ISO 2009 – All rights reserved

The number of reference areas, dependent upon the size of the individual articles in the control sample, shall be as identified in Table 2.

Table 2 — Required number of reference areas for testing

Category	Size of significant surface area	Number of reference areas to be taken per article
a	$> 2\ m^2$	W 3
b	$> 100\ cm^2$ to u $2\ m^2$	W 1
c	$> 10\ cm^2$ to u $100\ cm^2$	1
d	u $10\ cm^2$	1 on each of N articles
NOTE $2\ m^2 = 200\ cm \times 100\ cm$; $100\ cm^2 = 10\ cm \times 10\ cm$.		

For articles in category a in Table 2, with a significant surface area greater than $2\ m^2$ ("large" articles) for each article (taken separately) in the control sample, the mean coating thickness within the reference areas shall be equal to or greater than the mean coating thickness values in Table 3 or Table 4.

In categories b, c and d in Table 2, the average coating thickness on each reference area shall be equal to or greater than the "local coating thickness" values given in Tables 3 or 4, as appropriate. The average coating thickness on all reference areas in a sample shall be equal to or greater than the "mean coating thickness" values given in Tables 3 or 4, as appropriate.

For category d in Table 2 only, N is the sufficient number of articles to provide a minimum of $10\ cm^2$ of significant surface for an individual reference area. The total number of articles tested equals the number of articles required to provide one reference area, N, multiplied by the appropriate number from the second column of Table 1 related to the size of the lot (or the total number of articles galvanized if that is less). Alternatively, sampling procedures selected from ISO 2859-1, ISO 2859-2 or ISO 2859-3 shall be used.

When the zinc coating thickness is determined by the magnetic method in accordance with ISO 2178, the reference areas shall be within, and representative of, those that would have been chosen for the gravimetric method.

When more than five articles have to be taken to make up a reference area of at least $10\ cm^2$, a single magnetic measurement shall be taken on each article if a suitable area of significant surface exists; if not, the gravimetric test shall be used.

Within each reference area of $10\ cm^2$, a minimum of five magnetic test readings shall be taken on coated areas. If any of the individual readings is lower than the values in Tables 3 or 4, this is irrelevant, as only the mean value over the whole of each reference area is required to be equal to or greater than the local thickness given in the table. The mean coating thickness for all reference areas shall be calculated in a similar way for the magnetic test as for the gravimetric test (see ISO 1460).

Thickness measurements shall not be taken on cut surfaces or areas less than 10 mm from edges, flame-cut surfaces or corners (see ISO 14713-2 [8]).

© ISO 2009 – All rights reserved

Table 3 — Minimum coating thickness and mass on samples that are not centrifuged

Article and its thickness	Local coating thickness (minimum)[a] µm	Local coating mass (minimum)[b] g/m^2	Mean coating thickness (minimum)[c] µm	Mean coating mass (minimum)[b] g/m^2
Steel > 6 mm	70	505	85	610
Steel > 3 mm to u 6 mm	55	395	70	505
Steel W 1,5 mm to u 3 mm	45	325	55	395
Steel < 1,5 mm	35	250	45	325
Castings W 6 mm	70	505	80	575
Castings < 6 mm	60	430	70	505

NOTE This table is for general use: individual product standards may include different requirements including different categories of thickness. Local coating mass and mean coating mass requirements are set out in this table for reference in such cases of dispute.

[a] See 3.8.

[b] Equivalent coating mass using a nominal coating density of 7,2 g/cm^3 (see Annex D).

[c] See 3.9.

The local coating thickness in Table 3 shall only be determined in relation to reference areas selected in accordance with 6.2.3. In cases of dispute, the results of gravimetric tests (coating mass) take precedence over the results of coating thickness tests.

Table 4 — Minimum coating thickness and mass on samples that are centrifuged

Article and its thickness	Local coating thickness (minimum)[a] µm	Local coating mass (minimum)[b] g/m^2	Mean coating thickness (minimum)[c] µm	Mean coating mass (minimum)[b] g/m^2
Articles with threads:				
> 6 mm diameter	40	285	50	360
u 6 mm diameter	20	145	25	180
Other articles (including castings):				
W 3 mm	45	325	55	395
< 3 mm	35	250	45	325

NOTE This table is for general use: fastener coating standards and individual product standards may have different requirements: see also A.2.h). Local coating mass and mean coating mass requirements are set out in this table for reference in such cases of dispute.

[a] See 3.8.

[b] Equivalent coating mass using a nominal coating density of 7,2 g/cm^3 (see Annex D).

[c] See 3.9.

The local coating thickness in Table 4 shall only be determined in relation to reference areas selected in accordance with 6.2.3. In cases of dispute, the results of gravimetric tests (coating mass) take precedence over the results of coating thickness tests.

© ISO 2009 – All rights reserved

6.3 Renovation

The total uncoated areas for renovation by the galvanizer shall not exceed 0,5 % of the total surface area of the component. Each uncoated area for renovation shall not exceed 10 cm^2. If uncoated areas are larger, the article containing such areas shall be regalvanized, unless otherwise agreed between the purchaser and the galvanizer.

Renovation shall be by thermal zinc spraying (for example ISO 2063 [2]) or by a suitable zinc-rich paint where the zinc dust pigment conforms to ISO 3549 within the practical limits of such systems, or by suitable zinc-flake or zinc-paste products. The use of a zinc alloy stick is also possible (see Annex C).

Where the purchaser advises a special requirement (e.g. a paint coating is to be applied subsequently), the proposed renovation procedure shall be advised in advance to the purchaser by the galvanizer.

The treatment shall include the removal of any scale, cleaning and any necessary pretreatment to ensure adhesion.

The coating thickness on the renovated areas shall be a minimum of 100 µm unless the purchaser advises the galvanizer otherwise, for example, when the galvanized surface is to be over-coated and the thickness for renovated areas is to be the same as for the hot dip galvanized coating. The coating on the renovated areas shall be capable of giving sacrificial protection to the steel to which it is applied.

NOTE See also Annex C for advice on repair of damaged areas.

6.4 Adhesion

No suitable International Standards currently exist for testing the adhesion of hot dip galvanized coatings on fabricated iron and steel articles.

Adhesion between zinc and basis metal does not generally need to be tested as adequate bonding is characteristic of the galvanizing process and the coated work should be able to withstand, without peeling or flaking, handling consistent with the nature and thickness of the coating and the normal use of the article. In general, thicker coatings require more careful handling than thinner coatings. Bending or forming after hot dip galvanizing are not considered to be normal handling.

Where adhesion tests are required by the purchaser, any such test should be agreed by the galvanizer and the purchaser prior to the work being galvanized. Should it be necessary to test the adhesion, for example, in the case of workpieces that are to be subject to high mechanical stresses, any test shall only be on significant surfaces, i.e. in areas in which good adhesion is important for the proposed application.

A cross-hatch test (e.g. according to ISO 16276-2 [9]) will give some guidance on the mechanical properties of the coating but, in some cases, may be more demanding than the application requires. Other impingement tests and cutting tests may also be developed for hot dip galvanized coatings and will be further considered for possible eventual issue as a separate document.

6.5 Acceptance criteria

When tested in accordance with 6.2.2 for the appropriate number of reference areas given in 6.2.3, the coating thickness shall be not less than the values given in Table 3 or Table 4, as appropriate. Except in the case of dispute, the non-destructive test shall be used unless the purchaser specifically accepts that his articles may be cut for mass loss determinations. Where articles include a number of different thicknesses of steel, each thickness range shall be regarded as a separate article and the relevant values in Tables 3 and 4, as appropriate, shall apply.

If the thickness of coating on a control sample does not conform to these requirements, twice the original number of articles (or all the articles if that is the lesser number) shall be taken from the lot and tested. If this larger control sample passes, the whole inspection lot shall be accepted. If the larger control sample does not pass, the articles that do not conform to the requirements shall either be discarded or the purchaser may authorize them to be regalvanized.

© ISO 2009 – All rights reserved

7 Certificate of compliance

When required, the hot dip galvanizer shall provide a certificate of compliance with the requirements of this International Standard (see ISO 10474). Additionally, if the galvanizer is so registered, the purchaser may request a certificate that the work has been carried out according to this International Standard by a galvanizer registered to an appropriate quality assurance scheme, such as ISO 9001 [4].

© ISO 2009 – All rights reserved

Annex A
(normative)

Information to be supplied

A.1 Essential information for provision by the purchaser

The number of this International Standard, i.e. ISO 1461, shall be supplied by the purchaser to the hot dip galvanizer.

A.2 Additional information for provision by the purchaser

The following information might be required for particular purposes and, if so, shall be supplied or specified, as applicable, by the purchaser:

a) the composition and any properties of the basis metal that might affect hot dip galvanizing, including specification for the steel supply condition, with references such as EN 10025 [11], EN 10163-3 [12], EN 10204 [13];

b) the presence of flame-cut, laser-cut or plasma-cut surfaces on the work;

c) an indication of significant surfaces, for example, by drawings or by the provision of suitably marked samples;

d) a drawing or other means of identifying where surface unevenness, for example round drops or contact marks, will make the coated article unacceptable for its intended purpose; the purchaser shall discuss with the galvanizer the way to deal with such problems;

e) where fabrications sent for galvanizing include internally vented enclosed cavities, written evidence regarding this design feature shall be provided to the galvanizer prior to the work being undertaken, to ensure that the correct placement and size of venting arrangements have been undertaken;

NOTE 1 The galvanizer is not obliged to take on such work.

f) a sample or other means of showing the required finish;

g) any special pretreatment requirements;

h) any special thickness of coating (see 6.2);

i) the need for, or acceptability of, a centrifuged coating that is to meet the requirements of Table 4 instead of Table 3;

j) any after-treatments or over-coating to be given to the galvanized coating (see 6.3);

k) inspection arrangements (see Clause 5).

NOTE 2 Detailed guidance is given in ISO 14713-2 [8] on the effects of article condition on the results of hot dip galvanizing, with reference to the following:

1) steel composition (bulk and surface chemistry);

2) steel surface condition;

© ISO 2009 – All rights reserved

3) article surface roughness;

4) design of the article (size, weight and shape);

5) stresses in the article;

6) galvanizing practice used.

A.3 Additional information for provision by the galvanizer

The galvanizer shall, on request, provide the following:

a) any relevant information available to him, including the method of renovation of uncoated areas;

b) a certificate of compliance in accordance with ISO 10474, if required;

c) if the galvanizer is so registered, certification that the work has been carried out by a galvanizer registered to an appropriate quality assurance standard, such as ISO 9001 [4].

Requests from the purchaser for this type of certificate should be made prior to the work being undertaken.

© ISO 2009 – All rights reserved

Annex B
(normative)

Safety and process requirements

In the absence of national safety and health regulations covering venting and draining of cavities, the purchaser shall provide for safe handling of the work throughout the galvanizing operation. The work shall include a sufficient number of holes of sufficient size or other means for safe venting and draining of the work, or the purchaser give consent for the galvanizer to provide such vents and drains.

WARNING — Unvented enclosed cavities must not be galvanized as these can cause explosions during hot dip galvanizing which represent a major risk for those present.

NOTE 1 Further information on venting and draining is given in ISO 14713-2 [8].

NOTE 2 Additional information on the aspects of safety in operation of hot dip galvanizing thermoprocessing equipment is given in EN 746-4 [10].

© ISO 2009 – All rights reserved

Annex C
(informative)

Renovation of uncoated or damaged areas

Where the galvanizer is advised that an over-coating is to be specified (e.g. according to ISO 12944-5 [6] or EN 13438 [14]), the purchaser should be informed that repair of damaged areas is permitted and informed about the proposed methods and materials used for repair of uncoated or damaged areas. Purchasers and applicators of subsequent coatings should ensure that such a subsequent coating system is compatible with the methods and materials used.

Subclause 6.3 covers the thickness of coating required by the renovation procedure at acceptance inspection. The same techniques are used for on-site repairs to damaged areas. The size of areas acceptable for treatment should be similar to those acceptable for uncoated areas.

© ISO 2009 – All rights reserved

Annex D
(informative)

Determination of thickness

D.1 General

The most general non-destructive methods for determining thickness are the magnetic methods (see 6.2) set out in ISO 2178 and ISO 2808, and also described in ISO 3882.

Destructive methods include the determination of mass per area by the gravimetric method converted to thickness (micrometres) by dividing the value in grams per square metre by the nominal density of the coating (7,2 g/cm^3) or a value agreed to be most representative of the zinc/zinc alloy forming the coating (see D.3), and the microscopic cross-section method (see D.2).

D.2 Microscopic cross-section method

The microscopic cross-section method (see ISO 1463 [1]) may also be used. However, it is inappropriate for routine use on large or expensive articles as it is a destructive method and relates only to a single line. It gives a simple visual picture of the line examined.

D.3 Calculation of thickness from mass per area (reference method)

The method described in ISO 1460 gives the coating mass per unit area, expressed in grams per square metre. This can be converted to local thickness (micrometres) by dividing by the nominal density of the coating (7,2 g/cm^3) or a value agreed to be most representative of the zinc/zinc alloy forming the coating.

© ISO 2009 – All rights reserved

Annex E
(informative)

Corrosion resistance of hot dip galvanized coatings

For most applications where hot dip galvanized steel articles are exposed to atmospheric conditions, the coating life in those conditions is proportional to the thickness of the coating (see ISO 14713-1 [7]).

The corrosivity of the atmosphere with regard to externally exposed hot dip galvanized coatings has, in many instances, decreased due to (for the most part) the reduced average levels of ambient sulfur dioxide. This has lead to the achievement of longer lives for hot dip galvanized coatings than were otherwise expected. Thinner galvanized coatings than those previously specified have been found to provide sufficient corrosion protection in many instances.

Reference should be made to ISO 9223 [5] to determine the corrosion category for a particular external exposure environment. Guidance on the likely performance of the galvanized coating in a particular atmospheric exposure environment can be found in ISO 14713-1 [7]. Short-term corrosion test results derived from accelerated or short-term corrosion tests (e.g. Kesternick Test, ISO 6988 [3] and salt spray tests) should not be used to predict long-term corrosion performance of galvanized coatings.

© ISO 2009 – All rights reserved

Bibliography

[1] ISO 1463, *Metallic and oxide coatings — Measurement of coating thickness — Microscopical method*

[2] ISO 2063, *Thermal spraying — Metallic and other inorganic coatings — Zinc, aluminium and their alloys*

[3] ISO 6988, *Metallic and other non organic coatings — Sulfur dioxide test with general condensation of moisture*

[4] ISO 9001, *Quality management systems — Requirements*

[5] ISO 9223, *Corrosion of metals and alloys — Corrosivity of atmospheres — Classification*

[6] ISO 12944-5, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 5: Protective paint systems*

[7] ISO 14713–1, *Guidelines and recommendations for the protection against corrosion of iron and steel in structures — Zinc coatings — Part 1: General principles of design and corrosion resistance*

[8] ISO 14713–2, *Guidelines and recommendations for the protection against corrosion of iron and steel in structures — Zinc coatings — Part 2: Hot dip galvanizing*

[9] ISO 16276-2, *Corrosion protection of steel structures by protective paint systems — Assessment of, and acceptance criteria for, the adhesion/cohesion (fracture strength) of a coating — Part 2: Cross-cut testing and X-cut testing*

[10] EN 746-4, *Industrial thermoprocessing equipment — Particular safety requirements for hot dip galvanising thermoprocessing equipment*

[11] EN 10025 (all parts), *Hot rolled products of structural steels*

[12] EN 10163-3, *Delivery requirements for surface condition of hot-rolled steel plates, wide flats and sections — Part 3: Sections*

[13] EN 10204, *Metallic products — Types of inspection documents*

[14] EN 13438, *Paints and varnishes — Powder organic coatings for galvanized or sherardised steel products for construction purposes*

© ISO 2009 – All rights reserved

BSI - British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: +44 (0)20 8996 9000. Fax: +44 (0)20 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: +44 (0)20 8996 9001. Fax: +44 (0)20 8996 7001 Email: orders@bsigroup.com You may also buy directly using a debit/credit card from the BSI Shop on the Website http://www.bsigroup.com/shop

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact Information Centre. Tel: +44 (0)20 8996 7111 Fax: +44 (0)20 8996 7048 Email: info@bsigroup.com

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: +44 (0)20 8996 7002 Fax: +44 (0)20 8996 7001 Email: membership@bsigroup.com

Information regarding online access to British Standards via British Standards Online can be found at http://www.bsigroup.com/BSOL

Further information about BSI is available on the BSI website at http://www.bsigroup.com.

Copyright

Copyright subsists in all BSI publications. BSI also holds the copyright, in the UK, of the publications of the international standardization bodies. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI.

This does not preclude the free use, in the course of implementing the standard, of necessary details such as symbols, and size, type or grade designations. If these details are to be used for any other purpose than implementation then the prior written permission of BSI must be obtained.

Details and advice can be obtained from the Copyright and Licensing Manager. Tel: +44 (0)20 8996 7070 Email: copyright@bsigroup.com

BSI Group
Headquarters 389
Chiswick High Road,
London, W4 4AL, UK
Tel +44 (0)20 8996 9001
Fax +44 (0)20 8996 7001
www.bsigroup.com/
standards