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Prevleke na železnih in jeklenih predmetih, nanesene z vročim pocinkanjem - Specifikacije in metode preskušanja (ISO/DIS 1461:2021)

Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods (ISO/DIS 1461:2021)

Durch Feuerverzinken auf Stahl aufgebrachte Zinküberzüge (Stückverzinken) - Anforderungen und Prüfungen (ISO/DIS 1461:2021)

Revêtements par galvanisation à chaud sur produits finis en fonte et en acier - Spécifications et méthodes d'essai (ISO/DIS 1461:2021)

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

Revêtements par galvanisation à chaud sur produits finis en fonte et en acier — Spécifications et méthodes d'essai

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html. This document was prepared by Technical Committee ISO/TC 107, *Metallic and other inorganic coatings*, Subcommittee SC 4, *Hot dip coatings (galvanized, etc.)*.

This fourth edition cancels and replaces the third edition (ISO 1461:2009), which has been technically revised.

Significant changes to the text include the following:

— definitions are added for ‘galvanizer’; ‘after-treatment’; ‘additional coating’; ‘wet storage stain’ and ‘duplex system’ (Clause 3);

— the difficulty to remove flux residues and zinc ash when access is restricted is recognised (Clause 6.1);

— procedures for choice of reference areas is clarified and additional requirements to avoid reference areas on certain small ancillary elements on a larger article have been added (Clause 6.2.3);

— requirements for renovation of uncoated areas have been revised. The requirements for the pigment of a zinc-containing paint to comply with ISO 3549 is removed. Annex C has been extended to include additional information on the suitability of different methods of renovation (Clause 6.3 and Annex C);

— all requirements related to coating thickness, including Table 3 and Table 4, are within Clause 6.5, including requirements linked to the size of the article in the control sample previously within Clause 6.2.3. The lower coating thicknesses that may result on ultra-low reactive steels are recognised in new requirements for these steel types. (Clause 6.5);

— information on corrosion resistance of galvanized coatings has been updated, including reference to ISO 9224 for longer-term corrosion resistance (Annex E).

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

1 Scope

This document specifies the general properties of hot dip galvanized coatings and test methods for hot dip galvanized 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 document.

NOTE Individual product standards can incorporate this document for the galvanized 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/additional coating of hot dip galvanized articles is not covered by this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 limiting quality (LQ) for isolated lot inspection*

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

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*

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

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

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org

3.1
hot dip galvanizing
formation of a galvanized coating of zinc and/or zinc iron alloys on fabricated iron or steel articles by dipping in a zinc melt

Note 1 to entry: Also referred to as “batch galvanizing”.

3.2
hot dip galvanized coating
coating obtained by batch hot dip galvanizing

Note 1 to entry: The term “hot dip galvanized coating” is subsequently referred to as the “galvanized coating”.

3.3
galvanizer
company or organisation that operates a plant for the hot dip galvanizing of batches of fabricated iron or steel articles

3.4
galvanized coating mass
total mass of zinc and/or zinc alloys per area of surface

Note 1 to entry: The galvanized coating mass is expressed in grams per square metre, g/m^2.

3.5
galvanized coating thickness
total thickness of zinc and/or zinc alloys

Note 1 to entry: The thickness is expressed in micrometres, µm.

3.6
significant surface
part of the article covered or to be covered by the galvanized coating and for which the galvanized coating is essential for serviceability and/or appearance

3.7
control sample
article or group of articles from a lot that is selected for sampling

3.8
reference area
area within which a specific number of single measurements are made

3.9
local galvanized coating thickness
mean value of galvanized 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

3.10
mean galvanized coating thickness
average value of the local thicknesses

3.11
local galvanized coating mass
value of galvanized coating mass obtained from a single gravimetric test

3.12
mean galvanized coating mass
average value of the galvanized 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 galvanized coating thickness* (3.10)

3.13
minimum value of the galvanized 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

3.14
inspection lot
single order or single delivery load

3.15
acceptance inspection
inspection of an inspection lot at the hot dip galvanizing plant, unless otherwise specified

3.16
uncoated area
areas on the iron or steel articles that do not react with the molten zinc

3.17
zinc melt
molten mass containing primarily zinc

3.18
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

3.19
after-treatment
immediate application of chemical or other treatments with temporary effects such as inhibition of wet storage stain or to enhance appearance of galvanized articles

3.20
additional coating
application of coating layers, such as liquid paints or powder coating, after galvanizing as part of a duplex system

3.21
wet storage stain
surface stain resulting from the formation of zinc corrosion products (usually zinc hydroxide and zinc oxide) when freshly galvanized steel is stored or transported in moist or humid conditions

3.22
duplex system
hot dip galvanized coating with an additional liquid paint or powder coating

4 General requirements

4.1 General

This document 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 galvanized coating. This document does not define any requirements regarding these points. Guidance on these parameters can be found in ISO 14713-2.

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.

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 galvanizer's custody, unless otherwise specified at the time of ordering by the purchaser. Acceptance inspection involves assessment of the appearance of the surface of the galvanized article and testing of the galvanized coating thickness. Adhesion tests are normally not carried out and are only tested by agreement (see 6.4).

If the purchaser requires this, a control sample for thickness testing shall be taken randomly from each inspection lot (3.14) selected for testing. Unless otherwise agreed, 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 Galvanized coating properties

6.1 Appearance

At acceptance inspection, the visible 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 blisters (i.e. raised areas without solid metal beneath), roughness and sharp points (if that roughness or sharp point can cause injury) and uncoated areas. It shall be recognised that “roughness” is a relative term and the roughness of galvanized coatings on articles galvanized after fabrication differs from that of mechanically wiped products, such as hot dip coated sheet (e.g., to EN 10143 or EN 10346), tube (e.g., to EN 10240) and wire (e.g., to EN 10244).

The primary purpose of the galvanized coating is to protect the iron or steel articles 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 purchaser agree upon the standard of finish that is achievable on the articles (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. 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 (e.g., ‘orange peel’) shall not be a cause for rejection (see 4.1). The development of wet storage stain shall not be a cause for rejection, providing the galvanized coating thickness remains above the specified minimum value.

NOTE 1 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 and zinc ash shall be removed where they might affect the intended use of the hot dip galvanized article, or its corrosion resistance requirement, unless access is restricted, e.g., inside hollow sections.

Aesthetic effects (e.g., weld seepage resulting from the use of intermittent welds around overlapping surfaces in the fabrication) shall not be a cause for rejection.

NOTE 2 Use of this intermittent of welding often results from consideration of health and safety issues. Further guidance is given in ISO 14713-2.

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

Hot dip galvanized coatings are designed to protect iron and steel articles against corrosion (see Annex E). The length of time of corrosion protection by galvanized coatings is approximately proportional to the coating thickness (see ISO 14713-1).