SLOVENSKI STANDARD
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Cinkove prevleke - Smernice in priporočila za zaščito železnih in jeklenih konstrukcij proti koroziji - 1. del: Splošna načela za projektiranje in korozijsko odpornost (ISO/FDIS 14713-1:2016)

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/FDIS 14713-1:2016)

Zinküberzüge - Leitfäden und Empfehlungen zum Schutz von Eisen- und Stahlkonstruktionen vor Korrosion - Teil 1: Allgemeine Konstruktionsgrundsätze und Korrosionsbeständigkeit (ISO/FDIS 14713-1:2016)

Revêtements de zinc - Lignes directrices et recommandations pour la protection contre la corrosion du fer et de l'acier dans les constructions - Partie 1: Principes généraux de conception et résistance à la corrosion (ISO/FDIS 14713-1:2016)

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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

Revêtements de zinc — Lignes directrices et recommandations pour la protection contre la corrosion du fer et de l'acier dans les constructions —

Partie 1: Principes généraux de conception et résistance à la corrosion

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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 on 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 the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 107, *Metallic and other inorganic coatings*, Subcommittee SC 4, *Hot dip coatings (galvanized, etc.)*.

This second edition cancels and replaces the first edition (ISO 14713-1:2009), of which it constitutes a minor revision following the publication of ISO 17668:2016 and ISO 9223:2012, with the following changes:

— inclusion of ISO 17668 in normative references and replacement of various references to EN 13811 with reference to ISO 17668;

— revisions to Table 1 to align with corresponding descriptions of typical environments in ISO 9223:2012, Table C.1 and to make clearer that the corrosion rates presented are for the first year of exposure.

A list of all parts in the ISO 14713 series can be found on the ISO website.

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

1 Scope

This document provides guidelines and recommendations regarding the general principles of design which are appropriate for articles to be zinc coated for corrosion protection and the level of corrosion resistance provided by zinc coatings applied to iron or steel articles, exposed to a variety of environments. Initial protection is covered in relation to

— available standard processes,

— design considerations, and

— environments for use.

This document applies to zinc coatings applied by the following processes:

a) hot dip galvanized coatings (applied after fabrication);

b) hot dip galvanized coatings (applied onto continuous sheet);

c) sherardized coatings;

d) thermal sprayed coatings;

e) mechanically plated coatings;

f) electrodeposited coatings.

These guidelines and recommendations do not deal with the maintenance of corrosion protection in service for steel with zinc coatings. Guidance on this subject can be found in ISO 12944-5 and ISO 12944-8.

NOTE There are a variety of product-related standards (e.g. for nails, fasteners, ductile iron pipes, etc.) which provide specific requirements for the applied zinc coating systems which go beyond any general guidance presented in this document. These specific product-related requirements will take precedence over these general recommendations.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1461, ISO 2063, ISO 2064, ISO 8044, ISO 12683 and ISO 17668 and the following apply.

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

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

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

3.1
atmospheric corrosion
corrosion with the earth's atmosphere at ambient temperature as the corrosive environment

[SOURCE: ISO 8044:2015, 3.4]

3.2
elevated temperatures
temperatures between +60 °C and +200 °C

3.3
exceptional exposure
special cases such as exposure that substantially intensifies the corrosive exposure and/or places increased demands on the corrosion protection system

3.4
life to first maintenance
time interval that can elapse after initial coating before coating deterioration reaches the point when maintenance is necessary to restore protection of the basis metal

4 Materials

4.1 Iron and steel substrates

In hot dip galvanizing, the reactivity of the steel is modified by its chemical composition, particularly by the silicon plus phosphorus contents (see ISO 14713-2). The metallurgical and chemical nature of the steel is irrelevant to protection by thermally sprayed or sherardized coatings.

The broad range of steels likely to be subject to zinc coating will commonly fall into the following categories:

— carbon steel, composed simply of iron and carbon, accounts for 90 % of steel production [e.g. EN 10025-2 and EN 10080 (steel reinforcement)];

— high-strength, low-alloy (HSLA) steels have small additions (usually <2 % by weight) of other elements, typically 1,5 % manganese, to provide additional strength for a modest price increase (e.g. EN 10025-6);

— low-alloy steel is alloyed with other elements, usually molybdenum, manganese, chromium, or nickel, in amounts of up to 10 % by weight to improve the hardenability of thick sections (e.g. EN 10083-1).

Steel can be hot rolled or cold formed. Hot rolling is used to produce angle, "I", "H" and other structural sections. Some structural sections, e.g. safety barriers, cladding rails and cladding panels, are cold formed.

Cast and wrought irons are of various metallurgical and chemical compositions. This is irrelevant to protection by thermally sprayed or sherardized coatings but special consideration is needed regarding the cast irons most suitable for hot dip galvanizing (see ISO 14713-2).

4.2 Zinc coatings

The application of zinc coatings provides an effective method of retarding or preventing corrosion of ferrous materials (see Clause 1 for the range of zinc coatings/processes covered by this document). Zinc coatings are used in this regard because they protect iron and steel both by barrier action and by galvanic action.

5 Selection of zinc coating

The zinc coating system to be used should be selected by taking the following items into account:

a) the general environment (macro-climate) in which it is to be applied;

b) local variations in the environment (micro-climate), including anticipated future changes and any exceptional exposure;

c) the required life to first maintenance of the zinc coating system;

d) the need for ancillary components;

e) the need for post-treatment for temporary protection;

f) the need for painting, either initially (duplex system) or when the zinc coating is approaching the end of its life to first maintenance to achieve minimal maintenance cost;

g) the availability and cost;

h) if the life to first maintenance of the system is less than that required for the structure, its ease of maintenance.

NOTE The life for a zinc coating in any particular atmospheric exposure condition is approximately proportional to the thickness of the coating.

The operational sequence for applying the selected system should be determined in consultation with the steel fabricator and the applier of the zinc coating system.

6 Design requirements

6.1 General principles of design to avoid corrosion

Design of structures and products should influence the choice of protective system. It may be appropriate and economic to modify the design to suit the preferred protective system.

The items in a) to j) should be considered.

a) Safe and easy access for cleaning and maintenance should be provided.

b) Pockets and recesses in which water and dirt can collect should be avoided; a design with smooth contours facilitates application of a protective coating and helps to improve corrosion resistance. Corrosive chemicals should be directed away from structural components, e.g. drainage tubes should be used to control de-icing salts.

c) Areas which are inaccessible after erection should be given a coating system designed to last the required life of the structure.

d) If bimetallic corrosion (corrosion due to contact between dissimilar materials: metals and/or alloys) is possible, additional protective measures should be considered (see ISO 14713-2).

e) Where the coated iron and steel are likely to be in contact with other building materials, special consideration should be given to the contact area; e.g. the use of paint, tapes or plastic foils should be considered.

f) Hot dip galvanizing, sherardizing, mechanical coating, zinc flake coating or electroplating can be provided only in works; thermal spraying can be applied in works or on site. When paint is to be applied to a zinc coating, the application is more readily controlled in works but, where there is a likelihood of substantial damage occurring during transportation and erection, specifiers may

prefer to apply the final paint coat on site. The application of a powder coating on metal-coated steel can only be done in works.

Where the total system is applied offsite, the specification has to cover the need for care at all stages to prevent damage to the finished iron and steel and set out repair procedures to the coating once the steelwork is erected.

g) Hot dip galvanizing (in accordance with ISO 1461), sherardizing (in accordance with ISO 17668) or thermal spraying (in accordance with ISO 2063) should take place after bending and other forms of fabrication.

h) Methods of marking parts shall not have an influence on the quality of the pre-treatment operations prior to coating.

i) Precautions may be required to minimize the likelihood of deformation during processing or subsequently.

j) The conditions experienced by the articles during coating application may also need to be considered.

6.2 Design for application of different zinc coating processes

The design practice for hot dip coating differs from that for other zinc coating systems. ISO 14713-2 provides guidance on the design for hot dip coatings. This supplements the general principles of good design for steel structures.

The design practice for sherardized coatings can be found in ISO 14713-3.

The design for zinc thermal spraying should be discussed with the thermal sprayer at an early stage so that adequate provision is made for access to all areas of the article (see EN 15520).

The design for electroplating with zinc follows the general design principles for electroplating and these are not given here. The design for mechanical coating is best discussed with specialist applicators; in general, these processes are most suitable for small parts which can be tumbled in a barrel but specialist plants may be available for other shapes.

6.3 Tubes and hollow sections

6.3.1 General

If they are dry and hermetically sealed, the internal surfaces of tubes and hollow sections will not need protection. Where hollow sections are fully exposed to the weather, or interior environments that might give rise to condensation, and are not hermetically sealed, consideration should be given to the need for both internal and external protection.

6.3.2 Corrosion protection of internal and external surfaces

Hot dip galvanizing gives equal thickness internally and externally. There are some special products where the thickness of the coating is different on internal and external surfaces, e.g. tubes for water distribution systems (see EN 10240). When tubes and hollow sections are hot dip galvanized after assembly into structures, drainage/venting holes should be provided for processing purposes (see ISO 14713-2).

Sherardizing gives equal thickness internally and externally. No precautions are needed for hollow sections. When tubes are sherardized, the zinc dust and sand mixture should be loaded into the tubes before starting the thermal diffusion process (see ISO 14713-3).

6.4 Connections

6.4.1 Fastenings to be used with hot dip galvanized, sherardized or thermally sprayed coatings

The protective treatment of bolts, nuts and other parts of the structural connections should be given careful consideration. Ideally, their protective treatment should provide a similar performance to that specified for the general surfaces. Specific requirements are given in the appropriate product International Standards (e.g. ISO 10684) and in a series of International Standards for coatings on fasteners which are in the course of preparation/publication.

Hot dip galvanized (see, for example, ISO 1461 which covers specified minimum coating thicknesses up to 55 µm), sherardized or other coatings on steel fasteners should be considered. Alternatively, stainless steel fasteners can be used; for precautions, to take in order to minimize the potential for bimetallic corrosion, see 7.9.

The mating surfaces of connections made with high-strength friction-grip bolts should be given special treatment. It is not necessary to remove thermally sprayed, sherardized or hot dip coatings from such areas to obtain an adequate coefficient of friction. However, consideration has to be given to any long-term slip or creep-avoidance requirements and to any necessary adjustments to the assembly dimensions.

6.4.2 Welding considerations related to coatings

It is recommended to weld prior to hot dip galvanizing, sherardizing or thermal spraying. The use of welding anti-spatter sprays that cannot be removed in the pretreatment process at the galvanizers' works should be avoided. For this reason, where welding sprays are used, low silicone, water-soluble sprays are recommended. After welding, the surface should be prepared to the standard specified for preparing the steelwork overall before applying the protective coating process. Welding should be balanced (i.e. equal amounts on each side of the main axis) to avoid introducing unbalanced stresses in a structure. Welding residues have to be removed before coating. The normal pretreatments for thermal spraying are usually sufficient for this purpose but extra pretreatment may be needed for hot dip galvanizing; in particular, weld slag should be removed separately. Some forms of welding leave alkaline deposits behind. These have to be removed by blast-cleaning followed by washing with clean water before applying thermally sprayed coatings. (This does not apply to hot dip galvanizing and sherardizing where the pretreatment process removes alkaline deposits.)

It is desirable that fabrication takes place without the use of a blast primer, as this has to be removed before hot dipping, sherardizing or thermal spraying.

Where welding takes place after hot dip galvanizing, sherardizing or thermal spraying, it is preferable, before welding, to remove the coating locally in the area of the weld to ensure the highest-quality weld. After welding, protection should be appropriately restored locally by thermal spraying, "solder sticks" and/or zinc dust paints.

It is not recommended to weld sherardized articles, but spot-welding may be possible in certain applications.

After welding of coated steels, the surface should be prepared to the standard specified for preparing the steelwork overall before applying paint or fusion-bonded powder coatings.

Assemblies comprising different metals needing different pre-treatments should be discussed with the processor.

Welding of zinc-coated parts must be done with appropriate local air ventilation in accordance with health and safety regulations.