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Zinc coatings — Guidelines and recommendations for the protection against corrosion of iron and steel in structures —

Part 3: Sherardizing

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

Partie 3: Shérardisation

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Foreword

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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 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 the following URL: 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 second edition cancels and replaces the first edition (ISO 14713-3:2009), of which it constitutes a minor revision following the publication of ISO 17668 with the following changes:

— ISO 17668 has replaced EN 13811;

— Table 1 has been amended to align coating classes with ISO 17668.

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

Introduction

Sherardizing is a thermal diffusion process in which articles are heated in the presence of a sherardizing mixture consisting of zinc dust with or without an inert material.

The process is carried out in a slowly rotating closed container at temperatures ranging from about 300 °C to 500 °C. The normal processing temperature is below the melting point of zinc (419 °C).

During the process, zinc/iron alloys are built up on the surface of the ferrous articles. A coating thickness of 10 µm to 75 µm (and higher if required) can be achieved. The coating thickness is accurately controlled by the amount of zinc dust, the processing time and temperature. The coating closely follows the contours of the basis material, and uniform coatings are produced on articles, including those of irregular shape.

After sherardizing, the containers are cooled down. A screening process separates the sherardized articles from the unused sherardizing mixture. The articles, with the zinc/iron-alloyed layer, are normally post-treated by phosphating, chromating or another suitable passivation process (conversion coating) resulting in a dust-free and clean passivated surface.

Most steel and iron articles can be sherardized.

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Part 3: Sherardizing

1 Scope

This document provides guidelines and recommendations regarding the general principles of design that are appropriate for articles to be sherardized for corrosion protection.

The protection afforded by the sherardized coating to the article will depend upon the method of application of the coating, the design of the article and the specific environment to which the article is exposed. The sherardized article can be further protected by application of additional coatings (outside the scope of this document), such as organic coatings (wet paints or powder coatings). When applied to sherardized articles, this combination of coatings is often known as a "duplex system".

General guidance on this subject can be found in ISO 12944-5 and EN 13438.

The maintenance of corrosion protection in service for steel with sherardized coatings is outside the scope of this document.

Specific product-related requirements (e.g. for sherardized coatings on fasteners or tubes, etc.) will take precedence over these general recommendations.

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 8044, *Corrosion of metals and alloys — Basic terms and definitions*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8044 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
sherardizing
thermal diffusion process in which articles are heated in close contact with a sherardizing mixture, consisting of zinc dust with or without an inert material, in a closed container, usually rotated

3.2
sherardized coating
coating consisting of zinc/iron alloys obtained by the sherardizing process, and normally post-treated by phosphating, chromating or another suitable passivating process (conversion coating)

Note 1 to entry: "Sherardized coating" is referred to in this document as "coating".

4 Design for sherardizing

4.1 General

It is essential that the design of any article required to be finished should take into account not only the function of the article and its method of manufacture but also the limitations imposed by the finish.

Sherardizing is a process developed to protect components of various sizes, but mainly small articles, against corrosion and wear. No jig marks are visible after sherardizing. Normal sherardizing equipment has containers with nominal dimensions of 2 000 mm × 480 mm × 400 mm. Specialized equipment has been developed to treat large tubes for the gas and oil industry and large articles of complex shape for the automotive industry.

Some internal stresses in the articles to be sherardized will be relieved during the sherardizing process and this may cause deformation of the coated article. Normally, the sherardizing is carried out between 320 °C and 419 °C.

The purchaser should seek the advice of the sherardizer before designing or manufacturing a product that is subsequently to be sherardized, as it may be necessary to adapt the construction of the article for the sherardizing process, especially when very fragile components are sent for sherardizing. These components may be liable to damage and distortion during processing. The sherardizer may be able to recommend a design modification.

4.2 Surface preparation

The design and the materials used should permit good surface preparation. This is essential for the production of a high-quality coating. Sherardizing is only effective on surfaces free of oil, grease, and rust, scale or other surface contaminants. It is recommended to avoid lacquers, wax, paint, oil and grease-based markings. Surfaces should be free from defects to ensure a coating of good appearance and serviceability.

Grit blasting is the preferred surface preparation for sherardizing because

— the abraded surface responds very well to the sherardizing process, and

— the risk of hydrogen embrittlement to spring steels and to high-tensile steels, or damage to free-cutting steels, is avoided.

In case alkaline degreasing is applied, the articles should be dried before being grit blasted, if necessary, or before being sherardized.

Sintered materials should be free of oil and resins before they are sent for sherardizing.

For castings, grit blasting is essential to remove moulding sand.

In special cases, e.g. to remove scale, hydrochloric acid pickling can be considered. However, it is recommended to remove scale from articles before the final machining, so that the articles are not damaged in the pretreatment stage of the sherardizing process to provide a coating of good appearance and serviceability. The purchaser should seek the advice of the sherardizer in case such a pretreatment is required.

4.3 Design considerations

Articles to be sherardized are limited in size, since most of the containers used in the sherardizing process have nominal dimensions of 2 000 mm × 480 mm × 400 mm. Articles that are too large for such a container cannot be sherardized partially. When jointed assemblies on fabrications (not welded assemblies) have dimensions larger than the dimensions of the sherardizing containers, it should be considered to sherardize the unassembled parts and assemble the parts after sherardizing.

Internal threads or recesses can be cut before the articles are sent for sherardizing. The uniform zinc alloy layers closely follow the contours of the articles to be sherardized. Tubes and hollow articles can be sherardized. Special measures, e.g. prefilling the hollow sections with the sherardizing mixture, can be taken to ensure that the inside of these products is coated as well.

Springs and high-tensile steels are also suitable for sherardizing. To prevent affecting the integrating properties of such articles, the sherardizing should be carried out at appropriate temperatures, depending on the hardening and tempering temperatures of these articles. Springs should preferably be sherardized unassembled in a free and unloaded state. Depending on the heat treatment of these articles before finishing, the sherardizing can be carried out at lower temperatures between 320 °C and 380 °C. The processing time, however, will be extended when sherardizing at lower temperatures.

Articles having soft-soldered or resin-bonded joints should not be sent for sherardizing, as joints of this nature are affected by the sherardizing process.

Welding is preferable before sherardizing. All welds should be free of slag. Spot welding is possible after the articles are sherardized; ideally, thinner coatings, less than 15 µm in thickness, are desired.

On mating surfaces and holes, extra clearance should be provided to allow for the thickness of the coating material specified (see ISO 17668).

For the clearance recommendations for threaded components, see 4.4.

4.4 Clearances of threaded components

Although sherardizing gives a uniform coating without any significant changes in the profile of threads, there shall be adequate clearance between external and internal threads before sherardizing.

The recommended clearances are given in Table 1.

Table 1 — Clearances recommended for bolts and nuts to be sherardized

Minimum coating thickness µm	Coating class according to ISO 17668	ISO metric, UNF and UNC threads µm
10	Class 10	120
15	Class 15	180
30	Class 30	360
45	Class 45	540
60	Class 60	720
75	Class 75	900

If only the external thread is to be sherardized and then used with a standard uncoated internal thread (or *vice versa*), then half the clearance shown in Table 1 is required on the thread to be sherardized.

It is recommended to sherardize both bolts and nuts. Whenever possible, nuts and bolts sent for sherardizing should be forwarded to the sherardizer together, so that the clearance can be checked.