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Paints and varnishes — Corrosion protection of steel structures by protective paint systems —

Part 4: Types of surface and surface preparation

Peintures et vernis — Anticorrosion des structures en acier par systèmes de peinture —

Partie 4: Types de surface et de préparation de surface

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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 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 35, *Paints and varnishes*, Subcommittee SC 14, *Protective paint systems for steel structures*.

This second edition cancels and replaces the first edition (ISO 12944-4:1998), which has been technically revised.

The main changes compared to the previous edition are as follows:

— the terms and definitions which were not used in the main part of the standard have been deleted;

— the normative references have been updated;

— 5.6 “Surfaces with chemical treatment” has been included;

— 6.2.8 “Chemical treatment” has been included;

— Annex C has been restructured to contain two tables for distinction between “extraneous layers and foreign matter” and “native layers and contaminants”;

— the bibliography has been updated;

— the text has been editorially revised.

A list of all parts in the ISO 12944 series can be found on the ISO website.

Introduction

Unprotected steel in the atmosphere, in water and in soil is subjected to corrosion that can lead to damage. Therefore, to avoid corrosion damage, steel structures are normally protected to withstand the corrosion stresses to which they will be subjected during the service life required of the structure.

There are different ways of protecting steel structures from corrosion. ISO 12944 (all parts) deals with protection by paint systems and covers, in the various parts, all features that are important in achieving adequate corrosion protection. Additional or other measures are possible but require particular agreement between the interested parties.

In order to ensure effective corrosion protection of steel structures, owners of such structures, planners, consultants, companies carrying out corrosion protection work, inspectors of protective coatings and manufacturers of coating materials need to have at their disposal state-of-the-art information in concise form on corrosion protection by paint systems. It is vital that such information is as complete as possible, unambiguous and easily understandable to avoid difficulties and misunderstandings between the parties concerned with the practical implementation of protection work.

ISO 12944 (all parts) is intended to give this information in the form of a series of instructions. It is written for those who have some technical knowledge. It is also assumed that the user of ISO 12944 (all parts) is familiar with other relevant International Standards, in particular those dealing with surface preparation.

Although ISO 12944 (all parts) does not deal with financial and contractual questions, attention is drawn to the fact that, because of the considerable implications of inadequate corrosion protection, non-compliance with requirements and recommendations given in ISO 12944 (all parts) can result in serious financial consequences.

ISO 12944-1 defines the overall scope of ISO 12944. It gives some basic terms and definitions and a general introduction to the other parts of ISO 12944. Furthermore, it includes a general statement on health, safety and environmental protection, and guidelines for using ISO 12944 (all parts) for a given project.

This document describes the different types of surface to be protected and gives information on surface preparation methods such as chemical and mechanical cleaning. It deals with surface preparation grades, surface profile (roughness), assessment of prepared surfaces, temporary protection of prepared surfaces, preparation of temporarily protected surfaces for further coatings, preparation of existing metal coatings, and environmental aspects. As far as possible, reference is made to the basic International Standards on the surface preparation of steel substrates before application of paints and related products.

Paints and varnishes — Corrosion protection of steel structures by protective paint systems —

Part 4: Types of surface and surface preparation

1 Scope

This document covers the following types of surfaces of steel structures consisting of carbon or low-alloy steel, and their preparation:

— uncoated surfaces;

— surfaces thermally sprayed with zinc, aluminium or their alloys;

— hot-dip-galvanized surfaces;

— zinc-electroplated surfaces;

— sherardized surfaces;

— surfaces painted with prefabrication primer;

— other painted surfaces.

This document defines a number of surface preparation grades but does not specify any requirements for the condition of the substrate prior to surface preparation.

Highly polished surfaces and work-hardened surfaces are not covered by this document.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1461, *Hot dip galvanized coatings on fabricated iron and steel articles — Specifications and test methods*

ISO 2063 (all parts), *Thermal spraying — Zinc, aluminium and their alloys*

ISO 4628-1, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 1: General introduction and designation system*

ISO 4628-2, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 2: Assessment of degree of blistering*

ISO 4628-3, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 3: Assessment of degree of rusting*

ISO 4628-4, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 4: Assessment of degree of cracking*

ISO 4628-5, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 5: Assessment of degree of flaking*

ISO 4628-6, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 6: Assessment of degree of chalking by tape method*

ISO 8501-1:2007, *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings*

ISO 8501-2:1994, *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 2: Preparation grades of previously coated steel substrates after localized removal of previous coatings*

ISO 8501-3, *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 3: Preparation grades of welds, edges and other areas with surface imperfections*

ISO 8501-4, *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 4: Initial surface conditions, preparation grades and flash rust grades in connection with high-pressure water jetting*

ISO 8504 (all parts), *Preparation of steel substrates before application of paints and related products — Surface preparation methods*

ISO 12944-1, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 1: General introduction*

ISO 16276 (all parts), *Corrosion protection of steel structures by protective paint systems — Assessment of, and acceptance criteria for, the adhesion/cohesion (fracture strength) of a coating*

EN 10238, *Automatically blast-cleaned and automatically prefabrication primed structural steel products*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12944-1 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 https://www.iso.org/obp

3.1
abrasive blast-cleaning
impingement of a high-kinetic-energy stream of *blast-cleaning abrasive* (3.2) on to the surface to be prepared

[SOURCE: ISO 11124-1:1993, 2.2]

3.2
blast-cleaning abrasive
solid material intended to be used for *abrasive blast-cleaning* (3.1)

[SOURCE: ISO 11124-1:1993, 2.1]

3.3
dust
loose particulate matter present on a steel surface prepared for painting, arising from *blast-cleaning* (3.1) or other surface preparation processes, or resulting from the action of the environment

[SOURCE: ISO 8502-3:2017, 3.1]

3.4
dew point
temperature at which moisture in the air will condense out on to a solid surface

Note 1 to entry: See ISO 8502-4.

3.5
flash rusting
slight rust formation on a prepared steel surface soon after preparation

3.6
grit
particles that are predominantly angular, that have fractured faces and sharp edges and that are less than half-round in shape

[SOURCE: ISO 11124-1:1993, 2.4]

3.7
mill scale
heavy oxide layer formed during hot fabrication or heat treatment of steel

3.8
rust
visible corrosion products consisting, in the case of ferrous metals, mainly of hydrated iron oxides

3.9
shot
particles that are predominantly round, that have a length of less than twice the maximum particle width and that do not have edges, broken faces or other sharp surface defects

[SOURCE: ISO 11124-1:1993, 2.3]

3.10
substrate
surface to which a coating material is applied or is to be applied

[SOURCE: ISO 4618:2014, 2.244]

3.11
surface preparation
method of preparing a surface for coating

3.12
white rust
white to dark grey corrosion products on zinc-coated surfaces

3.13
chemical treatment
surface treatment process, based on a chemical or electrochemical reaction, which superficially modifies the metal *substrate* (3.10)

4 General

The primary objective of surface preparation is to ensure the removal of matter which negatively affects the corrosion protection and to obtain a surface that permits satisfactory adhesion of the coating to the surface. It will also assist in reducing the amounts of contaminants that initiate corrosion.

It is stressed that there is a very wide variation in the condition of steel surfaces requiring cleaning prior to painting. This particularly applies to maintenance of an already coated structure. The age of the structure and its location, the quality of the previous surface, the performance of the existing coating system and the extent of breakdown, the type and severity of previous and future corrosion environments, and the intended new coating system, all influence the amount of preparation required.

When selecting a surface preparation method, it is necessary to consider the preparation grade (according to this document) required to give a level of surface cleanliness and, if required, a surface profile (roughness) appropriate to the coating system to be applied to the steel surface.

Personnel carrying out surface preparation work shall have suitable equipment and sufficient technical knowledge of the processes involved to enable them to carry out the work in accordance with the required specification. It is important that the surfaces to be treated are readily accessible and sufficiently illuminated. All surface preparation work shall be properly supervised and inspected.

If the specified preparation grade has not been achieved by the preparation method selected or when the condition of the prepared surface has subsequently changed before the application of the coating system, relevant parts of the procedure shall be repeated so as to obtain the specified preparation grade.

Details regarding the preliminary treatment of welds, the removal of weld spatter and removal of burrs and other sharp edges shall be in accordance with ISO 8501-3. Details are given in ISO 12944-3. These measures should normally be taken in connection with the manufacturing process before the surface preparation.

NOTE For further details, see ISO 8504-1.

5 Types of surface to be prepared

5.1 General

The different types of surface shall be prepared as described in 5.2 to 5.6.

5.2 Uncoated surfaces

Uncoated surfaces consist of bare steel, which can be covered by mill scale or rust and other contaminants. They shall be assessed in accordance with ISO 8501-1 (rust grades A, B, C and D).

5.3 Metal-coated surfaces

5.3.1 Thermally sprayed surfaces

Thermally sprayed surfaces consist of steel coated with zinc, aluminium or their alloys by flame or arc spraying in accordance with ISO 2063 (all parts).

5.3.2 Hot-dip-galvanized surfaces

Hot-dip-galvanized surfaces consist of steel coated with zinc or zinc alloy by immersion in a molten bath in accordance with ISO 1461.

5.3.3 Zinc-electroplated surfaces

Zinc-electroplated surfaces consist of steel coated with an electrodeposited zinc coating.

5.3.4 Sherardized surfaces

Sherardized surfaces consist of steel coated with zinc-iron alloy layers obtained by heating the steel component in a container together with zinc dust.

5.4 Surfaces painted with prefabrication primer

Surfaces painted with prefabrication primer consist of automatically blast-cleaned steel to which a prefabrication primer has been applied automatically in a plant, in accordance with EN 10238.

NOTE For the purpose of this document, the expression "surfaces painted with prefabrication primer" has a restricted meaning, as defined in EN 10238. It is restricted to automatic blast-cleaning and automatic priming.

5.5 Other painted surfaces

Other painted surfaces consist of steel/metal-coated steel that has already been painted (see 7.5).

5.6 Surfaces with chemical treatment

In some specific uses, chemical treatments are implemented to enhance corrosion resistance and/or to improve paint bonding, before metal painting operations.

With regard to this document, chemical treatment refers to hot-dip-galvanized steel surfaces, electroplated-zinc steel surfaces and sherardized surfaces.

Chemical treatment includes a dedicated cleaning followed by the chemical treatment itself conducted by spray, runoff or immersion, usually ending with a final step of rinsing.

The paint manufacturer shall previously confirm compatibility of the paint system with the chemical pre-treatment.

6 Surface preparation methods

6.1 General

The use of the methods described in 6.2 and 6.3 requires surface preparation, in accordance with ISO 8504 (all parts). Oil, grease, salts, dirt and similar contaminants shall be removed after agreement between the involved parties, prior to further surface preparation, using an appropriate method. In addition, prior removal of heavy, firmly adhering rust and mill scale by suitable manual or mechanical techniques can be necessary. Where metal-coated steel is to be cleaned, the technique shall not unnecessarily remove sound metal. A survey of cleaning methods is given in Annex C. The different methods listed are not exhaustive.

6.2 Water, solvent and chemical cleaning

6.2.1 Water cleaning

This method consists of directing a jet of clean, fresh water on to the surface to be cleaned. The water pressure required depends on the contaminants to be removed such as water-soluble materials, loose rust and poorly adhering paint coatings. To remove oil, grease, etc., the addition of suitable detergents is necessary. When detergents have been used in the cleaning operation, rinsing with clean, fresh water is necessary.

6.2.2 Steam cleaning

Steam cleaning is carried out to remove oil, grease, salts, dirt and similar contaminants. If a detergent is added to the steam, rinsing with clean, fresh water is necessary.