INTERNATIONAL STANDARD

ISO 12944-4

First edition
1998-05-15

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

Contents

International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland
Internet iso@iso.ch

Printed in Switzerland

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.

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.

International Standard ISO 12944-4 was prepared by Technical Committee ISO/TC 35, *Paints and varnishes,* Subcommittee SC 14, *Protective paint systems for steel structures.*

ISO 12944 consists of the following parts, under the general title *Paints and varnishes — Protective paint systems for steel structures*:

— *Part 1: General introduction*

— *Part 2: Classification of environments*

— *Part 3: Design considerations*

— *Part 4: Types of surface and surface preparation*

— *Part 5: Protective paint systems*

— *Part 6: Laboratory performance test methods*

— *Part 7: Execution and supervision of paint work*

— *Part 8: Development of specifications for new work and maintenance*

Annexes A and B form an integral part of this part of ISO 12944. Annexes C, D and E are for information only.

Introduction

Unprotected steel in the atmosphere, in water and in soil is subject to corrosion that may lead to damage. Therefore, to avoid corrosion damage, steel structures are normally protected to withstand the corrosion stresses during the service life required of the structure.

There are different ways of protecting steel structures from corrosion. ISO 12944 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, it is necessary for owners of such structures, planners, consultants, companies carrying out corrosion protection work, inspectors of protective coatings and manufacturers of coating materials to have at their disposal state-of-the-art information in concise form on corrosion protection by paint systems. Such information has to be as complete as possible, unambiguous and easily understandable to avoid difficulties and misunderstandings between the parties concerned with the practical implementation of protection work.

This International Standard — ISO 12944 — 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 is familiar with other relevant International Standards, in particular those dealing with surface preparation, as well as relevant national regulations.

Although ISO 12944 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 this standard may result in serious financial consequences.

ISO 12944-1 defines the overall scope of all parts 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 for a given project.

This part of ISO 12944 describes different types of surface to be protected and gives information on surface preparation methods such as chemical, mechanical and flame 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 part of ISO 12944 deals with 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 part of ISO 12944 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 part of ISO 12944.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 12944. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 12944 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1461:—[1)], *Hot dip galvanized coatings on fabricated ferrous products — Specifications.*

ISO 2063:1991, *Metallic and other inorganic coatings — Thermal spraying — Zinc, aluminium and their alloys.*

ISO 2409:1992, *Paints and varnishes — Cross-cut test.*

1) To be published. (Revision of ISO 1459:1973 and ISO 1461:1973)

ISO 4628-1:1982, *Paints and varnishes — Evaluation of degradation of paint coatings — Designation of intensity, quantity and size of common types of defect — Part 1: General principles and rating schemes.*

ISO 4628-2:1982, *Paints and varnishes — Evaluation of degradation of paint coatings — Designation of intensity, quantity and size of common types of defect — Part 2: Designation of degree of blistering.*

ISO 4628-3:1982, *Paints and varnishes — Evaluation of degradation of paint coatings — Designation of intensity, quantity and size of common types of defect — Part 3: Designation of degree of rusting.*

ISO 4628-4:1982, *Paints and varnishes — Evaluation of degradation of paint coatings — Designation of intensity, quantity and size of common types of defect — Part 4: Designation of degree of cracking.*

ISO 4628-5:1982, *Paints and varnishes — Evaluation of degradation of paint coatings — Designation of intensity, quantity and size of common types of defect — Part 5: Designation of degree of flaking.*

ISO 4628-6:1990, *Paint and varnishes — Evaluation of degradation of paint coatings — Designation of intensity, quantity and size of common types of defect — Part 6: Rating of degree of chalking by tape method.*

ISO 8501-1:1988, *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 steel substrates after overall removal of previous coatings.*

Informative Supplement to ISO 8501-1:1988, *Representative photographic examples of the change of appearance imparted to steel when blast-cleaned with different abrasives.*

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/TR 8502-1:1991, *Preparation of steel substrates before application of paints and related products — Tests for the assessment of surface cleanliness — Part 1: Field test for soluble iron corrosion products.*

ISO 8502-2:1992, *Preparation of steel substrates before application of paints and related products — Tests for the assessment of surface cleanliness — Part 2: Laboratory determination of chloride on cleaned surfaces.*

ISO 8502-3:1992, *Preparation of steel substrates before application of paints and related products — Tests for the assessment of surface cleanliness — Part 3: Assessment of dust on steel surfaces prepared for painting (pressure-sensitive tape method).*

ISO 8502-4:1993, *Preparation of steel substrates before application of paints and related products — Tests for the assessment of surface cleanliness — Part 4: Guidance on the estimation of the probability of condensation prior to paint application.*

ISO 8503-1:1988, *Preparation of steel substrates before application of paints and related products — Surface roughness characteristics of blast-cleaned steel substrates — Part 1: Specifications and definitions for ISO surface profile comparators for the assessment of abrasive blast-cleaned surfaces.*

ISO 8503-2:1988, *Preparation of steel substrates before application of paints and related products — Surface roughness characteristics of blast-cleaned steel substrates — Part 2: Method for the grading of surface profile of abrasive blast-cleaned steel — Comparator procedure.*

ISO 8504-1:1992, *Preparation of steel substrates before application of paints and related products — Surface preparation methods — Part 1: General principles.*

ISO 8504-2:1992, *Preparation of steel substrates before application of paints and related products — Surface preparation methods — Part 2: Abrasive blast-cleaning.*

ISO 8504-3:1993, *Preparation of steel substrates before application of paints and related products — Surface preparation methods — Part 3: Hand- and power-tool cleaning.*

ISO 11124-1:1993, *Preparation of steel substrates before application of paints and related products — Specifications for metallic blast-cleaning abrasives — Part 1: General introduction and classification.*

ISO 11124-2:1993, *Preparation of steel substrates before application of paints and related products — Specifications for metallic blast-cleaning abrasives — Part 2: Chilled-iron grit.*

ISO 11124-3:1993, *Preparation of steel substrates before application of paints and related products — Specifications for metallic blast-cleaning abrasives — Part 3: High-carbon cast-steel shot and grit.*

ISO 11124-4:1993, *Preparation of steel substrates before application of paints and related products — Specifications for metallic blast-cleaning abrasives — Part 4: Low-carbon cast-steel shot.*

ISO 11126-1:1993, *Preparation of steel substrates before application of paints and related products — Specifications for non-metallic blast-cleaning abrasives — Part 1: General introduction and classification.*

ISO 11126-3:1993, *Preparation of steel substrates before application of paints and related products — Specifications for non-metallic blast-cleaning abrasives — Part 3: Copper refinery slag.*

ISO 11126-4:1993, *Preparation of steel substrates before application of paints and related products — Specifications for non-metallic blast-cleaning abrasives — Part 4: Coal furnace slag.*

ISO 11126-5:1993, *Preparation of steel substrates before application of paints and related products — Specifications for non-metallic blast-cleaning abrasives — Part 5: Nickel refinery slag.*

ISO 11126-6:1993, *Preparation of steel substrates before application of paints and related products — Specifications for non-metallic blast-cleaning abrasives — Part 6: Iron furnace slag.*

ISO 11126-7:1995, *Preparation of steel substrates before application of paints and related products — Specifications for non-metallic blast-cleaning abrasives — Part 7: Fused aluminium oxide.*

ISO 11126-8:1993, *Preparation of steel substrates before application of paints and related products — Specifications for non-metallic blast-cleaning abrasives — Part 8: Olivine sand.*

ISO 12944-1:1998, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 1: General introduction.*

EN 10238:1996, *Automatically blast-cleaned and automatically prefabrication primed structural steel products.*

3 Definitions

For the purposes of this part of ISO 12944, the following definitions apply in addition to those given in ISO 12944-1.

3.1 abrasive blast-cleaning: The impingement of a high-kinetic-energy stream of blast-cleaning abrasive on to the surface to be prepared.

3.2 blast-cleaning abrasive: A solid material intended to be used for abrasive blast-cleaning. [ISO 11124-1; ISO 11126-1]

3.3 dust: Loose particulate matter present on a steel surface prepared for painting, arising from blast-cleaning or other surface preparation processes, or resulting from the action of the environment. [ISO 8502-3]

3.4 dew point: The temperature at which moisture in the air will condense out on to a solid surface. 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. [ISO 11124-1; ISO 11126-1]

3.7 mill scale: The 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. [ISO 11124-1; ISO 11126-1]

3.10 substrate: The surface to which the coating material has been applied or is to be applied. [EN 971-1]

3.11 surface preparation: Any method of preparing a surface for coating.

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

4 General

The primary objective of surface preparation is to ensure the removal of deleterious matter and to obtain a surface that permits satisfactory adhesion of the priming paint to the steel. 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 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. Since the cost of surface preparation is usually in proportion to the level of cleanliness, a preparation grade appropriate to the purpose and type of coating system or a coating system appropriate to the preparation grade which can be achieved should be chosen.

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. All relevant health and safety regulations shall be observed. 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 specified. These measures should normally be taken in connection with the manufacturing process before the surface preparation.

For further details, see ISO 8504-1.

5 Types of surface to be prepared

The surfaces to be prepared can be divided into the following:

5.1 Uncoated surfaces

Uncoated surfaces consist of bare steel, which may 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).

5.2 Metal-coated surfaces

5.2.1 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.

5.2.2 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.

5.2.3 Zinc-electroplated surfaces

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

5.2.4 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.

5.3 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 purposes of this part of ISO 12944, the expression “surfaces painted with prefabrication primer” has a restricted meaning, in accordance with EN 10238. It is restricted to automatic blast-cleaning and automatic priming.

5.4 Other painted surfaces

Other painted surfaces consist of steel/metal-coated steel that has already been painted .

6 Surface preparation methods

Oil, grease, salts, dirt and similar contaminants shall be removed as far as possible, 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 may 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.

6.1 Water, solvent and chemical cleaning

6.1.1 Water cleaning

This method consists in 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.

6.1.2 Steam cleaning

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