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Preparation of steel substrates before application of paints and related products — Surface preparation methods —

Part 1: General principles

Préparation des subjectiles d'acier avant application de peintures et de produits assimilés — Méthodes de préparation des subjectiles —

Partie 1: Principes généraux

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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).

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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 35, *Paints and varnishes*, Subcommittee SC 12, *Preparation of steel substrates before application of paints and related products.*

This third edition cancels and replaces the second edition (ISO 8504-1:2000), which has been technically revised. The main changes compared to the previous edition are as follows:

— update of normative references;

— editorial revision.

A list of all parts in the ISO 8504 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The performance of protective coatings of paint and related products applied to steel is significantly affected by the state of the steel surface immediately prior to painting. The principal factors that are known to influence this performance are

— the presence of rust and mill scale,

— the presence of surface contaminants, including salts, dust, oils and greases, and

— the surface profile.

The ISO 8501 series, the ISO 8502 series and the ISO 8503 series provide methods for assessing these factors, while the ISO 8504 series provides guidance on the preparation methods that are available for cleaning steel substrates, indicating the capabilities of each of attaining specified levels of cleanliness.

These International Standards do not contain recommendations for the protective coating system to be applied to the steel surface. They do not contain recommendations on surface quality requirements for specific situations even though surface quality can have a direct influence on the choice of protective coating and on its performance. Such recommendations are found in other documents such as national standards and codes of practice. These International Standards are used to ensure that the specified qualities are

— compatible and appropriate both for the environmental conditions to which the steel will be exposed and for the protective coating system to be used, and

— within the capability of the cleaning procedure specified.

This document should be read in conjunction with ISO 8504-2, ISO 8504-3 that describe specific surface preparation methods.

Preparation of steel substrates before application of paints and related products — Surface preparation methods —

Part 1: General principles

1 Scope

This document describes the general principles for the selection of methods for the preparation of steel surfaces before application of paints and related products. It also contains information on features that are taken into account when selecting and specifying certain surface preparation methods and preparation grades.

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 8501-1, *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, *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 8501-4, *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 8502 (all parts), *Preparation of steel substrates before application of paints and related products — Tests for the assessment of surface cleanliness*

ISO 8503 (all parts), *Preparation of steel substrates before application of paints and related products — Surface roughness characteristics of blast-cleaned steel substrates*

3 Terms and definitions

No terms and definitions are listed in this document.

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

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

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

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 also helps in reducing the amounts of contaminants that initiate corrosion.

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. 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 specifications. All relevant measures related to health and safety should be taken into account. It is recommended that the surfaces to be treated be 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 the removal of burrs and other sharp edges shall be specified. These measures should be taken into account during the manufacturing process before the surface preparation (see ISO 8501-3 for more information).

5 Condition of the initial surface

5.1 Assessment of the surface condition

As the cost of surface preparation is significantly influenced by the condition of the initial surface, information as given in a) or b) below should be available before particular surface preparation methods and preparation grades are specified. The rust grade assessed in accordance with ISO 8501-1 will determine which representative photographic example(s) shall be used in accordance with ISO 8501-1, ISO 8501-2 or ISO 8501-4.

a) For uncoated surfaces

   — the type of steel (including special treatments that influence the surface preparation) and the thickness of the steel,

   — the worst rust grade, assessed in accordance with ISO 8501-1, that is evident, together with any relevant supplementary details (for example "rust grade D with heavy rust layers"), and

   — supplementary details concerning, for example, chemical and/or other contaminants such as water-soluble corrosion-promoting salts.

b) For coated surfaces

   — the type (for example type of binder and pigment), approximate film thickness, condition and age of the coating or coating system,

   — the degree of rusting assessed in accordance with ISO 4628-3, together with any relevant supplementary details on apparent under rust,

   — the degree of blistering assessed in accordance with ISO 4628-2,

   — the degree of cracking assessed in accordance with ISO 4628-4,

   — the degree of flaking assessed in accordance with ISO 4628-5, and

— supplementary details concerning, for example, adhesion and chemical and/or other contaminants.

5.2 Influence of on-site environmental conditions

In order to hold down the cost of surface preparation and because of possible severe contamination by corrosion-stimulating substances that are difficult to remove, storage of unprotected steel in industrial or marine environments should be avoided. As far as possible, surface preparation should take place when rust grade A or B (or rust grade C for manual preparation) as defined by ISO 8501-1 is present, followed by application of a suitable primer as soon as possible.

No surface preparation work using dry or moisture-injection (see ISO 8504-2) blast-cleaning methods or other dry surface preparation methods should be carried out on site during rainfall or other precipitation. To minimize condensation on the surface, the temperature of the surface being prepared should be higher (usually at least 3 °C higher) than the dew point of the surrounding air. If the work has to be continued even under unfavourable conditions, it is essential to take special precautions such as working under a cover, enclosing in a tent, warming the surface and/or drying the air (see ISO 8502-4).

Surface preparation work in areas where there is a fire or explosion hazard requires special precautions (for example low-spark, electrical-grounding or flame-free procedures).

5.3 Removal of contaminants

Oil, grease, dirt and similar contaminants shall be removed prior to surface preparation using the selected method. In addition, prior removal of heavy, firmly adhering rust and mill scale by suitable manual or mechanical techniques can be necessary.

If specified or agreed by interested parties, water-soluble contaminants, e.g. salt, shall be removed, using other techniques, prior to and/or after application of the selected surface preparation method.

Suitable methods for removal of contaminants are described in ISO 12944-4.

6 Selection of the surface preparation method

The selection of the method for the preparation of a given surface will depend on

— the surface condition (see Clause 5, the ISO 8502 series and the ISO 8503 series),

— practicability (for example operating conditions, target dates, and health, safety and environmental considerations such as evolution of dust, reduction of waste by choice of suitable blast-cleaning abrasives, amount of water required and flame application),

— whether the complete surface or only parts of it are to be prepared,

— the specified or required preparation grade,

— the coating system,

— economic considerations, and

— particular requirements with regard to operating conditions or the required result of the surface preparation procedure (for example surface profile or removal of water-soluble contaminants).

7 Selection of the preparation grade

The selection of the preparation grade for a given surface will depend on

— the surface condition (see Clause 5, the ISO 8502 series and the ISO 8503 series),

— the coating system,

— the corrosivity of the environment to which the coated surface will be exposed,

— whether the complete surface or only parts of it are to be prepared,

— the practicability of the surface preparation method associated with the preparation grade, and

— economic considerations.

Usually, the preparation grades specified in ISO 8501-1 and ISO 8501-2 are used. Other preparation grades (such as ISO 8501-4), defined either by special reference specimens or by reference areas that are part of the object to be treated, can be used by agreement between the interested parties. If reference areas are agreed, these should be either effectively protected against change or photographed.

Preparation grades corresponding to the highest degree of surface cleanliness, for example preparation grade Sa 3 as defined in ISO 8501-1, should be specified only when

a) they are required by the surface condition (for example considerable amount of corrosive contaminants), by the intended coating system and/or by the corrosivity of the environment for which the coated surface is intended, and

b) the conditions for achieving and maintaining the preparation grade (for example dry and clean air) can be met.

The highest degree of surface cleanliness can also be justified when the maintenance intervals are prolonged, thus reducing costs of later maintenance work (for example costs for scaffold work or production shut-down).

8 Assessment

The appearance of the prepared surface depends on

— the condition of the surface prior to treatment,

— the type of substrate, and

— the surface preparation method, including the tool or material used.

After the surface preparation procedure (cleaning as specified), the prepared surfaces shall be assessed as described in ISO 8501-1, ISO 8501-2 or ISO 8501-4, i.e. the cleanliness is assessed by evaluating the appearance of the surface only.

If specified or agreed, the surfaces shall additionally be assessed in accordance with the ISO 8502 series and the ISO 8503 series.

Bibliography

[1] ISO 4628-2:2016, *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*

[2] ISO 4628-3:2016, *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*

[3] ISO 4628-4:2016, *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*

[4] ISO 4628-5:2016, *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*

[5] ISO 8501-3:2006, *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*

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

[7] ISO 12944-4, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 4: Types of surface and surface preparation*

[8] ISO 8502-4, *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*

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