INTERNATIONAL STANDARD

ISO 8504-1

Second edition
2000-03-01

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

Reference number
ISO 8504-1:2000(E)

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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.

Attention is drawn to the possibility that some of the elements of this part of ISO 8504 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 8504-1 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 second edition cancels and replaces the first edition (ISO 8504-1:1992), which has been updated and editorially revised.

ISO 8504 consists of the following parts, under the general title *Preparation of steel substrates before application of paints and related products — Surface preparation methods*:

— *Part 1: General principles*

— *Part 2: Abrasive blast-cleaning*

— *Part 3: Hand- and power-tool cleaning*

Further parts are planned.

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:

a) the presence of rust and mill scale;

b) the presence of surface contaminants, including salts, dust, oils and greases;

c) the surface profile.

International Standards ISO 8501, ISO 8502 and ISO 8503 have been prepared to provide methods of assessing these factors, while ISO 8504 provides guidance on the preparation methods that are available for cleaning steel substrates, indicating the capabilities of each in attaining specified levels of cleanliness.

These International Standards do not contain recommendations for the protective coating system to be applied to the steel surface. Neither do they contain recommendations for the surface quality requirements for specific situations even though surface quality can have a direct influence on the choice of protective coating to be applied and on its performance. Such recommendations are found in other documents such as national standards and codes of practice. It will be necessary for the users of these International Standards to ensure the qualities specified 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;

— within the capability of the cleaning procedure specified.

The four International Standards referred to below deal with the following aspects of preparation of steel substrates:

ISO 8501 — *Visual assessment of surface cleanliness*;

ISO 8502 — *Tests for the assessment of surface cleanliness*;

ISO 8503 — *Surface roughness characteristics of blast-cleaned steel substrates*;

ISO 8504 — *Surface preparation methods*.

Each of these International Standards is in turn divided into separate parts.

This part of ISO 8504 describes the general principles for the selection of surface preparation methods. It should be read in conjunction with ISO 8504-2 and subsequent parts of ISO 8504 that describe particular surface preparation methods.

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

Part 1: General principles

1 Scope

This part of ISO 8504 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 must be taken into account before certain surface preparation methods and preparation grades are selected and specified.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 8504. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 8504 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

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 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 of steel substrates after overall removal of previous coatings*.

ISO 8501-1:1988/Suppl:1994, *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 — Informative Supplement: 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 8501-3:—[1)], *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 3: Preparation grades of welds, cut edges and other areas with surface imperfections*.

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 8502-9:1998, *Preparation of steel substrates before application of paints and related products — Tests for the assessment of surface cleanliness — Part 9: Field method for the conductometric determination of water-soluble salts*.

ISO 8502-10:1999, *Preparation of steel substrates before the application of paints and related products — Tests for the assessment of surface cleanliness — Part 10: Field method for the titrimetric determination of water-soluble chloride*.

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 8503-3:1988, *Preparation of steel substrates before application of paints and related products — Surface roughness characteristics of blast-cleaned steel substrates — Part 3: Method for the calibration of ISO surface profile comparators and for the determination of surface profile — Focusing microscope procedure*.

ISO 8503-4:1988, *Preparation of steel substrates before application of paints and related products — Surface roughness characteristics of blast-cleaned steel substrates — Part 4: Method for the calibration of ISO surface profile comparators and for the determination of surface profile — Stylus instrument procedure*.

ISO 8504-2:2000, *Preparation of steel substrates before application of paints and related products — Surface preparation methods — Part 2: Abrasive blast-cleaning*.

ISO 12944-4:1998, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 4: Types of surface and surface preparation*.

3 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.

1) To be published.

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 the 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 (see ISO 8501-3 for more information).

4 Condition of the surface to be prepared

4.1 Assessment of the surface condition

As the cost of surface preparation is significantly influenced by the condition of the surface to be prepared, 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) is (are) to be used in accordance with ISO 8501-1 or ISO 8501-2.

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");
- 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 underrust;
- 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;

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

4.2 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).

4.3 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 may be necessary.

If specified or agreed, 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.

5 Selection of the surface preparation method

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

— the surface condition (see clause 4 and ISO 8502 and ISO 8503);

— 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 to be applied;

— economic considerations;

— 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).

6 Selection of the preparation grade

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

— the surface condition (see clause 4 and ISO 8502 and ISO 8503);

— the coating system to be applied;

— 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;

— economic considerations.

Normally the preparation grades specified in ISO 8501-1 and ISO 8501-2 are used. Other preparation grades, 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 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 may 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).

7 Assessment of the prepared surface

The appearance of the prepared surface depends on

— the condition of the surface prior to treatment;

— the type of steel;

— the surface preparation method, including the tool or material (for example blast-cleaning abrasive) used.

NOTE Representative photographic examples of the colour changes imparted to steel that is dry blast-cleaned to ISO 8501-1, preparation grade Sa 3, with different metallic and non-metallic abrasives are provided in the Informative Supplement to ISO 8501-1.

After the surface preparation procedure (cleaning as specified), the prepared surfaces shall be assessed as described in ISO 8501-1 or ISO 8501-2, 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 ISO/TR 8502-1, ISO 8502-2, ISO 8502-9, ISO 8502-10 and ISO 8503-2.

ICS 25.220.10

Price based on 5 pages