INTERNATIONAL STANDARD

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2018-11

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

## Part 3: Hand- and power-tool cleaning

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

*Partie 3: Nettoyage à la main et à la machine*



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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 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 second edition cancels and replaces the first edition (ISO 8504-3:1993), which has been technically revised.

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

— addition of rotary impact tool to types of power-tools;

— replacement of inspection with assessment in Clause 6.

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:

a) the presence of rust and mill scale;

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

c) the surface profile.

ISO 8501 and ISO 8502 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 systems 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. The users of these International Standards should ensure that the qualities specified are:

— compatible with 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 three International Standards referred to above deal with the following aspects of preparation of steel substrates:

— ISO 8501 (all parts): visual assessment of surface cleanliness;

— ISO 8502 (all parts): tests for the assessment of surface cleanliness;

— ISO 8504 (all parts): surface preparation methods.

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

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 assists in reducing the amounts of contaminants that initiate corrosion.

This document describes methods for hand- and power-tool cleaning. It should be read in conjunction with ISO 8504-1.

Hand- and power-tool cleaning are methods of surface preparation that generally provide a surface cleanliness which is inferior to that achieved by abrasive blast-cleaning. When a result similar to that of abrasive blast-cleaning is required, these methods need in most cases the use of more than one type of power tool, which makes surface preparation complicated and expensive. It is usually not possible to remove oil, grease and corrosion-stimulating substances such as chlorides and sulphates.

Power-tool cleaning will generally provide a better foundation for the priming paint than hand-tool cleaning, which results in better paint performance.

Hand- and power-tool cleaning are both suitable methods of surface preparation. Hand-tool cleaning particularly requires the use of priming paints having good surface wetting ability. Power-tool cleaning is appropriate when a higher-quality surface preparation grade is required and when blast-cleaning is not permitted or the interested parties decide that it is not feasible.

Representative photographic examples of St 2, St 3, PSt 2, PSt 3 and PMa are available (see ISO 8501-1 and ISO 8501-2) for assessing some new and previously coated steel surfaces cleaned using hand or

power tools. Because of the many different situations that arise in the preparation of surfaces, these photographs are not always sufficient to describe specific instances and it is recommended that special photographs of a treated reference area that are acceptable to the interested parties be produced for use as a basis for further surface preparation procedures.

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

# Part 3:
# Hand- and power-tool cleaning



## 1 Scope

This document describes methods for hand-tool and power-tool cleaning of steel substrates before application of paints and related products. It is applicable both to new steelwork and to steel surfaces that have been coated previously and that show areas of breakdown requiring maintenance painting. It describes the equipment to be used and the procedures to be followed.

## 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*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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/

**3.1**
**hand-tool cleaning**
method of preparing steel substrates by the use of hand tools, without power assistance

Note 1 to entry: Chipping hammers, hand scrapers, hand wire brushes, abrasive papers and plastic fleece with embedded abrasive are generally used. Hand-tool cleaning is sometimes carried out initially in order to remove relatively loose contaminants prior to the use of power tools.

**3.2**
**power-tool cleaning**
method of preparing steel substrates by the use of power-assisted hand tools, but excluding blast-cleaning

Note 1 to entry: Rotary de-scalers, rotary wire brushes, rotary impact tools, sanding machines, sanding discs, rotary abrasive-coated paper wheels (flap wheels), abrasive grinders, plastic fleece with embedded abrasive, chipping hammers and needle guns, driven by electric or pneumatic power, or attached to a remote controlled or robotic equipment, are examples of equipment generally used.

**3.3**
**water, solvent or chemical cleaning**
method for removing visible oil, grease, soil or machining lubricants, and other soluble contaminants, from steel surfaces

Note 1 to entry: For more details and cleaning methods see ISO 12944-4:2017, 6.2.

**3.4**
**contaminated surface**
surface on which matter deleterious to the performance of a protective coating system is present

Note 1 to entry: Typical contaminants include slag, rust, laminated rust scale, mill scale, oil, grease, welding flux and weld spatter, soluble iron corrosion products and other soluble salts, including chlorides and sulphates.

**3.5**
**cleaned surface**
surface from which the contamination has been removed to the specified or agreed level of surface cleanliness

Note 1 to entry: Full details are given in ISO 8501-1 and ISO 8501-2.

# 4 Procedure

## 4.1 General

A test area can be made according ISO 12944-8 to select the method.

## 4.2 Initial treatment

Before hand- and/or power-tool cleaning, remove heavy oil or grease by means of a scraper and then, as far as possible, remove further contamination by water, solvent or chemical cleaning.

## 4.3 Hand-tool cleaning

Hand-tool cleaning is suitable for the following operations (see Annex A for more details on types of hand tools and their uses).

**4.3.1** Use impact hand tools to remove laminated rust and rust scale.

**4.3.2** Use impact hand tools to remove all loose weld slag.

**4.3.3** Use hand wire brushing, hand abrading, hand scraping or other similar non-impact methods to remove all loose mill scale, all loose or non-adherent rust and all loose paint.

## 4.4 Power-tool cleaning

On a contaminated surface, power-tool cleaning is suitable for the following operations, modified as necessary if hand-tool cleaning (4.3) is carried out initially. Take care not to burnish (polish) the surface (see Annex B for more details on types of power tools and their uses).

**4.4.1** Use rotary or impact power tools to remove laminated rust or rust scale to the specified or agreed preparation grade.

**4.4.2** Use rotary or impact power tools to remove weld slag and weld spatter to the specified or agreed preparation grade.

**4.4.3** Use power-wire brushing, power abrading, power impact or power-assisted rotary tools to remove loose mill scale, loose or non-adherent rust and loose paint to the specified or agreed preparation grade.

**4.4.4** Use rotary impact tools to provide a surface profile.

### 4.5 Final preparation before painting

Remove any burrs, sharp ridges or sharp cuts that have been produced during the cleaning operation (see ISO 8501-3).

Immediately before painting, unless otherwise specified, ensure that any remaining sound paint has no residual gloss. Ensure that the edges of any remaining intact paint have been feathered (bevelled) using one of the methods given in 4.3 or 4.4.

Dry the surface, if necessary, and remove any residual loose matter resulting from the cleaning methods by brushing, vacuum cleaning or a blast of clean, dry compressed air.

## 5 Reference standards

Unless otherwise agreed, visual reference standards shall be used to supplement the cleaning criteria given in Clause 4. These reference standards shall be either samples or photographs provided by one of the parties or published reference standards as given in ISO 8501-1 or ISO 8501-2 (see also Introduction, last paragraph).

## 6 Assessment

Work performed under this standard is subject to assessment by a representative of those responsible for establishing the requirements. Work areas shall be accessible to the assessor. The procedures and times of assessment shall be as agreed upon by those responsible for establishing the requirements and those responsible for performing the work.

Assess all cleaned surfaces in accordance with ISO 8501-1 and ISO 8501-2 for conformity. In the event of non-conformity repeat the procedure (see Clause 4).

Representative photographic examples of steel substrates after hand- or power-tool cleaning are provided in ISO 8501-1.

# Annex A
(informative)

# Types of hand tools and their uses

The materials and hand tools which can be used include the following:

a) knives, scrapers, chisels and chipping hammers for removing slag, laminated rust scale, chipping old paint, loose rust, etc.;

b) hand wire brushes, abrasive coated paper and plastic fleece with embedded abrasive for final hand preparation including feathering edges of any firmly adhering coating system.

The use of "non-spark" tools can be necessary in areas subject to fire or explosion hazards. However, tools made from metals whose residues can lead to galvanic corrosion, for example those made from bronze, are not suitable in such cases. Tools having bristles consisting of plastic materials with embedded abrasive can be a suitable alternative.

# Annex B
(informative)

# Types of power tools and their uses

**B.1** Acceptable power tools are those driven by either compressed air or electricity. The tools might be attached to remote controlled or robotic equipment.

The types of tools which can be used include the following:

a) chipping hammers, rotary impact tool and rotary descalers for removal of rough scale, including heavy laminated scale;

b) needle guns for welds, recessed work and fasteners;

c) sanding machines, sanding discs, rotary wire brushes, rotary impact tools, rotary abrasive-coated paper wheels (flap wheels), rotary finishing brushes having filaments impregnated with abrasive grit, and plastic fleece with embedded abrasive for removing rust, rust scale and paint;

d) power grinders to smooth welds, edges, etc., prior to general finishing;

e) rotary impact tools to provide a surface profile.

**B.2** Power-tool cleaning requires care to prevent excessive roughening of the steel surface. Ridges and burrs contribute to paint failures as sharp edges are often not covered by the specified thickness of paint. Similarly, excessive power wire brushing or disking can also be detrimental to paint adhesion. For instance, residual mill scale can easily be burnished (polished) to a smooth surface to which paint will adhere poorly. The use of needle guns should be limited to welds, corners, uneven edges, etc., as the impact of the needles can cause an unacceptable profile on flat surfaces. Grinding tools can cause “burn marks” in the substrate that can result in surface cracks, metallurgical alteration, and causes premature component failure."Non-spark" tools can be necessary in areas subject to fire or explosion hazards (see Annex A, last paragraph).