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

Part 2:

Abrasive blast-cleaning

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

ISO 8504-2:2000
Partie 2: Décapage par projection d'abrasif

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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 8504-2 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 8504-2:1992), 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.

Annex A of this part of ISO 8504 is for information only.

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; [ISO 8504-2:2000](https://standards.iteh.ai/catalog/standards/sist/9450ad4a-432a-43e8-bec4-cd7f0385e204-2-2000)
- 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.

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 steel. It should also assist in reducing the amounts of contaminants that initiate corrosion.

This part of ISO 8504 describes abrasive blast-cleaning methods. It should be read in conjunction with ISO 8504-1.

Abrasive blast-cleaning is a most effective method for mechanical surface preparation. It is widely applicable because this method of surface preparation has a number of versatile features listed below.

- a) The method allows a high production rate.
- b) The equipment can be stationary or mobile and is adaptable to the objects to be cleaned.

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- c) The method is applicable to most types and forms of steel surface.
- d) Many different surface states can be produced, for example different preparation grades and surface profiles.
- e) Effects such as cleaning, peening, roughening, levelling and lapping can be produced.
- f) It is possible to remove selectively partly failed coatings, leaving sound coatings intact.

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

Part 2: Abrasive blast-cleaning

WARNING — The procedures described in this part of ISO 8504 are intended to be carried out by suitably trained and/or supervised personnel. The substances and procedures used in these methods may be injurious to health if adequate precautions are not taken. Attention is drawn in the text to certain specific hazards. This part of ISO 8504 refers only to the technical suitability of the methods and does not absolve the user from statutory obligations relating to health and safety.

1 Scope

This part of ISO 8504 describes abrasive blast-cleaning methods for the preparation of steel surfaces before coating with paints and related products. It also contains information on the effectiveness of the individual methods and their fields of application.

ISO 8504 is applicable to new and corroded steel surfaces and to steel surfaces that are uncoated or have been previously coated with paints and related products. For limitations, see note 2.

NOTE 1 These methods are essentially intended for hot-rolled steel to remove mill scale, rust, etc., but could also be used for cold-rolled steel of sufficient thickness to withstand the deformation caused by the impact of abrasive.

NOTE 2 There are several items that should be included in the purchaser's procurement documents to supplement this part of ISO 8504. Items that should be considered as a part of surface preparation before coating are edge grinding, removal of grease and oil, porosity of welds, removal of weld spatter, removal of burrs and other sharp edges, grinding of welds, filling of pits and other surface imperfections that may cause premature failure of the coating system (see ISO 8501-3 for more information) and the removal of water-soluble contaminants.

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 4628-3:1982, *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 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*

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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 8502-9:1998, *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 8504-1:2000, *Preparation of steel substrates before application of paints and related products — Surface preparation methods — Part 1: General principles.*

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 (all parts), *Preparation of steel substrates before application of paints and related products — Specifications for metallic blast-cleaning abrasives.*

ISO 11126 (all parts), *Preparation of steel substrates before application of paints and related products — Specifications for non-metallic blast-cleaning abrasives.*

NOTE The titles of all parts of ISO 11124 and of ISO 11126 are listed in annex A for information.

1) To be published.

3 Terms and definitions

For the purposes of this part of ISO 8504, the following terms and definitions apply:

3.1

abrasive blast-cleaning

impingement of a high-kinetic-energy stream of abrasive on to the surface to be prepared

NOTE The abrasive is typically propelled either by centrifugal force or by a high-velocity stream of fluid such as air or water to remove rust, mill scale, existing coatings and other contaminants and expose the substrate. The cleaned surface has a characteristic secondary profile dependent on the blast-cleaning conditions, the properties of the abrasive, the initial condition of the surface and the properties of the steel being blast-cleaned. The initial surface roughness or primary profile may be altered by the abrasive blast-cleaning procedure. Surface profiles are assessed using the method described in ISO 8503-2. 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), such as coarse, medium or fine (see ISO 8503-1 and ISO 8503-2), 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.

3.2

blast-cleaning abrasive

solid material intended to be used for abrasive blast-cleaning

3.3

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

3.4

grit

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

3.5

cylindrical particles

sharp-edged particles, having a diameter-to-length ratio of 1:1, cut so that their faces are approximately at right angles to their centreline

4 Abrasives

4.1 Materials and types

4.1.1 A wide variety of natural and synthetic solid materials and several liquids are used for abrasive blast-cleaning. Solid materials commonly in use for the preparation of steel surfaces before coating are given in Table 1. Each material provides a characteristic performance and surface finish.

When selecting a blast-cleaning abrasive, the following factors relating to its initial condition shall be considered:

- sub-group and type (see Table 1);
- indication of chemical composition;
- range of particle size (see 4.1.2);
- particle hardness (for example Vickers, Rockwell or Mohs, or as measured by another appropriate method).

International Standards for metallic and non-metallic blast-cleaning abrasives are listed for information in annex A.

4.1.2 The size and shape of the particles of an abrasive may change during use or re-use and this change can affect the resultant surface texture of the blast-cleaned steel.

Table 1 — Commonly used blast-cleaning abrasives for steel substrate preparation

| Type | | Abbreviation | Initial particle shape (see Table 2) | Comparator ^a | Remarks | | |
|--|----------------|----------------------------|--------------------------------------|-------------------------|----------------|--|--|
| Metallic (M) blast-cleaning abrasives ^c | Cast iron | Chilled | M/CI | G | G | Mainly for compressed-air blast-cleaning | |
| | Cast steel | High-carbon | M/HCS | S or G | S ^b | Mainly for centrifugal blast-cleaning | |
| | | Low-carbon | M/LCS | S | S | | |
| | Cut steel wire | — | M/CW | C | S ^b | | |
| Non-metallic (N) blast-cleaning abrasives ^c | Natural | Olivine sand | N/OL | | | Mainly for compressed-air blast-cleaning | |
| | | Staurolite | N/ST | S | G | | |
| | | Garnet | N/GA | G | G | | |
| | Synthetic | Iron furnace slag | (Calcium silicate slags) | N/FE | G | G | Mainly for compressed-air blast-cleaning |
| | | Copper refinery slag | (Ferrous silicate slags) | N/CU | | | |
| | | Nickel refinery slag | | N/NI | | | |
| Coal furnace slag | | (Aluminium silicate slags) | N/CS | | | | |
| Fused aluminium oxide | | N/FA | G | G | — | | |

^a Comparator to be used when assessing the resultant surface profile. The method for evaluating the surface profile by comparator is described in ISO 8503-2.

^b Certain types of abrasive rapidly change their shape when used. As soon as this happens, the appearance of the surface profile changes and becomes closer to that of the "shot" comparator.

^c International Standards for the range of abrasives given here are listed in annex A: the ISO 11124 series for metallic blast-cleaning abrasives and the ISO 11126 series for non-metallic blast-cleaning abrasives.

Table 2 — Initial particle shape

| Designation and initial particle shape | Symbol |
|--|--------|
| Shot — round | S |
| Grit — angular, irregular | G |
| Cylindrical — sharp-edged | C |

4.2 General requirements

4.2.1 Technical

Abrasives shall be dry (except when added to pressurized liquid or slurry blast-cleaning systems) and shall be free-flowing to permit consistent metering into the blast stream.

Abrasives shall meet the requirements specified in the ISO 11124 and ISO 11126 series of standards and be free from corrosive constituents and adhesion-impairing contaminants. Because of their deleterious effect on the blast-cleaned steel surface, permanently contaminated abrasives (for example those that cannot be cleaned before recycling and those produced from slag that has been granulated by the use of saline water, i.e. sea water, for cooling) are not permitted.

4.2.2 Health and safety

Equipment, materials and abrasives used for surface preparation can be hazardous if used carelessly. Many national regulations exist for those materials and abrasives that are considered to be hazardous during or after use (waste management), such as free silica or carcinogenic or toxic substances. These regulations are therefore to be observed. It is important to ensure that adequate instructions are given and that all required precautions are exercised.

4.3 Selection considerations

4.3.1 Selection of a suitable abrasive, together with an appropriate blast-cleaning method and operating conditions, is necessary to achieve the required standard of surface preparation.

The type of blast-cleaning abrasive — i.e. its particle size distribution, shape, hardness, density and impact behaviour (deformation or shatter characteristics) — is important in determining the standards of cleanliness, the cleaning rate and the resulting surface profile of the blast-cleaned surface.

NOTE The particle size distribution of abrasives should be determined using the methods specified in ISO 11125-2 and ISO 11127-2 respectively (see annex A).

4.3.2 Preliminary blast-cleaning tests are recommended to determine the most effective abrasive, the resulting surface preparation grade and the resulting surface profile (see ISO 8501-1 or ISO 8501-2 and ISO 8503-2). If recycled abrasive is to be used for the surface preparation work, it is essential that a preliminary test be carried out with the same material, as new abrasive may give misleading results [see also 4.3.3 c)].

4.3.3 When selecting an abrasive, it is essential that the following considerations be taken into account:

- a) The influence of a particular particle size on the resulting surface profile is normally greater for metallic abrasives than for non-metallic abrasives. This is because the shatter characteristics differ and because differences in density affect the kinetic energy of the abrasive particles.
- b) A balanced mixture of particle sizes will produce the optimum level of cleanliness, cleaning rate and surface profile.
- c) In blast-cleaning plants where the abrasive is recycled, it is necessary
 - to remove dust and contaminants before the abrasive is re-used and
 - to make up for the abrasive which is lost by wear and adherence to the workpieces; this is done by controlled additions of new abrasive so that the abrasive mixture is maintained within the prescribed particle size limits or particle size distribution.

Complete renewal of abrasive charges in recycling machines requires a period of use before the mixture reaches a steady condition.