
**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**

*Préparation des subjectiles d'acier avant application de peintures et
de produits assimilés — Caractéristiques de rugosité des subjectiles
d'acier décapés —*

*Partie 1: Spécifications et définitions des comparateurs viso-tactiles ISO
pour caractériser les surfaces décapées 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 2.

The main task of technical committees is to prepare International Standards. 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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 8503-1 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 8503-1:1988), which has been technically revised.

ISO 8503 consists of the following parts, under the general title *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*
- *Part 2: Method for the grading of surface profile of abrasive blast-cleaned steel — Comparator procedure*
- *Part 3: Method for the calibration of ISO surface profile comparators and for the determination of surface profile — Focusing microscope procedure*
- *Part 4: Method for the calibration of ISO surface profile comparators and for the determination of surface profile — Stylus instrument procedure*
- *Part 5: Replica tape method for the determination of the surface profile*

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

These International Standards do not contain provisions for the protective coating systems to be applied to the steel surface or for the surface quality provisions 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 provisions are found in other documents, such as national standards and codes of practice.

It is necessary for the users of these International Standards to ensure that the qualities specified are:

- compatible and appropriate both for the environmental conditions to which the steel is exposed and for the protective coating system to be used;
- within the capability of the cleaning procedure specified.

The four International Standards referred to above 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.

Irrespective of the procedures and the type of abrasive used for the preparation of steel substrates, the surface after blast-cleaning consists of random irregularities with peaks and valleys that are not easily characterized. Consequently, it was concluded that, because of this random nature, no method is capable of giving a precise value for the profile. Thus, it is intended that the profile be identified as either dimpled (where shot abrasives are used) or angular (where grit abrasives are used) and that it be graded as “fine”, “medium” or “coarse”, each grade being defined by the limits specified in this part of ISO 8503. These surface characteristics are considered to give sufficient distinguishing features for most painting requirements.

Particular attention, however, is drawn to the fact that the grades “fine”, “medium” and “coarse” represent different ranges in terms of roughness parameters, dependent upon whether these grades are applied to shot abrasive or grit abrasive blast-cleaned surfaces. In consequence, the effect produced on a given coating by a given grade “fine”, “medium” or “coarse” is determined not only by the specific surface character but also by the specific roughness value $\overline{R_{y5}}$ or $\overline{h_y}$ belonging to that grade. Where surface profile is particularly important, both the grade of the surface profile (“fine”, “medium” or “coarse”) and the type of abrasive which is to be used are to be specified.

This part of ISO 8503 specifies the limits for the “fine”, “medium” and “coarse” surface for both dimpled and angular profiles, and specifies the design of ISO comparators for reference purposes.

Requirements regarding the care of ISO surface profile comparators are given in Annex A.

ISO 8503-2 describes the method of using these ISO comparators. The many abrasive blast-cleaning procedures in common use are described in ISO 8504-2.

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

1 Scope

This part of ISO 8503 specifies the requirements for ISO surface profile comparators, which are intended for visual and tactile comparison of steel substrates which have been blast-cleaned with either shot abrasives or grit abrasives. This part of ISO 8503 also includes definitions of the terms used in the ISO 8503 series and requirements for the care of ISO surface profile comparators.

NOTE 1 ISO surface profile comparators are used for assessing, on site, the roughness of surfaces before the application of paints and related products or other protective treatments.

NOTE 2 Where appropriate, these ISO comparators can be used for assessing the roughness profile of other abrasive blast-cleaned substrates and, in addition, their use is not restricted solely to surfaces that are to be painted.

2 Normative references

The following referenced documents are indispensable for the application 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 8503-2, *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, *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, *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*

3 Terms and definitions

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

3.1

surface profile

micro-roughness of a surface

NOTE This is generally expressed as the height of the major peaks relative to the major valleys. This term is defined in ISO 4287 as a “profile that results from the intersection of the real surface by a specified plane”. Characteristics of the roughness of blast-cleaned surfaces are defined in 3.7, 3.8, 3.10 to 3.12 and in ISO 8503-4.

3.2

ISO surface profile comparator

planar plate of four segments on which are imparted reference **surface profiles** (3.1)

NOTE The reference surface profiles are prepared by forming, on a corrosion-resistant metal, positive replicas of an appropriately blast-cleaned mild steel **coupon** (3.3) (see Clause 4).

3.3

coupon

mild steel flat plate of four segments and of sufficient gauge such that blast-cleaning does not cause distortion

3.4

surface profile comparator

specimen surface, or surface of known average profile, representing a particular abrasive blast-cleaning process

NOTE The comparator is used to give guidance on the appearance and feel of an abrasive blast-cleaned surface and to enable an assessment to be made of the profile of the surface.

3.5

grit comparator

ISO Comparator G

comparator with **surface profiles** (3.1) corresponding to (or simulating) surfaces obtained by abrasive blast-cleaning with metallic or mineral grit

3.6

shot comparator

ISO Comparator S

comparator with **surface profiles** (3.1) corresponding to (or simulating) surfaces obtained by abrasive blast-cleaning with metallic shot

3.7

maximum peak-to-valley height

h_y
<measurement by microscopy> vertical distance between the highest peak and the lowest valley in the field of view of a microscope

NOTE 1 h_y is usually measured in micrometres.

NOTE 2 For determination, see ISO 8503-3.

3.8

mean maximum peak-to-valley height

$\overline{h_y}$
<measurement by microscopy> arithmetic mean of a number of determinations (not less than 20) of **maximum peak-to-valley height**, h_y (3.7)

3.9

sampling length

l

length of the reference line used for identifying the irregularities characterizing the surface roughness

3.10**maximum peak-to-valley height** R_y

<measurement by stylus> largest single peak-to-valley height occurring within an individual **sampling length**, l (3.9), when using a stylus instrument

NOTE The determination of R_y is described in ISO 8503-4.

3.11**mean maximum peak-to-valley height** R_{y5}

<measurement by stylus> arithmetic mean of the **maximum peak-to-valley heights**, R_y (3.10), of five adjoining single **sampling lengths**, l (3.9)

NOTE R_{y5} is also sometimes known as R_z DIN or R_{tm} .

3.12**grand mean maximum peak-to-valley height** $\overline{R_{y5}}$

<measurement by stylus> arithmetic mean of not less than 10 determinations of **mean maximum peak-to-valley height**, R_{y5} (3.11)

3.13**primary profile**

original **surface profile** (3.1) prior to blast-cleaning

3.14**secondary profile**

surface profile (3.1) resulting from the effect of the blast-cleaning process on the **primary profile** (3.13)

3.15**hackles**

thin raised slivers of steel, still attached to the substrate, which are caused by the impact of abrasives on a steel surface during blast-cleaning and which sometimes protrude above the other peaks

3.16**rogue peak**

isolated peak, substantially higher than the surrounding peaks, normally caused by the presence of over-sized abrasive in the abrasive mixture used during blast-cleaning with grit abrasives

4 ISO surface profile comparators

ISO surface profile comparators shall be planar and shall have the dimensions given in Figure 1. The segments shall conform to the values given in Table 1 where measured in accordance with the methods described in ISO 8503-3 or ISO 8503-4. The visual assessment (of the ISO comparator) shall not be inferior to preparation grade Sa 2½ of ISO 8501-1.

ISO surface profile comparators shall be manufactured by forming positive replicas from nickel or other corrosion-resistant metals using master coupons prepared from mild steel.

NOTE 1 Electro-forming has, for example, been found to give suitable products.

ISO surface profile comparators shall be marked as follows:

Reference comparator G to ISO 8503-1	for ISO comparators representing profiles after blast-cleaning with grit abrasives
Reference comparator S to ISO 8503-1	for ISO comparators representing profiles after blast-cleaning with shot abrasives

Table 1 — Nominal values and tolerances for the surface profiles of the segments of ISO surface profile comparators

ISO comparators for steel, blast-cleaned with grit abrasives		
Segment	Nominal reading ^a µm	Tolerance µm
1	25	3
2	60	10
3	100	15
4	150	20
ISO comparators for steel, blast-cleaned with shot abrasives		
Segment	Nominal reading ^a µm	Tolerance µm
1	25	3
2	40	5
3	70	10
4	100	15
a Where using the microscope method (see ISO 8503-3), the nominal reading refers to h_y . Where using the stylus method (see ISO 8503-4), the nominal reading refers to R_{y5} .		

Each ISO comparator shall be accompanied by a calibration certificate stating the method for determining the surface profile, the estimated tolerance and the calibrated surface profile, in micrometres, of each segment (see Clause 8).

NOTE 2 It is possible for other comparator designs and configurations to be used, provided four segments are included, which conform to the profiles and tolerances specified in this part of ISO 8503. However, it is not intended that such a comparator be identified as an “ISO comparator”, but it can bear the inscription that it “conforms to the profiles specified in ISO 8503-1”.

5 Ranges of the profile gradings

The limits of profile grades, fine (G or S), medium (G or S) and coarse (G or S), are given in Table 2.

Table 2 — Limits of profile grades

ISO comparators for steel, blast-cleaned with grit abrasives	
Fine (G)	Profiles equal to segment 1 and up to but excluding segment 2
Medium (G)	Profiles equal to segment 2 and up to but excluding segment 3
Coarse (G)	Profiles equal to segment 3 and up to but excluding segment 4
ISO comparators for steel, blast-cleaned with shot abrasives	
Fine (S)	Profiles equal to segment 1 and up to but excluding segment 2
Medium (S)	Profiles equal to segment 2 and up to but excluding segment 3
Coarse (S)	Profiles equal to segment 3 and up to but excluding segment 4

6 Calibration of ISO comparators

An ISO comparator shall be deemed to have been calibrated if, on measuring each of the profiles on the reference surface by either the method described in ISO 8503-3 or the method described in ISO 8503-4, the values for all the profiles are within the respective nominal values and tolerances specified in Table 1. Only ISO surface profile comparators which conform may be inscribed on the underside as described in Clause 4.

NOTE In the absence of agreement, calibration by the method described in ISO 8503-3 is the reference procedure.

If at any time, the ISO comparator, after being calibrated using the stylus method (given in ISO 8503-4) or the microscope method (given in ISO 8503-3), does not conform to the specified limits given in Table 1, it shall be discarded. If the visual assessment of the cleanliness of the surface of the ISO comparator does not correspond to Sa 2½ or Sa 3 specified in ISO 8501-1, the ISO comparator shall be discarded.

7 Maintenance and re-calibration of ISO surface profile comparators

Requirements regarding the care of ISO comparators are given in Annex A.

ISO comparators require careful handling. If any wear is detected, the ISO comparator shall be discarded or, if appropriate, re-calibrated.

ISO comparators in frequent use should be checked against an unused ISO comparator at three-monthly intervals or whenever the surface appears worn or damaged. If a segment of a used ISO comparator, when compared with the equivalent segment of an unused ISO comparator, yields a different grading assessment (see ISO 8503-2) of a surface profile, the used ISO comparator should be discarded or re-calibrated.

8 Calibration certificate for ISO surface profile comparators

In addition to the requirements of Clauses 4 to 7, the calibration certificate for each ISO surface profile comparator shall state:

- the name of the manufacturer;
- the serial or identification number;
- a reference to the master coupon (see Clause 4) and its certification;
- the date of manufacture.

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Annex A
(normative)

Care of ISO surface profile comparators

The ISO comparator shall be treated as carefully as any other accurate instrument.

If not in use, keep the ISO comparator in the protective case provided.

Never place the ISO comparator face down on rough surfaces, despite the protection strips.

If the ISO comparator becomes tarnished, wash it with a dilute detergent solution and soft brush.

If the ISO comparator becomes wet, dry it with soft tissues.

The ISO comparator should be checked as described in Clause 7.

Bibliography

- [1] ISO 4287, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Terms, definitions and surface texture parameters*
- [2] ISO 8504-2, *Preparation of steel substrates before application of paints and related products — Surface preparation methods — Part 2: Abrasive blast-cleaning*

