

INTERNATIONAL STANDARD



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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

Endorsement

14 July 1989

INTERNATIONAL STANDARD

ISO 8501-1:1988

is endorsed as

AUSTRALIAN STANDARD

1627.9—1989

Metal finishing — Preparation and pretreatment of surfaces
Part 9: Pictorial surface preparation standards for painting steel surfaces

without Australian Amendment

This endorsement was recommended by Committee MT/9, Metal Finishing, and was approved on behalf of the Council of Standards Australia on 16 May 1989

This endorsement differs from the 1974 edition by the inclusion of four additional photographs of flame-cleaned surfaces from DIN 55 928, Part 4, Supplement 1.

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Reference number
ISO 8501-1:1988 (E/F/R)

ISO 8501-1 : 1988 (E/F/R)

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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75% approval by the member bodies voting.

International Standard ISO 8501-1 was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, and is published in collaboration with the Standardiseringskommissionen i Sverige (SIS).

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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

0 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 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. It will be 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 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 above deal with the following aspects of preparation of steel substrates:

ISO 8501 — *Visual assessment of surface cleanliness;*

ISO 8501-1 : 1988 (E)

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 8501 identifies four levels (designated as “rust grades”) of mill scale and rust that are commonly found on surfaces of uncoated erected steel and steel held in stock. It also identifies certain degrees of visual cleanliness (designated as “preparation grades”) after surface preparation of uncoated steel surfaces and of steel surfaces after overall removal of any previous coating. These levels of visual cleanliness are related to the common methods of surface cleaning that are used prior to painting.

This part of ISO 8501 is intended to be a tool for visual assessment of rust grades and of preparation grades. It includes 28 representative photographic examples.

NOTES

1 Twenty-four of the photographs originate from the Swedish standard SIS 05 59 00-1967, *Pictorial surface preparation standards for painting steel surfaces*, which is superseded by this part of ISO 8501 (see annex A). The other four photographs originate from the German standard DIN 55 928, Part 4, Supplement 1 (August 1978), *Protection of steel structures from corrosion by organic and metallic coatings; preparation and testing of surfaces; photographic standards*.

Originally SIS 05 59 00 was developed by the Swedish Corrosion Institute in co-operation with the American Society for Testing and Materials (ASTM) and the Steel Structures Painting Council (SSPC), USA. There are a number of national standards based on SIS 05 59 00, such as DIN 55 928, Part 4 (1977), TGL 18730/02 (1977), DS 2019 (1967), AS 1627, Part 9-1974, ASTM D 2200-67 (1980) and SSPC-Vis 1-82 T. In addition, there are other standards that have a similar layout, for example JSRA SPSS-1975, but which are less widely used and therefore were not taken into account.

The reasons for adopting the essential elements of SIS 05 59 00, including its format, are as follows:

- a) SIS 05 59 00 is already used on a world-wide scale;
- b) the creation of a completely new set of photographs would be costly and would not necessarily introduce any corresponding improvements;
- c) previous and current documents relating to this established system of rust grades and preparation grades could continue to be used in the future without amendment and without confusion;
- d) the A5 (pocket) size is convenient to handle and to refer to on site.

This part of ISO 8501 represents a slight extension of earlier editions of SIS 05 59 00 in that it is applicable also to surfaces that show residues of adhering paint and other foreign matter in addition to mill scale and rust.

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2 This part of ISO 8501 contains the text in the three official languages of ISO, namely English, French and Russian. It also contains the following annexes giving the equivalent text in other languages, published under the responsibility of the respective body indicated:

Annex A : Swedish (SIS: the text is the 1988 edition of the Swedish standard SS 05 59 00)

Annex B : German (DIN)

Annex C : Dutch (NNI)

Annex D : Italian (UNI)

Annex E : Spanish (AENOR)

Annex F : Portuguese (IPQ)

Annex G : Arabic (ASMO)

Annex H : Japanese (JISC)

Annex J : Chinese (CSBS)

1 Scope and field of application

This part of ISO 8501 specifies a series of rust grades and preparation grades of steel surfaces (see clauses 3 and 4, respectively). The various grades are defined by written descriptions together with photographs that are representative examples within the tolerance for each grade as described in words.

It is applicable to hot-rolled steel surfaces prepared for painting by methods such as blast-cleaning, hand and power tool cleaning and flame cleaning, although these methods rarely lead to comparable results. Essentially, these methods are intended for hot-rolled steel, but blast-cleaning methods, in particular, could also be used on cold-rolled steel of sufficient thickness to withstand any deformation caused by the impact of the abrasive or the effects of power tool cleaning.

This part of ISO 8501 is applicable also to steel substrates that show residues of firmly adhering paint and other foreign matter (see note 2 to 4.1) in addition to residual mill scale.

NOTE — The preparation grades of previously painted steel surfaces after only localized removal of paint coatings form the subject of ISO 8501-2.

It relates the cleanliness of the surface to its visual appearance. In many instances, this is sufficient for the purpose but for coatings likely to be exposed to severe environments, such as water immersion and continuous condensation conditions, consideration should be given to testing for soluble salts and other invisible contaminants on the visually clean surface by the physical and chemical methods which form the subjects of the various parts of ISO 8502. The roughness characteristics of the surface should also be considered by reference to ISO 8503.

ISO 8501-1 : 1988 (E)

2 References

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.*¹⁾

ISO 8502, *Preparation of steel substrates before application of paints and related products — Tests for the assessment of surface cleanliness.*¹⁾

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

ISO 8504, *Preparation of steel substrates before application of paints and related products — Surface preparation methods*

— *Part 2: Abrasive blast-cleaning.*¹⁾

— *Part 3: Hand and power tool cleaning.*¹⁾

3 Rust grades

Four rust grades, designated A, B, C and D respectively, are specified. The rust grades are defined by written descriptions together with representative photographic examples (see clause 6).

- A** Steel surface largely covered with adhering mill scale but little, if any, rust.
- B** Steel surface which has begun to rust and from which the mill scale has begun to flake.
- C** Steel surface on which the mill scale has rusted away or from which it can be scraped, but with slight pitting visible under normal vision.
- D** Steel surface on which the mill scale has rusted away and on which general pitting is visible under normal vision.

4 Preparation grades

4.1 General

A number of preparation grades, indicating the method of surface preparation and the degree of cleaning, are specified. The preparation grades are defined (see 4.2, 4.3 and 4.4) by written descriptions of the surface appearance after the cleaning operation, together with representative, photographic examples (see clause 6).

1) To be published.

ISO 8501-1 : 1988 (E)

Each preparation grade is designated by the appropriate letters "Sa", "St" or "Fl" to indicate the type of cleaning method used. The number following, if any, indicates the degree of cleaning from mill scale, rust and previous coatings.

The photographs are designated by the original rust grade before cleaning and the designation of the preparation grade, for example B Sa 2^{1/2}.

NOTES

1 The term "foreign matter" used in 4.2, 4.3 and 4.4 may include water-soluble salts and welding residues. These contaminants cannot be completely removed from the surface by dry blast-cleaning, hand and power tool cleaning or flame cleaning; wet blast-cleaning should be used.

2 Mill scale, rust or a paint coating is considered to be poorly adhering if it can be removed by lifting with a blunt putty knife.

4.2 Blast-cleaning, Sa

Surface preparation by blast-cleaning is designated by the letters "Sa".

Prior to blast-cleaning, any heavy layers of rust shall be removed by chipping. Visible oil, grease and dirt shall also be removed.

After blast-cleaning, the surface shall be cleaned from loose dust and debris.

NOTE — For descriptions of surface preparation methods by blast-cleaning, including treatment prior to, and after, the blast-cleaning procedure, see ISO 8504-2.

Sa 1 Light blast-cleaning

When viewed without magnification, the surface shall be free from visible oil, grease and dirt, and from poorly adhering mill scale, rust, paint coatings and foreign matter (see note 2 to 4.1). See photographs B Sa 1, C Sa 1 and D Sa 1.

Sa 2 Thorough blast-cleaning

When viewed without magnification, the surface shall be free from visible oil, grease and dirt, and from most of the mill scale, rust, paint coatings and foreign matter. Any residual contamination shall be firmly adhering (see note 2 to 4.1). See photographs B Sa 2, C Sa 2 and D Sa 2.

Sa 2^{1/2} Very thorough blast-cleaning

When viewed without magnification, the surface shall be free from visible oil, grease and dirt, and from mill scale, rust, paint coatings and foreign matter. Any remaining traces of contamination shall show only as slight stains in the form of spots or stripes. See photographs A Sa 2^{1/2}, B Sa 2^{1/2}, C Sa 2^{1/2} and D Sa 2^{1/2}.

ISO 8501-1 : 1988 (E)

Sa 3 Blast-cleaning to visually clean steel

When viewed without magnification, the surface shall be free from visible oil, grease and dirt, and shall be free from mill scale, rust, paint coatings and foreign matter. It shall have a uniform metallic colour. See photographs A Sa 3, B Sa 3, C Sa 3 and D Sa 3.

4.3 Hand and power tool cleaning, St

Surface preparation by hand and power tool cleaning, such as scraping, wirebrushing, machine-brushing and grinding, is designated by the letters "St".

Prior to hand and power tool cleaning, any heavy layers of rust shall be removed by chipping. Visible oil, grease and dirt shall also be removed.

After hand and power tool cleaning, the surface shall be cleaned from loose dust and debris.

NOTES

1 For descriptions of surface preparation methods by hand and power tool cleaning, including treatment prior to, and after, the hand and power tool cleaning procedure, see ISO 8504-3.

2 Preparation grade St 1 is not included as it would correspond to a surface unsuitable for painting.

St 2 Thorough hand and power tool cleaning

When viewed without magnification, the surface shall be free from visible oil, grease and dirt, and from poorly adhering mill scale, rust, paint coatings and foreign matter (see note 2 to 4.1). See photographs B St 2, C St 2 and D St 2.

St 3 Very thorough hand and power tool cleaning

As for St 2, but the surface shall be treated much more thoroughly to give a metallic sheen arising from the metallic substrate. See photographs B St 3, C St 3 and D St 3.

4.4 Flame cleaning, FI

Surface preparation by flame cleaning is designated by the letters "FI".

NOTE — Flame cleaning includes final power tool wire-brushing to remove the products of the cleaning process; hand wire-brushing does not achieve a satisfactory surface for painting.

ISO 8501-1 : 1988 (E)

Prior to flame cleaning, any heavy layers of rust shall be removed by chipping.

After flame cleaning, the surface shall be cleaned by power tool wire-brushing.

FI Flame cleaning

When viewed without magnification, the surface shall be free from mill scale, rust, paint coatings and foreign matter. Any remaining residues shall show only as a discoloration of the surface (shades of different colours). See photographs A FI, B FI, C FI and D FI.

5 Procedure for visual assessment of steel substrates

Either in good diffuse daylight or in equivalent artificial illumination, examine the steel surface and compare it with each of the photographs (see clause 6), using normal vision. Place the appropriate photograph close to, and in the plane of, the steel surface to be assessed.

For rust grades, record the assessment as the worst grade that is evident. For preparation grades, record the assessment as that grade nearest in appearance to that of the steel surface.

NOTES

1 In addition to the type of cleaning method used, for example dry blast-cleaning using a particular type of abrasive, the following factors can influence the result of the visual assessment:

- a) initial state of the steel surface other than any of the standard rust grades A, B, C and D;
- b) colour of the steel itself;
- c) regions of differing roughness, resulting from differential corrosion attack or uneven removal of material;
- d) surface irregularities such as dents;
- e) marks from tools;
- f) uneven lighting;
- g) shadowing of the surface profile caused by angled projection of abrasive;
- h) embedded abrasives.

2 For previously painted surfaces that have been prepared for renewed painting, only photographs with rust grade designations D or C (for example: D Sa 2^{1/2} or C Sa 2^{1/2}) may be used for the visual assessment. The choice (for example between D Sa 2^{1/2} and C Sa 2^{1/2}) depends on the degree of pitting.

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6 Photographs

Twenty-eight representative photographic examples for comparison with steel substrates are appended.

These photographs, which are not magnified, are copies that have been reproduced by a special technique whereby the colour print is applied to the back of plastics sheets. To prevent the specimens from being scratched, paper leaves have been inserted between the plastics sheets. For ease of manufacture, the plastics sheets do not carry page numbers. For convenience in use, the photographs are displayed in the order shown in the figure.

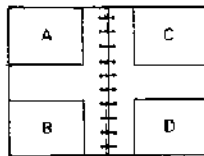
Four photographs relate specifically to the rust grades A, B, C and D (see clause 3).

Twenty-four photographs, A Sa 2^{1/2} to D Fl, relate specifically to the preparation grades obtained by dry blast-cleaning, by hand and power tool cleaning, and by flame cleaning (see clause 4). Other methods, such as wet blast-cleaning, produce surfaces that may differ in appearance, colour, etc., but the photographs can still be used to give an indication of the preparation grade.

Fourteen photographs, A Sa 2^{1/2} to D Sa 3, show steel surfaces that have been subjected to dry blast-cleaning with abrasives containing quartz sand. The use of such abrasives in enclosed areas is prohibited in many countries except under strictly controlled conditions. Therefore abrasives of other types (and hence colour) are often used for dry blast-cleaning. These abrasives may produce a different surface appearance, even after meticulous cleaning of the blast-cleaned surface.

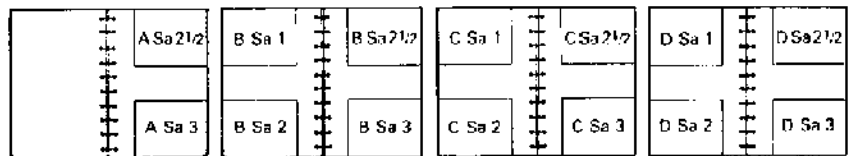
There are no photographs representing A Sa 1, A Sa 2, A St 2 or A St 3 because these preparation grades are not achievable and the existing photographs are sufficiently indicative.

Rust grades

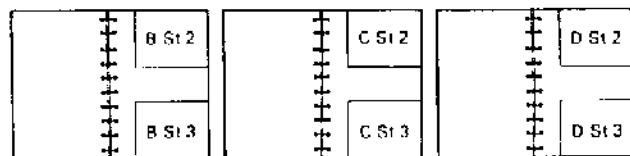


Preparation grades

Blast-cleaning



Hand and power tool cleaning



Flame cleaning

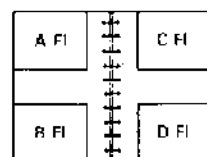


Figure — Layout and sequence of the appended representative photographic examples

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