**ДСТУ ISO 8501-1:2015**
**(ISO 8501-1:2007, IDT)**

# Підготовка сталевих поверхонь перед нанесенням фарб і подібних покриттів. Візуальне оцінювання чистоти поверхні. Частина 1. Ступені іржавіння та ступені підготовки непофарбованих сталевих поверхонь і сталевих поверхонь після повного видалення попередніх покриттів

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

# ISO 8501-1

Second edition
Deuxième édition
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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**

**Préparation des subjectiles d'acier avant application de peintures et de produits assimilés — Évaluation visuelle de la propreté d'un subjectile —**

Partie 1:
**Degrés de rouille et degrés de préparation des subjectiles d'acier non recouverts et des subjectiles d'acier après décapage sur toute la surface des revêtements précédents**

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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 8501-1 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 8501-1:1988). The main change is that the Informative Supplement ISO 8501-1:1988/Suppl.1994 has been included as Annex A.

ISO 8501 consists of the following parts, under the general title *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*

— *Part 2: Preparation grades of previously coated steel substrates after localized removal of previous coatings*

— *Part 3: Preparation grades of welds, edges and other areas with surface imperfections*

— *Part 4: Initial surface conditions, preparation grades and flash rust grades in connection with high-pressure water jetting*

# 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 given 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 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.

Fourteen of these photographic examples show steel surfaces that have been subjected to dry blast-cleaning using quartz sand as the abrasive. The use of other abrasives may affect the appearance of the surface. Colour changes caused by different abrasives are shown in Annex A.

NOTE Twenty-four of the photographs originated from the Swedish standard SIS 05 59 00-1967, *Pictorial surface preparation standards for painting steel surfaces*. The other four photographs originated 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*.

# 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

## 1 Scope

This part of ISO 8501 specifies a series of rust grades and preparation grades of steel surfaces (see Clauses 2 and 3, 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 3.1) in addition to residual mill scale.

NOTE 1 The preparation grades of previously painted steel surfaces after only localized removal of paint coatings form the subject of ISO 8501-2 [1].

This part of ISO 8501 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 [2]. The roughness characteristics of the surface should also be considered by reference to the various parts of ISO 8503 [3].

NOTE 2 This part of ISO 8501 contains the text in two of the three official languages of ISO, English and French. It also contains the text in German, published under the responsibility of DIN, and the text in Swedish, published under the responsibility of SIS.

## 2 Rust grades

Four rust grades, designated A, B, C and D respectively, are specified. The rust grades are defined by written descriptions.

**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.

Representative photographic examples of these rust grades are appended to this part of ISO 8501 (see Clause 5 for details).

# 3 Preparation grades

## 3.1 General

A number of preparation grades, indicating the method of surface preparation and the degree of cleaning, are specified. The preparation grades are defined in 3.2, 3.3 and 3.4 by written descriptions of the surface appearance after the cleaning operation. Representative photographic examples of these preparation grades are appended to this part of ISO 8501 (see Clause 5 for details).

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 2½.

NOTE 1 The term "foreign matter" used in 3.2, 3.3 and 3.4 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 or water jetting should be used.

NOTE 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.

## 3.2 Blast-cleaning, Sa

Surface preparation by blast-cleaning is designated by the letters "Sa". Descriptions of the blast-cleaning grades are given in Table 1.

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 Descriptions of surface preparation methods by blast-cleaning, including treatment prior to, and after, the blast-cleaning procedure, are given in ISO 8504-2 [4].

**Table 1 — Blast-cleaning grades**

| | | |
|---|---|---|
| **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 1 to 3.1). 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 3.1). See photographs B Sa 2, C Sa 2 and D Sa 2. |
| **Sa 2½** | **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 2½, B Sa 2½, C Sa 2½ and D Sa 2½. |
| **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. |

## 3.3 Hand and power tool cleaning, St

Surface preparation by hand and power tool cleaning, such as scraping, wire-brushing, machine-brushing and grinding, is designated by the letters “St”. Descriptions of the hand and power tool cleaning grades are given in Table 2.

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.

NOTE 1 Descriptions of surface preparation methods by hand and power tool cleaning, including treatment prior to, and after, the hand and power tool cleaning procedure, are given in ISO 8504-3 [5].

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

**Table 2 — Hand and power tool cleaning grades**

| | | |
|---|---|---|
| **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 1 to 3.1). 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. |

## 3.4 Flame cleaning, Fl

Surface preparation by flame cleaning is designated by the letters "Fl". Descriptions of the flame cleaning grades are given in Table 3.

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.

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.

**Table 3 — Flame cleaning**

| | | |
|---|---|---|
| **Fl** | **Flame cleaning** | When viewed without magnification, the surface shall be free from mill scale, rust, paint coatings and foreign matter (see Note 1 to 3.1). Any remaining residues shall show only as a discoloration of the surface (shades of different colours). See photographs A Fl, B Fl, C Fl and D Fl. |

# 4 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 appended to this part of ISO 8501 (see Clause 5 for details), 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.

NOTE 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.

NOTE 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 2½ or C Sa 2½) may be used for the visual assessment. The choice (for example between D Sa 2½ and C Sa 2½) depends on the degree of pitting.

# 5 Photographs

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

These photographs are shown full size, i.e. not magnified. For convenience in use, they are displayed in the order shown in Figures 1 and 2.

Four photographs relate specifically to the rust grades A, B, C and D (see Clause 2).

Twenty-four photographs, A Sa 2½ 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 3). Other methods, such as wet blast-cleaning and water jetting, 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 2½ 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 (see Annex A).

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.

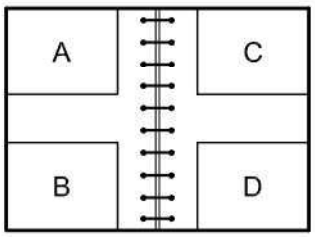
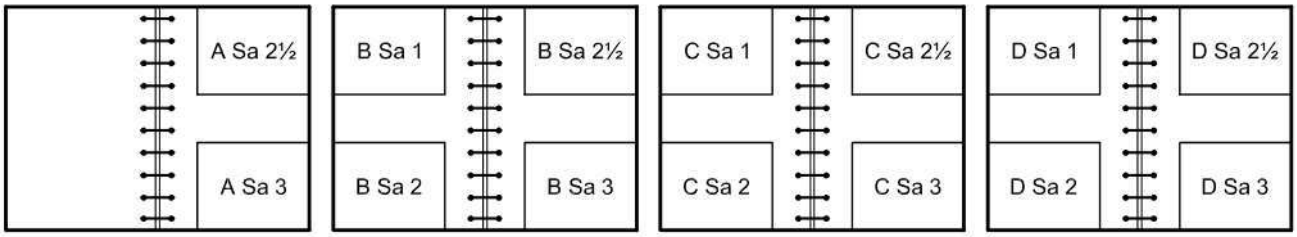
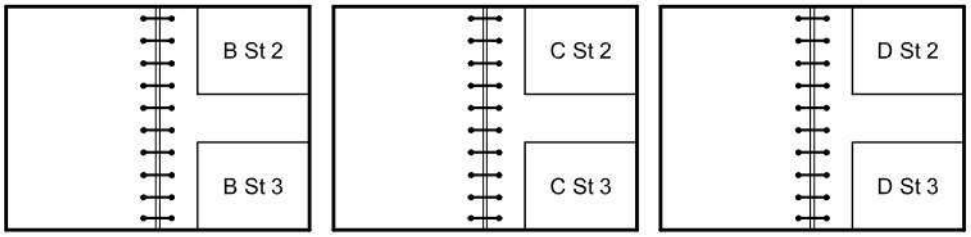


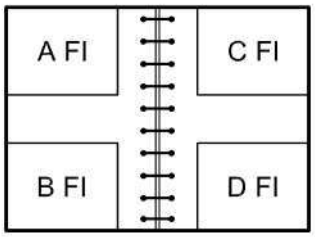

**Figure 1 — Layout and sequence of the appended representative photographic examples for rust grades**




a) Blast-cleaning




b) Hand and power tool cleaning




c) Flame cleaning

**Figure 2 — Layout and sequence of the appended representative photographic examples for preparation grades**

# Annex A
(informative)

# Representative photographic examples of the change of appearance imparted to steel when blast-cleaned with different abrasives

## A.1 General

This part of ISO 8501 provides written specifications and representative photographic examples of a number of rust grades and preparation grades. Fourteen of these photographic examples, A Sa 2½ to D Sa 3, show steel surfaces that have been subjected to dry blast-cleaning with abrasives containing quartz sand.

The basis of this annex is that many different abrasives are used for blast-cleaning. Since some abrasive remains embedded in a blast-cleaned surface, the colour of the abrasive affects the appearance of the surface. Generally, the use of dark-coloured abrasives, such as copper refinery or coal furnace slags, will result in an overall darker, duller appearance than if sand is used. Some hard, metallic abrasives, although themselves not coloured black, will also create a darker appearance due to the shadows formed by the deep-sided pitting on the blast-cleaned surface.

In addition, the use of quartz sand as an abrasive is subject to a number of prohibitive regulations in many countries and its use for the photographic representations in this part of ISO 8501 should not be taken as general approval for its use.

This annex provides representative photographic examples of mild steel of rust grade C, blast-cleaned to preparation grade Sa 3, using six different (metallic and non-metallic) abrasives that are in common use. For comparison, a photographic representation of the original steel surface, i.e. the surface before preparation, is also included.

## A.2 Procedure for visual assessment of steel substrates

Assess the preparation grade and record the result of the assessment as described in Clause 4.

If the appearance of the surface being assessed is different from that in the nearest photograph, use the examples described in this annex and shown in the photograph at the very end of this part of ISO 8501 as a guide to the change in colour depth and tone that may be due to the abrasive used to prepare the surface.

The examples illustrated in this annex meet the written description of preparation grade Sa 3 (see Table 1).

In all cases, assess compliance against the written descriptions for the preparation grades given in Table 1.

## A.3 Photographic examples

Six representative photographic examples are shown at the very end of this part of ISO 8501. The examples are shown full size, i.e. not magnified. These examples have been prepared by blast-cleaning mild steel of rust grade C to preparation grade Sa 3, as specified in Table 1, with six different abrasives that are in common use. Part of the original steel surface is included for visual comparison purposes. The photographic examples are displayed in the order shown in Figure A.1.

The abrasives were chosen to provide a “Medium” surface profile as described in ISO 8503-2. The photograph was obtained by progressively masking a single mild-steel plate into strips and blast-cleaning the rust grade C surface thus exposed with a different abrasive for each strip to preparation grade Sa 3. Care was taken to protect previously prepared strips when blast-cleaning other strips. The plate was photographed shortly after completion of the blast-cleaning in order to avoid deterioration of the freshly prepared surfaces.

The photograph illustrates the differences in surface appearance, including colour, that are obtained when the same substrate is prepared by blast-cleaning with different abrasive materials to the same preparation grade. The photograph illustrates the surface appearance typically obtained using each abrasive under the conditions described above but it should be noted that variations may be obtained in practice.

The high-carbon cast-steel shot abrasive used was of grade S 100 as specified in ISO 11124-3 [7]. The chilled-iron grit abrasive was in accordance with grade G 070 of ISO 11124-2 [6]. The two steel grit abrasives were in accordance with grade G 070 of ISO 11124-3. Their hardnesses, determined by the method described in ISO 11125-3 [8], are stated in the captions to the relevant parts of the photograph. Copper refinery slag and coal furnace slag abrasives are specified in ISO 11126-3 [9] and ISO 11126-4 [10] respectively.

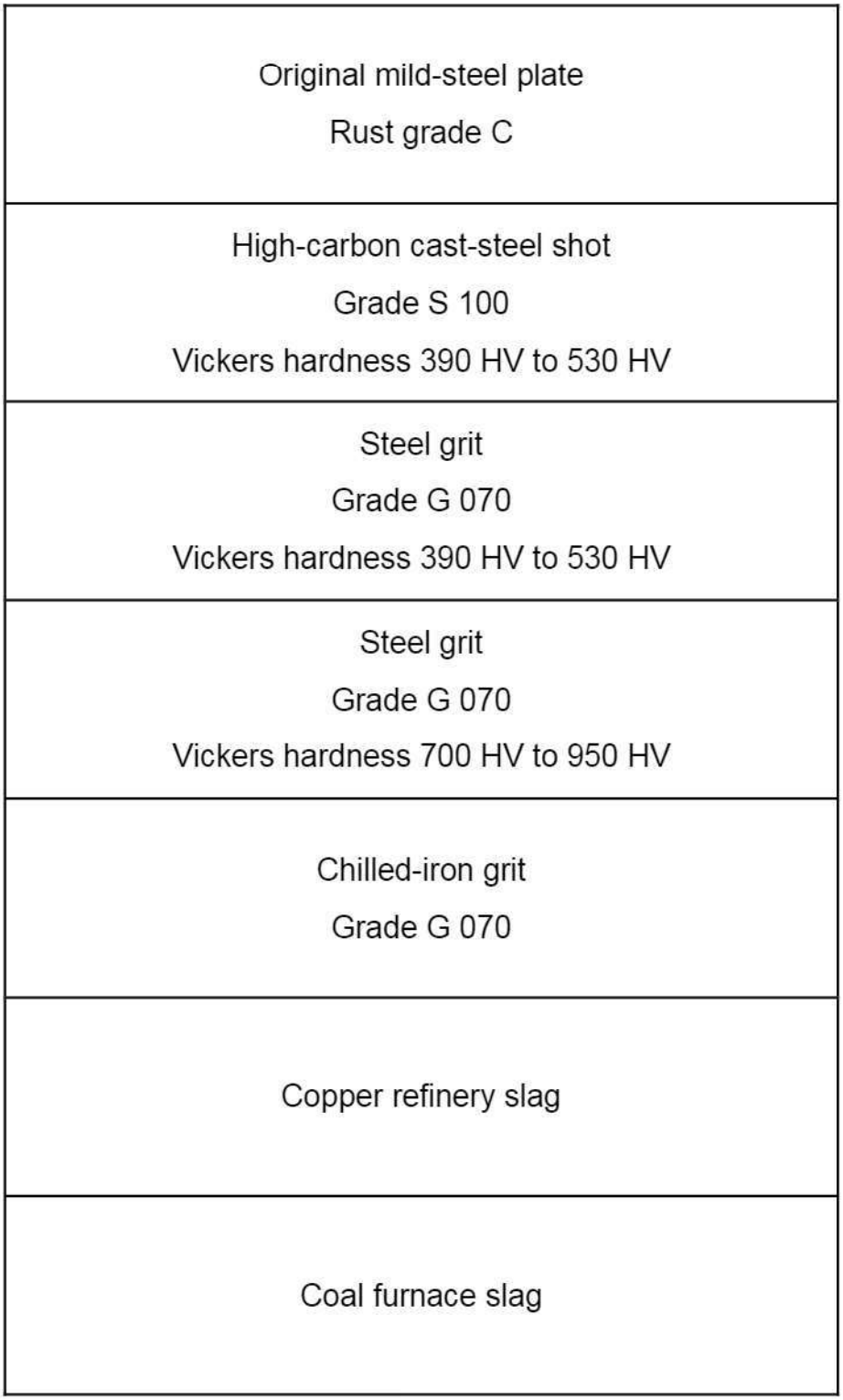



**Figure A.1 — Layout and sequence of the photographic examples shown in the last photograph appended to this part of ISO 8501**

# Bibliography

[1] 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*

[2] ISO 8502 (all parts), *Preparation of steel substrates before application of paints and related products — Tests for the assessment of surface cleanliness*

[3] ISO 8503 (all parts), *Preparation of steel substrates before application of paints and related products — Surface roughness characteristics of blast-cleaned steel substrates*

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

[5] ISO 8504-3, *Preparation of steel substrates before application of paints and related products — Surface preparation methods — Part 3: Hand- and power-tool cleaning*

[6] ISO 11124-2, *Preparation of steel substrates before application of paints and related products — Specifications for metallic blast-cleaning abrasives — Part 2: Chilled-iron grit*

[7] ISO 11124-3, *Preparation of steel substrates before application of paints and related products — Specifications for metallic blast-cleaning abrasives — Part 3: High-carbon cast-steel shot and grit*

[8] ISO 11125-3, *Preparation of steel substrates before application of paints and related products — Test methods for metallic blast-cleaning abrasives — Part 3: Determination of hardness*

[9] ISO 11126-3, *Preparation of steel substrates before application of paints and related products — Specifications for non-metallic blast-cleaning abrasives — Part 3: Copper refinery slag*

[10] ISO 11126-4, *Preparation of steel substrates before application of paints and related products — Specifications for non-metallic blast-cleaning abrasives — Part 4: Coal furnace slag*