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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

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

Partie 2:
Degrés de préparation des subjectiles d'acier précédemment revêtus après décapage localisé des couches

Подготовка стальной основы перед нанесением красок и подобных покрытий — Визуальная оценка чистоты поверхности —

Часть 2:
Степени подготовки ранее покрытой стальной основы после локального удаления прежних покрытий

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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.

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.

International Standard ISO 8501-2 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.*

ISO 8501 consists at present 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.*

— *Informative Supplement to part 1: Representative photographic examples of the change of appearance imparted to steel when blast-cleaned with different abrasives.*

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

— *Part 3: Preparation grades of welds, cut edges and surface imperfections.*

Annexes A to J form an integral part of this part of ISO 8501.

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

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 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 supplements ISO 8501-1. It identifies certain degrees of visual cleanliness (designated as "preparation grades") following surface preparation of steel surfaces after localized removal of previous paint coatings. These levels of visual cleanliness are related to the common methods of surface cleaning that are used prior to painting.

The photographic examples for preparation grades P Sa 2½ and P Ma have been taken from DIN 55 928, Part 4, Supplement 1 (August 1978) and Supplement 2 (January 1986), respectively.

The basis of this part of ISO 8501 is the experience that complete removal of all previous paint coatings is not always necessary. This is especially true where maintenance work is carried out at regular intervals. For localized removal to be preferred, the following conditions should be fulfilled:

— the remaining intact coating should make a useful and durable contribution to the new corrosion protection system and be compatible with it;

— during cleaning of locally corroded areas down to the substrate, the coatings on the surrounding areas should not be irreparably or significantly damaged;

— real savings in costs for the maintenance work should be made possible.

NOTE 1 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)

Annex B: German (DIN)

Annex C: Dutch (NNI)

Annex D: Italian (UNI)

Annex E: Spanish (AENOR)

Annex F: Portuguese (IPQ)

Annex G: Arabic (SASO)

Annex H: Japanese (JISC)

Annex J: Chinese (CSBTS)

1 Scope

This part of ISO 8501 specifies a series of preparation grades for steel surfaces after localized removal of previous paint coatings The various preparation grades are defined by written descriptions (see clause 4) together with the representative photographic examples given in ISO 8501-1. In addition, photographs showing examples of preparation grades P Sa 2½ and P Ma are given.

This part of ISO 8501 is applicable to surfaces prepared for painting by methods such as blast-cleaning, hand- and power-tool cleaning, and machine abrading.

This part of ISO 8501 relates the cleanliness of a surface to its visual appearance. In many instances this is sufficient, 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.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 8501. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 8501 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 2409:1992, *Paints and varnishes — Cross-cut test.*

ISO 4624:1978, *Paints and varnishes — Pull-off test for adhesion.*

ISO 4627:1981, *Paints and varnishes — Evaluation of the compatibility of a product with a surface to be painted — Methods of test.*

ISO 4628-1:1982, *Paints and varnishes — Evaluation of degradation of paint coatings — Designation of intensity, quantity and size of common types of defect — Part 1: General principles and rating schemes.*

ISO 4628-2:1982, *Paints and varnishes — Evaluation of degradation of paint coatings — Designation of intensity, quantity and size of common types of defect — Part 2: Designation of degree of blistering.*

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 4628-4:1982, *Paints and varnishes — Evaluation of degradation of paint coatings — Designation of intensity, quantity and size of common types of defect — Part 4: Designation of degree of cracking.*

ISO 4628-5:1982, *Paints and varnishes — Evaluation of degradation of paint coatings — Designation of intensity, quantity and size of common types of defect — Part 5: Designation of degree of flaking.*

ISO 4628-6:1990, *Paints and varnishes — Evaluation of degradation of paint coatings — Designation of intensity, quantity and size of common types of defect — Part 6: Rating of degree of chalking by tape method.*

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 steel substrates after overall removal of previous coatings.*

3 Condition of the painted surface to be cleaned

The degrees of degradation which may be found on previously coated surfaces shall be assessed in accordance with ISO 4628, parts 1 to 6.

If possible, supplementary information about the previous coating, concerning the generic type, number of coats applied, manufacturer's name, corrosive contaminants, adhesion and film thickness, shall be given.

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.

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

It should be realized that the various methods of cleaning do not give comparable results. The degree of cleaning shall be compatible with the generic type of coating system to be used for recoating.

Reference is made in 4.2 and 4.3 to the photographs in ISO 8501-1 which are representative photographic examples of preparation grades.

NOTES

2 The term "foreign matter" used in 4.2, 4.3 and 4.4 includes water-soluble salts and residues from welding flux. These contaminants cannot be completely removed from the surface by dry blast-cleaning, hand- or power-tool cleaning or machine abrading; wet blast-cleaning can be used.

3 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 The photographic representations appended to this part of ISO 8501 show some typical examples of steel prior to and after localized cleaning.

4.2 Localized blast-cleaning of previously coated surfaces, P Sa

Surface preparation by localized blast-cleaning is designated by the letters "P 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, loose dust and debris shall be cleaned from the surface.

NOTE 5 For descriptions of surface preparation methods by blast-cleaning, including treatment prior to and after the blast-cleaning procedure, see ISO 8504-2.

P Sa 2 Thorough localized blast-cleaning

Firmly adhering paint coatings shall be intact. The surface of the other parts, when viewed without magnification, shall be free from visible oil, grease and dirt, from loose paint coatings and from most of the mill scale, rust and foreign matter. Any residual contamination shall be firmly adhering (see note 3 to 4.1). For comparison, see photographs C Sa 2 and D Sa 2 given in ISO 8501-1. The choice depends on the degree of pitting.

P Sa 2½ Very thorough localized blast-cleaning

Firmly adhering paint coatings shall be intact. The surface of the other parts, when viewed without magnification, shall be free from visible oil, grease and dirt, from loose paint coatings and from mill scale, rust and foreign matter. Any remaining traces of contamination shall show only as slight stains in the form of spots or stripes. For comparison, see photographs C Sa 2½ and D Sa 2½ given in ISO 8501-1. The choice depends on the degree of pitting.

Photographs showing examples of preparation grade P Sa 2½ are appended to this part of ISO 8501.

P Sa 3 Localized blast-cleaning to visually clean steel

Firmly adhering paint coatings shall be intact. The surface of the other parts, when viewed without magnification, shall be free from visible oil, grease and dirt, from loose paint coatings and from mill scale, rust and foreign matter. It shall have a uniform metallic colour. For comparison, see photographs C Sa 3 and D Sa 3 given in ISO 8501-1. The choice depends on the degree of pitting.

NOTE 6 Preparation grade P Sa 1 is not included as it would correspond to a surface unsuitable for painting.

4.3 Localized hand- and power-tool cleaning[1)] of previously coated surfaces, P St

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

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

1) Except machine abrading, see 4.4.

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

NOTE 7 For descriptions of surface preparation methods by hand- and power-tool cleaning, including treatment prior to and after the hand-power-tool cleaning procedure, see ISO 8504-3.

P St 2 Thorough localized hand- and power-tool cleaning

Firmly adhering paint coatings shall be intact. The surface of the other parts, when viewed without magnification, shall be free from visible oil, grease and dirt and from poorly adhering mill scale, rust, paint coatings and foreign matter (see note 3 to 4.1). For comparison, see photographs C St 2 and D St 2 given in ISO 8501-1. The choice depends on the degree of pitting.

P St 3 Very thorough localized hand- and power-tool cleaning

As for P St 2, but the surfaces to be cleaned shall be treated much more thoroughly to give a metallic sheen arising from the metallic substrate. For comparison, see photographs C St 3 and D St 3 given in ISO 8501-1. The choice depends on the degree of pitting.

NOTES

8 Preparation grades P St 2 and P St 3 are not associated in any way with the use of particular hand- or power-tools, but are determined solely by the preparation grade definitions interpreted with the help of the representative photographic examples.

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

4.4 Localized machine abrading of previously coated surfaces, P Ma

Surface preparation by localized machine abrading is designated by the letters "P Ma". It comprises cleaning by thorough machine abrading (for example by disc with abrasive paper) or by special rotating wire brushes, which may be used in conjunction with needle guns.

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

After machine abrading, the surface shall be cleaned from loose dust and debris.

P Ma Localized machine abrading

Firmly adhering paint coatings shall be intact. The surface of the other parts, when viewed without magnification, shall be free from visible oil, grease and dirt, from loose paint coatings and foreign matter (see note 2 to 4.1) and from mill scale and rust. Any remaining traces of contamination shall show only as slight stains in the form of spots or stripes. For comparison, photographs showing examples of preparation grade P Ma are appended to this part of ISO 8501.

NOTE 10 Preparation grade P Ma is not associated in any way with the use of particular tools, but is determined solely by the preparation grade definition, interpreted with the help of the representative photographic example.

4.5 Treatment of remaining coatings

Prior to the application of further coatings, the remaining parts of the existing coatings, including any primers and undercoats that are firmly adhering after the surface preparation procedure, shall be freed from loose material and contaminants, if necessary, and roughened to ensure satisfactory adhesion. The adhesion of the remaining paint coating may be checked with a knife, by a cross-cut test in accordance with ISO 2409, by a portable apparatus for pull-off adhesion testing in accordance with ISO 4624, or by other suitable means.

Existing sound coatings adjacent to abraded or blast-cleaned areas shall be bevelled (feathered back) to give sound and firmly adhering edges. It is also imperative that subsequent coatings be compatible with the remaining coatings. Advice on assessing compatibility is given in ISO 4627.

5 Photographs

The representative photographic examples given in this part of ISO 8501 are typical of the general appearance of areas before and after localized preparation prior to recoating (magnification between ×5 and ×6). For ease of manufacture, the plastic sheets on which the photographs have been reproduced do not carry page numbers. For convenience in use, the photographs are displayed in the order shown in figure 1. On each page, the

upper photograph shows the surface condition before and the lower photograph the surface condition after surface preparation.

Detailed descriptions of the prepared areas are given in 5.1 to 5.3.

5.1 Typical cases of very thorough localized blast-cleaning (P Sa 2½)

The two pairs of photographs given in the first and second photographic plates and described in 5.1.1 and 5.1.2 illustrate two typical cases encountered in practice.

5.1.1 **Iron oxide shop primer** (first photographic plate)

These photos show a surface with a red iron oxide shop primer before and after the blast-cleaning procedure. On the left-hand side of the photo, a rusted weld joint is visible, while the upper right-hand side shows rusted weld runs.

5.1.2 **Corrosion protection system** (second plate)

These photos show a surface with a corrosion protection system (red lead/micaceous iron oxide), which has been exposed for a long period, before and after the blast-cleaning procedure. In the upper photo, widespread rusty regions and regions of sound coating can be seen. Before complete recoating of the surface, the regions of sound coating would have to be cleaned and roughened.

5.2 Extreme cases of very thorough localized blast-cleaning (P Sa 2½)

The two pairs of photographs given in the third and fourth photographic plates and described in 5.2.1 and 5.2.2 show extreme examples of the broad range of possibilities for application of preparation grade P Sa 2½.

5.2.1 **A sound coating** (third plate)

These photos show localized blast-cleaning of corroded spots on areas showing a generally sound coating that required only partial repair and which could also have been prepared by abrading or scraping and brushing the deteriorated areas.

5.2.2 An unsuitable coating (fourth plate)

These photos show a coating that will have to be recoated completely in spite of only insignificant visible rust stains. Overall removal of the coating to preparation grade Sa 2½ should also be considered.

5.3 Typical cases of localized machine abrading (P Ma)

The three pairs of photographs given on the fifth, sixth and seventh photographic plates and described in 5.3.1 and 5.3.2 illustrate three typical cases encountered in practice.

5.3.1 Repair work

5.3.1.1 Upper sides of a hatch cover (fifth plate)

These photos show a corrosion protective system, approximate age 15 years, applied by brush, consisting of two priming coats (orange and brown) based on red lead, followed by two grey finishing coats based on synthetic resin. Weathering of the coating system in the brush marks is clearly visible in the upper photo, because the surface has already been cleaned by steam jet.

The surface is shown before and after further preparation (derusting of the rusted areas by machine abrading using a disc followed by brushing of the surface).

5.3.1.2 Upper side of a steel girder (sixth plate)

These photos show a corrosion protection system, age unknown, consisting of two priming coats (orange and brown), followed by two grey finishing coats based on synthetic resin. The surface also has local mechanical damage.

The surface is shown before and after preparation (derusting of the rusted areas by machine abrading using a disc, followed by brushing of the surface).

5.3.2 New-construction work: Tubes in a power station (seventh plate)

Before assembly, all outer surfaces of the tubes were blast-cleaned to preparation grade Sa 2½, except in the region of weld joints, then coated with two

priming coats based on epoxy resin/zinc chromate (reddish-brown), followed by two intermediate coats based on epoxy resin (red/orange).

The surface of one tube is shown before and after further preparation (derusting of rusted areas and the weld-joint region by machine abrading, followed by brushing and removal of any remaining impurities).

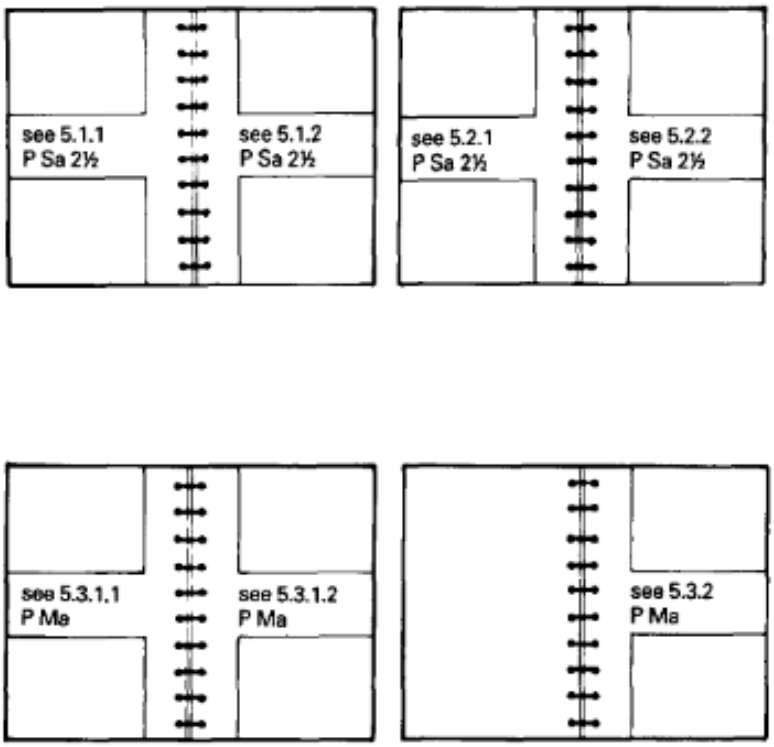
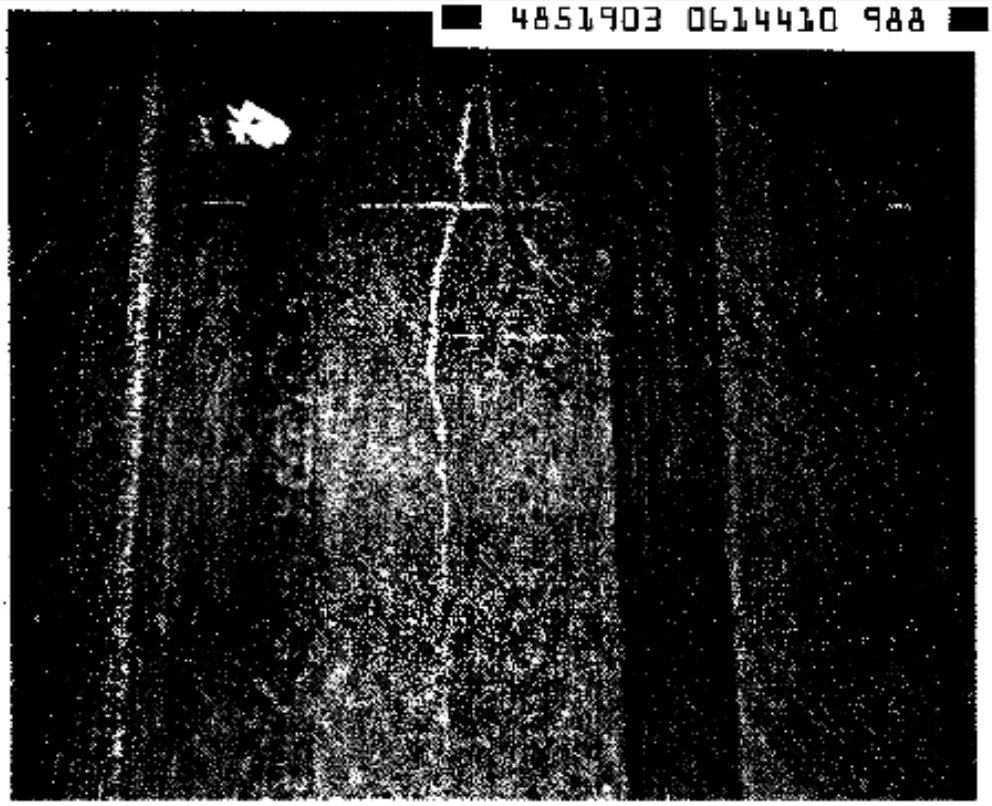
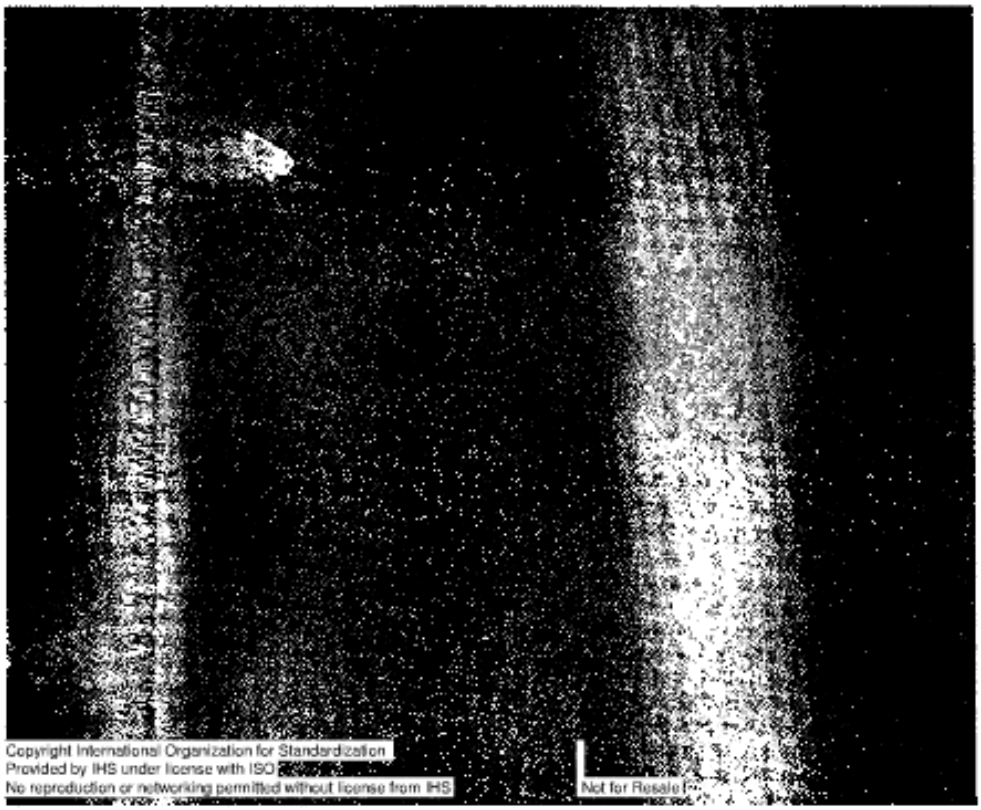


Figure 1 — Layout and sequence of the representative photographic examples appended to this part of ISO 8501

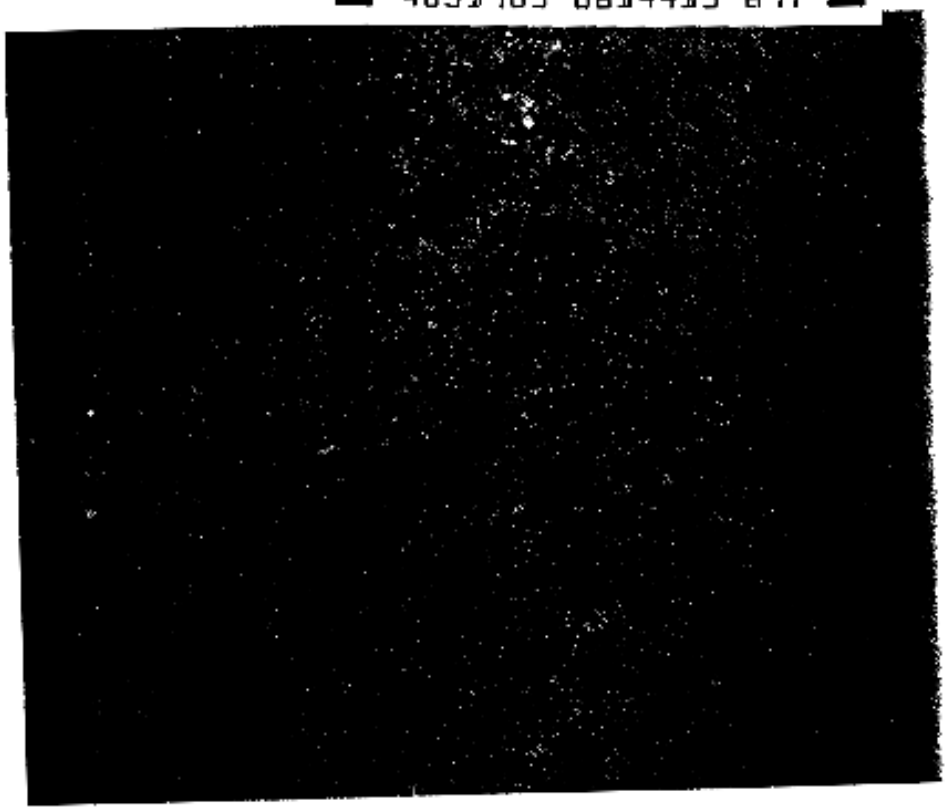


PSa 2½



First plate	See 5.1.1
Première planche	Voir 5.1.1
Первая пластина	См. 5.1.1
Erstes Beispielblatt	Siehe 5.1.1

Second plate	See 5.1.2
Deuxième planche	Voir 5.1.2
Вторая пластина	См. 5.1.2
Zweites Beispielblatt	Siehe 5.1.2



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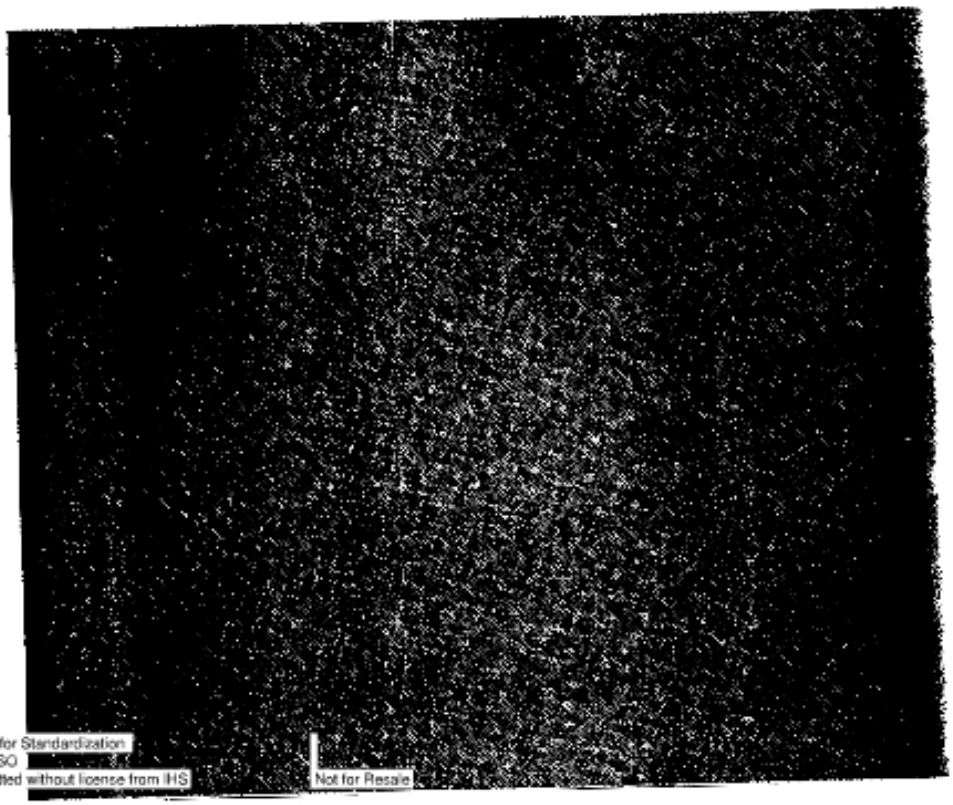
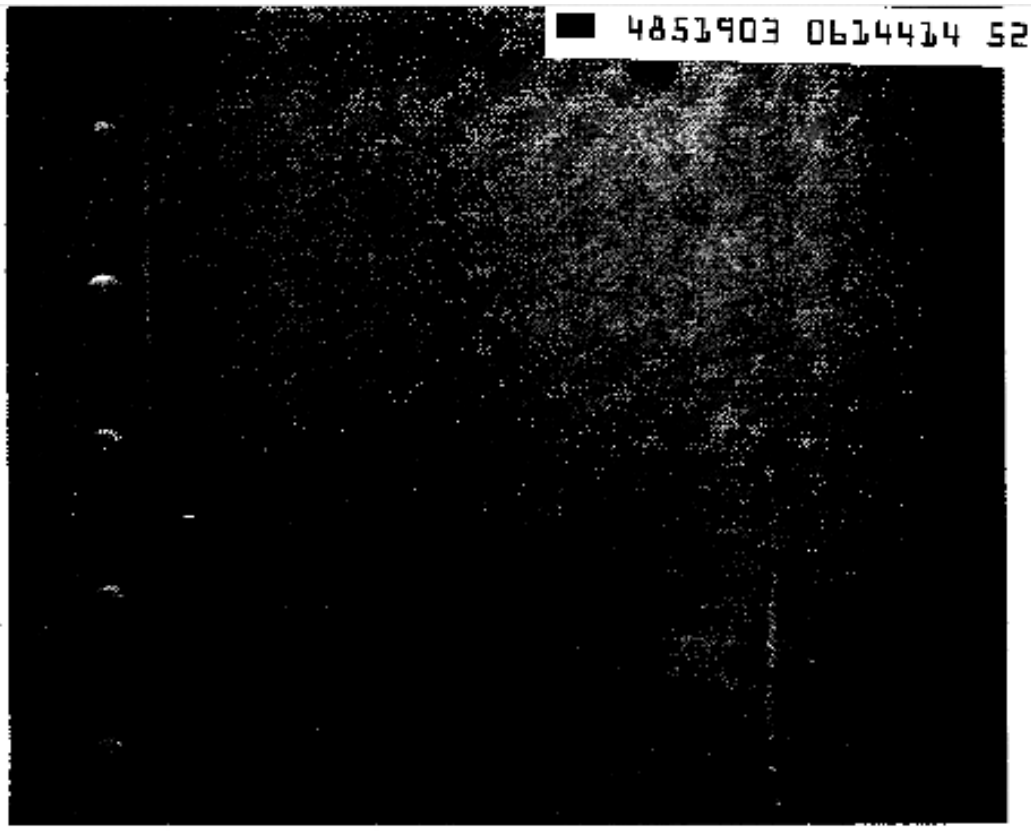
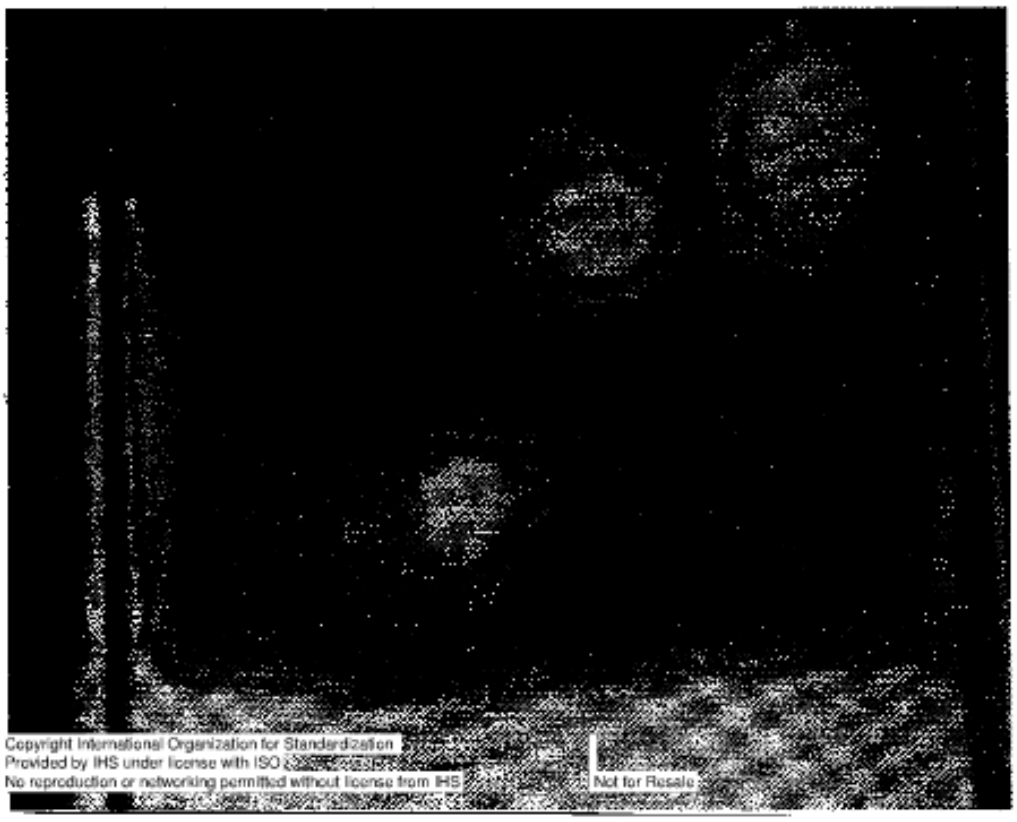




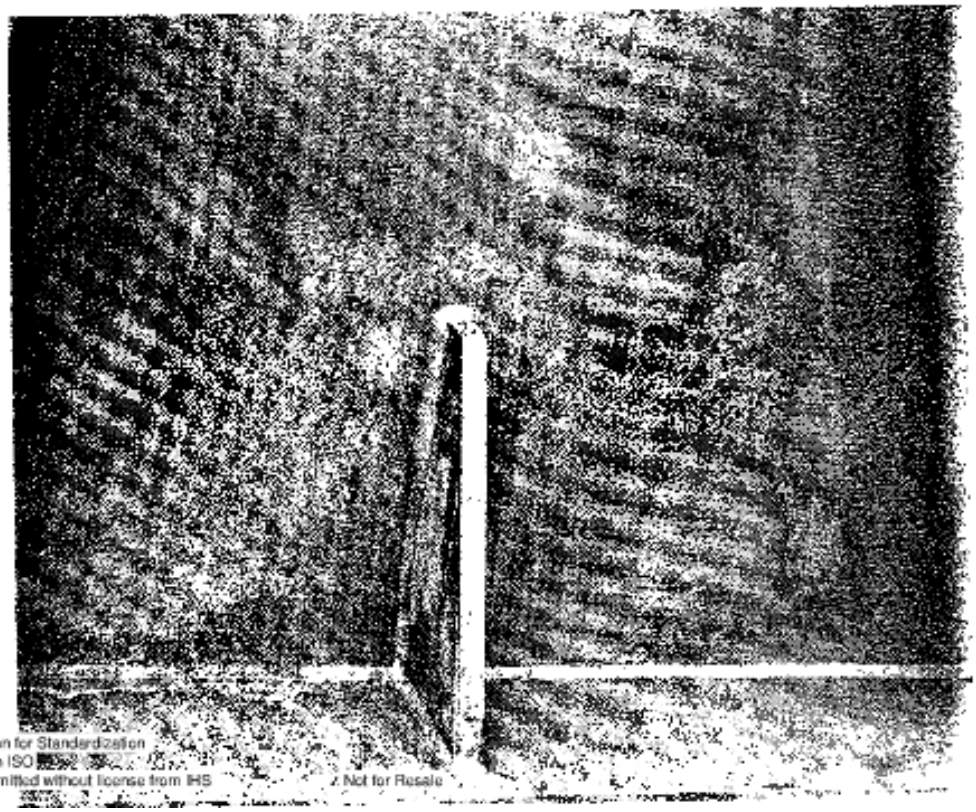
PSa 2½

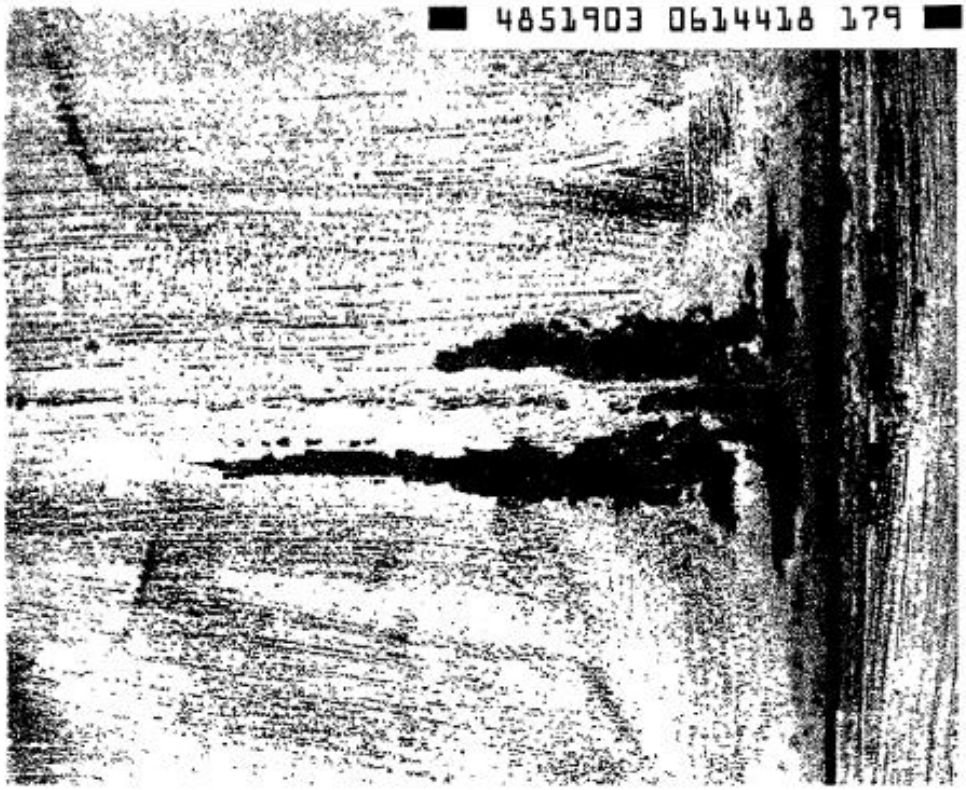


Third plate	See 5.2.1
Troisième planche	Voir 5.2.1
Третья пластина	См. 5.2.1
Drittes Beispielblatt	Siehe 5.2.1

Fourth plate	See 5.2.2
Quatrième planche	Voir 5.2.2
Четвертая пластина	См. 5.2.2
Viertes Beispielblatt.	Siehe 5.2.2

PSa 2 1/2





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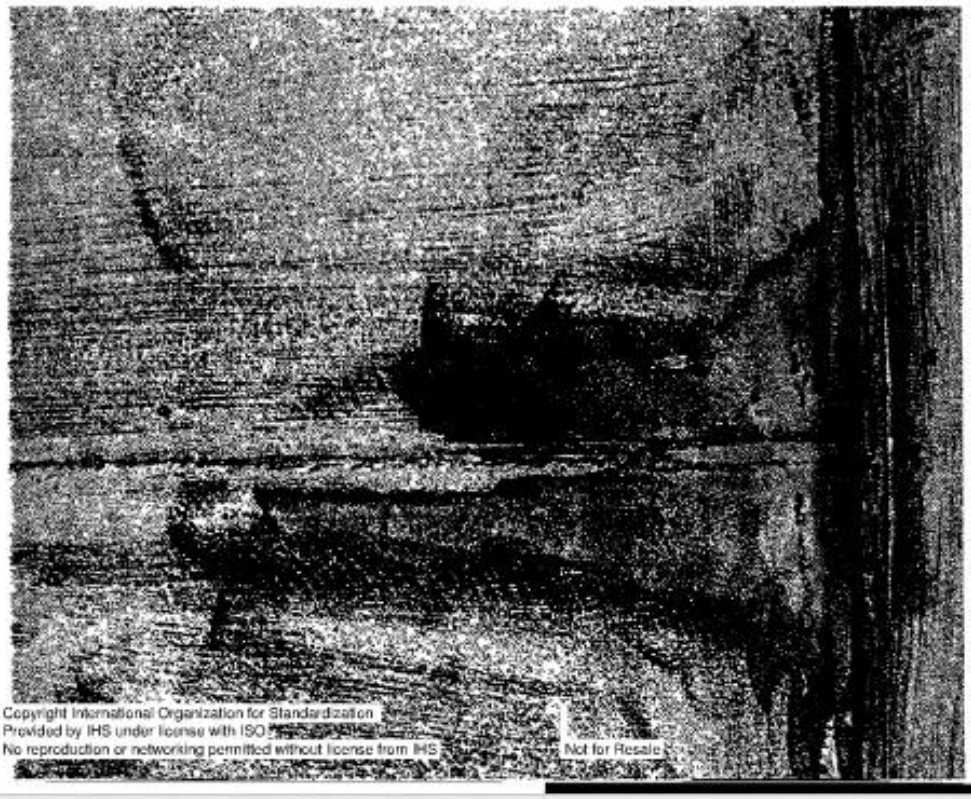
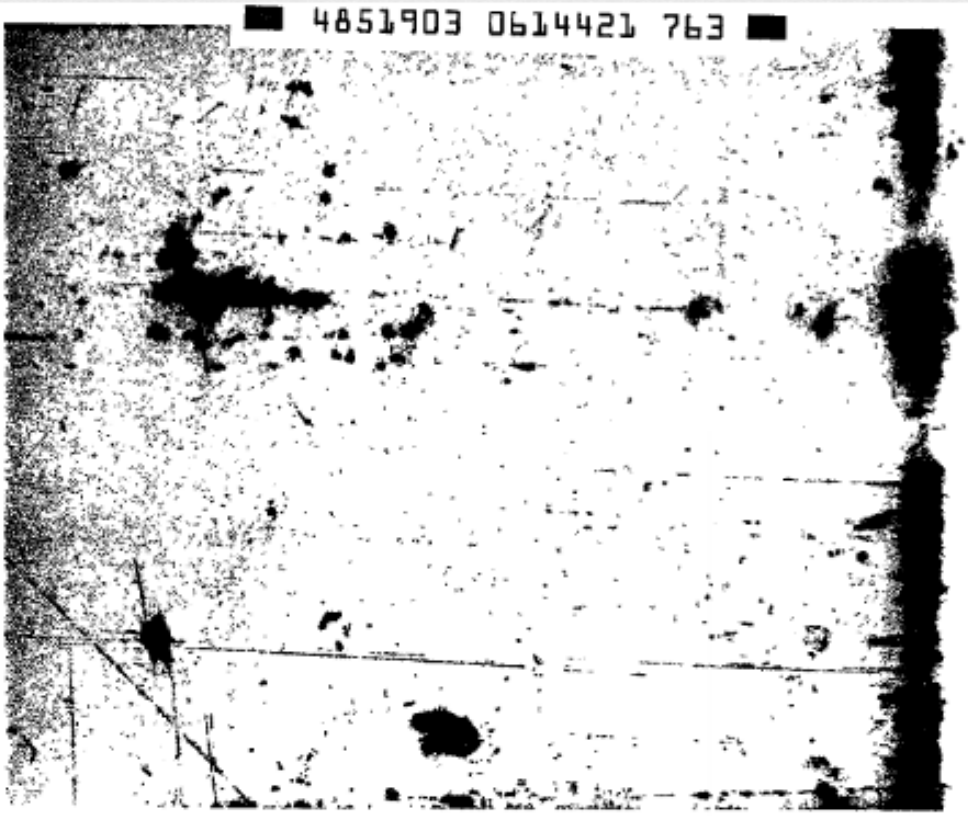


Fifth plate	See 5.3.1.1
Cinquième planche	Voir 5.3.1.1
Пятая пластина	См. 5.3.1.1
Fünftes Beispielblatt	Siehe 5.3.1.1

Sixth plate	See 5.3.1.2
Sixième planche	Voir 5.3.1.2
Шестая пластина	См. 5.3.1.2
Sechstes Beispielblatt	Siehe 5.3.1.2



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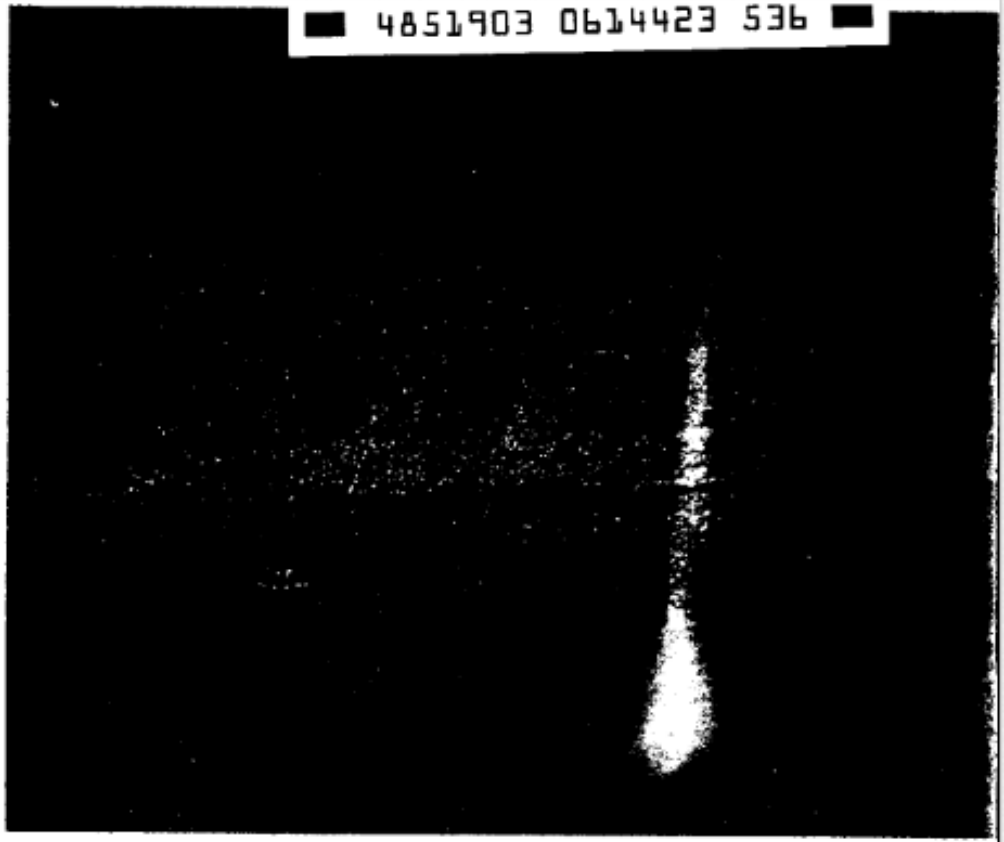
Seventh plate	See 5.3.2
Septième planche	Voir 5.3.2
Седьмая пластина	См. 5.3.2
Siebtes Beispielblatt	Siehe 5.3.2



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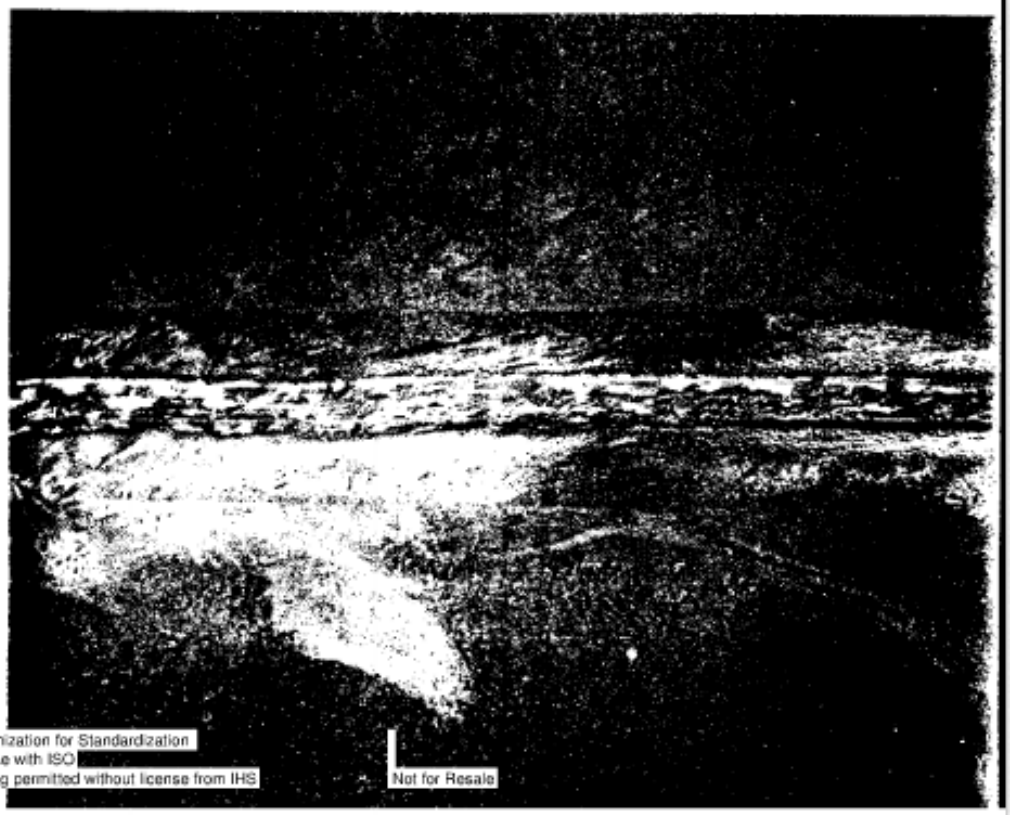

ISO 8501-2:1994(E/F/R)

ICS/МКС 87.020.00

Descriptors: paints, varnishes, substrates, steel products, surface condition, tests, determination, preparation grade, cleanliness checks, visual inspection (testing). / **Descripteurs:** peinture, vernis, subjectile, produit en acier, état de surface, essai, détermination, degré de soin, contrôle de propreté, inspection visuelle. / **Дескрипторы:** краски, лаки, основы, изделия стальные, состояние поверхности, испытания, определение, степени подготовки, контроль чистоты, визуальный контроль.

Price group XP / Groupe de prix XP / Группа цен XP