ISO 8501-4:2006

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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 8501-4 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 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 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, mill scale and previous coatings;

b) the presence of surface contaminants, including salts, dust, oils and greases;

c) the surface roughness.

International standards ISO 8501, ISO 8502 and ISO 8503 have been prepared to provide methods of assessing these factors, while ISO 4628-3 provides, *inter alia*, guidance on evaluating the degradation of paint coatings by assessing the degree of rusting.

ISO 8501, ISO 8502 and ISO 8503 do not contain recommendations for the protective systems to be applied to the steel surface. Neither do they contain recommendations for the preparation grades 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;

— compatible with any previous coatings remaining after cleaning;

— within the capability of the cleaning procedure specified.

ISO 8501, ISO 8502 and ISO 8503 deal with aspects of preparation of steel substrates under the general heading *Preparation of steel substrates before application of paints and related products*. They have the following titles:

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*.

Each of these International Standards is in turn divided into separate parts.

This part of ISO 8501 identifies

— five initial surface conditions, three of them applicable to degraded paint coatings and two of them to damaged pre-fabrication (shop) primer coatings;

— three preparation grades for each initial surface condition, after partial or full removal of previous paint coatings by high-pressure water jetting;

— three flash rust grades after pretreatment by high-pressure water jetting.

This part of ISO 8501 is intended to be a tool for the visual assessment of initial surface conditions, preparation grades and flash rust grades in connection with high-pressure water jetting. It includes 23 representative photographic examples.

The photographs showing the five initial surface conditions and each preparation grade are reproduced by permission of Hempel A/S. The photographs representing each of the three flash rust grades are reproduced by permission of International Paint, Ltd.

NOTE 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.

Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness —

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

1 Scope

This part of ISO 8501 specifies a series of preparation grades for steel surfaces after removal/partial removal of water-soluble contaminants, rust, previous paint coatings and foreign matter by high-pressure water jetting. The various grades are defined by written descriptions together with photographs that are representative examples within the tolerances for each grade as described in words. In addition, this part of ISO 8501 specifies both initial surface conditions and after-cleaning flash rust grades, also defined by written descriptions together with representative photographic examples.

NOTE 1 Examples of foreign matter are salt, grime, dirt, mill scale, oil, grease and marine growth, e.g. algae.

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.

The roughness characteristics of the surface should also be considered by reference to ISO 8503, although it must be noted that preparation by high-pressure water jetting does not create a profile or significantly change an existing profile.

NOTE 2 Water pressure, water volume, nozzle design, stand-off distance and traverse rate are factors which will affect the efficiency of removal of contaminants such as water-soluble matter, rust and paint coatings. The removal efficiency also depends on whether detergents are being used in the cleaning process. If so, rinsing afterwards with clean water is necessary.

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 4628-3, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 3: Assessment of degree of rusting*

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*

3 Terms and definitions

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

3.1
water jetting (preferred)
hydrojetting
aquajetting
water blast-cleaning (deprecated)
hydroblasting (deprecated)
aquablasting (deprecated)
cleaning a steel substrate by directing a high-speed jet of water onto its surface

3.1.1
high-pressure water jetting
water jetting that involves the use of water pressurized to above 70 MPa

NOTE Water jetting using higher pressures might remove loose mill scale from a steel surface, but it does not impart a surface profile to the substrate.

3.2
initial surface condition
visual appearance of a coated steel surface which has been degraded or damaged by rusting, blistering or flaking

3.3
preparation grade
visual appearance of a steel surface after contaminants on the surface have been removed by a preparation method

3.4
flash rust grade
visual appearance of a steel surface with respect to flash rust after the surface has been subjected to water jetting (see 3.1)

4 Initial surface conditions

Five initial surface conditions are defined.

Three initial surface conditions, designated DC A, DC B and DC C, are specified for steel surfaces that have degraded since being blast-cleaned and, in the case of DC A and DC B, painted with a protective paint system.

NOTE DC C is intended for use both in situations when a protective paint system has been applied previously and in situations when no protective paint system has been applied.

Two initial surface conditions, designated DP I and DP Z, are specified for steel surfaces that have degraded since being blast-cleaned and painted with an iron oxide prefabrication primer (DP I) or a zinc silicate primer (DP Z) alone.

The initial surface conditions are defined by written descriptions given in Table 1 together with the representative photographic examples appended to this part of ISO 8501.

Table 1 — Descriptions of initial surface conditions

DC A	A surface where the paint coating system has degraded to an extent similar to that illustrated by ISO 4628-3, grade Ri3.
DC B	A surface where the paint coating system has degraded to an extent similar to that illustrated by ISO 4628-3, grade Ri4.
DC C	A surface which might have been painted that has degraded to a major extent, as illustrated by ISO 4628-3, grade Ri5, or when completely degraded as illustrated by ISO 8501-1, rust grade C.
DP I	An iron oxide epoxy prefabrication (shop) primer surface that has degraded.
DP Z	A zinc silicate prefabrication (shop) primer surface that has degraded.

5 Preparation grades

Three preparation grades, designated Wa 1, Wa 2 and Wa 2½, indicating the degree of cleaning, are specified. They are defined by written descriptions of the surface appearance after the cleaning operation together with representative photographic examples.

The descriptions of the surface appearance are given in Table 2 and the representative photographic examples are appended to this part of ISO 8501.

Each of these photographs carries a designation combining that of the initial surface condition and that of the preparation grade, e.g. DC B Wa 2½.

Table 2 — Descriptions of the surface appearance after cleaning

Wa 1	**Light high-pressure water jetting** When viewed without magnification, the surface shall be free from visible oil and grease, loose or defective paint, loose rust and other foreign matter. Any residual contamination shall be randomly dispersed and firmly adherent.
Wa 2	**Thorough high-pressure water jetting** When viewed without magnification, the surface shall be free from visible oil, grease and dirt and most of the rust, previous paint coatings and other foreign matter. Any residual contamination shall be randomly dispersed and can consist of firmly adherent coatings, firmly adherent foreign matter and stains of previously existent rust.
Wa 2½	**Very thorough high-pressure water jetting** When viewed without magnification, the surface shall be free from all visible rust, oil, grease, dirt, previous paint coatings and, except for slight traces, all other foreign matter. Discoloration of the surface can be present where the original coating was not intact. The grey or brown/black discoloration observed on pitted and corroded steel cannot be removed by further water jetting.

NOTE This part of ISO 8501 does not imply that cleanliness is limited to Wa 2½, but achieving a greater degree of cleanliness could involve a disproportionate increase in time.

6 Flash rust grades

Three flash rust grades, designated L, M and H, are specified. They are defined by written descriptions of the surface appearance of uncoated steel areas before subsequent painting together with representative photographic examples.

The descriptions of the surface appearance are given in Table 3 and the representative photographic examples are appended to this part of ISO 8501.

Table 3 — Descriptions of the surface appearance for three flash rust grades

L	**Light flash rust** A surface which, when viewed without magnification, exhibits small quantities of a yellow/brown rust layer through which the steel substrate can be seen. The rust (seen as a discoloration) can be evenly distributed or present in patches, but it will be tightly adherent and not easily removed by gentle wiping with a cloth.
M	**Medium flash rust** A surface which, when viewed without magnification, exhibits a layer of yellow/brown rust that obscures the original steel surface. The rust layer can be evenly distributed or present in patches, but it will be reasonably well adherent and it will lightly mark a cloth that is gently wiped over the surface.
H	**Heavy flash rust** A surface which, when viewed without magnification, exhibits a layer of red-yellow/brown rust that obscures the original steel surface and is loosely adherent. The rust layer can be evenly distributed or present in patches and it will readily mark a cloth that is gently wiped over the surface.

7 Procedure for the visual assessment of steel substrates

Examine the steel surface either in good daylight or in good artificial illumination (as agreed between the parties) and compare it with each of the photographs appended to this part of ISO 8501, using normal vision. The comparison shall be made together with the written descriptions in Table 1, 2 or 3, respectively. Place the appropriate photograph close to, and in the plane of, the steel surface to be assessed.

For initial surface conditions, record the assessment as the worst condition, of those defined in Table 1, that is evident.

For preparation grades, record the assessment as the condition defined in Table 2 which is nearest to the cleanliness achieved.

Assessment of the preparation grade shall be made when the surface is dry and before any flash rusting occurs.

For flash rust grades, record the assessment as the grade in Table 3 which is nearest to the flash rust that is evident.

Assessment of the flash rust grade (if any) shall be made immediately prior to paint application.

8 Photographs

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

There is one photograph for each of the five initial surface conditions, and one photograph for each possible combination of initial surface condition and preparation grade. In addition, there is one photograph for each of the three flash rust grades.

The initial surface conditions DC A, DC B and DC C concern multicoat paint systems and hence the different coloured layers can be progressively revealed by the water jetting operation.

The photographs of the initial surface conditions and preparation grades depict the steel surface on a scale of 1:1. They are consistent copies reproduced from reliable masters.

Each of the photographs carries a designation combining that of the initial surface condition and that of the preparation grade, e.g. DC B Wa 2½.

A summary of layout and sequence of all the photographs is given in Figure 1.

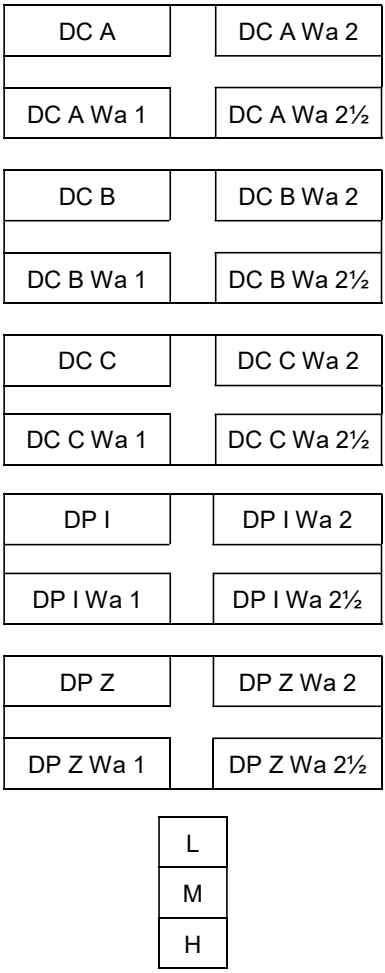

Figure 1 — Layout and sequence of the representative photographic examples in this part of ISO 8501

Annex A
(informative)

Guidance on cleaning with water

Cleaning with water can be carried out using a number of techniques and with water at a range of pressures. The terms “water cleaning” and “water jetting” are used to describe and define the cleaning processes and tend to define the process itself. The borderlines between techniques may occur at slightly different pressures, depending on usage.

Below 70 MPa, the techniques are called water cleaning. The NACE VIS 7/SSPC-VIS 4 standard gives two definitions of water cleaning, namely:

a) low-pressure water cleaning (LPWC), which is defined as cleaning performed at pressures less than 34 MPa (5 000 psi);

b) high-pressure water cleaning (HPWC), which is defined as cleaning performed at pressures from 34 MPa to 70 MPa (5 000 psi to 10 000 psi).

Above 70 MPa, the process of cleaning is generally described as high-pressure water jetting. Above 200 MPa (30 000 psi), the term ultra-high-pressure water jetting is commonly used.