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Preparation of steel substrates before application of paints and related products — Tests for the assessment of surface cleanliness —

Part 15: Extraction of soluble contaminants for analysis by acid extraction

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document 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*.

A list of all parts in the ISO 8502 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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.

The ISO 8501, ISO 8502 and ISO 8503 series have been prepared to provide methods of assessing these factors, while the ISO 8504 series 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 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 will be exposed and for the protective coating system to be used;
- within the capability of the cleaning procedure specified.

The four series of international standards referred to above deal with the following aspects of preparation of steel substrates:

- visual assessment of surface cleanliness (see ISO 8501);
- tests for the assessment of surface cleanliness (see ISO 8502);
- surface roughness characteristics of blast-cleaned steel substrates (see ISO 8503);
- surface preparation methods (see ISO 8504).

Each of these series of international standards is in turn divided into separate parts.

This document, along with the other parts of the ISO 8502 series, specifies tests for the assessment of surface cleanliness. In connection with such tests, there are several methods for the extraction, for analysis, of soluble contaminants on surfaces to be painted. Some of these methods are based on the swabbing of comparatively large test surfaces. This technique provides average values of the contamination present, but it might conceal localized concentrations of contaminants. Swabbing might not ensure sufficient penetration to dissolve all of the deep-seated contamination such as ferrous salts. Furthermore, the solvent used affects the dissolution rate and what contaminants are dissolved. This document covers sampling with a weak acid as solvent.

There are other methods, however, which use small cells for the liquid to remove and collect the surface contaminants. The cells (rigid or flexible) are attached to test surfaces where soluble contaminants could be expected, for example where pitting has occurred. This technique usually provides more accurate point values of the contamination present.

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Preparation of steel substrates before application of paints and related products — Tests for the assessment of surface cleanliness —

Part 15:

Extraction of soluble contaminants for analysis by acid extraction

1 Scope

This document specifies a method of extracting, for analysis, acid soluble contaminants from a surface by use of flexible cells in the form of adhesive patches or sleeves which can be attached to any surface, regardless of its shape (flat or curved) and its orientation (facing in any direction, including downwards).

The described method is suitable for use in the field to determine the presence of acid soluble contaminants before painting or a similar treatment.

This document does not cover the subsequent analysis of the contaminants that have been dissolved off. Methods of analysis suitable for field use are described in other parts of ISO 8502-5.

This document is similar in procedure to, but not equal to, ISO 8502-6. The main difference is the solvent used and the subsequent analysis that can be performed on the extraction solution.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 554, *Standard atmospheres for conditioning and/or testing — Specifications*

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/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

4 Principle

This document covers two types cells, adhesive patch and flexible sleeve. With the first type, an adhesive patch with a central compartment designed to hold a weak acid is attached to the surface from which acid soluble contaminants are to be removed. The acid is injected into the compartment by means of a syringe, and then sucked back into the syringe. This operation is repeated and the acid left to dissolve salts on the surface. With the second type of cell, a sleeve containing acid is attached to the surface and the acid is left, under some agitation, to dissolve the salts. The acid now containing contaminants extracted from the test surface is then transferred to a suitable vessel for analysis.

5 Apparatus and materials

5.1 Adhesive cell

The body is made of ageing-resistant, flexible material with closed pores, for example polyethylene foam, and with a hole punched in the centre. For the adhesive cell, the punched-out material is kept in the hole as a reinforcement until the patch is used. One side of the cell is coated with a thin elastomer film or an extraction sleeve. The other side is coated with adhesive and covered by a removable protective sheet made of paper.

The hole and the outer edge of the patch may be any shape, for example circular, rectangular or elliptical.

The thickness of the adhesive rim shall be $1,5 \text{ mm} \pm 0,3 \text{ mm}$. The width of the adhesive rim between the hole and the outer edge of the patch shall be at least 5 mm. The thickness of the adhesive rim of adhesive sleeves of size S-1000 (see [Table 1](#)) shall be $3,0 \text{ mm} \pm 0,3 \text{ mm}$ and the width at least 7 mm.

Cells with one of the standard compartment sizes specified in [Table 1](#) are called standard cells.

It is essential that the adhesive cell is leak-tight. An easily performed leak test has therefore been developed for type testing (see [Annex A](#)). Twelve cells of the same size shall be tested, and at least eight of them shall pass the test. The leak test shall be carried out by a competent laboratory meeting the requirements of ISO/IEC 17025 and the result stated in a test report.

Table 1 — Standard patches

Cell type	Size	Compartment area mm ²
Patch	A-0155	1 155 ± 2
	A-0310	1 310 ± 3
	A-0625	1 625 ± 6
	A-1250	1 250 ± 13
	A-2500	2 500 ± 25
Sleeve	S-1000	1 000 ± 10

5.2 Reusable syringe

Maximum cylinder volume: 10 ml

Maximum needle diameter: 1 mm

Maximum needle length: 50 mm

5.3 Solvent

Mildly acidic solutions, with $\text{pH } 3,6 \pm 0,3$ shall be used to dissolve the contaminants. The method of analyses after extraction and the solvent shall be selected properly. The mildly acidic solutions shall not

contain the ion(s) of interest (e.g. chloride, sulfate, nitrate) or an acid that interferes with the titration analysis, such as phosphoric acid.

The solvent used shall be specified in the report.

NOTE Examples of suitable weak acid from the carboxylic or sulphonic acid chemistry are sulphamic acid and hydroxy-acetic acid.

5.4 Contact thermometer

Accurate to 0,5 °C and graduated at 0,5 °C intervals.

6 Procedure

6.1 Selection of test surface

Choose test areas which are representative of the entire surface. Otherwise, it is important to select test areas where metal loss or pitting is observed, and on or around metal welds, as these are the areas where salts will be most prevalently concentrated.

6.2 Extraction by patch or sleeve by injection

6.2.1 Take an adhesive patch or sleeve (5.1) of a suitable size (see Table 1). Remove the protective paper; for the patch remove the punched-out material (see Figure 1 and Figure 7).

6.2.2 Press the adhesive side of the patch or sleeve against the test surface (see Figure 2) in such a way that the minimum amount of air is trapped in the compartment in the patch.

6.2.3 Fill the syringe (5.2) with solvent (5.3) (see Figure 3).

NOTE The volume of solvent needed to fill the patch compartment is proportional to the compartment area and normally amounts to $2,6 \times 10^{-3} \text{ ml/mm}^2 \pm 0,6 \times 10^{-3} \text{ ml/mm}^2$. The volume of solvent needed to fill the sleeve compartment is proportional to the compartment area and normally amounts to $10,0 \times 10^{-3} \text{ ml/mm}^2 \pm 0,6 \times 10^{-3} \text{ ml/mm}^2$ (10 ml for S-1000 sleeve).

6.2.4 Insert the syringe needle at an angle of about 30° to the test surface near the outer edge of the patch or sleeve, so that it passes through the adhesive foam body of the patch or sleeve into the compartment formed between the elastomer film and the test surface (see Figure 4).

If the patch or sleeve is in a position which makes access to the patch compartment difficult, bend the syringe needle as required.

6.2.5 Inject the solvent, ensuring that it wets the whole of the test surface (see Figure 4).

If necessary, to avoid air remaining trapped in the patch compartment, carry out the injection in two steps as follows: inject half of the solvent. When required, evacuate the air through the needle by reverse operation of the syringe. Remove the needle from the patch or sleeve. Holding the syringe with the needle pointing upwards, expel the air. Reinsert the needle into the compartment and inject the remainder of the solvent.

6.2.6 After a suitable period, to be agreed between the interested parties, suck the solvent back into the syringe (see Figure 5). During this period, agitate the solution in the patch without removing the syringe needle from the patch or sleeve. The solution can be agitated by reinjecting the solvent into the compartment. Then suck the solvent back into the syringe cylinder at least four times or massaging the patch or sleeve to create solvent movement over the test surface.