

INTERNATIONAL
STANDARD

ISO
8502-15

First edition
2020-09

**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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Reference number
ISO 8502-15:2020(E)

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Published in Switzerland

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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.

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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

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

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 such as 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 of 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, as indicated in [Annex A](#), and at least eight of them shall pass the test, as explained in [Annex A](#). 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	$1\ 155 \pm 2$
	A-0310	$1\ 310 \pm 3$
	A-0625	$1\ 625 \pm 6$
	A-1250	$1\ 250 \pm 13$
	A-2500	$2\ 500 \pm 25$
Sleeve	S-1000	$1\ 000 \pm 10$

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 $0,5\text{ }^\circ\text{C}$ and graduated at $0,5\text{ }^\circ\text{C}$ 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](#)).

6.2.2 Press the adhesive side of the patch or sleeve against the test surface (see [Figures 2](#) and [7](#)) 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.

6.2.7 Transfer the solvent to a suitable vessel for analysis (see [Figure 6](#)) as required for the analysis method.

6.2.8 During steps [6.2.3](#) to [6.2.7](#), it is essential that no solvent be lost from the cell or syringe, due for instance to inferior-quality materials or improper handling of the materials. If any solvent is lost, the solution obtained shall be rejected.

6.2.9 On completion of step [6.2.7](#), clean and rinse the syringe so that it can be reused. A bent needle is best left as it is until it becomes necessary to straighten it or bend it further.

6.3 Extraction by sleeve by pre-filling

6.3.1 Take an adhesive sleeve ([5.1](#)) of a suitable size (see [Table 1](#)). Remove the protective paper and straighten the sleeve.

6.3.2 Prefill the sleeve with the required volume of solvent ([5.3](#)) and adhere the patch to the surface without loss of solvent (see [Figure 7](#)).

NOTE The volume of solvent needed to fill the sleeve compartment is proportional to the compartment area and normally amounts to $10,0 \times 10^{-3}$ ml/mm² $\pm 0,6 \times 10^{-3}$ ml/mm².

6.3.3 Position the sleeve such that all solvent in the sleeve is in contact with the surface.

6.3.4 During a suitable period of time, to be agreed between interested parties, or recommended by the manufacturer of the test equipment, agitate the sleeve several times by massaging the solvent on the surface. After the time period, let the sleeve hang down in order for the solvent to flow into the compartment of the sleeve.

6.3.5 Carefully remove the sleeve from the surface. Retain the solvent for further analysis.

6.3.6 During steps [6.3.2](#) to [6.3.5](#), it is essential that no solvent be lost from the sleeve, due for instance to inferior-quality materials or improper handling of the materials. If any solvent is lost, the solution obtained shall be rejected.

6.3.7 Record the temperature of the steel surface to the nearest 0,5 °C using the contact thermometer ([5.4](#)). The temperature shall be over 0 °C to avoid ice on the surface.

6.4 Blank test

To check cleanliness of the cells, blank tests shall be performed in advance for each batch.

For the blank test, a piece of clean glass, to which the adhesive patch will adhere, shall be used and water of the same type as to be used for testing. The same procedure as in [6.2](#) or [6.3](#) shall be followed. If the background interference is significant the cause shall be investigated and, if possible, eliminated.

If the background interference introduced by the adhesive cell is significant, reproducible and cannot be eliminated, a blank test shall be performed in parallel to each test and the background subtracted from the field quantitative measurements in order to report a net surface contamination value. If this procedure is followed, it shall be stated in the report.

7 Analysis

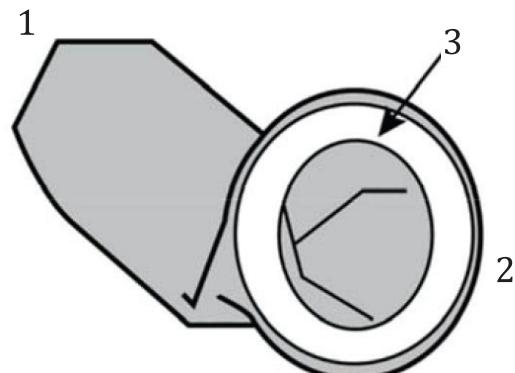
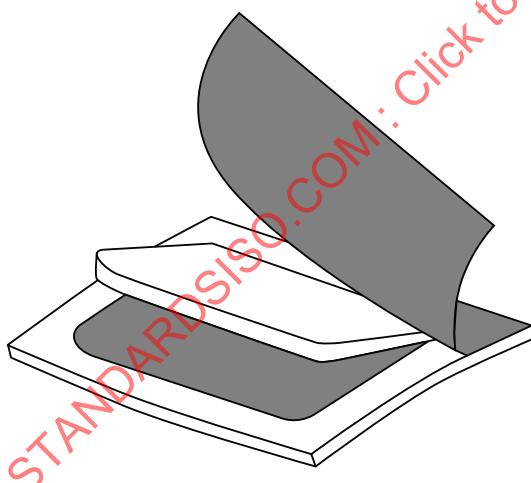
After sampling, the extract is analysed as agreed between the interested parties. Suitable methods of analysis are chlorides with the ion detection tube as described in ISO 8502-5 or other methods of chemical analysis. The analytical differences between the extraction methods covered in this method and those of ISO 8502-6 are discussed in Reference [5]. The origins of the extraction by cells are described in Reference [4].

NOTE Methods of analysis are not covered by this document.

8 Test report

The test report shall contain at least the following information:

- a) a reference to this document (i.e. ISO 8502-15:2020);
- b) the solvent used;
- c) the volume of solvent injected or pre-filled;
- d) the total volume of solvent after dilution;
- e) the total time of contact between the solvent and substrate;
- f) the temperature during steps [6.2.3](#) to [6.2.7](#) or [6.3.2](#) to [6.3.5](#) of the procedure;
- g) the type and size of extraction cell used: patch or sleeve;
- h) the manufacturer's batch number of the patch or sleeve used;
- i) the date of the test.



Key

- 1 flexible sleeve, closed end
- 2 flexible sleeve, open end
- 3 adhesive ring with protective paper

Figure 1 — Adhesive patch with protective paper and punched-out material (left), adhesive sleeve (right)

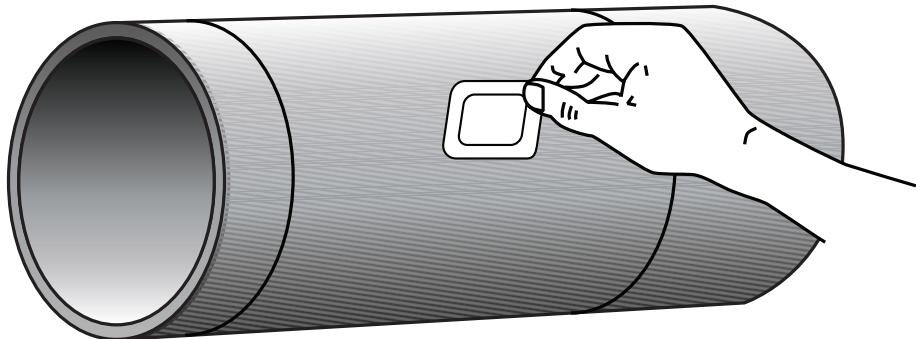


Figure 2 — Adhesive patch attached to the test surface

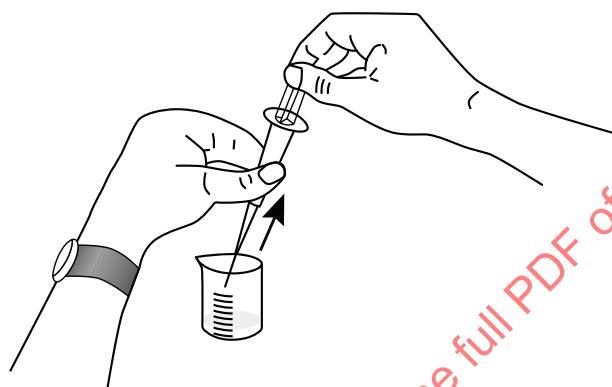


Figure 3 — Syringe, filled with water

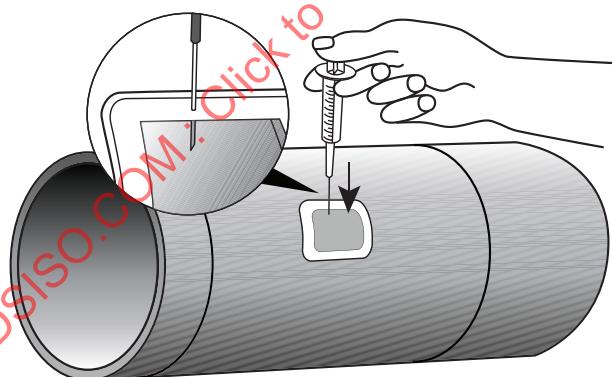


Figure 4 — Water injected into the compartment in the patch

Carefully follow the procedure described in [6.2.4](#) and [6.2.5](#).

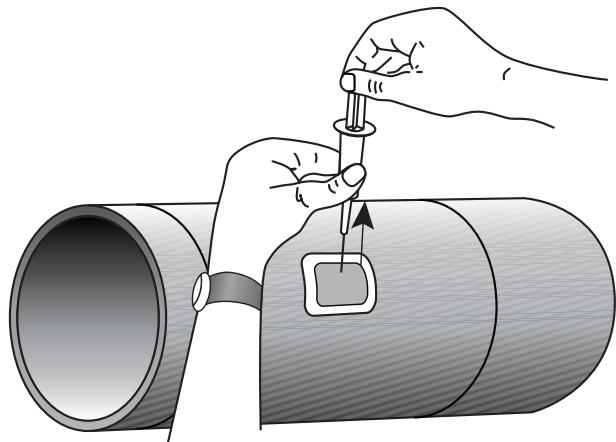


Figure 5 — Water retrieved from the compartment in the patch



Figure 6 — Water transferred to a suitable vessel for subsequent analysis

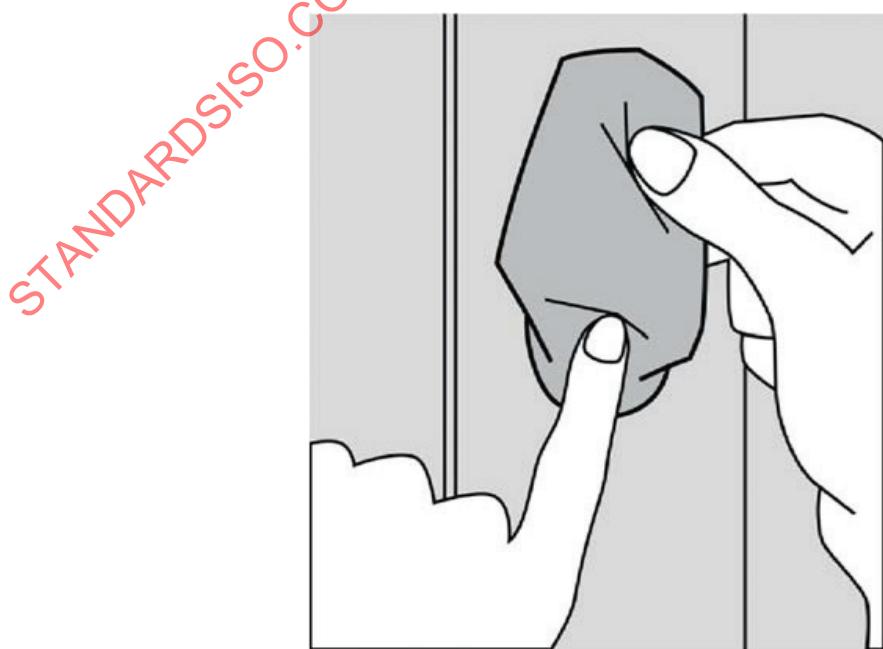


Figure 7 — Flexible sleeve adhered to a metal surface

Annex A (normative)

Leak test for type testing of adhesive cells (patches and sleeves)

A.1 General

The quantitative nature of the removal of the soluble contaminants from a steel surface largely depends on the leak-tightness of the adhesive patch and sleeve, including the adhesive bond between the patch or sleeve body and the steel surface.

Leakage of the water is more likely to occur when the surface is unclean (e.g. covered by rust or moisture) or when it is rough (e.g. due to pits remaining after blast-cleaning).

Leakage is also more likely to occur when the internal pressure is high and of long duration.

These factors affecting leakage are intentionally exaggerated in the following leak test, which is intended for type testing of adhesive patches having an elastomer film made of rubber.

The test method may also be used for production testing, as well as checking deliveries of such patches or sleeves. It may be used for comparisons and to predict possible difficulties in the contaminant-dissolution procedure (see [Clause 6](#)). Passing the test is no guarantee that a patch will function satisfactorily in practice under all circumstances.

A.2 Principle

A patch or sleeve is attached to a clean steel plate of known roughness. Water is injected into the test compartment in order to create an internal pressure and hence stress the patch or sleeve. The patch or sleeve is checked for leakage after a specified time.

A.3 Apparatus and material

A.3.1 Adhesive patch or sleeve, as in [5.1](#).

A.3.2 Visually clean steel plate, of convenient size, for example 150 mm × 150 mm, originally of rust grade D, prepared to D Sa 2 1/2 as defined in ISO 8501-1, and its secondary profile having been identified as “angular” and graded as “coarse” as defined in ISO 8503-2.

A.3.3 Syringe, as in [5.2](#).

A.3.4 Water, distilled or deionized.

A.3.5 Stopwatch.

A.4 Procedure

A.4.1 Perform the test in standard atmosphere 23/50 with wide tolerances as defined in ISO 554.

NOTE The numerical values 23 and 50 refer to the temperature in degrees Celsius and the relative humidity in percent, respectively.