SLOVENSKI STANDARD
SIST EN 13144:2019

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Nadomešča:
SIST EN 13144:2003

Kovinske in druge anorganske prevleke - Metoda za kvantitativno merjenje adhezije z nateznim preskusom

Metallic and other inorganic coatings - Method for quantitative measurement of adhesion by tensile test

Metallische und andere anorganische Überzüge - Verfahren zur quantitativen Messung der Haftfestigkeit durch den Zugversuch

Revêtements métalliques et autres revêtements inorganiques - Méthode de mesurage quantitatif de l'adhérence par essai de traction

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ICS:

25.220.40	Kovinske prevleke	Metallic coatings

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Metallic and other inorganic coatings - Method for quantitative measurement of adhesion by tensile test

Revêtements métalliques et autres revêtements inorganiques - Méthode de mesurage quantitatif de l'adhérence par essai de traction

Metallische und andere anorganische Überzüge - Verfahren zur quantitativen Messung der Haftfestigkeit durch den Zugversuch

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN 13144:2018) has been prepared by Technical Committee CEN/TC 262 “Metallic and other inorganic coatings, including for corrosion protection and corrosion testing of metals and alloys”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2019 and conflicting national standards shall be withdrawn at the latest by May 2019.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 13144:2003.

In comparison with EN 13144:2003, the following modifications have been made:

— the Scope has been rewritten to give more information;

— normative references have been added;

— the terms and definitions have been updated;

— in addition to the tensile testing machine previously described, the centrifuge has been added as a further type of testing machine;

— sample description has been expanded to describe test stamps, planar samples and coated samples;

— consideration of adhesives and their application has been expanded;

— the measurement section has been revised;

— the expression of results clause has been revised and failure pattern according to EN ISO 10365:1995 added;

— the test report clause has been revised.

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1 Scope

This document specifies a quantitative method for the measurement of adhesive strength of metallic and other inorganic coatings applied to metallic, polymer and glass substrates.

Typical coatings for which this document applies are metallic coatings such as aluminium, copper, nickel, nickel plus chromium, silver, tin, tin-nickel alloys, zinc, gold as well as other inorganic coatings such as oxides or nitrides, e.g. of aluminium, indium and indium-tin, silicon, niobium, titanium, tungsten, zirconium and others.

This document does not apply to certain hot dip, spray and mechanical coatings, for which other standards may apply, e.g. EN ISO 14916 or EN ISO 4624.

The measurement is valid if the cohesion and adhesion properties of the adhesive are higher than those of the coating subjected to test.

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.

EN 15870, *Adhesives - Determination of tensile strength of butt joints (ISO 6922:1987 modified)*

EN ISO 4624, *Paints and varnishes - Pull-off test for adhesion (ISO 4624)*

EN ISO 10365:1995, *Adhesives - Designation of main failure patterns (ISO 10365:1992)*

3 Terms and definitions

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

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

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

3.1
adhesive strength
force per unit area required to separate a coating from its substrate

Note 1 to entry: Adhesion can be deemed inadequate in the presence of blisters, scaling and any defect that results from the separation of the coating from its substrate.

3.2
adhesion
physical property resulting from the magnitude of forces joining the atoms and/or molecules at an interface of two materials

3.3
cohesion
physical property resulting from the magnitude of forces joining the atoms and/or molecules within one material

3.4
test block
metallic cylinder used for pull-off tests within the tensile testing machine (described in 4.2.1.2)

3.5
test stamp
metallic disc or cylinder used for pull-off tests within the tensile testing machine (described in 4.2.1.3) or centrifuge (described in 4.2.2.2)

3.6
substrate
base material to which the coating material is applied or is to be applied

Note 1 to entry: Real substrate from the production process or reference substrate of different material coated in the production process or test block of steel coated in the production process.

3.7
sample
coating/substrate system under test as used within the tensile testing machine or centrifuge as counterpart either of test blocks (3.4) or test stamps (3.5)

4 Determination of adhesive strength by measurement

4.1 Principle

The tensile strength required to separate the coating from its substrate is measured perpendicular to the substrate.

The result of the measurement is influenced not only by the mechanical properties of the system to be characterized, but also by the nature and preparation of the substrate.

The result of the measurement can also be affected by internal stress in the coating, which influences adhesion.

The result of the measurement is the tensile strength required to break the weakest interface or the weakest constituent of the test assembly. A combination of both adhesive and cohesive ruptures can also occur. A detailed description and designation of failure patterns is provided in 5.2 and in Table 1.

4.2 Testing devices

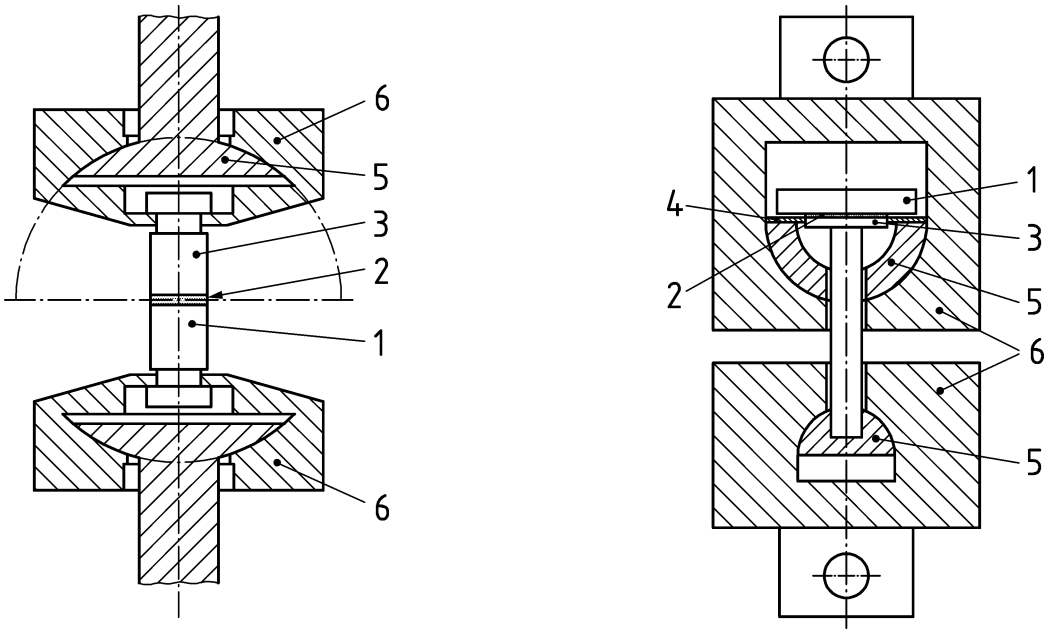
4.2.1 Tensile testing machine

4.2.1.1 General

A single-sample testing device that requires a two-sided sample clamping and usually a double cardanic suspension realized by means of ball joints.

It shall be capable of being used in accordance with 4.6. The tensile testing machine is operated either in the force- or path-controlled mode.

NOTE Suitable set-ups for the application of the tensile force are shown in Figure 1.



a) b)

Key

1 sample
2 adhesive
3 test block (Figure 1a)/test stamp (Figure 1b)
4 sample support
5 ball joint
6 suspension

Figure 1 — Set-ups for the application of the tensile force (tensile testing machine)

4.2.1.2 Test blocks

Test blocks shall be made of machined steel, having a cylindrical shape and a diameter of 20 mm, 10 mm or 7 mm in accordance with EN 15870 and EN ISO 4624 (unless otherwise agreed upon).

The thickness of the test block shall be not less than 10 mm to ensure the absence of deformations during the test. Prior to use, the faces acting as adherend shall be machined perpendicular to the major axis of the block.

4.2.1.3 Test stamps

Test stamps may be monolithic or modular. They shall be made of machined steel or other metals. In the case of monolithic test stamps, clamping body and adherend are one piece made from the same material. In the case of modular test stamps, clamping body and adherend are separate, but connectable pieces and can be made from different materials. The adherend diameters shall be 20 mm, 10 mm or 7 mm in accordance with EN 15870 and EN ISO 4624 (unless otherwise agreed upon).

Prior to use, the face acting as adherend shall be machined perpendicular to the major axis of the test stamp.

4.2.1.4 Planar samples

Coated substrate under consideration with diameters or size above the diameter of the test block or test stamp. Except for component geometry, the sample represents the interface of coating and substrate as processed and adhesive strength is tested as shown in set-ups according to Figure 1a) and 1b) and assemblies of Figures 3 and 4.

4.2.1.5 Coated test blocks

Alternatively to using planar samples (4.2.1.4), it is also possible to coat test blocks (4.2.1.2) and use them as samples to be tested. Adhesive strength is tested as shown in a set-up according to Figure 1a) and an assembly according to Figure 5.

4.2.2 Centrifuge

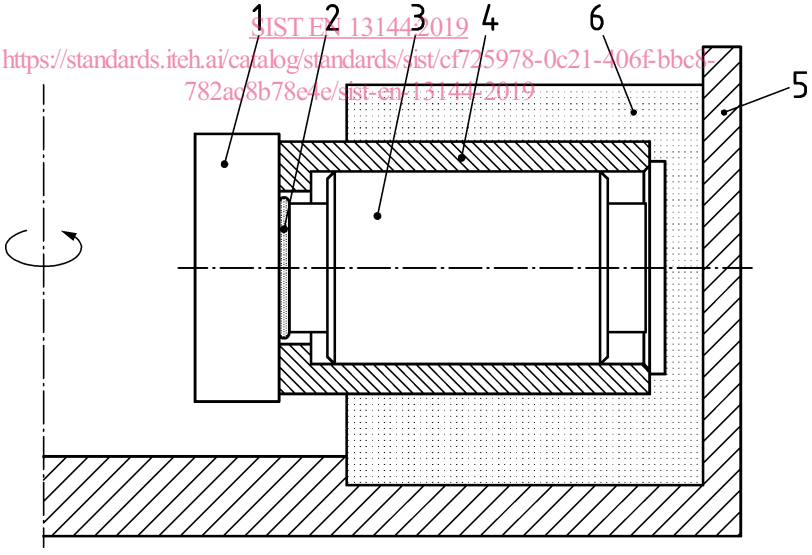
4.2.2.1 General

A multiple-sample testing device for the tensile test that requires a one-sided sample support.

It shall be capable of being used in accordance with 4.6. The centrifuge is operated in the force-controlled mode.

In combination with the coating/substrate system (acting as planar sample 4.2.2.3) and a monolithic or modular test stamp bonded on the coating/substrate system, a guiding sleeve acts both as sample support and as test stamp guidance. The guiding sleeve can also be used as adhesive application kit prior to testing. Thus, any shear force at testing can be avoided and the centrifugal force is used as normal testing force.

NOTE A suitable set-up for the application of the tensile force is shown in Figure 2.



Key

1	sample	4	guiding sleeve/sample support
2	adhesive	5	drum-rotor
3	test stamp	6	detection module

Figure 2 — Set-up for the application of the tensile force (centrifuge)