



SLOVENSKI STANDARD
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Determination of the transfer efficiency of atomising and spraying equipment for liquid coating materials - Part 1: Flat panels

Bestimmung des Auftragswirkungsgrades von Spritz- und Sprühgeräten für Beschichtungsstoffe - Teil 1: Flächenbeschichtung

Détermination de l'efficacité de transfert des équipements d'atomisation/pulvérisation pour produits de revêtement liquides - Partie 1: Panneaux plans

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87.100	Oprema za nanašanje premazov	Paint coating equipment
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This European Standard was approved by CEN on 28 November 2002.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

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Foreword

This document (EN 13966:2003) has been prepared by Technical Committee CEN/TC 271, "Surface treatment equipment - Safety", the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by October 2003, and conflicting national standards shall be withdrawn at the latest by October 2003.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

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Introduction

Transfer efficiency is a performance parameter that is used to express the effectiveness of spraying or atomising equipment in transferring a coating material to the surface of an object.

Transfer efficiency is defined as the ratio of coating solids laid down on the surface of an object and forming the dry film to the total solid content of the coating material delivered by the atomising and spraying equipment, expressed as a percentage.

The use of atomising and spraying equipment with a high transfer efficiency therefore has economic and environmental benefits.

A standard and reproducible procedure for determining the transfer efficiency is required to:

- enable a reliable comparison of atomising and spraying equipment through transfer efficiency data quoted by manufacturers;
- provide data to show that the atomising and spraying equipment meets minimum values stipulated in health, safety and environmental legislation.

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1 Scope

This European Standard specifies a laboratory procedure for determining the transfer efficiency of atomising and spraying equipment for the application of liquid coating materials onto flat panels. A second part (to be prepared) will cover coating material application to other substrate geometries and provide a method for the determination of transfer efficiency for atomising and spraying equipment with electrostatic support.

This standard applies to the determination of the transfer efficiency of atomising and spraying equipment, such as, but not limited to:

- conventional air atomiser (high air pressure);
- HVLP-atomiser (high volume low pressure);
- LVLP-atomiser (low volume low pressure);
- airless atomiser (hydraulic pressure);
- air assisted airless atomiser;
- vibratory or rotary atomiser (bells);
- electrostatic supported atomiser.

Two methods of determination are included in the standard.

The transfer efficiency value resulting from the application of this standard procedure expresses the potential performance of atomising and spraying equipment for comparison of different types or models. The value may or may not be attained in use, where the working conditions and operator practice are likely to differ from those of the standard test method.

The determined transfer efficiency is valid only in conjunction with the parameters shown in the test summary form, see annex C.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to the European Standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies (including amendments).

EN 971-1, *Paints and varnishes: Terms and definitions for coating materials. Part 1: General terms*

EN 1953, *Atomising and Spraying Equipment for Coating Materials - Safety requirements*

prEN 12215, *Coating plants - Spray booths for application of organic liquid coating materials - Safety requirements*

prEN 13355, *Coating plants - Combined booth – Safety requirements*

EN 21512, *Paints and Varnishes: Sampling of products in liquid or paste form*

EN ISO 1513, *Paints and Varnishes - Examination and preparation of samples for testing.*(ISO 1513:1992)

EN ISO 2431, *Paints and varnishes - Determination of flow time by use of flow cups* (ISO 2431:1993, including Technical Corrigendum 1:1994).

EN ISO 3219, *Plastics - Polymers/resins in the liquid state or as emulsions or dispersions - Determination of viscosity using a rotational viscometer with defined shear rate* (ISO 3219:1993)

EN ISO 3251, *Paints and varnishes - Determination of non-volatile matter of paints, varnishes and binders for paints and varnishes* (ISO 3251:1993)

ISO 2811-1, *Paints and varnishes - Determination of density - Part 1: Pyknometer method*

<https://standards.iteh.ai/catalog/standards/sist/8ec3433c-0d4d-40e9-bb7d-356a1201356a/iso-2811-1-2000>

ISO 2811-2, *Paints and varnishes - Determination of density - Part 2: Immersed body (plummet) method*

ISO 2811-3, *Paints and varnishes - Determination of density - Part 3: Oscillation method*

ISO 2811-4, *Paints and varnishes - Determination of density - Part 4: Pressure cup method*

ISO 2884, *Paints and varnishes - Determination of viscosity using rotary viscometer*

ISO 9944, *Plastics; phenolic resins; determination of electrical conductivity of resins extracts*

3 Terms and definitions

For the purposes of this standard, the terms and definitions given in EN 971-1 apply. For the purposes of this standard, the following terms and definitions also apply:

3.1

application time

time during which coating material is applied to the test sheet during the transfer efficiency test

3.2

atomising and spraying equipment

any type of device which can be used to atomise coating materials. Atomising may be achieved by air, hydromechanically (airless) with or without air assistance, or by centrifugal forces such as rotating bells or discs, as defined in EN 1953

3.3

background panel

rigid plate placed behind the test sheet to support it and enable a flat surface to be obtained

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- 3.4 coating material**
liquid product, pigmented or non pigmented, applied to a substrate, as defined in EN 971-1
- 3.5 coating film**
film possessing protective, decorative and/or other specific properties on a substrate, as defined in EN 971-1
- 3.6 solid content**
non volatile portion of a coating material, as defined in EN 971-1
- 3.7 spray pattern**
visual pattern width of the coating deposit on a vertical panel
- 3.8 stroke speed**
velocity of spray pattern traverse across the face of the test sheet. This is equivalent to the velocity of travel of the atomiser relative to the test sheet. Either the atomiser or the test sheet can be moved
- 3.9 test rig**
structure for supporting the background panel and maintaining the atomiser - test sheet distance constant

- 3.10 test sheet**
flat sheet of aluminium foil to which coating material is applied for the determination of the transfer efficiency

- 3.11 test method 1**
indirect method in which the mass of coating material delivered by the atomiser is determined from the fluid flow volume. It can be done by measurement with a fluid flow meter or by calculation from gravimetric measurement. The atomiser spray pattern is fully developed before it reaches the edge of the test sheet and is maintained constant over the test width
- 3.12 test method 2**
direct method in which the mass of coating material delivered by the atomiser within the test sheet dimensions, is determined gravimetrically (by weighing). The atomiser is triggered on and off within the test sheet dimensions
- 3.13 transfer efficiency**
defined as the ratio of the mass of coating material solids deposited on an object to the mass of coating material solids atomised, expressed as a percentage

4 Principle of test

The transfer efficiency of atomising and spraying equipment is determined by measuring directly or indirectly the mass of coating material solids delivered by the atomiser and the mass of dry coating material deposited on the test sheet.

5 Test procedure

The test procedure defines the steps to be carried out in the determination and the conditions under which the test is conducted as well as the minimum reporting requirements.

A transfer efficiency determination for a particular atomiser consists of at least three independent and consecutive tests of the transfer efficiency under the same conditions.

The atomiser transfer efficiency, under the prevailing conditions, is reported as the mean of the values obtained. If an individual test result differs from the mean value by more than +/- 1% the cause of the variation should be investigated and the determination repeated.

Step	Action	Reference
1	Record details of atomising and spraying equipment to be tested.	Use the form structure in annex C for recording data.
2	Record details of coating material to be used for transfer efficiency test.	see 6.2.1
3	Sample coating material for the test, thin and/or mix according to coating material manufacturer specification. Record preparation details.	see 6.2.2
4	Determine and record coating material solids content, viscosity and density.	see 6.2.2
5	Set up the test rig to configure the atomiser, panel and sheet.	see 6.4
6	Set atomising and spraying equipment to required settings.	see 6.5.2
7	Determine and record atomising and spraying equipment dynamic parameters and coating material characteristics. Measure the coating material flow rate and spray characteristics. Record coating material and air flow rate, atomiser stroke or test sheet traverse speed, to obtain required film thickness and the minimum/maximum dimensions of the spray pattern.	see 6.5, 6.6 and 6.7.
8	Clean, dry and weigh the test sheets. Indelibly label test sheets and record identification numbers and weights.	see 6.3
9	Measure and record test environmental conditions.	see 6.1
10	Re-determine coating properties (as necessary).	
11	Clean atomising and spraying equipment. Charge with coating material and measure coating material temperature. Set equipment parameters and mount in the test rig.	
11a	Method 1: Determine fluid flow rate	see 6.5.3
11b	Method 2: Measure and record initial weight of atomiser and coating material.	see 6.10
12	Mount test sheet on background panel and assemble in the test rig.	see 6.3 and 6.4
13	Apply coating material to the test sheet. Record coating material temperature, application period for each test sheet and the distance between fluid outlet and test sheet.	see 6.6
14	Remove the test sheet from the background panel taking care to avoid loss of coating material.	
15	Dry/stove the applied coating film. Record drying/curing temperature and time.	see 6.8
16	Allow the test sheet to cool to ambient temperature under clean dry conditions. Weigh the dry coated test sheet and record weight. The mass of deposited solids is the difference in the weights of the coated and uncoated test sheet.	
17a	Method 1: Check coating material flow rate	see 6.5.3
17b	Method 2: Weigh atomising and spraying equipment.	see 6.10

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	Record the weight.	
18	Check spray pattern uniformity. Record observations and film thickness.	
19	Repeat steps 11 to 16 twice.	
20	Re-measure test environmental conditions and atomiser settings. Record variations from initial conditions. Repeat test if conditions are outside parameter tolerance.	
21	Measure and record properties of coating used for the test. Repeat test if conditions are outside parameter tolerance.	
22	Calculate transfer efficiency for each test.	see clause 7 and annex B.
23	Prepare test report.	see annex C.

6 Test and measurement methods

6.1 Test environment

The transfer efficiency determination shall be made with temperature and relative humidity measured and recorded, observing any coating material manufacturer recommendations.

All materials and equipment used shall be equilibrated at the test conditions.

The following internal spray booth conditions shall be measured and recorded in the test report.

- air temperature,
- barometric pressure,
- relative humidity,
- air velocity and direction measured halfway along the axis of the atomiser fluid flow between the atomiser and test sheet.

6.2 Determination of coating material physical properties

6.2.1 Manufacturers data

The details of the coating material used in the test shall be recorded in the test report, such as, but not limited to:

- manufacturer / supplier,
- function (e.g. primer, basecoat, clearcoat etc.),
- type (e.g. 1-k, 2-k, UV-lacquer etc.),
- suppliers description, code number, batch number, colour;
- at multi-component lacquer additional mixing ratio and pot life.

6.2.2 Measured data

All properties identified in the following clauses shall be reported in the test report.

6.2.2.1 General

Samples of the coating material to be used for transfer efficiency testing shall be obtained and prepared in the manner set out in EN ISO 1513 and EN 21512.

6.2.2.2 Preparation and mixing

The coating material used in the test shall be prepared and mixed in the manner specified by the coating material manufacturer. All test coating materials shall be stored in sealed containers. The coating material(s) shall be well mixed and equilibrated at the ambient temperature specified in 6.1.

The age of a mixed multi-component coating material used for the test purpose shall not exceed 50% of the shelf life.

6.2.2.3 Solid content

The solid content of the coating material shall be determined according to EN ISO 3251, using test conditions as appropriate for the coating material under test.

A coating material manufacturers stoving (drying) schedule is permitted where the EN ISO 3251 temperature/time is inappropriate. Where a coating material manufacturer's schedule is used this shall be recorded in the test report.

6.2.2.4 Coating density, where applicable

Coating material density shall be determined according to ISO 2811.

6.2.2.5 Coating viscosity, where applicable

Coating material viscosity shall be determined according to EN ISO 2431 (flow cup), ISO 2884 (cone and plate) or EN ISO 3219 (rotary viscometer).

6.2.2.6 Coating material conductivity / resistivity, where applicable

The coating material conductivity / resistivity is to be determined according to ISO 9944.

6.3 Test sheet and background panel

6.3.1 Dimensions and preparation

The test sheet is a piece of aluminium foil (proposed thickness gauge 25 to 50 μm). The length l of the test sheet shall be at least 1.5 times the spray fan pattern with the atomiser to test sheet distance set at the manufacturer's recommendation.

The test sheet shall be free of grease, oil, moisture and dirt. Cleaning can be achieved by methods, such as, but not limited to, solvent wipe or tack rag, ultrasonic wash bath or thermal treatment. The test sheet shall be equilibrated at the test temperature before conducting the test.

Method 1:

The minimum dimensions of the test sheet are 400 mm x 1200 mm (width b x length l). The width B of the background panel shall be 1600 mm minimum longer than the test sheet and in minimum the same length L as the test sheet.

Method 2:

The minimum dimensions of the test sheet are 800 mm x 300 mm (width b x length l). The background panel shall have the same size as the test sheet.