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Papir, karton in lepenka - Laboratorijska preskusna metoda za oceno sposobnosti recikliranja materialov in izdelkov iz papirja, kartona in lepenke - 2. del: Flotacijski deinking postopek recikliranja pri odstranjevanju tiskarske barve

Paper and board - Laboratory test method for recyclability assessment of paper and board-based materials and products - Part 2: Flotation-deinking recycling process

Papier und Pappe - Laborprüfverfahren zur Bewertung der Rezyklierbarkeit von Materialien und Produkten auf der Basis von Papier und Pappe – Teil 2: Flotations-Entfärbungs-Recyclingverfahren

Papier et carton - Méthode d'essai en laboratoire pour l'évaluation de la recyclabilité des matériaux et produits à base de papier et carton - Partie 2 : Procédé de recyclage avec désencrage par flottation

Ta slovenski standard je istoveten z: **CEN/TS 18345-2:2026**

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85.020	Postopki v proizvodnji papirja	Paper production processes

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Papier et carton - Méthode d'essai en laboratoire pour l'évaluation de la recyclabilité des matériaux et produits à base de papier et carton - Partie 2 : Procédé de recyclage avec désencrage par flottation

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European foreword

This document (CEN/TS 18345-2:2026) has been prepared by Technical Committee CEN/TC 172 “Pulp, paper and board”, the secretariat of which is held by DIN.

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Introduction

The paper and paper board value chain is an example for circularity, displaying very high recycling rates.

Moreover, technical innovation is creating new products from paper and board-based materials which are aimed to become papers and boards for recycling after their use.

To maintain and further increase the sustainability and circularity of the paper and board value chain and to help EU Member States and other European countries meet high recycling targets[1], it is important to ensure that paper and board-based products are recyclable by the paper industry. A laboratory test method is needed for assessing the technical recyclability of these materials and products.

The test method in this document emulates the most common phases of the industrial processes to measure the main parameters of recyclability of paper and board-based products based on current knowledge and technology.

This makes it possible to:

— supplement the evaluation of recyclability required by EN 13430 with regard to paper and board-based products that are sent for recycling in the paper industry;

— guide eco-design, in terms of recyclability, of paper and board-based products currently in use, as well as new materials under development and new additives that can affect the recyclability of the final product;

— support declarations related to the recyclability of materials or products based on grading systems developed by third-party organizations and regulation.

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[1] Directives 2018/851/EU, 2018/852/EU set high recycling targets for municipal waste and paper-based packaging (85% by 2025, 90% by 2030).

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1 Scope

This document describes a laboratory test method for determining the key parameters for evaluating the level of technical recyclability of a paper-based material and product using a white or off-white substrate, emulating the relevant phases of paper and board mills with alkaline flotation deinking recycling process.

The assessment of the technical recyclability is out of the scope of this document.

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 ISO 187, *Paper, board and pulps — Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples (ISO 187)*

EN ISO 638-1:2022, *Paper, board, pulps and cellulosic nanomaterials — Determination of dry matter content by oven-drying method — Part 1: Materials in solid form (ISO 638-1:2022)*

EN ISO 5269-2, *Pulps — Preparation of laboratory sheets for physical testing — Part 2: Rapid-Köthen method (ISO 5269-2)*

ISO 1762, *Paper, board, pulps and cellulose nanomaterials — Determination of residue (ash content) on ignition at 525 °C*

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ISO 2469:2024, *Paper, board and pulps — Measurement of diffuse radiance factor (diffuse reflectance factor)*

ISO 2470-1, *Paper, board and pulps — Measurement of diffuse blue reflectance factor – Part 1: Indoor daylight conditions (ISO brightness)*

ISO 3310-1, *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth*

ISO 4119:1995, *Pulps — Determination of stock concentration*

ISO 5631-1, *Paper and board — Determination of colour by diffuse reflectance — Part 1: Indoor daylight conditions (C/2°)*

ISO 5815-1, *Water quality — Determination of biochemical oxygen demand after n days (BODn) Part 1: Dilution and seeding method with allylthiourea addition*

ISO 12641-1:2025, *Graphic technology — Prepress digital data exchange —Part 1: Colour targets for input scanner calibration*

ISO 13130, *Laboratory glassware — Desiccators*

ISO 14487, *Pulps — Standard water for physical testing*

ISO 15705, *Water quality — Determination of the chemical oxygen demand index (ST-COD) — Small-scale sealed tube method*

TAPPI/ANSI T275, *Screening of pulp (Somerville-type equipment)*

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3 Terms and definitions

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

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

— ISO Online browsing platform: available at https://www.iso.org/obp/

— IEC Electropedia: available at https://www.electropedia.org/

3.1
paper
generic term for a range of materials in the form of a coherent sheet or web, excluding sheets or laps of pulp as commonly understood for paper making or dissolving purposes and non-woven products, made by deposition of vegetable, mineral, animal or synthetic fibres, or their mixtures, from a fluid suspension onto a suitable forming device, with or without the addition of other substances

Note 1 to entry: Papers may be coated, impregnated or otherwise converted, during or after their manufacture, without necessarily losing their identity as paper. In conventional papermaking processes, the fluid medium is water; new developments, however, include the use of air and other fluids.

Note 2 to entry: In the generic sense, the term “paper” may be used to describe both paper and board as defined in this part of ISO 4046. The primary distinction between paper and board is normally based upon thickness or grammage, though in some instances the distinction will be based on the characteristics and/or end-use. For example, some materials of lower grammage, such as certain grades of folding boxboard and corrugating raw materials, are generally referred to as “board”, while other materials of higher grammage, such as certain grades of blotting paper, felt paper and drawing paper, are generally referred to as “paper”.

[SOURCE: ISO 4046-3:2016, 3.95]

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3.2
board
cardboard
paperboard
generic term applied to certain types of paper frequently characterized by their relatively high rigidity

Note 1 to entry: In the generic sense, the term “paper” may be used to describe both paper and board as defined in this part of ISO 4046. The primary distinction between paper and board is normally based upon thickness or grammage, though in some instances the distinction will be based on the characteristics and/or end-use. For example, some materials of lower grammage, such as certain grades of folding boxboard and corrugating raw materials, are generally referred to as “board”, while other materials of higher grammage, such as certain grades of blotting paper, felt paper and drawing paper, are generally referred to as “paper”.

[SOURCE: ISO 4046-3:2016, 3.16]

3.3
paper-based product
article, predominantly consisting of paper or board

Note 1 to entry: Moulded products are included.

3.4
deinking
process of ink removal from pulp during the recycling process

[SOURCE: ISO/TS 21331:2020, 3.2.2]

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3.5
flotation
process step intended to selectively remove ink particles from recycled pulp

Note 1 to entry: Air is injected into diluted pulp, intended to carry ink particles to the surface of the pulp and to form a froth there.

3.6
recyclability
ability of a paper or board product to be recycled into new paper and board

3.7
deinked pulp
pulp obtained from printed paper products, and deinked according to this document

[SOURCE: ISO 21993:2020]

3.8
undeinked pulp
pulp obtained from printed paper products, pulped with added deinking chemicals according to this document, prior to flotation

[SOURCE: ISO 21993:2020, 3.2]

3.9
stock concentration
ratio of the oven-dry organic and inorganic mass of material that can be filtered from a stock sample, to the mass of the unfiltered sample

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Note 1 to entry: the stock concentration is expressed as a percentage by mass [% (m/m)].

[SOURCE: ISO 4119:1995, 3.2]

3.10
fibre concentration
ratio of the oven-dry mass of organic material, that can be filtered from a stock sample, to the mass of the unfiltered sample

Note 1 to entry: Organic material is the total material, less its ash.

Note 2 to entry: The organic material mainly consists of cellulosic fibres and fines.

[SOURCE: ISO 21993:2020, 3.4]

3.11
fibre yield
ratio of the oven-dry mass of organic material after flotation to the oven-dry mass of organic material before flotation

Note 1 to entry: Organic material is the total material, less its ash.

Note 2 to entry: The organic material mainly consists of cellulosic fibres and fines.

[SOURCE: ISO 21993:2020, 3.5]

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3.12
non-fibrous coarse-screenable material
non-fibrous part of the sample which can be removed in the coarse sreening

Note to entry: The removal into the coarse reject is determined in batch 1.

3.13
constant mass
mass of the test piece determined at the equilibrium condition after drying until the difference between two successive dryings and weighings, separated in time by at least half the initial drying period, does not exceed 0,1 % mass fraction of the test piece before drying

[SOURCE: EN ISO 638-1:2022, 3.2]

Note 1 to entry: The removal into the coarse reject is determined in batch 1.

3.14
paper recycling process with flotation deinking
type of process that typically takes in paper for recycling which is based on white or off-white paper and board, and removes ink by flotation deinking

3.15
oven-dry mass
mass obtained on drying pulp at 105 °C ± 2 °C, until constant mass is reached

[SOURCE: ISO 801-3:1994, 3.5]

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3.16
constituents
part from which a material or its components are made and which cannot be separated by hand or by using simple physical means

[SOURCE: ISO 18601:2013, 3.12 - modified by deleting “packaging” from the term and “packaging constituent” and by replacing “packaging” by “material” in the definition]

3.17
technical recyclability
ability of a paper and board product to be recycled into new paper and board by means of an established recycling process

Note 1 to entry: The assessment of the technical recyclability is typically done by mimicking the recycling process by a suitable laboratory method and an appropriate assessment scheme.

Note 2 to entry: The term recyclability can also mean recyclability at scale.

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4 Principle

The method defined in this document enables analysis of both the process parameters (coarse reject, fine reject, luminance gain within the flotation, filtrate darkening, dissolved, and colloidal substances) and quality parameters of the pulp obtained from the processing of the paper-based product (luminance and a* value of deinked pulp, dirt specks area of deinked pulp, sheet adhesion and interfering materials e.g. stickies). Two subsequent repulping batches are required: the first batch is used to determine dissolved and colloidal substances, Chemical Oxygen Demand (COD), the coarse screening and the fine-screening reject amount as well as an assessment of the adhesives. The second batch is to ascertain the flotation-deinking criteria.

For the repulping for the deinking test the amount of non-fibrous coarse-screenable material that can be removed in coarse screening needs to be considered for the second batch calculations (i.e. to adjust chemical dosages and fibre concentration). The recyclability of paper-based products, introduced in the flotation deinking stream, is determined through a laboratory procedure emulating the relevant industrial phases in typical alkaline flotation-deinking mills dedicated to the recycling of paper and board.

5 Apparatus

The usual apparatus and, in particular, the following shall be used:

5.1 Forced air oven, able to maintain the required temperatures (60 °C, 105 °C and 130°C) with accuracy of ±2 °C.

5.2 pH meter.

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5.3 Analytical balance, up to 50 g with an accuracy of at least ±0,001 g.

5.4 Filter paper grade 388, with diameter of 150 mm (basis weight 84 g/m^2, filtration speed 10 s/10 ml, deposition range 12 µm to 15 µm).

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5.5 Büchner funnel, diameter 125 mm and 150 mm equipped with suction flask.

5.6 Aluminium trays, for the determination of the evaporation residue.

5.7 Refrigerator (optional), to store the filtrate.

5.8 Somerville-fractionator, compliant with TAPPI/ANSI T275.

5.9 Perforated screen plate, with 5 mm hole diameter (for details see Annex A).

5.10 Sample containers, beakers, buckets or barrels.

5.11 Filter paper grade 388, with a diameter of 125 mm (basis weight 84 g/m^2, filtration speed 10 s/10 ml, deposition range 12 µm to 15 µm).

5.12 Stopwatch/timer.

5.13 Thickener, as described in Annex B, with a test sieve compliant to ISO 3310-1.

5.14 Rapid Köthen sheet former, compliant with EN ISO 5269-2.

5.15 Carrier boards and cover sheets, compliant with EN ISO 5269-2.

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5.16 Metal plates (brass or steel), for adhesiveness test, weighing (3,7 ± 0,1) kg and with a diameter of 20 cm (corresponding to a pressure of 1 180 Pa).

5.17 Desiccator, compliant with ISO 13130.

The desiccator should be filled with desiccant to such an extent that there is at least a 10 mm gap between the desiccant and the perforated plate, sieve or grid. The use of a drying cabinet is possible, but ensure that the results are the same.

The temperature and relative humidity in the desiccator shall be measured regularly before and after each test with a suitable measuring device. Each laboratory should maintain a constant value, otherwise the desiccant shall be regenerated.

No specific value is set for the temperature and relative humidity. The values are rather for checking the correct functioning of the desiccator and the desiccant and should be recorded and checked regularly before, during and after each test.

5.18 LED light box, with a recommended LED light source of 5 500 K to 6 500 K (daylight range) and illuminance of at least 5 000 lx.

5.19 Glass bottle (optional), to store the filtrate.

5.20 Cutting mat, for photo documentation.

5.21 Balance, up to 2 kg with an accuracy of at least ±0,1 g.

5.22 Balance, up to 30 kg with an accuracy of ±5 g.

5.23 Digital thermometer, with an accuracy of ±0,1 °C.

5.24 Vacuum device, with a pressure difference ≥ 60 000 Pa.

5.25 Vacuum filtration unit, with 39 mm bottom inner diameter of the funnel.

5.26 Couching roller, compliant with EN ISO 5269-2.

5.27 Slotted screen plate, with 0,15 mm wide slots (for details see TAPPI/ANSI T275).

5.28 Filter paper grade 1289, Grammage of (84 ± 4) g/m², filtration time for deionized water (20 ± 4) s, tested according to Annex C and wet burst strength > 30 kPa according to ISO 3689. The definition of the filter paper is much stricter than in ISO 3688, because the filtrate is used for further analysis (filtrate darkening). For example, the filter paper Ahlstrom Munktell 12891[2] meets these requirements.

5.29 Muffle furnance, according to ISO 1762.

5.30 Crucible with lid, for determination of residue (ash content) on ignition at 525 °C.

5.31 Laboratory repulping device, capable of repulping about 200 g to 500 g of paper products under the conditions set in 8.2.1 and 8.3.1. Examples of suitable devices and operating conditions are listed in Annex D.

[2] Ahlstrom Munktell 12891 is a commercially available product. This information is given for the convenience of users of this document and does not constitute an endorsement by CEN of the product named. Equivalent products may be used if they can be shown to lead to the same results.

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5.32 Flatbed scanner or camera, a) Optical scan resolution ≥ 600 dpi, equivalent to a pixel size of ≤ 42 µm; b) Colour depth 24 bit; c) Optical density, DMAX ≥ 4,0; d) with the IT8 calibration (*.ICM-File) according to ISO 12641-1 (see also Annex E IT8 7.2 calibration) and reach a mean grey value of (115 ± 2) for all fields of the IT8 colour calibration sheet according to Annex E.

5.33 Image analysis software, according to Annex E.

5.34 Colour measuring device, according to ISO 2469.

5.35 Flotation cells, according to Annex J.

5.36 COD cuvette tests, (e.g. ranges 15 mg/l to 150 mg/l O_2 and 150 mg/l to 1 000 mg/l O_2).

5.37 Variable pipette, 1 000 µl to 5 000 µl.

5.38 Cuvette rack.

5.39 Cuvette heating block.

5.40 Photometer measuring device, for Chemical Oxygen Demand (COD) and Biological Oxygen Demand (BOD) measurement.

5.41 BOD5 Bio kit, for preparation of the dilution water.

6 Chemicals

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The following reagents shall be used.

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6.1 Water, distilled or deionized, according to ISO 14487.

6.2 Calcium chloride dihydrate ($CaCl_2 \cdot 2\ H_2O$), CAS Registry Number®[3]: 10035-04-8.

6.3 Sodium hydroxide (NaOH), pro analysis, CAS Registry Number®: 1310-73-2.

6.4 Sodium silicate, 1,3 g/cm³ to 1,4 g/cm³ (38 °Bé to 40 °Bé).

6.5 Hydrogen peroxide (H_2O_2), e.g. 35 %.

6.6 Oleic acid ($C_{18}H_{34}O_2$) purified, CAS Registry Number®: 112-80-1, with the following specifications:

a) acid number: 198 to 240;

b) iodine number: 92 to 100;

c) linoleic acid (C18:2): max. 18 %;

d) oleic acid (C18:1): min. 72 %;

e) palmitic acid (C16:0): max. 8 %;

[3] CAS Registry Number® (CAS RN®) is a trademark American Chemical Society (ACS). This information is given for the convenience of users of this document and does not constitute an endorsement by CEN of the product named. Equivalent products may be used if they can be shown to lead to the same results.

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