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EUROPEAN PRESTANDARD

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Descriptors: paper, printing paper, photocopying, tests, inks, determination, adhesion

English version

**Paper - Printing and business paper -
Determination of toner adhesion**

Papier - Papier d'impression et de bureau -
Détermination de l'adhésion du toner

Papier - Druck- und Büropapiere - Bestimmung
der Tonerhaftung

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MINISTRSTVO ZA ZNANOST IN TEHNOLOGIJO
Urad RS za standardizacijo in meroslovje
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This European Prestandard (ENV) was approved by CEN on 1996-10-05 as a prospective standard for provisional application. The period of validity of this ENV is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the ENV can be converted into an European Standard (EN).

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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Foreword

This European Prestandard has been prepared by Technical Committee CEN/TC 172 "Pulp, paper and board", the secretariat of which is held by DIN.

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to announce this European Prestandard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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Introduction

Toner adhesion is an important print quality factor and depends on paper properties as well as machine characteristics. A quick qualitative impression can be obtained by folding a fully toned image area and inspecting for a loss of toner. Another test method is to press adhesive tape on to such an image, slowly separate the adhesive tape from the print and examine the detached toner.

Although both these simple test methods can well be used for qualitative ranking purposes, they do not produce consistent scaleable data. When developing this European Prestandard, it was found that the IGT method gives accurately the same ranking order for toner adhesion as the other two test methods. In addition the IGT method can be calibrated to deliver reproducible quantitative results by independent laboratories.

The calibration is checked by running a reference sample of a particularly selected paper in parallel with each batch of samples under test.

Customers' needs for toner adhesion vary in practice and may require an agreement between customer and supplier.

This European Prestandard describes an average quality level of toner adhesion, useful in many routine situations, by using the IGT method at a constant speed.

The responsible working group has recognised that this test method will not be decisive for high demands on toner adhesion. For this purpose, and maybe even for the full practical range of toner adhesion levels, the variable speed IGT method might be applicable. The responsible working group will acquire more data on the variable speed method and then decide to add or even replace the now described constant speed method.

1 Scope

This European Prestandard specifies the determination of dry toner adhesion to paper. It applies to papers manufactured for imaging machines using dry toner, such as copiers and laser printers.

2 Normative References

This European Prestandard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the 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 this European Prestandard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 20187

Paper, board and pulps – Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples (ISO 187 : 1990)

EN 20216

Writing paper and certain classes of printed matter – Trimmed sizes – A and B series (ISO 216 : 1975)

ISO 3783

Paper and board – Determination of resistance to picking – Accelerating speed method using the IGT tester (Electric model)

3 Definitions

For the purposes of this Prestandard the following definitions apply:

3.1 dry toner imaging process: Imaging method using dry toner, that is generally fixed on paper by heat and/or pressure.

3.2 dry toner: Ink powder used for imaging in printers and copiers.

3.3 toner adhesion: Property that measures the bonding strength of a toner image to paper.

NOTE: Toner adhesion is dimensionless.

4 Principle

Creation of black test areas on the paper with a copier machine using dry toner. Subjecting the printed black areas to picking test in the IGT tester.

Measurement of the optical density of the printed black areas, before and after the test (see clause 8).

5 Apparatus and materials

5.1 Imaging machine

Any commercial machine using dry toner imaging process and in good working order as specified by the manufacturer.

5.2 Toner

Use the toner recommended by the manufacturer of the machine.

5.3 Image to be printed

In accordance with EN 20216 an A4 format original carrying two heavy solid black stripes, 30 mm wide and parallel to the longer side of the sheet, or the equivalent maximum density digital image.

5.4 IGT tester

An IGT tester as described in ISO 3783 with the following modifications:

- the printing force is adjusted to 800 N;
- the printing disc is 20 mm wide;
- the speed is kept constant at 0,4 m/s.

5.5 Picking oil

Use medium viscosity oil as defined in ISO 3783.

5.6 Optical densitometer

No filter is required and no extra-calibration needed.

5.7 Reference sample

A test piece of paper intended for use with imaging machines (5.1) is extracted from the paper making machine taking particular care to ensure maximum uniformity. The sheets shall be cut from consecutive rolls and taken from the same cross direction deckle position.

6 Conditioning

Condition the test pieces in accordance with EN 20187.

Keep them in this standard atmosphere 23/50 throughout the test. Allow the test pieces to condition for at least 8 h.

7 Procedure

7.1 Preparation of test pieces

Arrange the sheets to be tested in a stack so that they will be fed through the imaging machine in the following order:

- 10 sheets of any paper - to be discarded;
- 5 sheets of the reference sample, side 1 up;
- 5 sheets of sample 1, side 1 up;
- 5 sheets of sample 1, side 2 up;
- 5 sheets of sample 2, side 1 up;
- 5 sheets of sample 2, side 2 up;
- 5 sheets of sample n, side 1 up;
- 5 sheets of sample n, side 2 up;
- 5 sheets of the reference sample, side 1 up.

The maximum number of sheets that can be tested in one stack is limited by the requirement that the whole stack has to pass through the imaging machine in 2 min or less.

Operate the imaging machine (5.1) as instructed by the manufacturer. Check that the imaging machine has reached working conditions before continuing as described below.

Run blank sheets (without the image to be printed, 5.3) for 2 min to achieve constant conditions.

Run the stack, using the image to be printed (5.3).

If more than one stack shall be tested, run blank sheets again for 2 min before running the next stack.

From each copy, cut specimens, 35 mm wide. The specimens shall include the whole area of one printed black strip.

NOTE: Since A4 sheets are used, the length of each specimen is 197 mm. The paper is tested in the direction of the longer side, which commonly is the machine direction.

Keep the rest of the test piece to measure $D_{\text{solid black}}$ (8).

7.2 Picking test

Test one specimen from each copy, using the IGT tester (5.4).

Test as specified in ISO 3783, but observe the particular settings prescribed above in 5.4. Use medium viscosity oil (5.5).

Leave the tested specimens until the next day.

7.3 Determination of optical density

With an optical densitometer (5.6), measure the optical density on the printed black area of each specimen. Make the measurement at least 50 mm from either end of the specimen.

Take 5 readings from the center line of each specimen and calculate the mean.

8 Calculation

Calculate separately for each copy the toner adhesion T from the equation (1).

$$T = \frac{D_{IGT}}{D_{\text{solid black}}} \quad (1)$$

where

D_{IGT} is the mean optical density of the specimen tested in the IGT tester;

$D_{\text{solid black}}$ is the mean optical density of the test strip from the same copy that has not been subjected to the picking test.

NOTE 1: For papers with very good toner adhesion the value T can exceed unity. This is due to the fact that the printing oil can increase the optical density of the black area if no picking of toner occurs.

Examine the results so obtained and calculate the mean and standard deviation for each test piece. If both sides of the paper have been tested, calculate the results separately.

NOTE 2: For the calculation of the optical density the following equation is used:

$$D = \log \left(\frac{R_{\infty}}{R_{\infty p}} \right) \quad (2)$$

R_{∞} is the reflectance factor on the unprinted paper measured with paper backing;

$R_{\infty p}$ is the reflectance factor on the printed area (p) of paper measured with paper backing.

9 Precision

9.1 Repeatability

Seven test pieces of different origin were tested 5 times each using two different copying machines. The coefficient of variation ranged from 5 % to 15 %.