



Paper and board

Test printing

using a Prüfbau-type printability tester

0 Introduction

This SCAN-test Method describes the procedure to be adopted when using a Prüfbau-type printability tester to prepare prints on papers and boards with the exception of newsprint which is dealt with separately in SCAN-P 79.

A parallel method, SCAN-P 86, describes the procedure to be adopted when an IGT-type printability tester is used.

1 Scope

This Method specifies a procedure for test printing of papers and boards. Test prints prepared in accordance with this method can be evaluated according to SCAN-P 36.

Warning – Precaution shall be taken when making a comparison between printing results from different laboratories or from different printability testers, see Clause 10 *Precision*.

2 References

- ISO 2469 Paper, board and pulps – Measurement of diffuse reflectance factor + Corr. 1:1998
- ISO 187 Paper, board and pulps – Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples (EN 20187)

ISO 2471 Paper and board – Determination of opacity (paper backing) – Diffuse reflectance method

SCAN-P 9 Paper and board – Identification of machine and cross direction

SCAN-P 10 Paper and board – Identification of wire side

SCAN-P 36 Paper and board – Evaluation of test prints

Note – SCAN-test has withdrawn a number of test methods and refers instead to the corresponding ISO and/or EN Standards.

3 Definitions

For the purpose of this Method the following definitions apply:

3.1 *Print density, D* – The logarithm to base 10 of the ratio of the Y-value of the unprinted paper to the luminous reflectance factor of the print when it is placed over a pad of the unprinted paper.

3.2 *Set-off, SO* – A measure of the tendency for ink from a newly printed surface to be transferred to another surface with which the print is brought into contact under the action of a normal force without shear. The set-off is evaluated as the logarithm to base 10 of the ratio of the Y-value of the recipient surface to the luminous reflectance factor of the area stained by ink

transfer when the stained paper is placed over a pad of the recipient paper.

Note – The recipient paper may be a standard paper or a sheet of the paper being tested.

Other print quality definitions are given in SCAN-P 36.

4 Principle

A cylindrical printing form consisting of an offset rubber blanket on a light-weight metal disc is inked in an inking unit. The paper or board to be printed is mounted on a flat test-piece carrier covered with an offset rubber blanket. The ink is transferred to the paper under standardised conditions and the amount of ink transferred to the paper is determined by weighing the printing disc before and after printing.

If set-off is to be determined, the fresh print is brought into contact with a clean recipient paper in a second printing unit under normal pressure without shear a short time after the printing.

5 Apparatus

5.1 *Printability tester* with two adjustable printing units, and an inking unit.

5.1.1 *Inking unit* to give a uniform ink film on the printing disc.

5.1.2 *Printing units*, each consisting of a motor-driven shaft on which a printing disc can be fitted, and beneath which a test piece mounted on a special carrier can travel on a horizontal table. The test-piece carrier is driven through the printing nip at a constant speed synchronised with the printing disc. The printing units are adjustable with respect to the pressure in the nip and the speed. The tester shall be fitted with a device which stops the test-piece carrier before it enters the second printing unit, for a period of time which is measured from the moment when the front edge of the printed surface passes the first nip. The delay time between the two units is also adjustable.

5.1.3 *Cylindrical printing discs covered with a strip of an incompressible offset rubber blanket* with a hardness between 75 Shore A and 85 Shore A. The discs are 64 mm in diameter and 40 mm wide, made of light-weight metal. The discs must be dynamically balanced and light enough to be weighed on a normal analytical balance with a precision of 0,1 mg.

Note 1 – The exact diameter determines the pressure in the printing nip, and the rubber covering should not be changed without consulting the manufacturer.

Note 2 – The rubber deteriorates with use and with time, and the discs should be kept in the dark at room temperature. The covering should be changed at regular intervals as recommended by the manufacturer.

5.1.4 *Cylindrical printing discs without any covering for set-off determination*. The discs are 64 mm in diameter and 40 mm wide, made of light-weight metal.

5.1.5 *Test piece carriers* covered with a strip of an incompressible offset rubber blanket, with an indication of the thickness of the paper for which they may be used.

Note 3 – Information concerning the relationship between rubber properties and test piece thickness is available from the manufacturer.

5.2 *Analytical balance* with an accuracy of 0,1 mg.

5.3 *Ink pipette*, or other suitable device for transferring an appropriate amount of ink to the inking device.

5.4 *Printing ink*. A black lithographic offset ink of a grade chosen by agreement between parties concerned or according to current laboratory practice.

Note 4 – The continuing development in ink technology means that it is impossible to standardize a single ink for use over a long period.

5.5 *Solvent for cleaning purposes*. Petroleum ether alone or white spirit followed by petroleum ether is suitable.

Note 5 – Cleaning liquids containing surfactants or non-volatile components should not be used.

5.6 *Set-off paper*, either a cast-coated paper or a further supply of the paper being tested.

Note 6 – The grammage must be less than 100 g/m², since this affects the pressure in the nip.

Note 7 – A suitable cast-coated "Chromolux" paper is manufactured by Zanders and is available through their agents.

6 Sampling and preparation of test pieces

The sampling procedure is not covered by this Method. Make sure that the samples taken are representative of the sample received.

Condition the sample as described in ISO 187 and keep it in the conditioned atmosphere throughout the test.

Note 1 – Because the viscosity of the ink is temperature-dependent, temperature control is as important for this test as humidity control.

Cut test pieces with dimensions suitable for the test-piece carrier. Normally, the test-piece strips should be cut in the machine direction (see SCAN-P 9) to simulate web offset printing and in the cross direction to simulate sheet-fed offset. The direction of printing must be stated in the report. The pieces should be free from folds and wrinkles. Mark the side to be printed.

Note 2 – For subsequent evaluation according to SCAN-P 36, at least five strips are required for printing and a further five for set-off evaluation.

7 Procedure

7.1 Test conditions

7.1.1 *Temperature.* Make sure that the test equipment, inking unit and printing disc are maintained at the correct temperature ($23 \pm 0,5$) °C.

7.1.2 *Printing disc.* Select a printing disc with a rubber surface (5.1.3).

Note 1 – Several printing discs are normally required, to give adequate time (approx. 20 min) for drying after cleaning.

7.1.3 *Inking the printing disc.* Introduce ink into the inking unit, and ink the printing disc (7.1.2) in accordance with the manufacturer's instructions.

7.1.4 *Printing pressure.* Set the printing force to 600 N for a 40 mm wide printing disc to give a line load under dynamic conditions of (15 ± 1) kN/m.

7.1.5 *Printing speed.* Adjust the printing speed to 1,0 m/s.

Note 2 – If there is a risk that picking will occur, a lower speed, e.g. 0,5 m/s, may be chosen. This must be stated in the report.

7.1.6 *Delay time.* If set-off is to be measured, adjust the delay time to a suitable level to provide meaningful data for the paper concerned.

Note 3 – Different times may be necessary for different materials.

7.2 Test procedure

7.2.1 *Test piece carrier.* Select a suitable test-piece carrier (5.1.5), taking into account the thickness of the test pieces.

7.2.2 *Printing.* Fasten the test piece to the test piece carrier (5.1.5). Make sure that the test piece is flat. Weigh the inked printing disc (7.1.3) and place it in position on the shaft. Place the test piece on its carrier in the channel. Start the printing unit. Wait until the correct speed has been reached. Introduce the test piece carrier into the nip of the first printing unit so that it passes automatically through the nip. Remove the printing disc and weigh it immediately. Save the printed test piece for optical measurement (24 ± 2) h later.

Print a total of five test pieces with five different ink quantities. Print first with the lowest ink quantity and increase stepwise so that new ink is continually applied to the inking unit. Clean the printing disc after each printing. Clean the inking unit after each test series, i.e. after about 5 printings.

Choose the five ink quantities so that they cover a range of ink on the paper from 0,7 g/m² to at least 2,0 g/m². The print properties are evaluated by determining the print density at a weight per unit area of 1,00 g/m² and 1,50 g/m² in an instrument conforming to the requirements of ISO 2469 (see SCAN-P 36).

7.2.3 *Set-off.* If set-off is to be measured, a new set of test pieces must be printed. Fasten a strip of set-off paper to a printing disc and mount it in the second printing unit. If the same paper is used as that being tested, place it so that set-off takes place onto the reverse side. Print a second series of test pieces as described in 7.2.2. After the chosen delay time, allow the print to come into contact with the set-off paper in the second nip under the same pressure and at the same speed. Save the strips for later measurement according to SCAN-P 36.

Note 4 – The pressure may be slightly higher due to the extra thickness of the set-off paper.

8 Calculation

Calculate the mass per unit area of ink transferred to each test piece according to:

$$W = \frac{G_1 - G_2}{A} \quad [1]$$

where

- W is the ink transferred, in grams per square metre;
- G_1 is the mass of the printing disc before printing, in grams to the nearest 0,1 milligram;
- G_2 is the mass of the printing disc after printing, in grams;
- A is the area of the print, in square metre.

Note – The area of the print is normally considered to be the same as the normal surface area of the printing disc.

9 Report

The test report shall include reference to this SCAN-test Method and the following particulars:

- (a) time and place of testing;
- (b) identification of the test material, incl. the side and the direction of printing;
- (c) make of printing press, delay time;
- (d) type of ink including the manufacturer, the date of manufacture and the batch number;
- (e) the amount of ink transferred to each test piece, to the nearest 0,1 mg;
- (f) the type and grammage of the set-off paper used;
- (g) the delay time before set-off;
- (h) for each test piece, the time at which the printing was made;
- (i) any departure from the procedure described in this SCAN-test Method and any other circumstances that may have affected the result.

10 Precision

10.1 Repeatability

Results from repeated measurements ($n = 5$) under normal laboratory conditions using test pieces from the same gross sample, are shown in *Table 1*.

10.2 Reproducibility

Depending on the ink used and on the condition of the printability testers and materials, the results may vary and cannot be compared between laboratories.

Table 1 . An example of print density and print gloss and the coefficient of variation for repeated measurements. Tollenaar-Ernst equation was used for print density curve fitting and second order equation curve fitting for set-off density. The paper used was coated fine paper.

Ink transferred, g/m ²	Print density, D	CV, %	Print gloss, %	CV, %
1,0	1,36	2,3	61	2,9
1,5	1,62	2,1	66	3,8

CV = coefficient of variation, i.e. the standard deviation \times 100 divided by the mean.

11 Literature

11.1 SCAN-P 86, Paper and board – Test printing – using an IGT-type printability tester

11.2 SCAN-P 87, Newsprint – Test printing – using an IGT-type printability tester

SCAN-test Methods are issued and recommended by KCL, PFI and STFI-Packforsk for the pulp, paper and board industries in Finland, Norway and Sweden. Distribution: Sekretariat, Scandinavian Pulp, Paper and Board Testing Committee, Box 5604, SE-114 86 Stockholm, Sweden.