भारतीय मानक

Indian Standard

IS/ISO 2834-1 : 2020

ग्राफिक प्रौद्योगिकी — परीक्षण प्रिंट की प्रयोगशाला तैयारी

भाग 1 पेस्ट इंक

Graphic Technology — Laboratory Preparation of Test Prints

Part 1 Paste Inks

ICS 87.080

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NATIONAL FOREWORD

This Indian Standard which is identical to ISO 2834-1 : 2020 'Graphic technology — Laboratory preparation of test prints — Part 1: Paste inks' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendation of the Publication and Graphic Art Technology Sectional Committee and approval of the Management and Systems Division Council.

The text of the International Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as `Indian Standard'; and

b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, references appear to certain International Standards for which Indian Standard also exist. The corresponding Indian Standard, which is to be substituted in its place, is listed below along with its degree of equivalence for the edition indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 13655 Graphic technology — Spectral measurement and colorimetric computation for graphic arts images	IS/ISO 13655 : 2017 Graphic technology — Spectral measurement and colorimetric computation for graphic arts images	Identical
ISO 187 Paper, board and pulps — Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples	IS 1060 (Part 4/Sec 1) : 2014/ISO 187 Methods of sampling and test for paper and allied products: Part 4 Methods of test for paper, board and pulp, Sec 1 Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples	Identical

The technical Committee have reviewed the provisions of the following International standards referred in this standard and has decided that they are acceptable for use in conjunction with this standard:

International Standard	*Title*
ISO 5-4	Photography and graphic technology — Density measurements — Part 4: Geometric conditions for reflection density
ISO 2846-1	Graphic technology — Colour and transparency of printing ink sets for four-colour printing — Part 1: Sheet-fed and heat-set web offset lithographic printing
ISO 5631 (all parts),	Paper and board — Determination of colour by diffuse reflectance

Annexes B and C forms integral part of this standard. Annex A for information only.

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Introduction

This document exclusively describes the laboratory test print preparation for paste inks. The methods described in this document can be used in several other International Standards, such as ISO 2846-1, ISO 2846-2 and ISO 2836, and will be the basis for several printability standards to be developed by ISO/TC 6/SC 2 with TC 130. This document provides the tools to make uniform prints with a well-defined ink film thickness which can be used for analysis of the printed surface properties, fastnesses and which can be used for subsequent tests on the substrate or the printed image.

This document describes the procedure to be adopted when using IGT-type and prüfbau-type printability testers to prepare prints on papers, boards, metals, foils and other suitable substrates, for the main targets: reference optical density and reference ink film in g/m^2 on the substrate. Other inks, such as liquid inks for gravure or flexographical printing specified in ISO 2834-2 and screen print ink specified in ISO 2834-3, are developed with a similar structure to this document.

In this method, a procedure has been added to perform a periodic test with reference material to check deterioration of the used materials like rubbers and inks.

Indian Standard

GRAPHIC TECHNOLOGY — LABORATORY PREPARATION OF TEST PRINTS

PART 1 PASTE INKS

1 Scope

This document specifies a test procedure for the preparation of test prints on paper, board, metals, foils and other suitable substrates using paste inks, such as for offset and letterpress printing, using electrically driven IGT-type and prüfbau-type printability testers.

This document describes the procedure for reference optical density and reference ink film thickness.

This document describes the method as used on the current models of testers. Most of the described procedures are also applicable in analogy to the older models but can require additional steps to be executed or recalculation of the settings to make them conform to 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.

ISO 5-4, *Photography and graphic technology — Density measurements — Part 4: Geometric conditions for reflection density*

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

ISO 2846-1, *Graphic technology — Colour and transparency of printing ink sets for four-colour printing — Part 1: Sheet-fed and heat-set web offset lithographic printing*

ISO 5631 (all parts), *Paper and board — Determination of colour by diffuse reflectance*

ISO 13655, *Graphic technology — Spectral measurement and colorimetric computation for graphic arts images*

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:

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

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

3.1
breaking-in
roller conditioning
preparation process for new rollers or before using another *ink system* (3.4)

Note 1 to entry: Run rollers in an (or another) ink system to condition the elastomer until constant readings are achieved. See Annex B for the procedure.

3.2
ink
<printability> fluid to be printed under the conditions of this document

Note 1 to entry: It can be a commercial printing ink, a modified ink for the purpose of the test, a simulant like pick test oil, a varnish and other materials which create a print under the conditions as specified in this document.

3.3
inking device
separate or integrated part of the *printability tester* (3.6) used to distribute the ink in a uniform way on a roller system from where the *printing forme* (3.7) can be inked with a known amount of ink

3.4
ink system
range of inks which are comparable with regards to varnish system and liquid base

Note 1 to entry: For paste inks there are e.g. oxidative, setting and UV curing systems.

3.5
packing
underlayment under the sample to be printed

Note 1 to entry: This is used for mechanical protection or to simulate the hardness of the impression in printing practice or to accentuate the effects of the test on the printed image.

3.6
printability tester
printing device, with or without integrated *inking device* (3.3), able to print the inked *printing forme* (3.7) in conformance with the requirements of the test

Note 1 to entry: Depending on the type of test, the speed may be constant over the full print or may have to follow a specified speed profile.

3.7
printing forme
printing disc
roller with metallic, elastomer or rubber blanket coverage, used to transfer the ink film to a substrate to create a print

Note 1 to entry: The print may contain a solid tone or an image or halftone pattern.

3.8
reference material
ink (3.2) or *substrate* (3.10) with well-known properties

Note 1 to entry: Used to execute a reference test on a regular basis or for comparative testing. Inks and rubbers change properties in time. To prevent jumps in results between current and new materials; they should be tested at least once together.

Note 2 to entry: A distinction can be made between reference material, as material with well-known and publicly available specifications, and control material which is kept for comparison only and for which the absolute values do not have to be known.

3.9
rubber
elastomer
elastomeric materials covering *printing forms* (3.7), *top rollers* (3.12), *packings* (3.5) and *substrate carriers* (3.11)

Note 1 to entry: In practice, some of the materials are not rubber.

3.10
substrate
material to be printed on

3.11
substrate carrier
mounting plate for the sample to be printed

Note 1 to entry: With on top a specific material for mechanical protection or to simulate the hardness of the impression in printing practice or to accentuate the effect of the test on the printed image.

3.12
top roller
soft, elastomer covered roller

Note 1 to entry: Used in a three-roller inking system for ink distribution and as ink transfer roller to the printing form.

4 Apparatus

4.1 Inking device

An electrical driven device, used to generate a uniform ink film on the printing form, consisting of two inking drums or rollers having contact with a top roller covered with a rubber or other elastomer with specific quality for the test and the ink system. At least one of the inking drums shall oscillate to induce a sideways distribution of the ink. The ink distributing surface area A of the rollers shall be known to the nearest 0,1 cm^2. Each inking arrangement shall incorporate one or more holders on which the printing forme can be mounted to be inked.

The distributing surface area, A, is calculated as shown in Formula (1):

$$A = \sum_{1}^{n} (\pi \times d_n \times l_n) \tag{1}$$

where

d_n is the diameter of roller or drum number (n);

l_n is the effective (ink containing) length of roller or drum number (n);

n is the number of rollers excluding the printing form.

NOTE The terms “inked” and “ink” are used here to conform to general usage even when a pick test oil or other simulant is used instead of an ink.

4.2 Printing form

4.2.1 IGT-type

4.2.1.1 Aluminium

One or more aluminium printing forms, of specified width, with smooth edges, a diameter of (65,0 ± 0,2) mm and a temperature-insulating handgrip. The weight of the disc shall be low enough to weigh it on an analytical balance with an accuracy of 0,1 mg. An aluminium printing forme shall always be used in combination with a packing.

4.2.1.2 Elastomer

One or more rollers with a specific elastomer covered printing form, of specified width, a diameter of (67,0 ± 1,5) mm, a hardness of the covering of (80 ± 7) Shore A and a temperature-insulating handgrip. The weight of the disc shall be low enough to weigh it on an analytical balance with an accuracy of 0,1 mg. An elastomer covered printing forme shall not be used in combination with a packing. Different rollers/elastomers for conventional or energy curing applications are required.

Under certain circumstances, it can be required to use a dedicated type of printing form, e.g. coated, to prevent penetration of ink into the elastomer or with lower shore hardness, to get a good print quality of the ink on the substrate to be used. In this case, this shall be mentioned in the report.

See Annex C for maintenance of elastomer printing forms.

4.2.1.3 Rubber blanket

One or more rollers with a specific rubber blanket covered printing forme of specified width, a diameter of (67,0 ± 1,5) mm and a temperature-insulating handgrip. The weight of the disc shall be low enough to weigh it on an analytical balance with an accuracy of 0,1 mg. A rubber blanket printing forme shall not be used in combination with a packing.

See Annex C for maintenance of rubber blanket printing forms.

4.2.2 prüfbau-type

4.2.2.1 Aluminium

One or more aluminium printing forms, of specified width and a diameter of (65,0 ± 0,2) mm. The weight of the disc shall be low enough to weigh it on an analytical balance with an accuracy of 0,1 mg.

4.2.2.2 Elastomer

One or more rollers with a specific elastomer covered printing form, of specified width, with a diameter of (65,0 ± 0,2) mm and a hardness of the covering of 85 Shore A. The weight of the printing forme shall be low enough to weigh it on an analytical balance with an accuracy of 0,1 mg. Different rollers/elastomers for conventional or energy curing applications are required.

See Annex C for maintenance of elastomer printing forms.

4.2.2.3 Rubber blanket

One or more rollers with a specific rubber blanket covered printing form, of specified width and a diameter of (65,0 ± 0,2) mm. The weight of the disc shall be low enough to weigh it on an analytical balance with an accuracy of 0,1 mg. Different rollers for conventional or energy curing applications are required.

See Annex C for maintenance of rubber blanket printing forms.

4.2.3 Ink pipette

To apply an accurate quantity of ink to the inking device an ink pipette having a minimum volume of 2 ml and a resolution of at least 0,01 ml, but preferably 0,001 ml or other device to apply the ink volume with the required accuracy shall be used.

NOTE 1 If the inking device is equipped with a dispensing system with sufficient accuracy, or the applied amount of ink is weighted, no ink pipette is required.

NOTE 2 In principle, it is also possible to use the analytical balance to weigh the required amount of ink. In that case, the required ink film thickness can be calculated considering the mass density of the ink.

4.2.4 Top roller

One or more elastomer covered top rollers, with a specified diameter in accordance with the roller system, a hardness of the covering of (33 ± 7) Shore A. Different rollers for conventional or energy curing applications are required or in case a hybrid rubber is used it shall be broken-in according to Annex B.

See Annex C for maintenance of top rollers.

4.2.5 Substrate carrier

In case a round-flat principle is used, the substrate is mounted on a carrier to be fed through the nip of the printability tester. The carrier is covered with a rubber blanket of specific quality and shall be chosen for the sample thickness to be used in the test.

A substrate carrier shall only be used for the printing forme for which it is used the first time.

See Annex C for maintenance of elastomer substrate carriers.

4.3 Printability tester

4.3.1 IGT-type

4.3.1.1 Round-round printing principle

An electrical driven printing device having an impression cylinder or sector with a radius of (85,0 ± 0,2) mm. If the tests require the use of a packing the sector shall incorporate a facility enabling a packing to be mounted on the sector under defined tension and a test piece to be mounted on or over the packing. The sector shall be capable of being driven over a distance of at least 200 mm at a constant speed. For some tests, the speed may have to be adjustable as well.

The force with which the printing forms contacts the test piece on the sector shall be adjustable. The actual force shall not deviate by more than ±10 N or 5 % from the set force.

Depending on the test to be executed, the tester shall be equipped with one or more printing nips.

It is important that the printing device is properly calibrated with regard to printing speed and printing force between the printing forme and the sector. Check the instruction manual or contact your supplier for correct calibration.

This document describes the method as used on the current models IGT testers printing according to the round-round principle, most of the described procedures are also applicable in analogy to the older models but can require additional steps to be executed or recalculation of the settings to make them conform to this document. Before using devices of (very) old age or of non-standard construction for inking and testing, it is important to contact the supplier to confirm conformance with this document.

4.3.1.2 Round-on-flat printing principle

An electrical driven printing device having an impression cylinder. The system shall be capable to make a print of at least 200 mm at a constant speed.

The force with which the printing forms contacts the test piece on the sector may be adjustable. The actual force shall not deviate by more than ±10 N or 5 % from the set force.

Older and specific devices of this principle are produced with different or additional specifications. Check the instruction manual or contact your supplier to confirm if these are in conformance with this document.

4.3.2 prüfbau-type

An electrical driven printing device having an impression cylinder. The system shall be capable to make a print of at least 200 mm at a constant, adjustable speed.

The force with which the printing forms contacts the test piece on the sector shall be adjustable. The actual force shall not deviate by more than ±10 N or 5 % from the set force.

Depending on the test to be executed the tester shall be equipped with one or more printing nips.

4.3.3 Homogeneity

For printability testers for paste inks, the homogeneity of the print within defined printed areas shall be evaluated by using test prints of inks according to ISO 2846-1. Density measurements according to ISO 5-4 shall be performed in an equally spaced pattern adapted to the geometric form of the print area (minimum 25 measurements). Colouration gradients (e.g. ink feed, printing forme or pressure gradients) may therefore be identified and if so, measures shall be taken to adjust the printability tester. The standard deviation of density measurements shall not exceed 0,03.

4.4 Packing (IGT-type testers only)

4.4.1 Rubber packing

The sector of the printability tester shall be protected from physical damage from a hard printing forme like an aluminium printing form. For this, a packing is mounted on the sector. The packing can have two functions: protection only and protection and enhancement of the effect of the test.

The packing shall be specified in the referring test method or a standard rubber packing shall be used with an aluminium printing form.

The packing shall be used under a tension of (40 ± 5) cN.m, this can be realized by either a tensioning device with a calibrated spring, or a tensioning system with a torque wrench. If no controlled tension can be applied the operator shall ensure that the packing is under sufficient tension. A way to determine the tension in practice is to measure the elongation of the packing by checking the change in lifting distance of the clamps.

A packing shall only be used for printing forms of the same width.

NOTE Intermediate use of smaller width of printing forms creates a dent in the packing which results in an uneven print, for example a stripe or an optical density difference. This can also occur in case the packing is dismounted and remounted in a different lateral position.

See Annex C for maintenance of packings.

4.4.2 Paper packing

A paper packing consisting of 5 sheets of specific paper in accordance with the manufacturer's specifications, with a total thickness of (1,5 ± 0,1) mm.

The packing shall be used under a tension of (40 ± 8) cN.m, this can be realized by either a tensioning device with a calibrated spring, or a tensioning system with a torque wrench. If no controlled tension can be applied the operator shall ensure that the packing is under sufficient tension. A way to determine the tension in practice is to measure the elongation of the packing by checking the change in lifting distance of the clamps.

A packing shall only be used for printing forms of the same width.

NOTE Intermediate use of smaller width of printing forms creates a dent in the packing which results in an uneven print, for example a stripe or an optical density difference. This can also occur in case the packing is dismounted and remounted in a different lateral position.

Paper packings shall not be used longer than 3 months or 1 000 prints after first use.

4.5 Additional materials and aiding devices

4.5.1 Cleaning aids

These are lint-free rags or soft tissues.

It is practical to use white or light tinted tissues to be able to see if there is still colour coming off from the cleaned roller.

4.5.2 Solvents

In accordance with the elastomeric materials used, for example

— for conventional inks petroleum ether with a boiling range of 40 °C to 60 °C to 80 °C to 120 °C and preferably no or very low amount of aromatic compounds,

— for UV inks ethyl alcohol.

Cleaning liquids containing surfactants or non-volatile components shall not be used.

Contact the printability tester supplier for information concerning the correct solvent for cleaning as the use of incorrect solvents can cause damage to the rollers or printing forms which results in inconsistent ink transfers.

The test results depend on the dryness and cleanliness of all the rollers and printing forms. Make a drying time test according to Annex C if the drying behaviour of a roller is not known.

4.5.3 Ruler

A ruler with a minimum length of 300 mm, to measure the size of the print with an accuracy of 0,5 mm.

4.5.4 Timer

A timer or stopwatch with an accuracy of 1 s.

4.5.5 Analytical balance

An analytical balance with an accuracy of at least 0,1 mg to weigh the printing form.

NOTE Some rollers can become magnetized, others can become electrostatically charged, some analytical balances are sensitive to either of these phenomena.

4.5.6 Reference materials

Reference substrate and/or inks to execute a reference test on a regular basis in accordance with Annex A. Paper and inks change properties in time. To prevent jumps in results, current and new

materials shall be tested at least once together. The reference materials should be chosen by the user in accordance with his specific needs.

NOTE This combination of materials can be used in a process calibration, not in instrument calibration. Reference can also be made through comparative testing round robins.

4.6 Substrate

Substrates like paper, board and foils of any kind used for printing applications may be used.

For specific tests, such as optical tests, including the assessment of light fastness of an ink, there shall be prior agreement as to the substrate to be used.

Tests executed on any production paper for QC purposes only, have a relative character.

The substrate and properties shall be recorded.

4.7 Inks

Depending on the purpose of the test, different types of ink are normally used.

If problems in ink transfer arise with heatset inks or inks for waterless offset, a small amount of oil (e.g. linseed oil) may be added to the ink prior to ink distribution. The volume amount of oil added should be kept as low as possible and shall not exceed 5 %. The volume percentage of oil added shall be noted and be used to correct the ink film thickness.

5 Principle

Using a printability tester, a known quantity of ink is printed under specified conditions, uniformly on a known area of a (reference) paper or any other chosen substrate. The targets can be specified optical density or specified (wet) amount of ink on the substrate. The ink demand is calculated and is expressed in grams per square metre or, taking into account the mass density of the ink, by the ink film thickness in micrometres.

For ease of operation, an ink pipette may be used for metering the amount of ink supplied to the inking unit. The actual amount of ink transferred to the substrate can only be determined by weighing the printing forme immediately before and after printing. For cases where the transferred amount of ink cannot be calculated, e.g. in case of overprint or trapping or there where the speed of testing does not allow for this, the optical density may be determined and specified as reference.

The test prints serve for optical tests, such as colorimetry, transparency, gloss and optical density as well as for testing other print related paper and ink properties, such as striking-in/setting, mottling, ink transfer, picking, etc., where a well-known ink coverage in g/m^2 or in optical density on the substrate is required before any other evaluations or further testing can take place. For different test purposes, different ink film thicknesses or optical densities and other test specifications are specified in the reference standard. This document describes only the procedure used to print the sample. For further evaluations, other standards can be required.

It is important to contact the supplier to confirm conformance with this document before using it for inking and testing devices of (very) old age or of non-standard construction.

6 Preparation

6.1 Sampling

The sampling procedure is not covered by this document. Ensure that the test pieces taken are representative of the sample received or of the total lot to be evaluated.

6.2 Conditioning

Condition the samples to be tested as well as the inks and other reference materials in accordance with ISO 187 and keep them in the conditioned atmosphere throughout the test.

In case of large packing of ink, it is advised to repack the ink for the test in smaller containers to reduce conditioning time.

The transfer characteristics of rubber rollers can change by, for example, using them for different applications, inks, bad cleaning, unsuitable cleaning solvents and ageing. If tests are made using different top rollers it is important that the top rollers are close to identical, and a test to determine the ink transfer might have to be performed.

NOTE Because the viscosity of the ink is temperature dependent, temperature control is as important for this test as humidity control.

6.3 Sample preparation

Cut the test pieces to the dimensions suitable for the printability tester:

— IGT-type round-to-round: 55 mm × 300 mm to 340 mm

— IGT-type round-to-flat: 45 mm to 55 mm × 250 mm to 280 mm

— prüfbau-type: 45 mm × 250 mm to 300 mm

The test pieces shall be cut in the machine direction to simulate web offset printing and in cross direction to simulate sheet-fed offset. In case the final use is not known it is recommended to execute the test in both directions. The direction of printing w.r.t. machine direction (MD) or cross direction (CD) shall be stated in the report. The pieces should be free from folds and wrinkles and fingerprints. Mark the side to be printed.

For subsequent evaluation according to most other standards, at least five pieces are required of each side and direction to be evaluated.

7 Procedure

7.1 General

Operate the testers in accordance with the instruction manual provided with the instruments.

7.2 Preparation and instrument settings

Select an appropriate combination of settings for speed, printing force, printing form(s), packing or carrier and ink film thickness for the test to be executed in accordance with the referring standard.

7.2.1 Standard test settings

If rubber rollers are required, select the appropriate rubber rollers for the ink system to be used. Make sure that the rubber roller has been broken-in with the current ink system, this is particularly important if a so-called hybrid rubber is used for the rollers. Follow Annex B for the break-in procedure.

Select the test set in accordance with the final application, if no specific specifications are set the following settings shall be used:

— IGT: a 50 mm wide rubber printing forme as specified in 4.2, a printing speed of 0,3 m/s and a printing force of 625 N;

— prüfbau: a 40 mm wide rubber blanket printing forme as specified in 4.2, a printing speed of 1,0 m/s and a printing force of 800 N.

If the equipment has a temperature control system, set the target temperature to 23,0 °C.

7.2.2 Settings for specific tests not covered by a test set

For some substrates and tests a different printing forme may be specified, in such case select a printing forme in accordance with the instructions in the standard or method for the test to be executed. The type shall be recorded in the report.

In case a metal printing forme is to be used on an IGT-type tester, a packing shall be mounted. Place a type of packing in accordance with the instructions of the standard or method for the test to be executed. The type of packing shall be recorded in the report.

For some tests, using specific inks with high viscosity, a different, higher temperature may be required. The temperature to be used shall be agreed between parties and shall be recorded in the report.

Set the printing speed to the speed in accordance with the instructions of the standard or method for the test to be executed. The set speed shall be recorded in the report.

Set the printing force to the force in accordance with the instructions of the standard or method for the test to be executed. The printing force shall be recorded in the report.

7.3 Inking of the printing form

An appropriate amount of ink shall be applied to the inking unit. The exact amount of ink or the other specific test liquid is specified in the International Standard or the method describing the specific purpose of the test. The ink amount can be specified in a volume, in a weight or in an optical density, depending on the application. To apply accurately a specific volume of the ink, an ink pipette shall be used. The required amount can be derived from the documentation provided with the equipment or calculated using Formula (1) and the specified ink film thickness. In case of a target optical density, the required ink volume has initially to be estimated, after the first print a correction shall be made to reach the correct optical density.

NOTE The exact amount of ink transferred on the substrate depends on several circumstances: absorption of the substrate, temperature of the ink, speed of printing, printing force, roughness of the substrate, release factor of the rubber and some secondary factors like cleanliness of the rollers, ink distribution time and time between different steps of the process. Therefore, the amount of ink applied on the rollers by weight or by volume does not guarantee a certain ink film on the substrate. The only way to know the exact ink film thickness is by gravimetrical determination of the ink transferred.

Appropriate time for distribution on the inking unit shall be chosen to ensure a homogeneous distribution of the ink. The application of the ink shall be done in at least 3 stripes across the width of the top roller, evenly spread over the circumference of the top roller. The required time depends on the speed of the distribution, the side-wise oscillation of the rollers, the diameter of the rollers and the distribution of the application of the stripes of ink on the top roller.

The distribution time and the inking time of the printing forme shall be chosen as short and as constant as possible, preferably controlled by the inking unit itself. If the unit is not equipped with such facility, a separate timer shall be used. Leaving the ink too long on the inking unit and prolonged running at high speed will cause ink type dependent changes in the properties of the ink due to misting, drying and evaporation of the components.

Follow Annex C for roller maintenance and drying properties.

Evaporation of the solvents after cleaning draws most of the required energy from the surface of the roller, therefore metal rollers can cool several degrees while drying. They should be allowed to reach temperature equilibrium again before the next use, by letting them run dry on the inking unit or giving them sufficient time.

For tests with inks for colour measurement, it is recommended to use separate rubber rollers or sections of the top rollers for each colour to prevent contamination of the colour by previous ink particles from the pores of the rubber. This is valid for the printing forms as well as for top rollers.

Calibration of the printing device is important for obtaining correct, reliable and repeatable results. For details on calibration, consult the supplier and the documentation supplied with the instrument.

If tests are made using different distribution rollers it is important that the distribution rollers behave identical, a test to determine the ink transfer may have to be performed.

7.4 Printing

7.4.1 Standard procedure

— Mount the substrate sample on the sector or substrate carrier, do not touch the surface to be printed with bare hands to prevent contamination.

— Adjust the settings according to either 7.2.1 or 7.2.2.

— Remove the inked printing forme from the inking unit, weigh the inked printing forme on the analytical balance in g and record the weight, m_1.

— Place the printing forme on the printability tester.

— Apply the printing force.

— Start the motor and make the print.

— Remove the printing forme from the tester, weigh the printed printing forme on the analytical balance in g and record the weight, m_2.

— Remove the sample.

— Measure and calculate the printed area P in mm^2.

— The printing forme shall be cleaned and dried after each print. This requirement can be relaxed only in case where there is no chance of contamination of the printing forme.

Depending on the required accuracy and the behaviour of the ink, the inking unit should be cleaned, or the amount of ink removed by the print should be supplemented/replenished conform the instructions with the inking apparatus.

7.4.2 Procedure to reach the target ink coverage in g/m^2

— Determine the difference in % between the calculated ink coverage and the desired coverage.

— Add or subtract this percentage ink from the initial applied amount of ink and apply this new amount of ink on the cleaned inking unit.

— Repeat this procedure until the correct amount of ink for the required ink film thickness is reached.

7.4.3 Procedure to reach the target optical density

— If the optical density is not within ± 0,05 optical density units from the target optical density, estimate the correct ink volume/mass to reach the desired optical density. Note that the optical density does not have a linear relation to the ink film thickness and at high densities a small increase in optical density may require a substantial extra amount of ink and vice versa

— Repeat the test until the target optical density is reached within the set tolerance.

For several tests the optical density variation of ± 0,05 is too large, the referring standard should specify the maximum allowed deviation, or the maximum deviation shall be agreed upon between parties.

7.5 Drying

Prior to testing or evaluation, the prints shall be thoroughly dry. If necessary, appropriate drying equipment, such as heatset dryer or UV-curing device, shall be used. For tests, where it is not possible to wait sufficient long until the print has dried sufficiently on the conventional way and any artificial drying would affect the results, a fixed time between printing and measurement shall be specified and recorded in the report.

If other, subsequent tests require testing the sample within short time after the print, the requirements of this standard prevail over the above-mentioned procedure.

8 Evaluation

8.1 Evaluation of the transferred ink coverage in g/m²

The amount of ink transferred from the printing forme to the substrate shall be determined by calculating the difference in mass of the printing forme before and after printing. The ink coverage shall be expressed in grams per square metre (g/m²) and is calculated according to Formula (2):

$$C = \frac{m_1 - m_2}{P} \times 10\,000 \tag{2}$$

where

C is the ink coverage in g/m²;

m_1 is the mass of the inked forme before printing in g;

m_2 is the mass of the forme after printing in g;

P is the printed area in mm².

If required, conversion of the ink coverage C to equivalent ink film thickness in micrometres shall be made by using the mass density of the ink according to Formula (3):

$$d = \frac{C}{\rho} \tag{3}$$

where

d is the equivalent ink layer thickness in µm;

C is the ink coverage in g/m²;

ρ is the mass density of the ink in kg/m³.

8.2 Optical characterization

8.2.1 Evaluation of optical density

Optical density measurement should be performed using equipment according to ISO 5-4 or any other standardized method.

— Zero the densitometer on the substrate to compensate for the optical density of the unprinted substrate.

— Measure the ink optical density at 10 random spots on the print and calculate the mean optical density.

8.2.2 Evaluation of colour

Colour measurements shall be performed in accordance with ISO 13655 or ISO 5631.

9 Report

The report shall contain the following:

— exact date and time of the test and the separate steps of preparation, test and further processing;

— a reference to this document, i.e. ISO 2834-1:2020

— purpose of the test and a reference to the International Standard for this purpose;

— the printing apparatus, manufacturer and type;

— speed and force settings;

— the inking apparatus, manufacturer and type:

  — distribution and inking times;

  — applied amount of ink;

  — temperature of inking unit;

— type and material of printing form;

— type and material of packing;

— drying or curing:

  — method;

  — time;

  — energy, temperature;

— the ink coverage in grams per square metre or the ink layer thickness in micrometres;

— the printed area;

— substrate specifications, incl. side and direction;

— the ink (designation, supplier, mass density);

— any deviations from this document;

— any operations not specified in this document which might have influenced the print result (e.g. solvent, drying times, type of balance, type and settings of densitometer).

Annex A
(informative)

Reference tests

A.1 Overview

Printability testing is by nature comparative. Results vary depending on a large number of parameters, the used materials and the printing technology used. To reduce the influence of the variables which can be controlled, it is recommended to perform regular reference testing for the rollers and the operation procedures. The reference testing can be part of a comparative testing service.

A.2 Reference test

Purpose is to test the change in behaviour of the test with a reference ink and a reference substrate, for a reference test use a standard ink with properties known to be constant over a long time.

a) Prepare the devices in accordance with this document.

b) Record accurately the amount of ink applied on the distribution roller, in volume or in weight, to reach on the roller system.

c) Make the number of measurements as required by the test procedure.

If the ink transfer differs more than ± 5 % from the specification this indicates a change in any of the parameters which shall be addressed:

— Operation

— Ink application

— Ink distribution

— Roller change

— Cleanliness of the rollers

— Aging of the rollers

— Deterioration of the ink

— Instrument out of calibration

A.3 Reference ink

It is recommended to select one or more standard inks and substrates, corresponding to the general use in the lab, to perform regular tests on the performance of the total system and to use as a standard in case any new rollers are used or calibration is done.

Annex B
(normative)

Breaking-in of elastomer rollers

B.1 General

New elastomer rollers may selectively absorb components of some inks and vehicles, up to a saturation point, at which point they may be said to be broken-in. Until this selective absorption is complete, measurements made with these rollers may not be repeatable. The same procedure can be used in case of hybrid rubber rollers, suitable for different ink systems, when changing over from one ink system to another.

B.2 Procedure

Break-in the rollers using the following procedure:

Place the rollers on the inker. Choose as break-in ink samples those representative of the ink-system that will be used on the rollers. Run approximately 1,0 to 1,5 cm^3 of the break-in sample for extended periods of time, wash-up with the solvent to be used, re-apply the sample, run, wash-up, and so forth at least three times.

NOTE Wash-up is a significant part of the break-in process.

A major change in ink systems can adversely affect the rollers. When a set of rollers has been used for one system, and it is to be used for another, use this same break-in procedure.

Contact the supplier of the rollers for suitability of the solvents for the rollers surface and possible evaporation time after cleaning.

Annex C
(normative)

Maintaining elastomer rollers and other materials

C.1 General

Elastomers deteriorate with usage and time. This happens under influence of chemicals, sun light (UV radiation), usage, aging, cleaning, temperature changes, material contact, etc. Generally, deterioration increases once the material is used and/or has been in contact with chemicals like ink and solvents.

Therefore, the printing forms, substrate carriers, rubber packings and other elastomeric or elastomer covered materials should be kept in the dark, at room temperature, away from chemical fumes, free from contact with other materials and shall be replaced before deterioration starts to influence the results.

The elastomeric materials may become harder, softer, glazed, cracked, swell, shrink or eventually disintegrate. After getting harder and over time softer again, the ink transfer properties will not return to the same level as at the initial hardness. Also, absorption properties will be different.

C.2 Drying time curve

After cleaning an amount of the solvent will enter the pores of the material. This will need time to evaporate again, this time depends on the elastomer and the used solvent. To ensure a sufficient dry roller, it is recommended to make an evaporation curve.

— Ink a roller for 2 min with the ink to be used in the test.

— Clean the printing forme with the solvent required for this ink.

— Directly after cleaning, place the roller on an analytical balance and tare the balance.

— Record the weight every 30 s during a time of 15 minutes or until three consecutive 30 s periods the difference was less than 2 %.

— If the time until this 2 % difference was reached is longer than the normal time between testing, 2–5 minutes, it is recommended to use two or more printing forms alternating and to allow sufficient drying time for each printing forme after cleaning.

C.3 Life time

C.3.1 Solid elastomer printing forms

The shelf life of solid elastomer printing forms is 3 years.

After first use in general the transfer properties change by 3 % to 5 % per year. Up to 10 % change will be difficult to distinguish due to the variability of the combination of materials. Ten % or more will show a noticeable difference.

To ensure a smooth transition between a used and a new printing forme the printing forme should be replaced after 2 years and shall be replaced after 3 years or after about 5 000 prints.

C.3.2 Rubber blanket printing forms

The shelf life of rubber blanket printing forms is 3 years

Due to the layered structure, the more open surface structure and the thinner layers of the rubber blankets these are more sensitive to mechanical stress than solid elastomer printing forms.

To ensure a smooth transition between a used and a new printing forme the printing forme or the rubber blanket on the printing forme should be replaced after 6 months and shall be replaced after 1 year or after about 1 000 prints.

C.3.3 Packings and substrate carriers

Packings and substrate carriers are normally not covered with ink and will not be regularly in contact with solvents. The main reason of deterioration is mechanical stress and aging.

A serious stress factor is the start position of the print: here the printing forme lands always on almost the same location in stand-still. Here a dent will be formed. As most printability testers generate their pressure from the first contact this dent will cause that the pressure is (much) higher on the higher laying surface after start of the print.

Another stress factor is the width of the printing form. The carrier is wider than the printing form, if a hard printing forme is used, harder than the packing or carrier, the printing forme will create a dent in the packing or carrier over the full length of the print. Over time this area will become compressed, harder or cracked.

For this reason, a packing or carrier shall never be used for different width of printing forms, each type of printing forme shall be used in combination with its own packing or carrier.

The shelf life of packings and substrate carriers is 5 years.

A substrate carrier should be replaced or recovered with new elastomeric material after 1 year and shall be replaced after 2 years or 1 000 prints or if a noticeable dent has formed.

Remove before every use all contamination, glue remainders or remainders of adhesive tape from top and bottom.

Rubber packings should be replaced after 3 months and shall be replaced after 1 year, 100 prints or if a noticeable dent has formed.

Paper packings should be replaced after 1 month and shall be replaced after 6 months or if any damage on the surface becomes visible. The packing shall also be replaced if a double edge is visible at the dent after the packing has been remounted after removal.

NOTE If a packing has been used, removed and is intended to be mounted again, make sure that it is mounted on the same position and direction as when removing it, if there is a dent and the printing forme runs on the edge of the dent the ink film can become uneven on one side.

C.3.4 Special printing forms

For special printing forms, e.g. halftone forms made of photopolymer or forms treated with special coating contact the supplier for storage conditions, cleaning instructions, shelf life and use life.

C.3.5 Top rollers

The shelf life of top rollers is 3 years.

Due to the softness of the top rollers these are more sensitive to hardening and glazing then printing forms. Top rollers should be replaced latest 2 years after first use and shall be replaced latest 3 years after first use or after glazing become irreversible.

NOTE Chemical deep cleaning, as used on some elastomer rollers in the printing industry, can destroy the roller surface irreversible.

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