

Graphic technology — Laboratory preparation of test prints

Part 3: Screen printing inks

ICS 87.080

National foreword

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Foreword

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Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 2834-3 was prepared by Technical Committee ISO/TC 130, *Graphic technology*.

ISO 2834 consists of the following parts, under the general title *Graphic technology — Laboratory preparation of test prints*:

- *Part 1: Paste inks*
- *Part 2: Liquid printing inks*
- *Part 3: Screen printing inks*

Introduction

This part of ISO 2834 describes the procedure for the preparation of test prints using screen inks. Test prints need to have a uniform distribution of ink on the substrate to be used for testing. Where such test prints are to be used for optical tests, the level of ink coverage needs to be controlled and reproducible to allow the relationship between reflectance data and ink coverage to be determined. If test prints are intended to only be used for evaluation of mechanical and/or chemical resistance, less accurate preparation methods can be used.

Test prints, as well as production prints, can have an ink film thicknesses that range between 10 µm and more than 100 µm. The viscosity range is from about 300 Pa·s to 2 000 Pa·s. The inks' varnish systems used can be oil-based, solvent-based, water-based, plastisol or energy curing. Print substrates include paper, board, glass, textiles, plastics and metals.

The test print preparation methods described in this document support, and are referenced by, ISO 2846-4 and ISO 2836. The preparation of test prints using paste inks (lithography) is defined in ISO 2834-1 and the preparation of test prints using liquid inks is defined in ISO 2834-2.

Graphic technology — Laboratory preparation of test prints —

Part 3: Screen printing inks

1 Scope

This part of ISO 2834 specifies a test method for preparation of test prints produced with screen printing inks. These test prints are intended primarily for optical tests, such as colorimetry, transparency and reflection density as described in ISO 2846-4. They can also be used for testing gloss, light fastness and the chemical, physical and mechanical resistance to mechanical and chemical attack regarding either printing ink or substrate, or both.

2 Normative references

The following referenced documents are indispensable for the application 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 187, *Paper, board and pulps — Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples*

ISO 2846-4, *Graphic technology — Colour and transparency of printing ink sets for four-colour-printing — Part 4: Screen printing*

ISO 14981, *Graphic technology — Process control — Optical, geometrical and metrological requirements for reflection densitometers for graphic arts use*

3 Terms and definitions

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

3.1

extender

transparent material (varnish or polymer solution) to reduce the colorant concentration and to adapt ink concentration to print substrates

3.2

flooding

procedure of filling the openings of the screen printing forme with printing ink before the printing process

3.3

flooding device

device not in contact with the mesh used to fill the openings of the screen printing forme with printing ink before the printing process

- 3.4**
ink rest
area on the surface of the screen-printing forme outside the ink trail
- 3.5**
mesh
uniformly spaced arrangement of interlaced or interlocked stands of thread; screen material
- 3.6**
mesh count
number of threads per unit length in a screen mesh
- 3.7**
mesh volume
open space between the threads of a woven screen printing fabric or effective openings of otherwise manufactured screen
- 3.8**
off contact distance
adjustable distance between printing forme and substrate
- 3.9**
printing forme
device consisting of a frame, a mesh and a stencil carrying the image to print
- 3.10**
printability tester
device for uniformly inking a printing forme and transferring a reproducible amount of ink onto a substrate under specified conditions
- 3.11**
retarder
additive to reduce the evaporation speed of the solvent in an ink to prevent drying during the application of ink to the substrate
- 3.12**
squeegee
device for simultaneously pressing the mesh against the substrate, forcing the printing ink through the openings of the forme on the substrate, and scraping the excess ink from the forme, consisting, for example of a holder and a blade or a roll coater (revolving squeegee)
- 3.13**
squeegee angle
angle between the blade and the forme before pressure has been applied
- 3.14**
stencil
blocking layer on or in the mesh, making the mesh impermeable to printing ink at the places which are not to print
- 3.15**
test-ready ink
printing ink of the appropriate composition and viscosity for the purpose of the test

4 Test method

4.1 Principle

Using a printability tester, an amount of screen printing ink is applied uniformly on the chosen substrate. The procedures described in this part of ISO 2834 are used to prepare test prints for optical tests and can be used to prepare test prints for any other testing of printed ink.

4.2 Apparatus

Any printability tester, printing ink, substrate and drying apparatus may be used as long as the requirements of 4.2.1 to 4.2.4, 4.3 and 4.4 are met. Test conditions and variables associated with such equipment and materials shall be agreed upon between parties since variations have a strong influence on the results and comparability of the properties of the test sample.

4.2.1 Printability tester

The printability tester may use flatbed or rotational principals. To ensure repeatable operation, the printability tester shall provide motorized control of the ink transfer function. The printing speed, the squeegee angle, the pressure of the squeegee and the off contact distance shall be adjustable. These shall be constant and uniform during the printing process. The used settings shall be recorded. The squeegee should be easily replaceable. A flooding device shall be provided.

4.2.2 Printing forme

The printing forme shall be designed for solid tones of an area not smaller than 50 mm × 75 mm. The stencil shall be produced using a capillary film of an agreed-upon thickness to ensure a sufficient surface smoothness. The mesh shall be produced from polyester. The mesh count and the diameter of the wires determine the mesh volume and therefore shall be agreed upon between parties. For flatbed equipment and printed areas smaller than 150 mm × 200 mm, the ink rest area on each side of the printing area of the mesh shall be at least as large as the corresponding size of the printing area. The mesh tension shall be appropriate with respect to the type of mesh and the dimension of the frame.

During cleaning processes and printing, the printing forme is subjected to abrasion. Therefore, reference test prints using a black ink shall be performed at regular intervals, in accordance with the intensity of use of the printing forme. This black ink shall be test ready and shall be stored during the lifetime of the particular printing forme but not for longer than 6 months. Each reference print shall be made five consecutive times, where the first two prints will be discarded. Density measurements shall be performed in accordance with ISO 14981 and the average density of at least 10 measurements of each of the last three prints shall be calculated. If this density differs by more than 5 % from the reference density determined with the printing forme in first use, the forme shall be replaced.

4.2.3 Squeegee and flooding device

The squeegee may be produced from any suitable material, but there shall be prior agreement regarding the hardness of the material, and the shape, profile and smoothness of the doctoring edge.

There shall be prior agreement regarding the type of and settings for the flooding device and its use.

4.2.4 Quality requirements for printability testers

Before use, a screen ink printability tester shall be tested to insure uniformity of printing. Sample prints shall be prepared using a black ink and shall be performed in a way that an optical density of $1,5 \pm 0,3$ is achieved. Print density shall be measured in accordance to ISO 14981. Measurements shall be made in an equally spaced pattern adapted to the geometric form of the print area (minimum 25 measurements). If the standard deviation of density measurements exceeds 0,03, the performance of the screen ink printability tester shall be considered unacceptable.

4.3 Materials

4.3.1 Printing ink

Printing inks to be tested may be received as two components, with high viscosity or press ready.

Since extension, drying properties, viscosity and, for two-component inks, the mixing ratio and open time of the printing inks to be printed and tested have a specific influence on the print result, these parameters shall be specified and adjusted to create a test-ready ink.

4.3.1.1 Extension

If a printing ink is supplied at a high colorant concentration, it should be mixed with an extender. There shall be prior agreement as to the type and amount of extender to be used.

4.3.1.2 Viscosity adjustment

The viscosity shall be determined and adjusted with a solvent at a certain temperature. The printing ink viscosity shall be determined using a viscometer. There shall be prior agreement as to the required viscosity, the measuring system and settings of the viscometer and the solvent to be used. The initial viscosity, the nature and amount of material used to dilute the sample and the final viscosity shall be recorded.

NOTE To compensate for differences in printing speeds and different drying conditions between test and production printing, the adjustment of the viscosity may require the use of different diluting materials for the test printing that would be needed for production printing.

4.3.2 Printing substrate and its preparation

There shall be prior agreement as to the printing substrate to be used and its preparation (e.g. application of primer, corona treatment) and properties.

For prints obtained in accordance with ISO 2846-4, specify the use of the reference substrate with specific characteristics.

4.4 Test conditions

4.4.1 Climatic conditions

Samples shall be conditioned and tests shall be executed under standard conditions in accordance with ISO 187.

4.4.2 Settings for the printability tester

There shall be prior agreement regarding fixation of substrate (clamps and/or vacuum), flooding procedure, squeegee angle, printing speed, printing pressure and off-contact distance.

4.4.3 Drying

The method of drying (e.g. ambient temperature, infrared, hot air or radiation-curing) shall be agreed upon between parties and recorded.

NOTE For radiation curing printing inks, an appropriate time interval between printing and curing might be necessary.

5 Procedure

Condition the printability tester for at least 2 h and the ink and the printing substrate for a sufficient period of time (at least 2 h) to create temperature and humidity equilibrium.

Use gloves and safety goggles during preparation and test.

Thoroughly clean the printing forme, squeegee and all items that come in contact with the ink or the printing substrate.

Prepare a test-ready ink.

Switch on the curing devices, if required.

Mount the printing forme and adjust the agreed-upon off contact distance.

Mount the squeegee and the flooding device agreed upon and adjust the angle agreed upon.

Following the instructions of the device manufacturer of the printability tester, set the agreed printing speed and pressure for the ink and printing substrate to be tested.

Place the substrate on the printability tester according to the instructions of the device manufacturer. Do not touch the printing surface, to prevent fingerprints or other contaminations.

Before applying the ink, homogenize it without introducing air into it.

Apply the required amount of ink to the printability tester according to the instructions of the device manufacturer.

NOTE For the purpose of comparison, a test ink and a sample of a reference ink can sometimes be printed simultaneously by placing both samples in the printing forme and evaluating the resultant print regarding colour differences on two sides of the print.

Carry out the printing process according to the instructions of the device manufacturer. Make five consecutive prints, discard the first two prints and use the other three prints for assessments.

Dry the print in accordance with the ink manufacturer's or agreed-upon instructions.

Measure the optical density of the last three prints, at least four times per print at different spots, and report the resulting average.

6 Report

The report shall contain the following information:

- a) a reference to this part of ISO 2834, ISO 2834-3:2008;
- b) any deviation from this part of ISO 2834;
- c) the type of printability tester used and all its settings as specified in 4.2.1;
- d) the type of mesh (mesh count and diameter of wires) and the thickness of the stencil as specified in 4.2.2;
- e) the squeegee and the flooding specifications as specified in 4.2.3.
- f) the amount and nature of any addition of extender, retarder or diluting material added to the printing ink as specified in 4.3.1;

- g) the viscosity of the printing ink and method of its measurement as specified in 4.3.1.2;
- h) the type of printing substrate;
- i) the method of drying or curing;
- j) the temperature of the printing ink if different from ambient temperature;
- k) the ambient temperature and relative humidity at the time of printing;
- l) the mean density of the prints;
- m) any operations not specified in this part of ISO 2834 which might have influenced the result.

Bibliography

- [1] ISO 2834-1, *Graphic technology — Laboratory preparation of test prints — Part 1: Paste inks*
- [2] ISO 2834-2, *Graphic technology — Laboratory preparation of test prints — Part 2: Liquid printing inks*
- [3] ISO 2836, *Graphic technology — Prints and printing inks — Assessment of resistance of prints to various agents*

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