INTERNATIONAL STANDARD

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Graphic technology — Prints and printing inks — Assessment of resistance to various agents

Technologie graphique — Impressions et encres d'imprimerie — Évaluation de la résistance des impressions à divers agents

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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 2836 was prepared by Technical Committee ISO/TC 130, *Graphic technology*.

This third edition cancels and replaces the second edition (ISO 2836:1999). It also incorporated the requirements of, and cancels, ISO 2837:1996 *Graphic technology — Prints and printing inks — Assessment of resistance to solvents* and ISO 11628:1995 *Graphic technology — Prints and printing inks — Determination of resistance of prints to acids.*

Graphic technology — Prints and printing inks — Assessment of resistance to various agents

1 Scope

This International Standard specifies methods of assessing the resistance of printed materials to liquid and solid agents, solvents, varnishes, and acids.

It applies to printing on all substrates by all of the traditional printing processes and digital imaging processes such as ink-jet, electrophotography, etc. using marking materials appropriate to the printing process used.

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 2834:1999, *Graphic technology — Test print preparation for offset and letterpress inks*

ISO 105-A03:1993, *Textiles — Tests for colour fastness — Part A03: Grey scale for assessing staining*

3 Terms and definitions

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

3.1
agent
liquid or solid to which a sample of printed material is exposed for the purpose of determining the resistance characteristics of that printed sample

3.2
resistance
ability of a printed material to withstand exposure to a specified agent as determined by the tests defined in this International Standard

4 Principle

4.1 Liquid and solid agents

A test piece cut from the print is brought into contact with the agent used. Assessment is made of any changes in the print and in the receptor surface which has been in contact with the print.

4.2 Solvents and varnishes

A test piece cut from the print is immersed in the prescribed solvent or test varnish for a given time. The colour change of the solvent or varnish and the discoloration and any change of the test piece are noted and reported.

4.3 Acids

A test piece cut from the print is pressed between two sheets of filter paper previously wetted with a solution of the relevant acid. An assessment is made of any change to the print and any bleeding of the colour onto the filter paper.

NOTE 1 The type and concentration of the acid and the duration of exposure are not standardized, but should be chosen according to the intended application of the print. Table 1 gives a list of commonly used types, concentrations and exposure durations.

NOTE 2 The test piece includes both printing ink and substrate, because resistance may be affected by ink, substrate or the interaction between them.

Test samples may be taken from existing printed material, or may be prepared to be representative of a planned printed product.

5 Agents

5.1 General

The type of agent used and its concentration shall be reported.

5.2 Water

This International Standard does not specify the type of water used for the assessment of resistance of prints. It may be tap water, distilled water, deionized water, natural water, carbonated water, sea water, etc.

5.3 Alkali

This International Standard specifies a 1 % by mass solution of sodium hydroxide in distilled water used for the assessment of resistance of prints.

5.4 Oils and fats

This International Standard does not specify the oil or the fat to be used for the assessment of resistance of prints. It may be animal, vegetable, mineral, essential or synthetic, e.g. fish oil, olive oil, liquid paraffin, lavender oil, silicone oil, butter, margarine, lanolin, grease.

5.5 Cheese

This International Standard does not specify the type of cheese, e.g. soft cheese or hard cheese, used for the assessment of resistance of prints. However, the cheese shall be used as a solid agent in a natural state, i.e. not liquefied.

5.6 Detergents

This International Standard does not specify the type of detergent, e.g. liquid or solid, used for the assessment of resistance of prints, only its concentration: 1 % by mass.

5.7 Soaps

This International Standard does not specify the type of soap, hard or soft, used for the assessment of resistance of prints, only its concentration: 1 % by mass.

5.8 Waxes

This International Standard does not specify the type of wax to be used for the assessment of resistance of prints, i.e. animal, vegetable, mineral or synthetic, e.g. beeswax, carnauba wax, paraffin wax, Fischer Tropsch wax.

5.9 Spices

This International Standard does not specify the spice to be used for the assessment of resistance of prints.

5.10 Solvents and varnishes

This International Standard specifies solvents and varnishes, e.g. denatured ethanol, a mixture of ethanol, ethyl acetate and 1-methoxy-propanol-2, or any other solvent or varnish for assessing the resistance of prints.

5.11 Acids

This International Standard does not specify any particular acid or concentration, but does give examples of acids that are commonly found in commerce and in the home which can be used for the assessment of resistance of prints. The acid and concentration should be chosen according to the intended application of the print. The following acids are mentioned in this International Standard:

— lactic acid — to simulate cheese and cheese products;

— citric acid — to simulate the juice of citrus fruits;

— acetic acid — to simulate pickles and vinegars;

— hydrochloric acid — to simulate products with pH values < 2;

— sulfuric acid.

5.12 Other agents

The test methods set out in this International Standard may be used in the assessment of the resistance of prints to other agents such as the following:

— hydraulic fluids;

— perfumes, deodorants;

— beverages: coffee, tea, beer, spirits;

— cosmetics: lipstick; skin cream.

6 Apparatus and reagents

This clause lists supplies and equipment necessary to perform resistance tests.

6.1 Equipment and apparatus

6.1.1 Glass plates, 2, 60 mm × 90 mm × 2 mm.

6.1.2 Laboratory filter paper, for qualitative chemical analysis, white, neutral, with a very smooth and soft surface, cut into strips 60 mm × 90 mm.

6.1.3 Petri dish, ⩾100 mm in diameter.

6.1.4 Test tubes, 2, of colourless glass, with inside diameter of approximately 16 mm and a height of approximately 160 mm.

6.1.5 Mass, 1 kg.

6.1.6 Time-piece.

6.1.7 Thermometer, capable of measuring from 20 °C to 30 °C.

6.1.8 Oven, capable of heating to 40 °C.

6.1.9 Oven, capable of maintaining a temperature of (50 ± 2) °C.

6.1.10 Hot plate, capable of heating to 40 °C above melting point of the wax.

6.1.11 Depth gauge, rule, etc.

6.1.12 Surface, white, illuminated.

6.1.13 Grey scale for colour evaluation (see ISO 105-A03).

6.1.14 pH measuring device, e.g. test strip or meter.

6.2 Solvents and varnishes

6.2.1 **Water**, deionized.

6.2.2 **Ethanol**, denatured.

6.2.3 **Denatured ethanol — ethyl acetate — 1-methoxy-propanol-2 mixture**, 60 % by volume; 30 % by volume; 10 % by volume.

6.2.4 **Solvent**, any provided that it is identified in the test report.

6.2.5 **Acid**, for test.

6.2.6 **Varnish**, for test.

7 Preparation of test pieces

Prepare production prints or test prints using any suitable method that allows a uniform distribution of ink to be formed on a specified substrate and dried in an appropriate manner, e.g. prepared in accordance with ISO 2834.

8 Test methods

8.1 Liquid agents

Test conditions for various liquid agents are summarized in Table 2.

Immerse the four strips of filter paper (6.1.2) to be used for the test totally in the liquid agent being tested and then drain them until no free agent drips from the filter paper.

Place two saturated strips of filter paper on the lower glass plate (6.1.1).

Place the 20 mm × 50 mm test piece being evaluated on the filter paper and cover it with the other two strips of saturated filter paper.

Cover with the other glass plate and place a 1 kg mass on top. Leave the package for the test duration specified in Table 2.

Rinse the test pieces being tested for alkali, detergent or soap resistance with deionized water until the rinse water has a neutral pH and dry test pieces (except those for oil resistance) in an oven for 30 min at a temperature of about 40 °C.

8.2 Solid agents

Test conditions for various solid agents are summarized in Table 2.

Place a 20 mm × 50 mm test piece with its printed side in contact with the freshly prepared smooth surface of the agent being tested.

Exert sufficient pressure on the test piece to ensure optimum contact with the solid agent.

Store this package for the test duration under the conditions specified in Table 2.

Carefully remove the test piece and, if required, allow to dry naturally.

8.3 Meltable solid agents (waxes)

Test conditions for various waxes are summarized in Table 2.

Melt 50 g of the solid agent in the Petri dish and maintain a temperature of not more than 40 °C higher than its melting point.

Immerse a 20 mm × 50 mm test piece for 5 min, leaving a small section unimmersed to facilitate handling.

Remove the test piece and allow to drip on a white filter paper while it is cooling.

8.4 Solid spices

Test conditions for solid spices are summarized in Table 2.

Place a 20 mm × 50 mm test piece on the bottom of the Petri dish, with the printed side up.

Place a filter paper on top of the test piece and spread a layer of the test agent to a depth of at least 3 mm.

Place a glass plate on the layer of the test agent and cover the Petri dish with the lid. Expose at the conditions specified in Table 2.

8.5 Solvents and varnishes

Fill the test tube half full with the chosen solvent or varnish and submerge a test piece with an area of 6 cm^2 in the solvent or varnish. The test temperature shall be (23 ± 2) °C.

If only a limited solvent resistance is required from the ink, the duration of the test shall not exceed 5 s; otherwise, remove the test piece after 5 min and note whether the solvent has changed colour. For this purpose, compare the test tube to a second test tube containing only the solvent, both test tubes placed in front of a white surface and illuminated from the side.

Dry the test piece for 10 min in the oven (6.1.8) at approximately 40 °C.

8.6 Acids

The recommended concentrations and durations of exposure for testing the resistance of prints to the most commonly used acids are given in Table 1. These recommended acids, concentrations and duration of exposures shall be used when no other guidelines concerning acids and test conditions are given.

The test shall be conducted at a standard temperature depending on the climate where the print is used, commonly (20 ± 2) °C, (23 ± 2) °C or (27 ± 2) °C.

Immerse the two strips of filter paper to be used for the test totally in the acid being tested and then drain until no free solution drips from the filter paper.

Place one of the sheets of filter paper on the lower glass plate.

Place a 20 mm × 50 mm test piece to be evaluated on the filter paper and cover it with the second piece of filter paper.

Place the upper glass plate on top and place the whole in a moisture-tight wrapper or container. Place a 1 kg load on the glass plates to provide pressure.

After exposing the print to the test acid for the specified duration (see Table 2), remove it and rinse it in deionized water until the rinse water has a neutral pH. Dry the print in the oven at (50 ± 2) °C for 30 min.

Dry the strips of filter paper used for the test in free air. Do not rinse them before examining them.

Table 1 — Recommended acid solutions

Acids	Option	Concentration % by volume	Duration of Exposure	Typical products for which testing of acid resistance can replace testing of resistance against the product itself
Lactic acid	1	10	1 h	cheese and cheese products
	2	5	24 h	
Citric acid	1	5	1 h	juice of citric fruits
	2	1	24 h	
Acetic acid	1	5	30 min	vinegar and pickles
	2	1	24 h	
Hydrochloric acid	1	5	10 min	products with pH < 2
	2	1	24 h	
Sulphuric acid	1	5	10 min	–
	2	1	24 h	

9 Evaluation of results

9.1 Liquid and solid agents

Compare the treated test piece to an untreated test piece. Observe any changes, including whether the ink film is completely intact.

Observe the receptor surface that has been used in the test for staining and/or ink transfer, and record any changes that have been observed.

9.2 Solvents and varnishes

Compare the dried test piece to an untreated test piece.

Record whether the solvent has caused a discoloration of the test piece.

Record whether the ink film is completely intact and whether its adhesion to the substrate is maintained.

Record whether the solvent has changed colour.

9.3 Acids

Compare the dried print with an unexposed reference print and examine the filter paper.

The results shall be evaluated in accordance with the following.

— If the print has changed significantly in appearance, it shall not be considered to be acid-resistant.

— If the appearance of the print has not changed, but the filter paper shows staining, this shall be evaluated as to intensity. The print is deemed to have bled when the stain on the filter paper is just visible, i.e. reaches step 4 of the grey scale as specified in ISO 105-A03.

— Record any colour change in the substrate.

NOTE Certain test prints are not acid-resistant in accordance with this International Standard. In many cases, the printed product can, however, still be satisfactory in use, even though a slight staining of the filter has been observed.