INTERNATIONAL STANDARD

ISO 18935

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Imaging materials — Colour images on paper prints — Determination of indoor water resistance of printed colour images

Matériaux pour l'image — Images en couleurs sur impressions en papier — Détermination de la résistance interne de la couleur à l'eau

Reference number
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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 18935 was prepared by Technical Committee ISO/TC 42, *Photography*.

This International Standard is one of a series of International Standards dealing with the physical properties and stability of imaging materials. To facilitate identification of these International Standards, they are assigned a number within the block from 18900 to 18999 (see Annex A).

Introduction

Water resistance is not an important consideration in the normal storage of colour prints. However, in a disaster situation such as floods, earthquakes, or water main breaks, this property can be of critical importance if the print is to be salvaged. A wide variety of materials are used for digital colour prints and the colorants used in some digital prints are water soluble. The degree of their water resistance varies depending upon the dyes used and if the print has a water-resistant overcoat. In addition, the paper used may be of equal importance. The same dyes may exhibit very good water resistance on one paper but can be completely washed off from a different paper. Even print systems that use water-insoluble colorants may be damaged by water exposure if the paper is not also water resistant. This International Standard provides a standardized method to evaluate the qualitative water resistance of colour prints.

Imaging materials — Colour images on paper prints — Determination of indoor water resistance of printed colour images

1 Scope

This International Standard specifies tests to determine the relative indoor water resistance of printed colour images. This International Standard is applicable to both digital and analogue prints.

2 Terms and definitions

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

2.1
ambient conditions
environmental conditions of (23 ± 1) °C and (50 ± 5) % RH

3 Categories of water resistance

3.1 General

The water resistance of a print is categorized into one of three categories, i.e. water resistant, moderately water resistant and not water resistant as defined in 3.2 to 3.4.

3.2 Water resistant

Water-resistant print is print that is not noticeably affected by exposure to liquid water and moisture.

NOTE No significant degradation of the colorant (bleeding, smearing, hue change), of the support (curl, cockle, delamination), or of the image surface (gloss changes, water rings, etc.) is found.

3.3 Moderately water resistant

Moderately water-resistant print is print that exhibits some change or damage by water but is still considered usable for its intended application.

NOTE The damage can manifest itself as slight media curl, partial delamination along an edge, or ring-like watermarks due to gloss changes or a minor amount of colorant migration. This damage can be mitigated by the rapid removal of the water (careful blotting, shaking off the water, etc.).

3.4 Not water resistant

Not water-resistant print is print that is easily damaged by contact with water, even when incidental (e.g. a water mist) and is considered unsuitable for applications involving contact with water.

NOTE Such damage can manifest itself as appreciable curl, delamination of the image layer, colorant bleed into non-imaged areas or from colour to colour, or image degradation (hue and gloss changes, surface marks, etc.). It is strongly advisable to users of these materials to prevent water contact.

4 Water resistance estimating procedures

4.1 General considerations

Water resistance is the ability of a print to resist water damage which may manifest itself in a number of ways, such as migration of colorants; changes in the size and/or optical density of image elements; degradation of the image layer, as well as cockle, curl or loss of gloss. The water resistance of prints made by current methods varies considerably. For example, some ink-jet prints sustain no observable damage when the surface is rubbed immediately after water has been poured over the image. While others, that do not show any water damage after soaking for hours, lose a portion of their image layer if it is wiped off before drying.

Extensive tests have shown that full characterization of water resistance requires several different methods. Many attempts were made to quantify the test data generated by these methods in inter-laboratory comparison, but none were successful. (It is likely that within a given laboratory, the tests described in this International Standard are sufficiently reproducible to yield statistically reliable data. However, this is not enough to adopt fixed evaluation criteria.) For this reason, qualitative analysis of the test results is prescribed. This entails grouping of the results obtained from different print materials into water-resistant (no change) or not water-resistant categories. An intermediate level of moderate water resistance is also recognized, although its boundaries cannot be determine exactly.

This International Standard requires the use of de-ionized or distilled water for all of the tests. The pH of this water is not controlled (unless it is certified, which will be at pH 7) but pH will have little effect on the tests. This is because any water-soluble components in the media coating will dissolve into the water and rapidly change the pH. The final value of this will depend on the media used.

4.2 Control sample

The evaluation of test results based on qualitative criteria for water resistance (as defined in Clause 3) requires that untreated control specimens be used for comparison with water-treated specimens.

5 Test methods

5.1 General

Three methods are given for water resistance. Method 1 models the effect of water spilt on an image and left to dry. Method 2 tests the physical integrity of the colorant receptive layer. This may be an important feature, as it is possible to have images that may resist smearing and other defects when in contact with water, but will be destroyed if touched before fully drying. Method 3 indicates how images will behave under catastrophic conditions (e.g. flood damage). Clause 6 shows some example test patterns that were generated using a simple drawing program on a PC computer.

The test methods discussed in 5.2 to 5.4 all involve the cyan, magenta, yellow, red, green, blue and black colours. For black, the processed black generated by the printer with the user specified driver settings (see Clause 6 for more information and warnings) shall be used. As an option, the user may also use black generated in a different manner (e.g. 3- or 4-colour composite, pure black, etc.) if the option is available to the user. Some printer systems utilize more than cyan, magenta and yellow primary colours (e.g. hexachrome systems that also use orange or green colorants). In such a case, the user of this International Standard may include these extra colours in the tests. All print specimens shall be allowed to dry at ambient conditions for 24 h prior to proceeding with the test.

5.2 Method 1 — Standing water evaporation

The test target consists of cyan, magenta, yellow, black, red, green and blue colour blocks of convenient size (~2 cm^2) with a chequered board fill pattern (1,5 mm^2) printed at the maximum density for that colour allowable by the printing system. Another set of chequered board squares is also printed at 0,5 $\pm$ 0,1 density above d_{min}. A 0,1 ml drop of water is then placed onto the centre of each colour patch and allowed to dry for at least 24 h at ambient conditions.

5.3 Method 2 — Standing water plus wiping effects

The test target and initial procedure is the same as Method 1, except that the 0,1 ml water drop is applied only to the maximum density patches. After allowing this drop to stand for 1 min, the water is wiped up. This is accomplished by placing a 2 cm^2 piece of laboratory tissue [e.g. Kimwipe[1)]®] backed by a semi-rigid support (e.g. cardboard) of the same size on top of the test target (over the water drop). A 50 g weight is applied to the laboratory tissue and the tissue is pulled once across the sample at an approximate rate of 5 cm/s.

5.4 Method 3 — Water soak

The test target consists of cyan, magenta, yellow, black, red, green and blue colour blocks (2,5 cm × 2 cm, h × w) printed at approximately 0,5 density above d_{min} with 7 lines (approximately 1 mm width) separated by 2 mm, drawn through the colour blocks. Each line is a different colour (CYMKRGB) printed at the full density allowable by the printing system for that media (see Clause 6). Another set of the chequered board test patterns used in 5.2 is also printed. Then they are immersed into de-ionized or distilled water at ambient temperature for 1 h; it may be necessary to use weights to hold the test specimen under the water), removed and hung vertically to dry (about 0,5 h to 1 h). Separate containers shall be used for each test specimen to avoid cross-contamination.

6 Test pattern preparation

6.1 General considerations

The example test pattern shown in 5.1 can be produced in any of the available image programs [in this case, Adobe Photoshop® [2)] was used]. The high-density areas were generated by assigning them the maximum RGB colour values. The lower density areas are targeted to be approximately 0,5 OD above d_{min}. The RGB values used are determined by trial and error and will likely be different for each printer system investigated. The print should be made by using the manufacturer's recommended driver settings for the colorant and media being investigated. Strong caution should be observed when using driver settings that are not recommended or unknown (i.e. the media and/or colorant being used has no recommended values by the printer's manufacturer). In these cases, the amount of colorant delivered to the media may be too little or too much and thus not represent a true d_{max} for that system. This can cause the results of the above tests to be in error. However, if those settings represent the intended use, then these shall be used, as they will then represent what the end user will observe.

In all cases, the exact printer settings used, the colour settings (i.e. RGB values) given by the imaging-processing program, and the program used shall be reported.

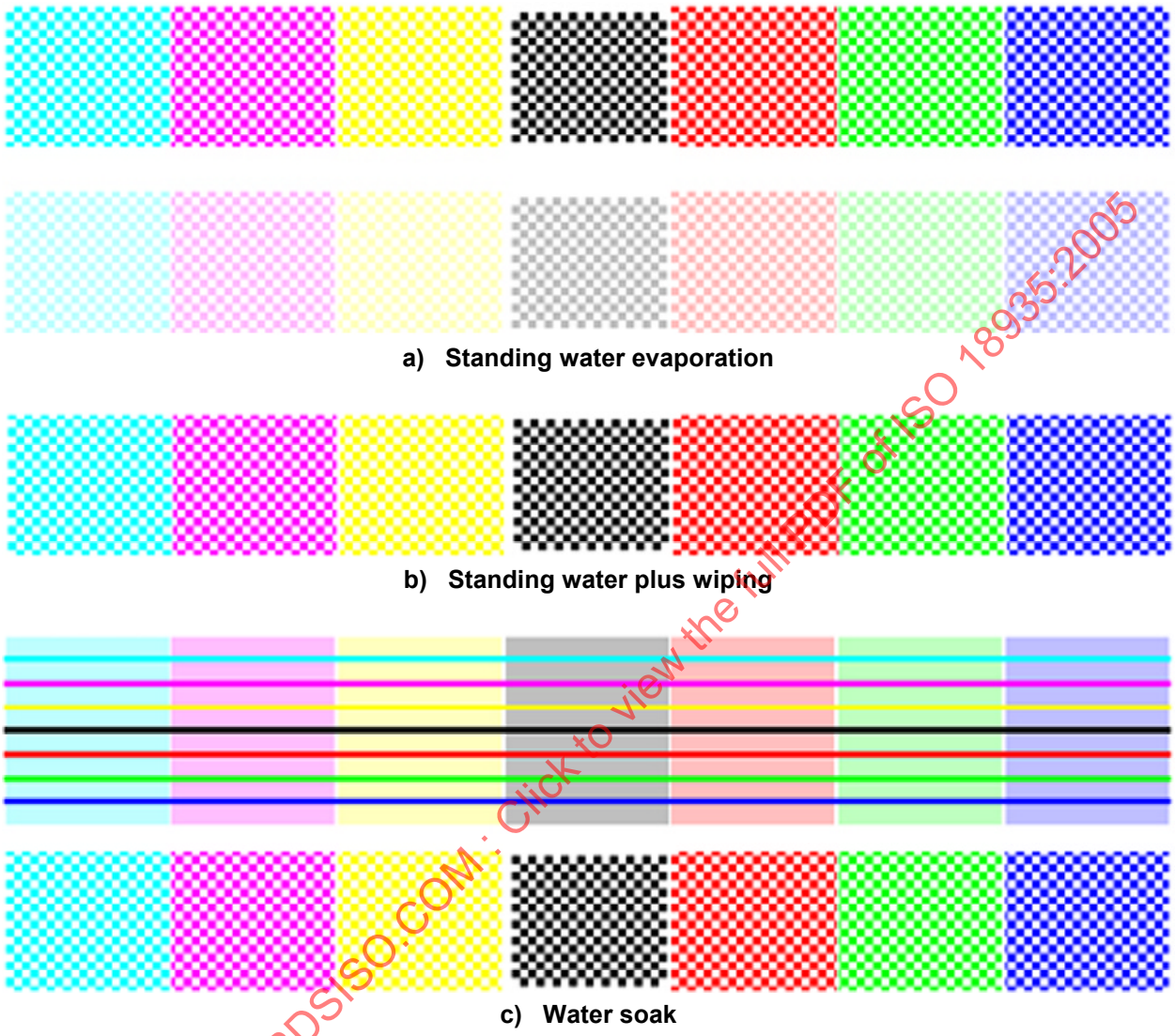
When producing print samples from analogue imaging systems, the manufacturer's recommended processing conditions shall be used. If deviations from that method occur, they shall be reported.

1) Kimwipe® is an example of a suitable product available commercially. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of this product. Equivalent products may be used if they can be shown to lead to the same results.

2) Adobe Photoshop® is an example of a suitable software package available commercially. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of this product. Equivalent products may be used if they can be shown to lead to the same results.

6.2 Example test patterns

Examples of test patterns are given in Figure 1.



a) Standing water evaporation

b) Standing water plus wiping

c) Water soak

Figure 1 — Examples of test patterns

7 Test report

For each system tested, the user of this International Standard shall report the primary failure mode, such as colorant bleed, paper cockle, delimitation, formation of rings (caused by colorant migration or water damage to the medium), loss of gloss, and removal of colorant, colour to colour bleed, etc. Comparison to the control (untreated) print is very helpful in this regard. The overall water resistance shall also be assigned using the categories listed in 3.2 to 3.4. It is especially important to note conditions where the print is damaged to the point that image information is lost.

In addition to the results, the printer settings used to make the print sample shall be reported, since as noted in Clause 6, these settings may have a significant impact on the observed water resistance. In the case of analogue test specimens, the process used to make the print shall be reported.

Annex A
(informative)

Numbering system for related International Standards

The current numbering system for TC 42 documents dealing with the physical properties and stability of imaging materials is confusing since the five digit numbers that are used are not in any consecutive order. To facilitate remembering the numbers, ISO has set aside a block of numbers from 18900 to 18999 and all revisions and new International Standards will be given a number within this block. The last three digits will be identical to the current ANSI/PIMA numbers of published documents. This will be advantageous to the technical experts from Germany, Japan, United Kingdom, and the USA who have prepared the standard and who are familiar with the ANSI/PIMA numbers.

As the present International Standards are revised and published, their new numbers will be as given in Table A.1.

Table A.1 — New ISO numbers

Current ISO number	Title	New ISO number
10602	*Imaging materials — Processed silver-gelatin type black-and-white films — Specifications for stability*	18901
10214	*Imaging materials — Processed photographic films, plates and papers — Filing enclosures and storage containers*	18902
6221	*Imaging materials — Films and paper — Determination of dimensional change*	18903
5769	*Imaging materials — Processed films — Method for determining lubrication*	18904
8225	*Imaging materials — Ammonia-processed diazo photographic film — Specifications for stability*	18905
543	*Imaging materials — Photographic films — Specifications for safety film*	18906
6077	*Imaging materials — Photographic films and papers — Wedge test for brittleness*	18907
8776	*Imaging materials — Photographic film — Determination of folding endurance*	18908
10977	*Photography — Processed photographic colour films and paper prints — Methods for measuring image stability*	18909
4330	*Imaging materials — Photographic film and paper — Determination of curl*	18910
5466	*Imaging materials — Processed safety photographic films — Storage practices*	18911
9718	*Imaging materials — Processed vesicular photographic film — Specifications for stability*	18912
—	*Imaging materials — Permanence — Vocabulary*	18913
—	*Imaging materials — Photographic film and papers — Method for determining the resistance of photographic emulsions to wet abrasion*	18914
12206	*Imaging materials — Methods for the evaluation of the effectiveness of chemical conversion of silver images against oxidation*	18915
14523	*Photography — Processed photographic materials — Photographic activity test for enclosure materials*	18916
417	*Photography — Determination of residual thiosulfate and other related chemicals in processed photographic materials — Methods using iodine-amylose, methylene blue and silver sulfide*	18917