INTERNATIONAL STANDARD

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# Imaging materials — Photographic reflection prints — Determination of abrasion resistance of photographic images

*Matériaux pour l'image — Impressions de reflexion photographiques — Détermination de la résistance à l'abrasion des images photographiques*



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# Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

The committee responsible for this document is ISO/TC 42, *Photography*.



 

# Introduction

This method is one of a series relating to image durability. Others in this family include scratch resistance and water resistance. Compared to image permanence standards that cover ever-present environmental factors such as light, heat, ozone, and humidity, this family of durability standards covers factors that are not necessarily present in the environment. Although the consumer may have less control over the environmental factors in which a print is stored or displayed, they may have more control over durability aspects such as careful handling and good quality storage enclosures. “Accidental” exposures and resulting damage such as water or food spills on a print, as opposed to always-present environmental factors, can, with care on the part of the consumer, be reduced. Obviously, this is not always true and in some cases, such as rubbing caused by turning pages in a photo book or natural disasters caused by flooding, the end user has little control. This International Standard provides standardized requirements to evaluate and quantify the abrasion resistance of photographic images in their various formats such as hard copy prints and photo books.

Abrasion and smudge can include both accidental and repeating factors resulting from handling of the image. The following are some examples of sources of abrasions:

— dirt particles rubbing on printed surface;

— sheet-to-sheet abrasion (sliding motion of sheets relative to each other);

— prints sliding on tables or other flat surfaces;

— interaction with dirt or components inside of printers;

— magnets or other items used in the display of images.



 

# Imaging materials — Photographic reflection prints — Determination of abrasion resistance of photographic images

## 1 Scope

This International Standard specifies tests to determine the abrasion, scuff, and smudge resistance of photographic images. This International Standard is applicable to photographic prints and photo books prepared by digital and analogue processes.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2813, *Paints and varnishes — Determination of specular gloss of non-metallic paint films at 20 degrees, 60 degrees and 85 degrees*

ISO 8254-1, *Paper and board — Measurement of specular gloss — Part 1: 75 degree gloss with a converging beam, TAPPI method*



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



ASTM D 2240, *Standard Test Method for Rubber Property — Durometer Hardness*



## 3 Terms and definitions

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

**3.1**
**ambient conditions**
environmental conditions of the test

**3.2**
**abrasion**
process of wearing away or deformation of a surface by friction as a result of rubbing

**3.3**
**scuff**
result of abrasion, leading to a change in gloss

**3.4**
**smudge**
result of abrasion leading to the displacement of colorants into adjacent areas as a result of the re-deposition of abraded material

**3.5**
**receptor**
substrate used to abrade the test specimen and onto which ink or overcoat that is removed from the specimen is transferred during the abrasion test

Note 1 to entry: An example of a receptor is the back side of the printed media being evaluated or a standard reference paper.

# 4 General test background

## 4.1 Summary of practice

This method utilizes a reciprocating rubbing device, or its equivalent, as described in ASTM F 2497, ASTM D 5264, and ASTM F 1571. Reciprocating abraders of alternate designs, such as those described in JIS K 5701-1, JIS L 0849, ISO 7784-3, or ASTM F 1319, may also be used as noted below. The test specimen is placed in contact with a receptor surface under a specified load and is rubbed with a back and forth motion at a specified frequency and for a specified number of cycles.

After treatment, the test specimen is removed from the test device and evaluated for degree of degradation by measuring the change in gloss, optical density, colorimetry, and/or change in physical appearance in both printed and unprinted (Dmin) areas. The receptor is analysed for the amount of colorant or coating transferred from the specimen as evidenced by an increase in optical density or change in colorimetry. Results are compared to equivalent, unabraded specimen and receptor.

NOTE It is not the purpose of this International Standard to define limits of acceptability or failure.

## 4.2 Significance and use

Depending upon their intended use applications, abrasion resistance is a desirable and sometimes critical property of imaging materials. The result of abrasion can be degradation in both image quality and functionality. The amount of abrasion damage to a photograph is dependent on many variables, including the nature of the abrading material, pressure, temperature, and humidity. This practice can be used to evaluate the relative abrasion, smudge, and scuff resistance of printed photographic images and unprinted photographic materials under laboratory conditions.



This practice can provide a reasonably simple procedure that can be used to set specifications for printed photographic materials and determine whether a product meets a predetermined standard for abrasion, smudge, or scuff resistance for a given use application.



## 4.3 Applicability and usage of alternative test methods

It should be noted that there are several alternative standard test methods that attempt to characterize other degradation aspects of imaging materials due to frictional contact with various surfaces under different loads and geometries. Specifically, the user of this International Standard is directed to ASTM F 1486 (GA-CAT), ASTM D 6037 (Taber), and ASTM F 1478 (Taber). Depending on the specific end-user application, one or more alternative methods may produce a more relevant result.

# 5 Test device

## 5.1 Test device description

This International Standard uses a test device[1)], such as described in ASTM D 5264, ASTM F 1571, ASTM F 2497, JIS K 5701-1, JIS L 0849, ISO 7784-3, and ASTM F 1319. See Annex A for a more complete description of the different abrasion testers mentioned in these referenced documents. Equipment that applies a similar reciprocating abrasive force in a similar manner as described in the preceding standards may also be used.

1) Examples of test devices are the Sutherland® Rub Tester (Danilee Co.), the AB-301 Colour Fastness Rubbing Tester (Tester Sangyo Co., Ltd.), the NUS-ISO 3 (Suga Test Instruments Co., Ltd.), the FR-2 (Suga Test Instruments Co., Ltd.), and the TRIBOGEAR TYPE 32 (Shinto Scientific Co., Ltd.) This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of these products.

 

### 5.2 Test device preparation

The test device shall be set on a sturdy bench, in a room conditioned to the desired test temperature and relative humidity. Conditions of 23 °C ± 1 °C and (50 ± 5) % relative humidity shall be used for testing, unless specific product end-use requires different conditions.

## 6 Sample preparation and conditioning

### 6.1 Test target definition

Test targets consisting of uniform patches sized to fit the test device described above shall be used. The target shall comprise a specified image substrate, with an associated substrate colour as measured in the Dmin patch, as well as the colour(s) of the imaging material utilized by the printing system under test. In the printed image areas, the target shall include neutral patches and print primary colorant patches, typically cyan, magenta, and yellow. Patches corresponding to additional colorants may also be added for such systems. For example, red, green, or blue patches may be added for systems using red, green, or blue colorants. Each colour patch shall be bordered by adjacent unimaged (Dmin) areas, oriented with the abrasive action of the test instrument, such that the smudging of colorant or imaging media into adjacent unprinted (Dmin) areas can be assessed. The optical density of each patch shall aim to be 1,5. If this density target cannot be obtained with the printing system of interest, the maximum density achievable may be used. If the printing system makes use of multiple ink levels for a colorant (e.g. cyan and light cyan ink), then a second set of patches falling between 0,3 and 0,5 density may also be included. Monochrome imaging systems (e.g. silver halide, true monochrome inks) and chromogenic imaging systems (e.g. colour silver halide) shall also use these additional density patches. The size of the patches shall be large enough to accommodate the size of the device mountings and weights. See Annex B for an example of a test target suitable for use in the test equipment described in ASTM F 2497, ASTM D 5264, and ASTM F 1571. See Clause 8 for instructions on how to measure optical density.



### 6.2 Test target printing and conditioning

The specimen shall be a flat sample with no surface irregularities, such as scoring or creases.

If testing multiple samples, it is important that each has comparable, if not, identical colorant coverage and colorant density. When testing across different print technologies, select appropriate imaging substrates and minimize substrate differences whenever possible.

The test specimen shall be sized such that the printed colour patches and the adjacent unprinted (Dmin) areas of comparable dimensions are within the area of abrasion as defined by the specific test device being used for the test. If all colour patches and adjacent unprinted (Dmin) areas cannot fit within the area of abrasion, multiple test specimens shall be printed and tested under identical conditions.

Printer settings shall be recorded.

The method of printing and handling of printed samples shall be consistent with the anticipated product end use, including the presence of an image overcoat if integral to the printing process.

Test specimens shall be conditioned uncovered for at least 72 h at 23 °C ± 1 °C and (50 ± 5) % relative humidity. Inkjet-printed samples should be kept at these conditions for 14 days prior to testing. A shorter conditioning time may be specified when the purpose of the test is to evaluate the abrasion resistance at a shorter time after printing.

Care shall be taken to avoid contaminating the sample with fingerprints during handling, as this can potentially influence the test results.

## 7 Test procedure

The test shall be conducted under environmental conditions of 23 °C ± 1 °C and at a relative humidity of (50 ± 5) %. The test procedure for each of the test devices referenced in 4.1 and 5.1, and described in