International Standard

ISO 18916

Imaging materials — Photographic activity test for enclosure materials — Processed silver-gelatin and dye-gelatin prints

Matériaux d'imagerie — Test d'activité photographique pour matériaux d'encadrement — Tirages traités à la gélatine argentique et à la gélatine teintée

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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.

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 document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 42, *Photography*.

This second edition cancels and replaces the first edition (ISO 18916:2007), which has been technically revised.

The main changes are as follows:

This revision resolves issues regarding the scope of ISO 18916:2007 and its applicability to photographic images that are not comprised of silver and/or gelatin-based materials. This revision removes these types of materials from the scope of the document. The following additional changes have been made:

— A new Annex D addresses and warns against the use of the test outside of its intended scope, e.g. as a general screen for oxidants and reductants and applied to all collection types. This annex also addresses the test's applicability towards 19$^{\text{th}}$ century photographic processes and digital hard copy such as inkjet, dye sublimation, and electrophotography.

— A new Annex E includes guidance on the interpretation of test results for short-term applications, such as display and transport.

— Language addressing the use of the test for consumer vs. museum applications has been added to the introduction.

— The standard no longer specifies an annual testing requirement. Instead, the standard recommends testing by batch or lot, and requires materials be re-tested upon changes in formulation or supplier change, or upon other changes in production of the product.

— Test modifications for chromogenic (dye coupler) and diazo images have been moved to a normative annex, as these are optional additional test methods for specific types of photographic processes and are not requirements of the test.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The use of materials for the storage, display, and transport of photographic records having a long-term value has necessitated the development of International Standards to specify important considerations in this field. The important elements affecting the useful life of imaging materials are as follows:

a) humidity and temperature of the environment;

b) hazards of fire;

c) hazards of water;

d) light exposure;

e) fungal growth;

f) contact with certain chemicals in solid, liquid, or gaseous form;

g) physical damage;

h) chemical processing;

i) damage from pests;

j) enclosures and containers in contact (or in close proximity) with the imaging material.

International Standards have been published which specify the material requirements for silver-gelatin type film (ISO 18901), diazo film (ISO 18905), and vesicular film (ISO 18912). Specifications for proper processing are also included in these documents. ISO 18918, ISO 18911 and ISO 18920 specify the storage conditions for photographic plates, films, and paper prints, respectively.

In addition to the storage conditions, the enclosure materials used are extremely important. Processed photographic materials in archival collections require a high degree of individual packaging to protect them from atmospheric influences, dust, and handling damage, and also to keep them from contaminating each other. For this purpose, a wide variety of paper and plastic materials are commercially available, fabricated into albums, boxes, sleeves, envelopes, folders, mat boards, and interleaving tissues. However, it is absolutely essential that these storage enclosures not cause harm to the photographic image. For optimum stability, it is necessary that storage enclosures and their components meet the requirements in ISO 18902, which includes passing the criteria of the photographic activity test.

The photographic activity test described in this document is a predictive test of chemical interactions between the storage enclosure and the photographic material. It can also be used to evaluate possible photographic activity caused by components of enclosures such as adhesives and marking substances.

This document uses detectors comprised of silver and gelatin to assess photographic activity, and therefore the test applies to silver-gelatin type film. Two modifications of this test method are provided in Annex A and apply to chromogenic (dye coupler) and diazo photographic materials. This test does not apply to other non-silver-gelatin or non-dye-gelatin systems. Many other historical prints, such as collodion, albumen, and historic silver-halide systems, contain either silver materials within the image or gelatin as a binder material, but not both. For these types of historical prints, the photographic activity test may be applicable, but best judgement should be used when applying the results of this test method to a specific type of historical print.

It is assumed that both consumers and collecting institutions such as museums, archives, and libraries, wish to preserve their photographs for extended periods of time. The photographic activity test applies to storage, display, and transport materials for both consumer and museum use. Consumers may choose to deviate from recommendations for a variety of reasons, such as aesthetics or price, but at least will have been informed on the potential consequences of those deviations.

Imaging materials — Photographic activity test for enclosure materials — Processed silver-gelatin and dye-gelatin prints

1 Scope

This document specifies the test method for evaluating possible chemical interactions between enclosures and photographic materials that are produced in a light sensitive silver halide and gelatin containing layer, processed using wet chemistry and where the final image retains metallic silver, herein referred to as silver-gelatin materials. Modified versions of the test method are applicable to chromogenic (dye coupler) and diazo photographic materials (see Annex A).

This document is applicable to all general photographic enclosure materials used for storage, display, and transport, such as paper, tissue, cardboard, mat board and plastics. It is also applicable to components of photographic enclosure materials such as adhesives and marking substances, including inks, paints, labels, and tape. This document applies to all storage, display, and transport materials used for silver-gelatin photographs whether intended for short or long-term use (see Annex E).

This document does not apply to non-silver-gelatin imaging systems. It does not pertain to harmful physical interactions such as blocking (sticking together), dye bleed, adhesive migration, or plasticizer exudation. It does not pertain to important criteria of enclosures such as their inherent chemical stability, physical integrity, and workmanship. Passing the photographic activity test (PAT) alone does not indicate that a material is archival. Quality requirements for photo-safe storage enclosures and their components are covered in ISO 18902, which includes passing the criteria of the PAT.

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 5-2, *Photography and graphic technology — Density measurements — Part 2: Geometric conditions for transmittance density*

ISO 5-3, *Photography and graphic technology — Density measurements — Part 3: Spectral conditions*

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

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

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

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

3.1
silver-halide print
photographic print made from material sensitised with silver halide emulsion and chemically processed to produce an image

3.2
image interaction
measurable density change in the image interaction detector, for example after contact with photographically active foreign matter

Note 1 to entry: See 4.2.1 for as description of the image interaction detector.

3.3
mottle
localized non-uniform and easily recognizable visual density variation in the *image interaction* (3.2) detector.

Note 1 to entry: Mottle is used in this document in a different context to that defined in ISO 18913. More detail on this is given in Annex C.

3.4
stain
measurable density increase in the stain detector, for example after contact with photographically active foreign matter

Note 1 to entry: See 4.2.2 for as description of the stain detector.

3.5
blocking
undesired adherence between sheets of printed material

Note 1 to entry: Blocking can occur under a variety of pressures, temperatures, and humidity conditions, while in storage or in use.

Note 2 to entry: Blocking effects include delamination, paper splitting, tearing, gloss changes, physical image transfer, permanent bonding to adjacent materials and prints, and edge deformation

4 Test conditions

4.1 Principle

The photographic activity test applies to processed silver-gelatin and colour (dye-gelatin) materials. It can apply to many historic photographic processes, such as other metallic silver-containing materials, and a modified version applies to chromogenic (dye coupler) and diazo images. For discussion of this standard's applicability to other imaging systems, such as albumen, dye-diffusion-transfer prints, inkjet, etc., see Annex D. The test consists of incubating the enclosure material or its components against the surfaces of two sensitive detectors.[8] The photographic density of these detectors is measured both before and after incubation and the density changes compared with those obtained when the detectors are incubated against a filter paper control. Three criteria are used to evaluate an enclosure, i.e. its tendencies to cause image interaction, stain, and mottle on the detectors. A material shall pass all three criteria in order to pass the overall photographic activity test. Specific details for each property are given in Clauses 5 to 7. The test conditions described in Clauses 4 to 7 pertain to paper and plastic enclosures. Modifications of the photographic activity test for enclosure components are given in Clause 8.

For enclosure materials intended for use with processed silver-gelatin and colour (dye-gelatin) images, only the PAT described in Clauses 4 to 7 is applicable. The dye coupler reactivity test, described in Annex A, is optional as the results are valid only for the specific chromogenic print product being investigated. Different chromogenic print products can have different staining sensitivities. For enclosure materials intended for use with diazo images, only the modified PAT described in Annex A is applicable. Applicability of the PAT detectors for use with non-silver-gelatin prints and for short-term applications are discussed in Annexes D and E.

If a particular brand of commercially made enclosure materials is found to be safe for long-term storage purposes, there is no assurance that subsequent batches will contain the same ingredients of the same purity, chemical inertness, concentrations, or sound and sturdy construction. For this reason, it is recommended that materials are tested by batch or lot. Materials shall always be re-tested upon changes in formulation or supplier change, or upon other changes in production of the product. The test report shall be applicable to

the particular batch or lot of material tested. For materials which are manufactured in a variety of colours, such as papers and inks, each colour is evaluated and reported separately.

4.2 Apparatus and materials

4.2.1 Image interaction detector, consisting of unprocessed colloidal silver (i.e. Carey Lea silver) in gelatin on a polyester base[1)].

4.2.2 Stain detector, consisting of a conventional non-resin-coated grade 2 or 3 black-and-white photographic paper having a relatively thick emulsion layer, processed to minimum density (D_{min}) according to the manufacturer's instructions. A warm-tone paper base or multigrade paper shall not be used. The paper shall be processed without development, using fix, wash, hypo-clearing agent and wash stages.

4.2.2.1 Fix solution, consisting of 240 g of sodium thiosulfate pentahydrate and 15 g of anhydrous sodium sulfite added to 1 l of water at 50 °C.

4.2.2.2 Hypo-clearing agent, consisting of 5 g of anhydrous sodium sulfite and 26 g of sodium hydrogen sulfite per litre of water.

It is recommended that the final washing be for 0,5 h with good agitation. This will avoid uneven leaching of brightener.

NOTE Longer wash times can cause physical distortion and leaching of fluorescent brighteners. The uniformity of the fluorescent brightener can be checked by visual examination using a UV lamp.

4.3 Incubation

Subject sandwiches of the detectors and enclosure material to an accelerated ageing test of 70 °C ± 1 °C and 86 % RH ± 3 % RH for 15 days, for example by means of a suitable temperature- and humidity-controlled chamber.

Moisture condensation on the specimen sandwiches, when directly (i) inserting them into the temperature- and humidity-controlled chamber at the test conditions, or (ii) upon removal, can confound the results and shall be avoided. To mitigate moisture condensation the climate chamber can be equilibrated to transition conditions of 70 °C ± 1 °C and 50 % RH ±3 % RH ~1 h before and after the test,

a) inserting: after the samples have equilibrated to 50 % RH ±3 % RH the humidity shall then be brought to 86 % RH ± 3 % RH to commence the test, and

b) upon removal: upon completion of the test, the humidity can be lowered to 50 % RH ±3 % RH and the specimens are allowed to equilibrate for one hour before removing from the chamber.

In practice, these additional steps have not shown to contribute to blocking of the detectors and filter paper.

Pull the sandwiches apart immediately after they are removed from the humidity chamber. Failure to do so may result in the adhering of adjacent layers and detectors.

4.4 Measurement

Measure the Status A blue diffuse density of the detector strips both before and after incubation at four locations for each strip. Make the after-incubation measurements at approximately the same locations as the before-incubation measurements. Measurements shall not be made at the edges of the strip. Measurements

1) The sensitivity of the colloidal silver detector is dependent upon the silver grain size and the degree of hardness. To ensure test sensitivity and reliability, the colloidal silver detector can be obtained from the Image Permanence Institute, Rochester Institute of Technology, 70 Lomb Memorial Dr., Rochester, NY 14623-5604, USA, or equivalent. Processed stain detector may also be purchased from the Image Permanence Institute. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of the product named. Equivalent products may be used if they can be shown to lead to the same results.

of density using either a filter instrument, such as a densitometer using filters to achieve Status A density, or spectral instrument, such as a spectrophotometer, shall conform to the spectral conditions of ISO 5-3. If measurements are made using a spectral instrument, weighting factors given in ISO 5-3 to achieve Status A density shall be used. Instruments shall conform to the geometric conditions of ISO 5-2 for transmittance density and ISO 5-4 for reflection density. Determine the transmittance density on the colloidal silver image interaction detector and reflection density on the photographic paper stain detector.

5 Image interaction test

5.1 Procedure

Make a stack of two image interaction test sandwiches of the enclosure material and the colloidal silver image interaction detector. Construct a sandwich so that the emulsion side of each image interaction detector strip faces a filter paper separator as shown in Figure 1. These two sandwiches shall consist of two strips of the image interaction detector, two strips of the enclosure material, two strips of a filter paper separator (see Note), and two pieces of glass. The glass shall be clean and shall be discarded if there are any signs of corrosion, such as dulling, iridescence, staining, cracking, pitting, efflorescence, or weeping. Apply a pressure of 500 Pa to the enclosure materials and detectors in the sandwich (including the mass of glass), which can be obtained by adding weight pieces to the sandwich surface. Cut the enclosure material, filter paper separators, detectors and glass into strips having the same dimension, being at least 30 mm × 20 mm. Sandwich construction is facilitated by using a specimen jig (see Figure 2) to hold the materials in place.

NOTE The filter paper separator is used to prevent any physical interactions between smooth impermeable enclosures and the detector, as well as any fibre transfer, enclosure sticking, ink transfer, or adhesive sticking to the detector surface.

Make two control sandwiches using filter paper[2)] instead of the enclosure material.

Within any single evaluation, use the same batch of materials for the detectors as well as for the filter paper for both the sample and the controls.

2) Whatman Number 1 filter paper has proven suitable. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of the product named. Equivalent products may be used if they can be shown to lead to the same results.