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**Imaging materials — Processed imaging  
materials — Albums, framing and storage  
materials**

*Matériaux pour image — Matériaux pour image après traitement —  
Albums, cadrage et matériaux d'archivage*

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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 18902 was prepared by Technical Committee ISO/TC 42, *Photography*.

This second edition cancels and replaces the first edition (ISO 18902:2001), which has been technically revised.

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## Introduction

Black-and-white and colour photographic materials, including traditional silver halide, inkjet, dye sublimation, and electrophotography, have become increasingly important as documentary and pictorial reference materials for consumers and in archives, libraries, government, commerce and academia. This importance has focused attention on the preservation of such materials to ensure their longest possible life.

The stability and useful life of processed imaging materials depends on their physical and chemical properties, as well as on the conditions under which they are stored and used. The important elements affecting the useful life of imaging materials are as follows:

- humidity and temperature of the storage environment;
- hazards of fire, water and light exposure;
- fungal growth;
- contact with certain chemicals in solid, liquid or gaseous form;
- physical damage;
- proper processing;
- enclosures and containers in contact with the imaging material.

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International Standards have been written specifying the stability requirements for different types of photographic film: ISO 18901<sup>[13]</sup>, ISO 18905<sup>[14]</sup>, ISO 18912<sup>[16]</sup> and ISO 18919<sup>[18]</sup>.

Recommended storage conditions are given in the following International Standards for different photographic materials: ISO 18911<sup>[15]</sup>, ISO 18918<sup>[17]</sup> and ISO 18920<sup>[19]</sup>.

This International Standard is an auxiliary document and deals specifically with the enclosure materials used in storage. It pertains to the materials used in filing enclosures, containers, albums and frames, as well as to construction details used in folders, sleeves, jackets, envelopes, pocket pages and slide mounts. In addition, ISO 18916 describes the test method used to evaluate materials for photo-reactivity, referred to in this International Standard.

The term “archival” is no longer used in International Standards for imaging materials for defining optimum storage conditions and enclosures, because the meaning of “archival” has become too ambiguous. In common usage, “archival” has been used to mean that documents can be preserved “forever.” The new terms, when applied to the storage standards mentioned above are “extended-term” and “medium-term.” Likewise, enclosure materials should not be referred to as “archival,” but rather as meeting the specifications of this International Standard and ISO 18916.

When filing processed imaging materials, it is customary and good practice to enclose these materials in envelopes, sleeves, folders or other forms of enclosure in order to exclude dirt, protect them against mechanical damage, and facilitate identification and handling.

Storage conditions for visual records can be designed for extended-term preservation or for preservation for moderate periods of time. The storage protection required in each case will differ in degree according to the inherent stability of the visual records, the cost of providing storage facilities, the desired record life, and the frequency of record use. Storage conditions shall be chosen within specified limits in order to obtain a satisfactory compromise between the degree of protection required and the practical consideration of immediate availability.

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Specifying the chemical and physical characteristics of the enclosure materials does not, by itself, ensure satisfactory storage behaviour. It is also essential to provide proper storage temperature and humidity, as well as protection from the hazards of fire, water and fungal growth, from contact with certain chemicals in solid, liquid or gaseous form (e.g., atmospheric pollutants) and from physical damage.

Furthermore, different types of imaging materials may respond uniquely to varying storage conditions. Clean, dust-free storage areas are essential because dust particles can be chemically destructive to images and base materials. In addition, solid particles can abrade photographic prints and negatives when these items are slid in and out of filing enclosures or when stacked items are sorted. Atmospheric conditions, natural and man-made, must be controlled since paper and plastic enclosures are permeable and they do not protect the photograph from environmental effects. Such effects include non-recommended relative humidities or atmospheric pollutants such as hydrogen sulfide, sulfur oxides, nitrogen oxides, peroxides and ozone.

Frames and framing material are included in this International Standard since it is realistic to assume that photographs will be viewed or displayed at some point during their lifetime. In addition, the photograph may be housed in the frame even when not on display. The lifetime of photographs on display is beyond the scope of this International Standard, however in general, long-term display is not recommended for photographs since colour and appearance may change over time.

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# Imaging materials — Processed imaging materials — Albums, framing and storage materials

## 1 Scope

This International Standard specifies the principal physical and chemical requirements for filing enclosures, containers, albums and frames, particularly designed for storing wet or dry processed films, plates and papers. This International Standard covers requirements for paper and board, plastic, metal, adhesives (except spray adhesives), writing, labelling and printing materials. It is applicable to photographs made with hardcopy materials. Included are photographs made with traditional chromogenic (“silver-halide”) and silver dye bleach photographic materials, dye- and pigment-based inkjet, dye diffusion thermal transfer (“dye sublimation”), liquid- and dry-toner electrophotography, and other analogue and digital print processes.

This International Standard applies to storage copies and does not include work copies as defined in Annex A. It applies to visual records for extended-term preservation and to visual records for preservation for moderate periods of time. The requirements are limited to the characteristics that may affect the enclosed item chemically or physically when it is stored under recommended conditions. (For methods of proper storage, see ISO 18911<sup>[15]</sup>, ISO 18918<sup>[17]</sup> and ISO 18920<sup>[19]</sup>).

This International Standard does not apply to the material used as a support for prints or documents. (For permanence requirements for paper for documents, see ISO 9706<sup>[12]</sup>).

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## 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 302, *Pulps — Determination of Kappa number*

ISO 699, *Pulps — Determination of alkali resistance*

ISO 10716, *Paper and board — Determination of alkali reserve*

ISO 12757-1:1998, *Ball point pens and refills — Part 1: General use*

ISO 12757-2:1998, *Ball point pens and refills — Part 2: Documentary use (DOC)*

ISO 14145-1:1998, *Roller ball pens and refills — Part 1: General use*

ISO 14145-2:1998, *Roller ball pens and refills — Part 2: Documentary use (DOC)*

ISO 18916, *Imaging materials — Processed imaging materials — Photographic activity test for enclosure materials*

ISO 18932, *Imaging materials — Adhesive mounting systems — Specifications*

TAPPI T 406, *Reducible sulfur in paper and paperboard*<sup>1)</sup>

TAPPI T 408 cm, *Rosin in Paper and Paperboard*<sup>1)</sup>

TAPPI T 509 om-06, *Hydrogen ion concentration (pH) of paper extracts (cold extraction method)*<sup>1)</sup>

### 3 Terms and definitions

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

#### 3.1

##### **acid-free adhesive**

mounting adhesive with a cold extraction pH between  $7,0 \pm 0,2$  and  $9,5 \pm 0,2$

#### 3.2

##### **acid-free paper or paperboard**

paper or paperboard with a cold extraction pH between  $7,0 \pm 0,2$  and  $9,5 \pm 0,2$  that is produced in an acid-free process and is sized in a neutral or alkaline manner

#### 3.3

##### **anti-blocking agent**

component of a material which provides microscopic bumps on the surface in order to minimize contact area and reduce the coefficient of friction

NOTE Examples are talc and other silicates.

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#### 3.4

##### **archival** (deprecated)

material that can be expected to preserve images forever, so that such images can be retrieved without significant loss when properly stored

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NOTE However, as no such material exists, this is a deprecated term and as such is not to be used in International Standards for imaging materials or in systems specifications.

#### 3.5

##### **buffered**

paper or paperboard with an alkali reserve that is equivalent to at least 2,0 % mass fraction calcium carbonate ( $\text{CaCO}_3$ )

#### 3.6

##### **ferrotyping**

changes in the surface gloss of swellable photographic coatings (e.g. gelatine) resulting from high humidity and direct contact with another surface

#### 3.7

##### **lignin-free**

paper or paperboard with a Kappa number of 7,0 or less, corresponding to a lignin concentration of approximately 1,0 % or less by mass

#### 3.8

##### **Newton's rings**

faint coloured rings or fringe patterns formed by the interference between a direct and a reflected beam of light generated by two transparent surfaces in close contact

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1) Available from the Technical Association of Pulp and Paper Industry, Box 105113, Technology Park, Atlanta, GA 30348, USA. These documents are examples of suitable documents available commercially. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of these documents.



**3.9****photo-safe**

material that meets the requirements of this International Standard so that it will not accelerate the natural ageing of photographic prints or films

**NOTE** Material that only meets pH requirements or passes the photographic activity test described in ISO 18916 is not necessarily photo-safe due to other factors that may be harmful to images and bases. These factors can include poor workmanship, poor design features and harmful chemical interactions not predicted by pH or PAT alone. In addition, some materials are themselves physically and chemically unstable and thus will not last long, even though they may not initially be reactive.

**3.10****slip agent**

component added to plastic material in order to reduce the coefficient of friction

**NOTE** Slip agents are usually amide-type materials.

**4 Materials****4.1 General**

The enclosure material shall be free of harmful materials that may be released slowly with time and cause degradation to the image or support material. For example, ageing blemishes in processed silver gelatine microfilm may be caused by chemicals such as peroxides evolved from the paper, see Bibliography [1], [2]. Likewise, the presence of acid in paper can cause paper degradation.

The enclosure itself shall be chemically stable. Otherwise, the decomposition products might be harmful to the photographic material, and dirt or dust might be produced that could scratch, or become embedded in the image surface. Cellulose nitrate, polyvinyl chloride, and glassine sheeting are examples of enclosure materials that are either chemically or physically unstable and shall not be used, see Bibliography [3], [4].

The surface of the enclosure material is also important. The enclosure shall not abrade the photographic print, film or plate. While a slightly textured or matte surface is recommended for the filing enclosure to minimize ferrotyping, a rough surface can produce abrasion problems. There may be other harmful physical characteristics of the enclosure material that may develop under adverse environmental conditions, e.g. elevated relative humidity. These include wrinkling and distortions common to glassine paper, or ferrotyping, of the image surface, i.e. local or overall glazing that can result from contact under pressure with smooth, glossy, plastic enclosure materials. Finally, enclosures shall be of sound and sturdy construction so that the enclosure functions properly during use, without seams or fabrication components failing or otherwise damaging the photographs during storage.

Paper, cardboard, mat board, mounting board, slide mounts, plastic materials, inks, adhesives and frames used without matting shall meet the requirements of the photographic activity test as described in ISO 18916. This incubation test determines whether these materials have a chemical interaction with silver, colour or diazo images or cause stain in the image binder layer, see Bibliography [5]. Paper shall also have a Kappa number of 7,0 or less, corresponding to a lignin concentration of approximately 1,0 % or less by mass, as lignin adversely affects photographs stored in lignin-containing enclosures, even when not in direct contact with the photographs, see Bibliography [6].

If a particular material or product is found to be safe for long-term storage purposes (i.e. passes the requirements of ISO 18916 and does not fail with use or cause physical damage), there is no assurance that subsequent lots will contain ingredients of the same purity, chemical inertness or sound and sturdy construction. All materials or products shall require annual evaluation and testing in accordance with this International Standard and ISO 18916, unless the specific lot of materials or products was previously tested. All materials shall also be retested in accordance with this International Standard and ISO 18916 should the formulation or supplier change.

## 4.2 Paper and board

Paper and paperboard material should meet the physical tests required for the particular application. These include folding endurance (Bibliography [10]), tear resistance (Bibliography [9]) and tensile strength (Bibliography [8]).

Paper and paperboard material shall have a pH between  $7,0 \pm 0,2$  and  $9,5 \pm 0,2$  as determined by the cold extraction method given in TAPPI T 509 om-06, with the following modifications.

- Verify that the ASTM D1193<sup>[21]</sup> Type I or Type II water used for this measurement has a conductivity that does not exceed 0,1 mS/m ( $1,0 \mu\text{S}/\text{cm}$ ) and a pH between 6,8 and 7,3. Should either the pH or conductivity not meet these requirements, boil water for 1 h and allow the water to cool under pure nitrogen or CO<sub>2</sub>-free air so that it meets these requirements.
- The temperature of the water shall be  $25 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$  and the circuit of the pH meter shall include temperature compensation.
- Reagent water may be added as a single 75 ml addition in order to limit the exposure of the extract solution to acids in the atmosphere.
- Gently mix the sample at least once during the one hour soak to promote homogeneity. Purge the sample with pure nitrogen or CO<sub>2</sub>-free air during the one hour soak. Purging may be conducted at intermittent times, if necessary, to prevent foaming.
- Rinse the probe with a small quantity of extract before measuring the pH of that particular extract.

Paper and paperboard material shall include an alkali reserve of at least  $0,4 \pm 0,1$  mol/kg, which is the molar equivalent of at least 2,0 % by weight calcium carbonate (CaCO<sub>3</sub>), as determined by the alkali reserve test described in ISO 10716. This alkali reserve shall be accomplished by the incorporation of an alkaline earth carbonate or equivalent. The alkali reserve shall be evenly distributed throughout the paper or paperboard.

Paper and paperboard material shall meet the requirements of the photographic activity test described in ISO 18916. It shall be made from high alpha-cellulose, bleached sulfite, or bleached kraft pulp with an alpha-cellulose content greater than 87 %, as determined by the method given in ISO 699. It shall be lignin-free, with a Kappa number of 7 or less when measured by the method given in ISO 302, corresponding to a lignin concentration of approximately 1,0 % or less (see, e.g., TAPPI T 236 om<sup>[22]</sup>), shall contain less than 0,000 8 % reducible sulfur when measured according to TAPPI T 406 and shall not contain alum rosin sizing when tested according to TAPPI T 408 cm. For album binding, requirements for the photographic activity test, alpha-cellulose, lignin, reducible sulfur and sizing do not apply to lined board materials, where the exterior covers are not in direct contact with photographs inside, are separated by a barrier material such as a plastic cover sheet over the pages, or where the interior lining is either a barrier or meets all the requirements in this subclause, thus mitigating possible chemical interactions caused by the board composition and cover material.

NOTE Copper, iron, and manganese adversely affect paper permanence and photo-safety (TAPPI T 266 om<sup>[23]</sup>).

A minimum of sizing chemicals shall be used, the amount being dictated by the requirements of the end use (enclosures, overwraps, interleaving, etc.). If sizing is used, neutral or alkaline sizing chemicals (internal and/or surface) shall be employed. Dyes or pigments used to colour the paper shall show no bleeding or transfer when soaked in distilled water for 24 h while held in direct contact with white bond paper.

The surface of the paper shall be free of knots, shives and other abrasive particles. Surface fibres that might offset on to image layers should not be present. The paper shall not contain waxes, plasticizers or other ingredients that may transfer to the photographic print or film during storage.

Each colour of paper or paperboard shall be tested separately to meet all requirements in this International Standard.

### 4.3 Plastic

Plastics shall meet the requirements of the photographic activity test described in ISO 18916.

A suitable plastic enclosure material is polyester [poly(ethylene terephthalate)]. In addition, polystyrene, polyethylene, polypropylene and spun-bonded polyolefins generally have been found suitable as they are usually inert, unplasticized and have good chemical stability. Other plastics may be satisfactory, but there has been no extended experience with such materials. Chlorinated, nitrated or acetate plastic sheeting, such as polyvinyl chloride, cellulose nitrate and cellulose acetate, shall not be used.

Highly plasticized sheetings or coatings shall not be employed, as this might result in image transfer, sticking, or changes to the image surface. Plastics of unknown quality containing residual solvents or plasticizers are suspect, because these chemicals may escape and have a harmful effect on the image.

Fire-retardant plastics used for containers, shall contain anti-oxidants and non-halogenated fire retardants, such as antimony oxide.

Most plastic sheeting used for enclosures contains slip agents and anti-blocking agents, in order to lower the coefficient of friction on the surface and thus prevent blocking of the sheets. In low density polyethylene and cast polypropylene, these components may migrate from the body of the plastic sheeting to the surface, where they are deposited as a waxy residue that may transfer to the film or photographic print stored inside the enclosure. In addition, this waxy film may attract dust and other foreign matter that could cause abrasion or otherwise deteriorate the photograph. Currently there is no standard test procedure to evaluate the suitability of slip agents and anti-block agents in plastic enclosures for long-term storage of photographic prints or films.

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The plastic shall meet the physical tests required for the particular application. These include folding endurance (Bibliography [10]), tear resistance (Bibliography [11]) and tensile strength (Bibliography [7]).

### 4.4 Metal

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Metals used for cores, reels, containers and frames shall be noncorrodible, such as anodized aluminium or stainless steel. The use of steel is permissible, provided the surface is well protected by powder coating, tinning, plating or some other corrosion-resistant finish. Lacquer or enamel that might give off reactive fumes, peroxides or exudations during storage shall not be used. Powder coated finishes are generally inert and do not release solvents or reactive fumes. Metal finishes shall meet the requirements of the photographic activity test described in ISO 18916.

**NOTE** Zinc and other potentially reactive metals may oxidise silver in the presence of atmospheric oxygen leading to silver image deterioration in black-and-white silver-gelatine films and papers. Iron, zinc and other potentially reactive metals may also reduce some cyan dyes used in the 1940s to the early 1980s in chromogenic negative, slide and motion picture films and in chromogenic paper. Aluminium, stainless steel, and gold are generally photo-safe.

### 4.5 Adhesives

#### 4.5.1 Basic requirements for all adhesives

Adhesives used as mounting adhesives and in the construction of albums, framing and storage materials and to adhere paperboard plies shall meet the requirements of the photographic activity test described in ISO 18916. Some images can be damaged by adhesives that contain impurities such as sulfur, iron, copper or other ingredients that might attack image silver, gelatine or film and paper supports. Various adhesives are hygroscopic, thus increasing the possibility of local chemical activity. Many adhesives discolour with age, staining any material with which they are in contact, or fail over time causing enclosure seams to open up.