INTERNATIONAL STANDARD

ISO 10214

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Photography — Processed photographic materials — Filing enclosures for storage

Photographie — Produits photographiques après traitement — Contenants pour classement destinés à l'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.

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.

International Standard ISO 10214 was prepared by Technical Committee ISO/TC 42, *Photography*.

Annexes A and B of this International Standard are for information only.

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Introduction

The use of photographic materials for the storage of records having a long-term value has necessitated the development of International Standards to specify the important considerations in this field. Satisfactory long-term storage is dependent upon three factors:

a) suitability of photographic materials;

b) satisfactory photographic processing conditions;

c) recommended storage conditions.

International Standards have been prepared which specify the material requirements for silver-gelatin type film (ISO 4331), diazo film (ISO 8225), and vesicular film (ISO 9718). Specifications for the proper processing conditions are also included in these documents. ISO 3897, ISO 5466, and ISO 6051 specify the storage conditions for photographic plates, films, and paper prints respectively.

This International Standard is an auxiliary document to the latter three International Standards and specifies the enclosure materials used in storage. It pertains to the materials used in filing enclosures and containers as well as to construction details of folders, sleeves, jackets, envelopes, and slide mounts. In addition, a photographic activity test is included for enclosures that are to be stored with photographic materials.

When filing processed films, plates, or papers, it is customary and good practice to enclose them in envelopes, sleeves, folders, or other forms of enclosures to exclude dirt, protect them against mechanical damage, and facilitate identification and handling.

Storage conditions for photographic records can be designed for extended preservation or for moderate periods of time. The storage protection required in each case will differ in degree, depending on the cost of providing storage facilities, the desired record life, and the frequency of record use. Storage conditions may be chosen within specified limits in order to obtain a satisfactory compromise between the degree of protection required and the practical considerations of immediate availability.

Specifying the chemical and physical characteristics of the photographic and enclosure materials does not, by itself, ensure satisfactory storage behaviour. It is essential also 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; from atmospheric pollutants; and from physical damage.

Furthermore, different photographic materials may respond in different manners to varying storage conditions. Because solid particles abrade prints and negatives when being slid in and out of filing enclosures or when stacked items are sorted, and because such particles can some-

times be chemically destructive to images and base materials, clean, dust-free storage areas are essential. Atmospheric conditions — natural and man-made — should also be controlled since paper or plastic enclosures are permeable and do not protect the photographic image from environmental effects. Such effects include non-recommended relative humidities or atmospheric pollutants such as hydrogen sulfide, sulfur dioxide, nitrogen oxides, and peroxides.

Photography — Processed photographic materials — Filing enclosures for storage

1 Scope

This International Standard specifies the principal physical and chemical requirements for filing enclosures and containers particularly designed for storing processed films, plates, and papers. The photographic image may be silver-gelatin type, colour (dye-gelatin), diazo, or vesicular. This International Standard applies to storage copies and does not include work copies as defined in annex A. 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, refer to ISO 3897, ISO 5466, and ISO 6051.)

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 5-2:1985, *Photography — Density measurements — Part 2: Geometric conditions for transmission density.*

ISO 5-3:1984, *Photography — Density measurements — Part 3: Spectral conditions.*

ISO 5-4:1983, *Photography — Density measurements — Part 4: Geometric conditions for reflection density.*

ISO 699:1982, *Pulps — Determination of alkali resistance.*

ISO 1184:1983, *Plastics — Determination of tensile properties of films.*

ISO 1974:1990, *Paper — Determination of tearing resistance (Elmendorf method).*

ISO 5626:1978, *Paper — Determination of folding endurance.*

ISO 6383-2:1983, *Plastics — Film and sheeting — Determination of tear resistance — Part 2: Elmendorf method.*

ISO 6588:1981, *Paper, board and pulps — Determination of pH of aqueous extracts.*

TAPPI T453su-70, *Effect of Heating on Folding Endurance (Relative stability of Paper)*[1].

3 Definitions and descriptions

For the purposes of this International Standard, the following definitions apply. (The choice of enclosure depends on the degree of protection required, the frequency of use, and the application of the photographic material.)

3.1 enclosure: Any storage container in close or direct contact with the processed film, paper, or plate such as reels, cans, bags, folders, sleeves (sheaths), jackets, envelopes, window mount or mat, slide mounts, cartons, and aperture cards. All materials used in fabricating enclosures shall comply with the appropriate requirements of clauses 4, 5 and 6.

3.2 dimensions: The dimensions of enclosures for processed photographic materials are guided by the

1) Available from the Technical Association of the Pulp and Paper Industry, Box 105113, Technology Park, Atlanta, GA 30348, USA.

dimensions and thickness of the photographic materials, and the number of rolls, sheets or strips to be stored within the enclosure. The enclosures shall be sufficiently large to permit the desired number of photographic materials to be inserted and withdrawn without producing abrasion, and, at the same time, be sufficiently close-fitting to prevent excessive movement within the enclosure.

3.3 seam: The area where an enclosure has an adhesive bond in its structure. If a pasted seam contacts the surface of the enclosed item, staining or other adverse effects may occur in the vicinity of the seam because of the individual or combined effect of an unsuitable adhesive, unsuitable enclosure material, or residual processing chemicals. Bottom seams have the disadvantage that photographs usually slide to the bottom of the envelope and may, therefore, cause pressure distortion, staining, or other adverse effects. The use of envelopes constructed with a bottom fold and with the side edge seams having the adhesive band narrower than the flap so that no adhesive can extend beyond the flap avoids these problems. The seam should be as narrow as possible to reduce or prevent pressure distortion.

This arrangement will also prevent "pressure marks" and permanent distortion of the film support during storage from pressure being exerted along the extra thickness of the seam. (Wrinkles in the enclosures are another possible source of pressure marks.) Envelopes shall be sufficiently large to contain photographs without having the seam coincide with the enclosed photograph. Photographs having emulsion on only one surface shall be inserted with the emulsion-side away from the envelope seam.

3.4 folder: A single sheet of material that is folded and does not have cemented seams.

3.5 sleeve, sheath: An enclosure with one seam and both ends open. The seam may be formed with an adhesive or ultrasonic welding, or the same result may be achieved by tightly creasing a flap of enclosure material, sometimes referred to as a captive flap enclosure. If an adhesive is used, it shall not extend beyond the area of the overlap.

3.6 jacket: Two transparent sheets separated by divider strips with single or multiple channels made to hold processed film strips. The channels shall be designed to permit insertion of the processed photographic material without undue abrasion.

3.7 envelope, bag: An enclosure which is cemented, mechanically joined, or heat-sealed on two edges with a bottom fold and one end open. No bottom seam shall be used because the contents tend to slide to the bottom of the envelope. The adhesive used on the edges shall not extend beyond the overlap. The width of the sealed flaps shall be as narrow as practical in order to reduce pressure differential effects upon the photographic material.

The envelope may or may not have a protective flap at the open end to provide additional protection against contamination by dust. If a flap is used, it shall not have adhesive or be sealed with tape or rubber bands. If a flap is not used, some degree of dust protection is obtained when the opened end is not used as the top.

NOTE 1 Enclosures for microfiche usually have the front side lower than the full height of the back side to permit easy reading of the eye-legible header normally found on microfiches and jackets. This modification does not offer as much protection from dirt as a full panel, but it makes access to the microform very convenient.

3.8 window mount, window mat: Two sheets of card hinged together with an aperture cut in the front sheet to show the image. This is principally used for the storage or display of paper prints attached to the back card.

3.9 slide mount: A structure to retain a film for slide projection. It may be fabricated of paper, plastic, or metal and held together by adhesives or interlocking parts. The photographic film may be encased between two glass plates. The glass may have a coating to reduce the formation of Newton rings.

3.10 carton: An outer container which can hold more than one individual unit. It may be a fabrication of paper or plastic.

3.11 aperture card: A processable card of standard dimensions with one or more openings into which a microfilm frame or frames can be mounted or inserted.

3.12 reel, spool: A hub or core with flanges (protective sides) on to which film is wound.

4 Materials

4.1 General

The enclosure material shall be free of acids and peroxides that may be released slowly with time and cause image instability or chemical decomposition of the film. For example, ageing blemishes in processed silver-gelatin microfilm may be influenced by chemicals evolved from the film boxes during storage [1,2]. Likewise, the presence of acid in paper that is in contact with photographic materials can cause 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 ni-

trate and glassine sheeting are examples of unsatisfactory enclosure materials because of their own instability [3,4].

The physical surface of the enclosure material also is important. A very smooth, glossy surface can result in sticking or ferrotyping (i.e. local or overall glazing) of the image surface. A slightly rough or matte surface is recommended for the filing enclosure, but a very rough surface can produce abrasion problems.

All paper, cardboard, and adhesive components of the enclosure and the photographic material to be stored shall meet the requirements of the photographic activity test as described in 6.1. This incubation test determines whether there may be a chemical interaction between these particular components of the package and a photographic material.

4.2 Paper

Corrugated cartons, boxes, or containers that are not in direct contact with the photographic material shall have a pH between 7,2 and 9,5 as determined by the method given in ISO 6588[2]. An alkali reserve shall be the molar equivalent to at least 2 % (m/m) of calcium carbonate ($CaCO_3$), as determined by the alkali reserve test described in 6.2 [5]. This alkali reserve shall be accomplished by the incorporation of an alkaline earth carbonate or equivalent [magnesium carbonate ($MgCO_3$) and zinc oxide (ZnO) are also being used, which in molar equivalencies correspond to approximately 1,6 % (m/m) reserve. This has the same effect as 2 % (m/m) molar equivalencies of $CaCO_3$].

Paper that is in direct contact with black-and-white photographic material shall be made from rag, bleached sulfite, or bleached kraft pulp with an alkali resistance expressed as R_{18} value greater than 87 % (m/m) as determined by the method given in ISO 699. It shall be free from such highly lignified fibres as groundwood, as determined by microscopic analysis and the phloroglucinol spot test. The pH shall be between 7,2 and 9,5 as determined by the method given in ISO 6588. The alkali reserve shall be the molar equivalent to at least 2 % (m/m) $CaCO_3$, as determined by the alkali reserve test described in 6.2 [5]. This alkali reserve shall be accomplished by the incorporation of an alkaline earth carbonate or the equivalent. [$MgCO_3$ and ZnO are also being used, which in molar equivalencies correspond to approximately 1,6 % (m/m) reserve.] A minimum of sizing chemicals shall be used, the amount being dictated by the requirements of the end use (enclosures, overwraps, interleaving, etc.) Neutral or alkaline sizing chemicals shall be employed.

The material shall be essentially free from particles of metal. Surface fibres that might offset on to photographic layers should not be present. The paper shall not contain waxes, plasticizers, or other ingredients that may transfer to the photographic material during storage. Glassine envelopes[3] shall not be used. The paper shall meet the physical tests required for the particular application[3)].

Paper that is in indirect contact with processed colour photographic material shall have similar composition to that used for black-and-white material except that the pH shall be between 7,0 and 7,5 and the 2 % (m/m) alkaline reserve requirement shall not apply.

4.3 Plastic

Suitable plastic enclosure materials are uncoated polyester [poly(ethylene terephthalate)], polyethylene and polypropylene as they are generally inert, unplasticized, and have good chemical stability. Other plastics may be satisfactory, but there has been no extended experience with such materials. Chlorinated or nitrated sheeting shall not be used, and cellulose nitrate in particular shall be avoided.

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

Plastic shall meet the physical tests required for the particular application[4)].

The photographic activity test shall not be made on plastics as it is not applicable for these materials.

4.4 Metals

Metals used for cores, reels, and containers shall be non-corrosible, for instance, anodized aluminium or stainless steel. The use of steel is permissible provided the surface is well protected by lacquer, enamel, tinning, plating, or some other corrosion-resistant finish. Lacquer which might give off reactive fumes, peroxides, or exudations during storage shall not be used.

The photographic activity test is not applicable for metals.

2) Plastics are a recommended alternative to paper for cartons, boxes or containers.

3) These include stability (see TAPPI T453su-70), folding endurance, (see ISO 5626), and tear resistance (see ISO 1974).

4) These include folding endurance (see ISO 5626), tear resistance (see ISO 6383-2) and tensile strength (see ISO 1184).

4.5 Adhesives

If an adhesive is used it shall have no harmful effect on the photographic image. The adhesive shall be applied to Whatman No.1 filter paper or its equivalent[5] and shall pass the photographic activity test outlined in 6.1. The test shall be made with the adhesive applied to the filter paper surface opposite to that in contact with the detectors. Some photographic images can be damaged by adhesives incorporating impurities such as sulfur, iron, copper, or other ingredients that might attack image silver or gelatin. Various adhesives are hygroscopic, thus increasing the possibility of local chemical activity. Photographic quality gelatin and many polyvinyl acetate and cellulose ester adhesives are suitable for use with paper enclosures. Heat-sealing and mechanical sealing should be used when possible.

Pressure-sensitive and ether-linked products should be avoided. Avoid using rubber-base products such as rubber cement. Not only might they contain harmful solvents or plasticizers, but they might be compounded with photographically damaging sulfur, usually a vulcanizer, accelerator, or stabilizer. Even some "low-desensitizing" or "sulfur-free" rubbers contain sulfur.

If a particular brand of commercially made adhesive is found to be safe for long-term storage purposes, there is no assurance that subsequent batches will contain ingredients of the same purity.

4.6 Printing inks

Printing inks have been known to cause microscopic spots in fine-grain silver microfilm[1]; consequently, there shall not be any printed matter on the inside of the filing enclosure. The ink used for imprinting the outside of filing enclosures shall not bleed, spread, or transfer, nor shall it be a source of products that attack the photograph or the enclosure itself. To ensure that the ink is inactive, it shall be applied to Whatman No.1 filter paper or the equivalent and shall pass the photographic activity test outlined in 6.1.

5 Materials and construction selection

Each material and enclosure type has advantages and disavantages. Paper is opaque and thus protects the photographic image from light, but the contents must be removed for identification or use. However, paper readily accepts writing. Plastic sheeting is generally transparent, permitting easy identification, but offering little light protection. Polyester sheeting is difficult to form and seal and is subject to dust attraction due to static.

Folders are the easiest to use and they reduce the possiblity of abrading the photographic material upon insertion or withdrawal, but they offer the least protection from dust and gaseous contaminants. They are suitable for photographic materials that are frequently used.

Sleeves or sheaths are usually transparent and therefore offer little light protection. Although the photographic image may be abraded during insertion, it is thereafter well protected from abrasion. The open ends provide little protection from airborne contaminants. Sleeves or sheaths made of polyester sheeting may cause abrasion during handling if they develop kinks in the surface.

Jackets, like sleeves, generally offer little light protection, but good dust and abrasion protection. The photographic image is readily identifiable and may be viewed without removal from the jacket.

Window mounts or mats offer very good protection in handling as they are somewhat rigid. They provide a means of easy identification and also protection during display. However, they do not offer dust protection.

Envelopes, especially those with protective flaps, offer the best protection from light and airborne contaminants, as well as providing a good writing surface for identifying the contents[6]. The photographic material is more subject to abrasion upon insertion or withdrawal. Envelopes are a good choice for material with low referral rates.

Slide mounts provide a convenient means of storing films intended for projection. None of the mounts offers protection against light, moisture, or gaseous contaminants. Glass mounts protect the film from abrasion and improve projection performance. However, if the glass does not have a matte surface, ferrotyping or Newton rings may occur.

Cartons are convenient for storing several individual photographic units (packages) and offer good protection from light and dust. More room may be available for identification and indexing. The units may not be held securely, however, if the carton is not full. This may call for individual protection of each unit within the carton.

Aperture cards, like slide mounts, hold relatively small pieces of film with the intention that the film remains attached to the card during use. This feature is a good choice for photographic material with high referral rates because of the ease of use.

5) Whatman No.1 is an example of a suitable filter paper 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.

6) The envelope should be written on before the photographic material is inserted.

However, the open structure offers little physical or elemental protection. Aperture cards with sleeves are used to provide physical protection. Two sets may be used, one for storage and one as a work copy.

6 Test methods

6.1 Photographic activity test

The photographic activity test consists of incubating the enclosure material or ink surface against the surfaces of two sensitive detectors. Adhesive shall not be placed against the surface of the detectors but applied to the filter paper and its opposite surface shall contact the detector (see 4.5)[7].

6.1.1 Detectors

There are two detectors used in this test — one for fade (interactions with silver images) and one for stain (interactions which discolour gelatin). The fading detector to be used is unprocessed colloidal silver (i.e. Carey Lea silver) in gelatin on polyester base[8].

The stain detector is a conventional non-resin-coated black-and-white photographic paper processed to D-min[9].

Both detectors shall be cut into strips at least 100 mm × 20 mm.

6.1.2 Procedure

Status A blue diffuse density of the detector strips shall be measured both before and after incubation at a minimum of four locations for each strip. Measurements shall not be made at the edges of the strip. Densities shall be measured with a densitometer conforming to the geometric conditions specified in ISO 5-2 and ISO 5-4 and the spectral conditions specified in ISO 5-3. Transmission density shall be determined on the colloidal silver detector and reflection density on the photographic paper stain detector.

Four "sandwiches" shall be made — a fade testing sandwich, a stain testing sandwich and two control sandwiches. The control sandwiches shall be made using Whatman No.1 filter paper. Both the enclosure material to be tested and the filter paper shall be cut to the same size as the detectors.

The fade testing sandwiches shall be made with two strips of the fade detector, two strips of the enclosure material (or filter paper), one strip of uncoated polyethylene teraphthalate, and two pieces of glass. The stack shall be constructed such that the emulsion side of each detector strip faces a strip of enclosure material. The order shall be: glass, fade detector, enclosure material, fade detector, enclosure material, uncoated polyethylene terephthalate[10], and glass.

The stain testing sandwiches shall be made with two strips of the stain detector, two strips of the enclosure material (or filter paper), three strips of uncoated polyethylene terephthalate, and two pieces of glass. The stack shall be constructed such that the emulsion side of each stain detector strip faces a strip of enclosure material. The order shall be: glass, uncoated polyethylene terephthalate, stain detector, enclosure material, uncoated polyethylene terephthalate, stain detector, enclosure material, uncoated polyethylene terephthalate, and glass.

The enclosure materials and detectors in the sandwich shall be under a pressure of 500 Pa which can be adjusted by adding weights to the sandwich surface. These sandwiches shall be subjected to an accelerated ageing test of 70 °C ± 2 °C and 86 % RH for 15 d. These temperature and humidity conditions can be obtained readily by storing the sandwiches in a desiccator jar that is placed in a forced air circulating oven at 70 °C. The 86 % RH can be obtained by keeping a saturated solution of

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7) The photographic activity test was developed for silver photographic images. For non-silver (e.g. colour, diazo, vesicular) images, a satisfactory test has not yet been established. In the interim it is recommended that for enclosures intended for use with non-silver photographic images, an additional third detector shall be used in the form of processed samples of the type of photograph to be stored. The general procedures of 6.1.2 and 6.1.3 shall be followed, except that evaluation of image changes upon incubation shall be appropriate for the detector. Image changes shall be no greater than the filter paper control. The incubation conditions specified in 6.1.2 may cause high levels of staining and fading of some colour images, which in turn may mask the effects of the enclosure. For chromogenic colour print detectors, a suggested incubation test is 60 °C and 86 % relative humidity.

8) 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 shall be obtained from either the Image Permanence Institute, Rochester Institute of Technology, Frank E. Gannett Memorial Bldg., Rochester, NY 14623-0887, USA, or Agfa-Gevaert AG, Sparte Bild-Foto, D-5090 Leverkusen, Germany.

9) A suitable non-resin-coated paper is premium grade print material having a relatively thick emulsion layer. The paper shall be processed without development, using a fix, wash, hypo-clearing agent and wash stages.

10) The uncoated polyethylene terephthalate (polyester) strips shall be used to isolate each detector group within the sandwich. Since the fade detector already has a polyester base, only one strip of uncoated polyethylene teraphthalate is necessary to isolate the fade detector group.