
**Imaging materials — Processed
photographic reflection prints — Storage
practices**

*Matériaux pour image — Tirages photographiques traités par réflexion —
Directives pour 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 18920 was prepared by Technical Committee ISO/TC 42, *Photography*.

This first edition cancels and replaces the fourth edition of ISO 6051 (ISO 6051:1997), and is mainly an editorial revision.

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This International Standard is one of a series of 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).

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Annexes A to I of this International Standard are for information only.

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Introduction

Photographic and other reflection prints, including hard-copy output from digital imaging systems, have become increasingly important as documentary and pictorial reference material in archives, libraries, government, commerce and academia. This has focused attention on the importance of the preservation of such materials to ensure their longest possible life.

The stability and useful life of photographic reflection prints depend on their physical and chemical properties and the processing, as well as on the conditions under which they are stored and used. This International Standard provides recommendations on proper storage conditions and practices.

The important elements affecting the useful life of photographic reflection prints during storage are as follows:

- relative humidity and temperature of the storage environment;
- hazards of fire, water, and light exposure;
- fungal growth and other micro-organisms;
- contact with certain chemicals in solid, liquid, or gaseous form;
- physical damage.

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The extent to which the relative humidity and temperature of the storage environment, or variations of both, can be permitted to reach beyond recommended limits without producing adverse effects will depend upon the duration of exposure, biological conditions conducive to fungal growth, and the accessibility of the atmosphere to the print surfaces.

The term “archival” is no longer used to express longevity or stability in International Standards on imaging materials since it has been interpreted to have many meanings, ranging from preserving documents “forever”, which is unattainable, to temporary storage of actively used materials.

This International Standard defines two levels of recommended storage conditions: medium-term and extended-term. Medium-term storage conditions can be used to preserve information for a minimum of 10 years. Extended-term storage conditions shall be used when it is desired to preserve information for as long as possible, and these conditions will prolong the life of all prints, even those not optimized for permanence.

The space requirements and costs for establishing and operating the two levels of storage conditions (medium-term and extended-term) differ significantly. Furthermore, the specified limits of temperature and relative humidity for both sets of storage conditions may not be realizable due to budgetary constraints, energy considerations, climatic conditions, building construction, etc. However, it must be recognized that any deviation from the specified conditions will reduce the effectiveness of the storage environment. If such deviation is unavoidable, the lowest possible storage temperature should be provided. In any event, the best preservation of prints will be attained with extended-term storage conditions.

The recommendations of this International Standard for the storage of photographic reflection prints encompass the following:

- storage enclosures, housing, and rooms;
- atmospheric and environmental conditions;
- fire protection;

— handling and inspection procedures.

With the exception of fire and associated hazards that are sufficiently common to warrant inclusion of protective measures, this International Standard does not pertain to means or methods for protecting photographic reflection prints against natural or man-made catastrophes.

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Imaging materials — Processed photographic reflection prints — Storage practices

1 Scope

1.1 This International Standard specifies dark storage conditions, storage facilities, and procedures for the handling and inspection of photographic reflection prints of all types and sizes.

1.2 This International Standard is applicable to photographic reflection prints on the following opaque supports:

- fibre-base paper;
- RC (resin coated) paper;
- plastic films (polyester, cellulose acetate, etc.).

1.2.1 This International Standard is applicable to the following black-and-white silver gelatin prints:

- wet-processed, including those that have been chemically treated to improve the permanence of the silver image and/or to modify its colour (e.g. with gold, selenium or sulfur formulations);
- diffusion transfer (e.g. Polaroid and Fuji Photo Film instant prints¹⁾);
- stabilization-processed (which contain the silver image as well as invisible, chemically stabilized silver halides);
- heat-processed.

1.2.2 This International Standard is applicable to the following multicolour and monochrome photographic prints:

- chromogenic, washed and stabilized;
- silver dye bleach;
- dye transfer;
- diffusion transfer (e.g. Polaroid and Fuji Photo Film instant prints¹⁾, peel-apart or integral);
- pigmented gelatin (carbon, carbro, etc.).

1.2.3 This International Standard is applicable to black-and-white and colour photographic reflection prints made with the following systems:

- thermal dye transfer (commonly referred to as dye sublimation);

1) Polaroid and Fuji Photo Film instant prints are examples of suitable products 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 products.

- thermal wax transfer;
- electrophotographic;
- ink jet;
- diazo.

1.3 Recommendations for storage of photographic films are given in ISO 18911 and for storage of processed photographic plates in ISO 18918. Print material on translucent film supports intended to be viewed primarily by transmitted light should be stored in accordance with ISO 18911.

1.4 This International Standard is applicable to medium-term and extended-term storage conditions as defined in clause 3.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 14523:1999, *Photography — Processed photographic materials — Photographic activity test for enclosure materials*.

ISO 18902:—²⁾, *Imaging materials — Processed films, plates and papers — Filing enclosures and storage containers*.

ISO 18911:—²⁾, *Imaging materials — Processed safety photographic films — Storage practices*.

ISO 18918:2000, *Imaging materials — Processed photographic plates — Storage practices*.

3 Terms and definitions

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

3.1 archival medium

recording material that can be expected to retain information forever, so that such information can be retrieved without significant loss when properly stored

NOTE There is, however, no such material and it is not a term to be used in International Standards or system specifications.

3.2 extended-term storage conditions

storage conditions suitable for the preservation of recorded information having a permanent value

2) To be published.

3.3**fire-protective storage**

facility designed to protect records against excessive temperatures, water and other fire-fighting agents, and steam developed by insulation of safes or caused by the extinguishing of fires and collapsing structures

3.4**fire-resistant vaults**

fire-resistant vaults as defined in appropriate national standards and regulations [1, 2]³⁾

3.5**insulated record containers (Class 150)**

insulated record containers (Class 150) as defined in appropriate national standards and regulations [3, 4]

3.6**life expectancy****LE**

length of time that information is predicted to be acceptable in a system at 21 °C and 50 % RH

3.7**medium-term storage conditions**

storage conditions suitable for the preservation of recorded information for a minimum of 10 years

3.8**storage container**

box or can used to store prints

3.9**storage enclosure**

any item in close or direct contact with recording material such as folders, envelopes, sleeves, albums and mats

3.10**storage housing**

physical structure supporting materials and their enclosures

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NOTE It may consist of drawers, racks, shelves or cabinets.

4 Enclosures and containers

All enclosures and containers used for medium-term and extended-term storage shall meet the requirements of ISO 18902 and ISO 14523. This includes enclosures and containers that are in either direct or indirect contact with the prints. Photographic reflection prints may be stored in envelopes or sleeves of paper or plastic, file folders, folding cartons, boxes, and albums, or may be matted. Photographic reflection prints should be protected from unnecessary light exposure, especially colour and diazo prints which shall not be exposed at all.

Generally, prints smaller than 28 cm × 36 cm in size may be stored vertically, but shall be placed between rigid supports to minimize slumping and curling. Prints 28 cm × 36 cm or larger should be stored horizontally, unless mounted on rigid supports. Stacks of horizontal prints should be less than 5 cm high to prevent excessive pressure on prints at the bottom.

Multiple prints, stored within an enclosure or container, shall be oriented with the emulsion sides against back sides, never emulsion against emulsion.

³⁾ The numbers in square brackets refer to references listed in the bibliography.

Suitable plastic enclosure materials are uncoated polyester (polyethylene terephthalate), polystyrene, high-density polyethylene and polypropylene. Other plastics may be satisfactory, but there has been no extended experience with such materials. Glassine envelopes and chlorinated, nitrated, or highly plasticized sheeting shall be avoided. Specifically, cellulose nitrate and polyvinyl chloride are not acceptable.

Sealed enclosures shall be used where needed to maintain the desired moisture content of the prints, to protect against gaseous and solid atmospheric contaminants, or when low-temperature storage is used without humidity control. Heat-sealed foil bags can provide this protection.

The adhesive used for seams and joints shall also meet the requirements of ISO 18902 and ISO 14523. The filing enclosure shall be constructed so that the seam or joint will be at the edge of the enclosure and not in contact with the image layer. Photographic-quality gelatin, modified and photographically inert starch, some acrylic and polyvinyl acetate adhesives, and methyl cellulose are suitable adhesives for use with paper.

For maximum life, prints shall be in a clean condition before being placed in storage and shall be inspected periodically thereafter, as outlined in 9.3.

5 Storage housings

Photographic reflection prints should be stored in closable storage housings such as drawers or cabinets, in storage cabinets with tightly fitting doors, or on open shelves when enclosed inside containers. The storage-housing materials shall be non-combustible, non-corrosive, and chemically inert, for example, anodized aluminum, stainless steel, or steel with a non-plasticized synthetic resin-powder coating. Wood, pressboard, particle-board, plywood, and other such materials shall be avoided because of their combustible nature and the possibility of their producing active deteriorating agents as they age.

The finish on the storage housing materials shall be durable and shall not contain substances that can have a deleterious effect on the stored prints. Adverse effects may be produced by finishes containing chlorinated or highly plasticized resins, or by solvents off-gassing from freshly applied finishes. Paints used on cabinets may give off peroxides, solvents and other contaminants for up to three months after application. Cabinets made of stainless steel or anodized aluminum are recommended. Metal housing materials that have been powder-coated (a layer of resin particles that are electrostatically applied to the surface of the metal and then fused to the surface using heat without the use of chemical solvents) are also recommended.

When air-conditioned individually, storage housings shall be arranged to permit interior circulation of air to all shelves and drawers holding print containers, so as to provide uniform humidity conditions. Storage housing located in rooms conditioned in accordance with 7.2 shall be provided with ventilation openings that permit access of air to the interior. Such openings shall not interfere with the requirements for fire-protective storage or water protection.

Different types of prints and films may be stored in the same storage area. However, different types of material shall not be stored in the same enclosure or storage container. Magnetic tapes or optical disks shall not be stored in the same storage vault as photographic prints due to the possible deleterious effects.

6 Storage rooms

6.1 Medium-term storage rooms

Rooms and areas used for print storage should be located in the same area as rooms containing provisions for inspection and viewing of prints. Good housekeeping is essential. Walls and enclosed air-conditioned spaces shall be designed to prevent condensation of moisture on interior surfaces and within walls, especially during periods of low exterior temperatures when the walls may be cooled below the dew-point of the air.

Provisions shall be made against damage of prints by water from floods, leaks and sprinklers, and from the steam released from masonry walls during a fire. A special storage room separated from the work areas for print records of medium-term interest generally will not be required, provided the conditions recommended in 7.2 are maintained.

6.2 Extended-term storage rooms

For extended-term storage, the requirements of 6.1 shall be met. The value of photographic prints kept for long-term purposes makes it advisable to provide a storage room or vault separate from medium-term storage facilities, temporary storage facilities, offices or work areas.

7 Environmental conditions

7.1 Introduction

The recommended relative humidity and temperature conditions given in Table 1 shall be maintained either within individual storage housings or within storage rooms containing such housings.

7.2 Temperature and humidity specifications for storage (see annexes B, C and D)

7.2.1 Medium-term storage environment

The maximum temperature for medium-term storage shall be 25 °C. Cycling of temperature shall not be greater than ± 5 °C over a 24 h period, and the peak temperature shall not exceed 30 °C. Some temperature fluctuation is allowable as long as the relative humidity stays within the specified limits.

The relative humidity of a medium-term storage environment shall be between 20 % and 50 %, and cycling of relative humidity shall not be greater than ± 10 % over a 24 h period. The moisture content in prints shall not be greater than the moisture in equilibrium with these relative humidities. Storing prints at the lower limit of the specified relative humidity range may cause curling of the prints or physical damage during handling (see annex E); prints may need to be equilibrated to a higher relative humidity prior to use.

7.2.2 Extended-term storage environment

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The maximum temperature for extended-term storage shall be as specified in Table 1. Cycling of temperature shall not be greater than ± 2 °C over a 24 h period, and some temperature fluctuation is allowable as long as the relative humidity stays within the specified limits.

The relative humidity of an extended-term storage environment shall be as specified in Table 1. The variation of relative humidity shall not be greater than ± 5 % over a 24 h period. The moisture content in prints shall not be greater than the moisture in equilibrium with these relative humidities.

For black-and-white silver, silver dye bleach, dye/silver diffusion transfer (instant), dye imbibition (transfer), pigment and diazo, a maximum storage temperature of 18 °C shall be used. Added protection may be obtained for all prints by low-temperature storage, as such storage improves the stability of both the print support and the image.

For multicolour and monochrome chromogenic dye prints and all other types of prints not specified, a maximum storage temperature of 2 °C shall be used. Excellent keeping behaviour has been obtained by storing colour prints at such low temperatures. The recommended humidity and temperature conditions may be maintained either within individual storage housings or within storage rooms containing such housings. Either of the following two methods may be used in order to prolong the useful life of prints.

- a) The first method is to use a storage room controlled at 2 °C and maintained within the recommended relative humidity range. This method alleviates the need for sealed storage containers, but requires expensive equipment and facilities to maintain the environmental conditions. One problem is the danger of moisture precipitation on print surfaces when they are brought into a warm room. This can be avoided by placing prints in sealed moisture-proof containers or in heavy-gauge self-sealing plastic bags prior to removal from the cold vault and allowing them to warm above the dew-point prior to opening.