

# INTERNATIONAL STANDARD

**ISO**  
**5466**

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## Photography — Processed safety photographic films — Storage practices

**iTeh STANDARD PREVIEW**

*Photographie — Films photographiques de sécurité traités — Techniques  
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.

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.

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International Standard ISO 5466 was prepared by Technical Committee ISO/TC 42, *Photography*.

This fourth edition cancels and replaces the third edition (ISO 5466:1992), which has been technically revised.  
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Annex A forms an integral part of this International Standard. Annexes B to J are for information only.

## Introduction

Photographic film is an important documentary and pictorial material. There is a recognized need for information on safeguarding photographic film having legal, scientific, industrial, artistic or historical value. The value of such records used in archives, museums, libraries, government, commerce and universities has focused attention on the care of such records to ensure their longest possible life<sup>[1][2]</sup>.

Films are susceptible to degradation from many sources. These factors may be divided into three general categories as follows.

### a) Nature of the photographic film

The stability of photographic film records depends on the physical and chemical nature of the film. Only safety photographic films are suitable for storage; the specification for safety photographic film is given in ISO 543.

For preservation purposes, processed photographic films are classified according to their life expectancy or LE designation. These are specified in the appropriate International Standards. The term "archival" is no longer used to express longevity or stability in International Standards on imaging materials since it has been interpreted as having many meanings, ranging from the preserving of information "for ever" to the temporary storage of actively used information.

The best film material for preservation is silver-gelatin-type film which meets the requirements of ISO 10602. This International Standard also applies to processed colour, diazo (ISO 8225) and vesicular (ISO 9718) films. Although these film types may not have as high an LE designation, excellent keeping properties have been obtained with many of them. For the optimum preservation of photographic information, a high LE film should be used and it should be stored under extended-term storage conditions.

### b) Photographic processing of the film

For black-and-white silver-gelatin-type film, ISO 10602 specifies a maximum residual thiosulfate level and residual silver compounds level for different LE classifications.

For diazo film, ISO 8225 specifies a proper development test. ISO 9718 includes both a proper development test and a residual diazonium salt test for vesicular film.

### c) Storage conditions

The conditions under which safety photographic film records should be stored are extremely important for the preservation of film and are the subject of this International Standard.

The important elements affecting preservation of processed film are humidity, temperature and pollutants of the air, as well as the hazards of fire, water, light, fungal growth, insects, microbiological attack, contact with certain chemicals in solid, liquid or gaseous form, and physical damage due to handling. Direct contact with other generic types of film can be detrimental to either film.

The extent to which humidity, temperature, atmospheric contaminants or variations thereof can be permitted to reach beyond recommended limits without producing adverse effects will depend upon the duration of exposure, on the biological conditions conducive to fungal growth, and on the accessibility of this atmosphere to the emulsion and support surfaces.

Exposure to high temperatures and, in particular, to high humidities can lead to degradation of the film supports and the photographic emulsion<sup>[3][4][5]</sup>. Cellulose ester base films are more subject to base degradation than polyester base films.

There are two levels of storage conditions

- 1) medium term,
- 2) extended term.

Extended-term storage conditions were called "archival" storage conditions in the 1992 issue of this International Standard but this name change was made to remove the term "archival" from International Standards. Medium-term storage can be used for films where the information is to be preserved a minimum of 10 years while extended-term storage conditions will prolong the life of all films, even those not optimized for permanence. The storage protection provided by each level will differ in degree, as will the cost of providing and maintaining the storage facility.

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Immediate availability of space and cost may need to be considered when selecting storage conditions. It is recognized that many facilities may not be able to obtain the low humidity and low temperature levels specified in this International Standard because of energy considerations, climate conditions or building construction. Such deviations from the specified conditions will reduce the degree of protection offered, and in such cases maintaining a humidity as low as possible will still provide some benefits.

This International Standard is not designed to provide protection against natural or manmade catastrophes, with the exception of fire and associated hazards which are sufficiently common to warrant inclusion of protection measures.

In addition to the specifications in this International Standard, good storage practices must consider the filing enclosure. This is covered in ISO 10214.

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# Photography — Processed safety photographic films — Storage practices

## 1 Scope

**1.1** This International Standard provides requirements and recommendations concerning the storage conditions, storage facilities, handling and inspection for all processed safety photographic films (hereafter referred to as photographic film) in roll, strip, aperture-card or sheet form, regardless of size.

**1.2** This International Standard applies to extended-term and medium-term storage of photographic film as defined in clause 3.

**1.3** It applies to photographic film records intended as storage copies, which should not be in frequent use. It does not apply to “work” or “use” copies (see annex A).

**1.4** This International Standard, while intended for materials that are well processed, should also be of considerable value in prolonging the useful life of photographic film whose processing conditions are unknown, or that have been toned, retouched or have markings with materials of uncertain or unknown stability.

**1.5** This International Standard applies only to safety photographic film (see ISO 543). Nitrate base films are hazardous and are not covered by this International Standard<sup>[6]</sup>. They require special storage considerations<sup>[7]</sup>.

**1.6** The storage of photographic paper and photographic plates requires different considerations. They are not covered in this International Standard, but are described in ISO 6051 and ISO 3897, respectively.

## 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 543:1990, *Photography — Photographic films — Specifications for safety film*.

ISO 10214:1991, *Photography — Processed photographic materials — Filing enclosures for storage*.

## 3 Definitions

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

**3.1 archival medium:** Recording material that can be expected to retain information for ever, 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 material or system specifications.

**3.2 duplicate:** Reproduction of a master, retaining the same polarity and size.

**3.3 extended-term storage conditions:** Storage conditions suitable for the preservation of recorded information having permanent value.

**3.4 fire-protective storage facilities:** Facilities designed to protect photographic film against excessive temperatures, water and other fire-fighting agents, and steam developed by the insulation of safes or caused by the extinguishing of fires and collapsing structures.

**3.5 life expectancy (LE):** Length of time that information is predicted to be retrievable in a system under extended-term storage conditions.

**3.6 LE designation:** Rating for the “life expectancy” (see 3.5) of recording materials and associated retrieval systems.

NOTE — The number following the LE symbol is a prediction of the minimum life expectancy, in years, for which information can be retrieved without significant loss when stored under extended-term storage conditions. For example, LE-100 indicates that information can be retrieved for at least 100 years storage.

**3.7 medium-term storage conditions:** Storage conditions suitable for the preservation of recorded information for a minimum of ten years.

**3.8 open enclosure:** Enclosure which is intended for physical protection against mechanical damage, but is neither light-tight nor airtight. Such enclosures may be reels, cores, spools, cassettes, magazines, folders, envelopes, cartons, boxes, sleeves, transparency mounts or aperture cards.

**3.9 protective enclosure:** Light-tight, impermeable container used for protection from outside factors such as reactive gases and moisture, including relative humidity changes.

**3.10 safety photographic film:** Film that meets flammability specifications defined in ISO 543.

**3.11 storage housing:** Physical structure supporting photographic materials and their enclosures.

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

## 4 Film enclosures

All enclosures used for medium-term and extended-term storage shall meet the requirements of ISO 10214.

### 4.1 Film in roll form

#### 4.1.1 Medium-term storage enclosures

Aerial film, microfilm, motion-picture film, and some portrait films are wound on reels or cores and stored in roll form. Rolls shall all be wound tightly, but not under extreme tensions. A tension caused by 0,3 N of pullout force for a 35 mm width is recommended. Rolls greater than 150 m in length shall be stored so that the radius of the roll is in the horizontal position and the film is supported on its edges. Rolls less than 150 m in length may also be stored with the radius of the roll in the vertical position, if the core itself is supported by a horizontal spindle inserted into the cores so as to avoid pressure on the bottom of the roll. However, if such rolls are on reels or spools which have flanges, a spindle is not required since the flanges support the weight of the roll.



Motion-picture film shall be wound with the emulsion surface on the inside of the roll, as this improves subsequent projection performance<sup>8)</sup>.

Rolls of photographic film shall be stored, preferably, in closed containers to provide protection against dirt and physical damage, unless the film is protected by the storage housing (see clause 5). Colour, diazo and heat-processed silver films shall be stored in closed, opaque enclosures or be otherwise protected from light exposure. Suitable enclosures are containers with telescoping, slip-type or threaded twist-on lids. The materials used shall meet the same requirements as those for cores and reels as specified in ISO 10214. Closed enclosures are not necessarily airtight and may provide limited access to ambient air. Therefore, if they are used, the humidity of the ambient air shall not exceed the recommended limits.

Protective enclosures made from impermeable materials shall be used where needed to maintain humidity limits of the film (see clause 7), to protect against gaseous impurities in the atmosphere, or when low-temperature storage is used without humidity control (see annex B). Suitable enclosures are closed containers with friction-type or threaded, twist-on lids having an incorporated seal. Rubber gaskets shall not be used. Cans within heat-sealed foil bags also provide additional protection from high humidity. Metal containers provide the best protection against gases from the environment. However, they may corrode from acidic fumes<sup>1)</sup> from within the container unless they are protected with an overcoat. Alternative materials are polystyrene, polyethylene and polypropylene.

#### 4.1.2 Extended-term storage enclosures

For extended-term storage, the requirements of 4.1.1 shall be met. The materials used for reels, cores and containers shall meet the requirements of ISO 10214. Rubber bands shall not be used for confining film on reels or cores. If paper bands are used, the paper shall meet, as a minimum requirement, the specifications given in ISO 10214. Films on reels may be confined by tucking the film end between the roll and flange. Pressure-sensitive tape, if needed for the enclosure, shall be free from peroxide and pass the photographic activity test given in ISO 10214. Pressure-sensitive tape shall not be used in contact with the film.

Films may have possible interactions with other films which are of a different generic type (e.g. diazo and silver-gelatin), as well as with magnetic tapes and optical disks. Films of a different generic type shall not be wound on the same rolls or stored in the same enclosures. Closed containers are required, unless the photographic film is protected from dirt and damage by the storage housing (see clause 5).

## 4.2 Film in sheet and slide form

### 4.2.1 Medium-term storage enclosures

Film in sheet form shall be stored in envelopes of paper or plastic foil, folding cartons, boxes, file folders, aperture cards or film strip jackets. Photographic slides shall be stored in cardboard, metal or plastic boxes. Colour, diazo and heat-processed silver films shall be stored in opaque envelopes or folders, or otherwise protected from light exposure. Films should not be stacked, as this could cause excessive pressure on the lower ones. When in direct contact with the surface of the photographic film, the paper or plastic material used for envelopes, sleeves, jackets, folders, boxes and cartons shall meet, as a minimum requirement, the specifications given in ISO 10214. Suitable plastic enclosure materials are uncoated polyester (polyethylene terephthalate), high-density polyethylene and polypropylene. Glassine envelopes and chlorinated, nitrated or highly plasticized sheeting shall be avoided.

Protective enclosures shall be used where needed to maintain humidity within the limits of the film (see clause 7), to protect against gaseous impurities in the atmosphere or when low temperature storage is used without humidity control. Heat-sealable envelopes consisting of aluminium foil extrusion coated with clear polyethylene on the inside and laminated to a suitable paper sheet on the outside have been successfully used as sealed enclosures. Precautions should be taken in handling these envelopes, so that they are not punctured. To provide greater protection against pinholes, a double bagging technique is recommended.

1) Some vesicular films give off acidic fumes which may interact with silver, diazo or dye-gelatin type films. Decomposing acetate base films release acetic acid which further catalyses base degradation.

The adhesive used for seams and joints shall also meet the requirements of ISO 10214. The filing enclosure shall be constructed so that any seam or joint will be at the edge of the enclosure and not in contact with the image layer.

Any film which is not essentially free from acid release<sup>1)</sup> shall be stored in plastic envelopes.

#### 4.2.2 Extended-term storage enclosures

For extended-term storage, the requirements of 4.2.1 shall be met.

Photographic quality gelatin and many polyvinyl acetate and cellulose acetate adhesives are suitable for use with paper. Pressure-sensitive (permanently tacky) adhesives shall meet the specifications of ISO 10214.

Films may have possible interactions with other films which are of a different generic type (e.g. diazo and silver-gelatin), as well as with magnetic tapes with optical disks. Films of different generic types shall not be interfiled or be in physical contact with each other.

## 5 Storage housing

Photographic film shall be stored in closed housings, such as drawers, or on shelves and racks enclosed by doors in order to provide protection from dust and dirt. Alternatively, open shelves and racks may be used if the film is in closed containers. The storage housing materials shall be non-corrodible as described in ISO 10214. They shall also be non-combustible. Due to their combustible nature and the possibility of producing active fading agents on ageing, materials made of wood, pressed-board, hard-board, particle-board and other natural materials shall be avoided.

The finish on housing materials shall be durable and shall not contribute any deleterious effects to stored photographic film. Adverse effects can be produced by finishes containing chlorinated or highly plasticized resins, or by freshly painted or lacquered surfaces. Freshly painted cabinets shall not be used for 3 months, as they can give off peroxides and contaminants.

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When air-conditioned individually, storage housings shall be arranged to permit interior circulation of air to all shelves and drawers holding film containers to allow uniform humidity conditions. Storage housings located in rooms conditioned in accordance with 7.1 shall be provided with ventilation openings permitting access of air to the interior. Such openings shall not interfere with the requirements for fire-protective storage or water protection. Films and other materials that release acidic fumes, magnetic tapes and optical disks shall not be stored in the same storage housing as other photographic products.

## 6 Storage rooms

### 6.1 Medium-term storage rooms

Rooms and areas used for film storage should be associated with rooms allowing facilities for inspection and viewing of the film. Good housekeeping is essential. Walls and enclosures of 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 can be cooled below the dewpoint of the air. Provisions shall be made against damage to the film by water from floods, leaks, sprinklers, etc., and from steam released during a fire from masonry walls. Storage rooms or vaults should be located above basement levels where possible. A special storage room separated from the work areas will generally not be required for film records of medium-term interest, provided that conditions as recommended in 7.1.1 are maintained.

Films which are not essentially free from release of acidic fumes, such as some vesicular films, shall be stored in separate storage rooms. Films showing any sign of chemical degradation shall be stored in a separate storage room having a separate circulating air system.

### 6.2 Extended-term storage rooms

For extended-term storage, the requirements of 6.1 shall be met.

The value of photographic film kept for long-term purposes makes it advisable to provide a storage room or vault that is separated from temporary storage facilities, offices or work areas. Storage rooms for films which are not essentially free from acid release shall have a separate circulating air system (see annex C).

Storage rooms have been constructed in caves and mines and have proven very satisfactory when accepted requirements are met for environmental conditions (see 7.1) and air purity (see 7.3).

## 7 Environmental conditions

### 7.1 Humidity and temperature limits (see annexes D and E)

#### 7.1.1 Medium-term storage environment

The average relative humidity of a medium-term storage environment shall not exceed 50 %. Ideally, the maximum temperature for extended periods shall not exceed 25 °C, and a temperature below 21 °C is preferable (see table 1). The peak temperature for short periods shall not exceed 32 °C.

Short-term cycling of temperature shall be avoided. Cycling of relative humidity shall not be greater than  $\pm 10$  % over a 24-h period. Protection may be increased by storing film at low temperature and low relative humidity.

**Table 1 — Maximum temperatures and relative humidity range for storage**

Sensitive layer	Medium-term storage		Extended-term storage <sup>1)</sup>	
	Maximum temperature °C	Relative humidity range <sup>2)</sup> %	Maximum temperature °C	Relative humidity range <sup>2)3)</sup> %
Silver-gelatin	25	20 to 50	21	20 to 30
Thermally processed silver			15	20 to 40
Vesicular			10	20 to 50
Electrophotographic				
Photoplastic				
Diazo				
Colour	25	20 to 50	2 – 3 – 10	20 to 30 20 to 40 20 to 50

1) Formerly known as “archival storage”; see Introduction.  
 2) The moisture content of the film to be stored shall not be greater than film in moisture equilibrium with these relative humidities.  
 3) See annex G for storage of historic still photographic records.

#### 7.1.2 Extended-term storage environment

##### 7.1.2.1 Recommended environment for black-and-white films

The rate of most chemical reactions, such as the degradation of film base and the fading of chromogenic dyes, is lowered with decreasing temperature and decreasing relative humidity. Consequently, life expectancy is increased as either storage temperature or storage humidity is lowered. Moreover, a lower storage temperature can compensate for a higher humidity to provide the same life expectancy (see annex F). For this reason, several relative humidity-temperature combinations can be used for an extended-term storage environment as specified in table 1. Higher relative humidity ranges can be employed if the average temperature is reduced, but the maximum relative humidity shall not exceed 50 %. Cycling of relative humidity shall be no greater than  $\pm 5$  % over a 24-h period.