Sri Lanka Standard

PHOTOGRAPHY - PROCESSED SAFETY PHOTOGRAPHIC FILMS - STORAGE PRACTICES.

SLS 1089 : 1995
ISO 5466 : 1992

Gr. F

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SRI LANKA.

Sri Lanka Standard
PHOTOGRAPHY - PROCESSED SAFETY PHTOGRAPHIC FILMS - STORAGE PRACTICES

NATIONAL FOREWORD

This standard was approved by the Sectoral Committee on Information Technology on 1994-12-06 and was authorized for adoption and publication as a Sri Lanka standard by the Council of the Sri Lanka Standards Institution on 1995-11-23.

This Sri Lanka Standard is identical with ISO 5466, Photography -Processed safety photographic films - Storage practices, published by the International Organization for Standardization (ISO).

Terminology and conventions

The text of the International Standard has been accepted as suitable for publication, without deviation, as a Sri Lanka Standard. However, certain terminology and conventions are not identical with those used in Sri Lanka Standards, attention is therefore drawn to the following:

Wherever the words 'International Standard' appear, referring to this standard they should be interpreted as 'Sri Lanka Standard'.

Cross references

Corresponding Sri Lanka Standard for the following International Standards referred in the standard are not available at present.

ISO 543 : 1990, Photography - Photographic films - Specifications for safety film

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

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INTERNATIONAL STANDARD

ISO 5466

Third edition
1992-12-15

Photography — Processed safety photographic films — Storage practices

Photographie — Films photographiques de sécurité traités — Directives pour l'archivage

Reference number
ISO 5466:1992(E)

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

This third edition cancels and replaces the second edition (ISO 5466:1986), of which it constitutes a technical revision.

Annexes A, B, C, D, E, F and G of this International Standard are for information only.

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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 [1] [2].

Films are susceptible to degradation from many sources. These factors can be divided into three general categories:

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 being described in ISO 543.

For preservation purposes, film can be given three classifications:

1) medium-term;

2) long-term; and

3) archival.

The best film material for preservation is silver-gelatin type film which meets the requirements of ISO 10602 for archival film.

This International Standard also applies to processed colour, diazo (see ISO 8225) and vesicular (see ISO 9718) films. Although these film types are not archival, they can be medium-term or long-term and excellent keeping experience has been obtained with many of them.

For optimum preservation of photographic information, archival film should be used and it should be stored under archival storage conditions.

b) Photographic processing of the film

For silver-gelatin type archival film, ISO 10602 specifies a maximum residual thiosulfate level and a maximum residual silver compounds level.

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 water, light, fungal growth, insects, microbiological attack, contact with certain chemicals in solid, liquid of gaseous form, and physical damage.

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 biological conditions conducive to fungal growth, and on the accessibility of this atmosphere to the film surfaces.

Exposure to high temperatures and more particularly to high humidities can lead to degradation of the film supports and the photographic emulsion [3] [4] [5]. Cellulose ester base films are more subject to base degradation than polyester base films.

The recommendations of this International Standard also pertain to fire protection, and inspection. This International Standard does not give recommendations concerning protection against natural or man-made catastrophes, with the exception of fire and associated hazards which are sufficiently common to warrant inclusion of protection measures.

Storage conditions for photographic records are of two classes:

1) medium-term; and

2) archival.

The storage protection provided by each class will differ in degree because of the cost of providing storage facilities, desired record life and frequency of record use. Storage conditions may be chosen within specified limits representing a satisfactory compromise between degree of protection required and practical considerations of immediate availability.

In addition to the specifications in this International Standard, good storage pratices should consider the filing enclosure. These are covered in ISO 10214.

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Photography — Processed safety photographic films — Storage practices

1 Scope

1.1 This International Standard gives 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 only to safety photographic film (see ISO 543). Nitrate base films are hazardous and unstable and are not covered by this International Standard [6] [7].

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

1.4 This International Standard applies to archival and medium-term storage of photographic film as defined in clause 3.

1.5 This International Standard applies to photographic film records intended as storage copies, which should not be in frequent use. This International Standard does not apply to "work" or "use" copies (see annex A).

1.6 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. It is not intended to predict or assign a useful lifetime to photographic film stored in accordance with the specifications of this International Standard.

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 safety photographic film: Film meeting the specifications as defined in ISO 543.

3.2 medium-term film: A photographic film which is suitable for the preservation of records for a minimum of 10 years under "medium-term" storage conditions, providing the original images are of suitable quality.

3.3 long-term film: A photographic film which is suitable for the preservation of records for a minimum of 100 years under "archival" storage conditions, providing the original images are of suitable quality.

3.4 archival film: A photographic film which is suitable for the preservation of records having permanent value under archival storage conditions.[1)]

1) Films suitable for archival records are specified in ISO 10602.

3.5 medium-term storage: Those storage conditions suitable for ensuring a minimum useful life of 10 years for medium-term films.

3.6 archival storage: Those storage conditions suitable for the preservation of photographic film having permanent value.

NOTES

1 Archival storage conditions will prolong the useful life of both archival and non-archival films.

2 The term "archival" as used in photography and defined as in this International Standard is frequently being misapplied in related fields of imaging. ISO/TC 42 will therefore replace the term "archival storage" with "extended-term storage" or specify a "life expectancy (LE)" classification in future editions of its standards.

3.7 fire-protection storage: Facilities designed to protect photographic film against excessive temperatures, water and other fire-fighting agents, steam developed by insulation of safes, and collapsing structures.

3.8 insulated record container: Container as defined in appropriate national standards and regulations.[2)]

3.9 fire-resistant vault: Vault as defined in appropriate national standards and regulations.[3)]

3.10 open enclosure: Enclosure which is intended for physical protection against mechanical damage but is neither lighttight nor airtight.

Reels, cores, spools, cassettes, magazines, folders, envelopes, cartons, sleeves, transparency mounts and aperture cards are examples of open enclosures.

3.11 protective enclosure: Lighttight, impermeable container used for protection from outside factors such as reactive gases and moisture, including relative humidity changes.

Taped cans and sealed envelopes are examples of protective enclosures.

4 Film enclosures

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 of 0,3 N for a 35 mm width is recommended. Rolls, mounted on cores, shall be stored with the core axis vertical. If it is necessary to store rolls less than 20 cm in diameter with the core axis horizontal, the roll shall be supported so that the lower part of the roll does not 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 [10].

Rolls of photographic film should be preferably stored in closed containers to provide protection against dirt and physical damage unless the film is protected by the storage housing (see clause 5). Colour and diazo 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. Closed enclosures are not necessarily airtight and may give 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. Cardboard enclosures are not recommended for microfilm because of the danger of their producing microscopic blemishes (see annex F). Suitable enclosures are closed containers with friction-type or threaded, twist-on lids having an incorporated seal. Rubber gaskets shall not be used. Flip-top, hinged or telescoping lids can be used, but the joint shall be sealed by several wraps of pressure-sensitive adhesive tape having low gas permeability. Taped cans within heat-sealed foil bags provide additional protection from high humidity. If tape is used, routine retaping of joints every 2 years is recommended; in any case, if the tape seal is observably deficient in integrity, it shall be replaced.

Any film which is not essentially free from gas release[4)] shall be stored in separate storage rooms (see clause 6). Polystyrene, polypropylene or polyethylene enclosures are preferable to cardboard or metal enclosures for such films.

For maximum storage life, photographic film shall be in a clean condition before being placed in storage.

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2) Example: Class 150 of UL 72 [8].

3) Example: NFPA 232 [9].

4) Some vesicular films give off acidic fumes which can interact with silver, diazo or dye-gelatin type films.

4.1.2 Archival storage enclosures

For archival storage, the requirements of 4.1.1 shall be met. The materials used for reels, cores and containers shall meet the requirements for ISO 10214. They shall be non-corrodible and peroxide-free. Rubber bands or pressure sensitive tape 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 described in ISO 10214. Films on reels may be confined by tucking the film end between the roll and flange.

Films can have interactions with other films which are of a different generic type (for example, diazo and silver-gelatin), with magnetic tapes and with optical disks. Films of different generic type shall not be wound in the same rolls or stored in the same enclosures. Magnetic tapes and optical disks should not be stored in the same storage housing.

Closed containers are required unless the photographic film is protected from dirt and damage by the storage housing (see clause 5).

Periodic inspection shall be made as outlined in 9.2.

4.2 Film in sheet and slide form

4.2.1 Medium-term storage enclosures

Film in sheet form may be stored in envelopes of paper or plastic foil, folding cartons, file folders, aperture cards or in film strip jackets. Photographic slides may be stored in cardboard, metal or plastic boxes. Colour or diazo films shall be stored in opaque envelopes or folders or otherwise protected from light exposure. Films should not be stacked as this can 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 and cartons shall meet as a minimum requirement the specifications described in ISO 10214.

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. 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.

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 film surface.

Any film which is not essentially free from gas release[4] shall be stored in plastic envelopes and in separate storage rooms (see clause 5).

For maximum storage life, photographic film shall be in a clean condition before being placed in storage.

4.2.2 Archival storage enclosures

For archival storage, the requirements of 4.2.1 shall be met.

Films can have possible interactions with other films which are of a different generic type (for example, diazo and silver-gelatin), with magnetic tapes and with optical disks. Films of different generic types shall not be interfiled or be in physical contact. Magnetic tapes and optical disks should not be stored in the same storage housing.

Periodic inspection shall be made as outlined in 9.2.

5 Storage housing

Photographic film should be stored in closed housings such as drawers, or on shelves and racks enclosed by doors 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. Because of their combustible nature and the possibility of producing active fading agents on ageing, materials made of wood, pressed-board, hardboard, particle-board and other natural materials shall be avoided.

The finish on housing materials shall be durable and shall not contribute deleterious effects to the stored photographic film. Adverse effects can be produced by finishes containing chlorinated or highly-platicized resins, or by freshly-painted or lacquered surfaces. Cabinets painted with oil-base paints shall not be used for 3 months as they can give off peroxides.

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 affect accordance with re-

quirements for fire-protection storage or water protection.

Films which are not essentially free from release of acidic fumes 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 dew point of the air. Provisions shall be made against damage of film by water from floods, leaks, sprinklers, etc. Storage rooms or vaults should be located above basement levels where possible.

A special storage room separated from the work areas for film records of medium-term interest will generally not be required, 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.

6.2 Archival storage rooms

The value of photographic film kept for long-term or archival purposes makes it advisable to provide a storage room or vault 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 also annex D).

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

7 Environmental conditions

7.1 Humidity and temperature limits (see annexes B and C)

7.1.1 Medium-term storage environment

The relative humidity shall not exceed 60 % and the recommended range varies with the product type as given in table 1. The maximum temperature for black-and-white films for extended periods shall not exceed 25 °C and a temperature below 20 °C is preferable. Peak temperature for short time periods shall not exceed 32 °C. For colour film, a storage temperature not exceeding 10 °C is recommended for proper protection. Cycling of humidity or temperature should be avoided. Protection can be increased by storing at low temperature and low relative humidity.

7.1.2 Archival storage environment

The relative humidity range for archival storage varies with the product type as given in table 1.

When several film types are to be stored within the same storage area, the recommended relative humidity is 30 %. Short-term cycling of humidity should be avoided.

When inactivity of an archival film permits, protection can be increased by conditioning and sealing the film (see 4.1.1 and 4.2.1) in equilibrium with air at the lower end of the recommended relative humidity range. This may be accomplished by running roll film, as a single strand, through a suitable conditioning cabinet, or by hanging film sheets in such a cabinet. A conditioning time of 20 min is suitable. Individual rolls of film can be conditioned to the recommended storage humidity by keeping them in the recommended atmosphere for 3 days for 16 mm film and for 1 week for 35 mm film. Small quantities of roll films can be dried by keeping them for 2 or 3 weeks in a desiccator with a suitable quantity of activated silica gel. They should then be transferred quickly to cans or bags and sealed. Very low humidity conditions can produce brittleness or curl in films having a gelatin emulsion, by extraction of moisture from the emulsion. In such cases, it is good practice to recondition the film to a higher humidity prior to use. After use, reconditioning to the recommended humidity is required before replacement in sealed containers.

Temperatures for black-and-white films shall not exceed 21 °C and added protection can be obtained for all films by low-temperature storage. The storage temperature for colour films shall be 2 °C or below [11][12]. Two methods may be used.

a) The film may be conditioned to the recommended relative humidity at room temperature, placed in hermetically sealed containers and then placed in cold storage [13]. Taped cans within heat-sealed foil bags can provide good moisture protection for roll films, while sheet films can be placed within two heat-sealed bags. The use of such bags improves moisture protection but does not guarantee it. This procedure has the advantage of excellent keeping conditions and the use of reasonably-priced deep-freeze units. It is essential to limit as much as possible the volume of free air in the sealed film container.

Table 1 — Recommended relative humidity and temperature conditions for storage

Sensitive layer	Base type	Medium-term storage		Archival storage	
		Relative humidity range %	Maximum temperature °C	Relative humidity range %	Maximum temperature °C
Microfilm					
Silver-gelatin	Cellulose ester	15 to 60	25	15 to 40	21
Silver-gelatin	Polyester	30 to 60	25	30 to 40	21
Heat processed silver	Polyester	15 to 60	25	15 to 50	21
General					
Silver-gelatin	Cellulose ester	15 to 60	25	15 to 50	21
Silver-gelatin	Polyester	30 to 60	25	30 to 50	21
Colour	Cellulose ester	15 to 30	10	15 to 30	2
Colour	Polyester	25 to 30	10	25 to 30	2
Diazo	Cellulose ester	15 to 50	25	15 to 30	21
Diazo	Polyester	15 to 50	25	15 to 30	21
Vesicular	Polyester	15 to 60	25	15 to 50	21
Electrophotographic	Polyester	15 to 60	25	15 to 50	21
Photoplastic	Polyester	15 to 60	25	15 to 50	21

b) An alternative procedure is to use a storage room controlled at 2 °C and at the recommended relative humidity. This eliminates the requirement of sealed containers but does require an expensive installation. Low relative humidity is difficult and expensive to maintain at low temperatures.

The container should be allowed to warm up to room temperature prior to opening to avoid moisture condensation on the film (see annex C). Cycling of temperature should be avoided.

The recommended humidity and temperature conditions may be maintained either within individual storage housings or within storage rooms containing such housings.

7.2 Air-conditioning requirements

Properly controlled air-conditioning can be necessary for maintaining humidity and temperature within the limits specified, particularly for archival storage where the requirements are more stringent than for medium-term storage. Slightly positive air pressure should be maintained within the storage room or vault.

Air-conditioning installations and automatic fire control dampers in ducts carrying air to or from the storage vault shall be constructed and maintained on the basis of the recommendations contained in appropriate national standards and regulations[5]. They shall also follow recommendations for fire-resistant file rooms contained in appropriate national standards and regulations[3].

Automatic control systems are recommended and they shall be checked frequently. Where air-conditioning is not practical, high humidities can be lowered by electrical refrigeration-type dehumidifiers, controlled with a hygrostat. Inert desiccants, such as chemically-pure silica gel, may be used provided that the dehumidifier is equipped with filters capable of removing dust particles down to 0,3 µm in size and is controlled to maintain the relative humidity prescribed in 7.1 . Dehumidification can be required in storage areas such as basements and caves that have inherently low temperatures and frequently exceed the upper humidity limit.

Humidification is necessary if the prevailing relative humidity is less than that recommended in 7.1 or if physical troubles such as curl or brittleness are encountered with active files. If humidification is required, a controlled humidifier shall be used. Water trays or saturated chemical solutions shall not be used because of the serious danger of over-humidification.

7.3 Air purity (see annex D)

Solid particles, which can abrade film or react with the image, shall be removed by mechanical filters from air supplied to housings or rooms used for storage. These mechanical filters are preferably of the dry-media type having an arrestance rating of not less than 85 % as determined by tests contained in appropriate national standards and regulations[6].

5) Example: NFPA 90A [14].

6) Example: Stain test of ASHRAE Standard 52-68 [15].

Filters shall be of the non-combustible type, meeting the construction requirements of appropriate national standards and regulations[7].

Gaseous impurities such as sulfur dioxide, hydrogen sulfide, peroxides, ozone, acidic fumes, ammonia and nitrogen oxides can cause deterioration of the film base or degradation of the image in some films. They can be removed from the air by suitable washers or absorbers. An archival storage film vault should be located as far as possible from an urban or industrial area where contaminants can be present in harmful concentrations. Where practical, storage of film in sealed containers in accordance with clause 4 will afford adequate protection.

As paint fumes can be a source of oxidizing contaminants, film shall be removed from either an archival or medium-term storage area for a period of 3 months when the area is freshly painted.

Gases given off by decomposing nitrate-base film can damage or destroy the image on safety film records stored in the same area [17]. Therefore, film shall not be stored with nitrate-base films, either in the same room or in rooms connected by ventilating ducts.

7.4 Light

Normally, film is kept under dark conditions. This is recommended practice as light can be detrimental to some images.

8 Fire-protection storage (see annex E)

During heating for 4 h at 150 °C in the package that is to be stored, enclosure materials for fire-protection storage shall not ignite or release more reactive fumes than the film itself does. Many enclosure materials will melt or become badly distorted at this temperature. However, this melting or distortion shall not cause damage to the film or prevent it from being removed from the enclosure. The materials used in reels or cores shall be neither more flammable nor more decomposable than the film which is stored on them.

For protection against fire and associated hazards, the film shall be placed in closed containers in either fire-resistant vaults or insulated record containers. If fire-resistant vaults are used, they shall be constructed in accordance with recommendations contained in appropriate standards and regulations[3].

When the quantity of film is not too great, insulated record containers conforming to appropriate national standards and regulations[2] may be used. An interior temperature of 65 °C and an interior relative humidity of 85 % shall not be exceeded when given a fire exposure test from 1 h to 4 h in duration depending on the classification of the record container. Insulated record containers shall be situated on a ground-supported floor if the building is not fire-resistant.

For the best fire protection, duplicate copies should be placed in another storage area.

9 Film handling and inspection

9.1 Handling

Proper handling of film is important. Some types of film can be used frequently, generating damage and imposing critical handling and filing requirements[8]. Good housekeeping and cleanliness are essential. Films should be handled by their edges and the wearing of thin cotton gloves by the handlers is good practice.

9.2 Inspection

A number of different representative samples of film should be inspected every 2 years. If deviations from recommended temperature and relative humidity ranges have occured, inspection should be made more frequently. A sampling plan established in advance should be used and a different lot should be inspected each time. Deterioration of either film or enclosure materials shall be noted.

There can be physical changes in the film (curl, distortion, brittleness, adhesion failure, etc.), visual changes in the film (fading, microblemishes, colour change) or changes in the enclosure material (embrittlement, discolouration). The cause of the problem should be determined and corrective action taken.

If film has been stored at a temperature below the dew point of the atmosphere where inspection is to take place, the film in its enclosure shall first be allowed to warm up, before opening, to a temperature within a few degrees Celsius of that of the inspection room. The time required for heating increases with the volume of the film and the temperature difference (see annex C).

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7) Example: Class 1 construction of UL 900 [16].

8) Gelatin emulsion layers can be physically scratched; vesicular images are sensitive to pressure damage causing bubble collapse.

Annex A
(informative)

Distinction between film storage copies and work copies

The distinction between photographic film records which are intended for storage and those intended for use has not always been clear. Work or use copies are the predominant photographic records found in libraries or record centres. Their value lies in their being available for ready reference. However, as a result of this use, they are subjected to dirt, abrasion, fingerprints, contamination with foreign materials, and exposure to excessive light and temperatures. Such work copies can become moisture conditioned to the conditions of the working area, which can be quite different from the storage area where they are filed in the library. In fact, physical distortions of work copies can occur if they are not reconditioned to the moisture conditions of the library storage area. It is evident that work copies of photographic records are not suitable for long-term preservation.

Where there is a need for extended storage of film records, duplicate storage copies should be prepared and they should be kept in a collection area separate from the one in which work copies are stored. Storage copies should meet the appropriate ISO requirements for the photographic material used and should be stored in accordance with the recommendations of this International Standard. Storage records should occasionally be looked at, otherwise the need for keeping these records is pointless. However, the use of storage copies should be infrequent. If more than infrequent use is required, duplicate work copies should be printed from the storage copies. One procedure is to establish the number of uses acceptable for a storage copy and to prepare a duplicate work copy when that limit is reached.

Annex B
(informative)

Humidity during storage

Humidity appreciably beyond the limits specified in this International Standard can have a very deleterious effect on photographic film. Both the extremes of low and high humidity should be avoided.

Prolonged exposure to conditions above 60 % relative humidity will tend to damage or destroy the gelatin emulsion layer due to growth of fungus, and will eventually cause softening and sticking of the emulsion. High humidity exposure will also accelerate any effect of residual processing chemicals (for example, thiosulfate) on the stability of silver images and will impair the stability of dye images. Relative humidities above 90 % can lead to degradation of the film base.

Storage at low humidities not only avoids fungal growth but reduces the rate of chemical degradation. However, under conditions of low or cycling humidities, gelatin photographic layers and backing layers on polyester base sometimes develop adhesion defects such as edge peeling, flaking or emulsion cracking (see ISO 10602).

Consistent exposure to humidity below 15 % relative humidity will tend to produce a temporary brittleness in gelatin emulsion film but flexibility can be restored by reconditioning the film to 30 % relative humidity or higher. Film having a low moisture content is apt to develop static charges causing attraction of dust particles, but this difficulty can be avoided by appropriate discharging during handling and printing.

Annex C
(informative)

Temperature during storage

Continuous temperatures above approximately 40 °C can permanently reduce the pliability of some film bases and can accelerate fading of dye images and vesicular images. While gelatin film becomes brittle at low temperatures (below 0 °C), flexibility is restored upon return to room temperature. Storage temperatures below the dew point of the air can produce condensation of moisture upon film surfaces unless container and contents are brought above the dew point temperature before removal of film. The required warm-up time can amount to several hours, depending on the size of the package and the temperature differential.

An important aspect of temperature is its effect on relative humidity of the storage area. A fall in temperature can raise the relative humidity if the storage area is not humidity-controlled. This can cause conditions beyond the range of recommended humidities for proper storage and therefore sealed containers should be used.

Annex D
(informative)

Air-entrained and gaseous impurities

When dust and other air-entrained solid particles are deposited on photographic film, they can interfere with legibility and produce scratches. Reactive types of dust can cause fading or staining of the image layer. Gaseous impurities such as sulfur compounds, peroxides, paint fumes and other active compounds can cause deterioration of the base and a chemical degradation of the photographic image. The most frequently encountered impurity, especially in urban and industrial atmospheres, is sulfur dioxide and small concentrations are likely to produce detrimental effects. Hydrogen sulfide is not a common impurity but is a very active one even at low concentrations; it can occur in air washers containing decomposed biological slime. Oxidizing gases, such as peroxides, are responsible for the local oxidation of image silver in fine grain images [18] [19] [20] causing formation of minute deposits of coloured colloidal silver.

Suitable means for removal of gaseous impurities are available such as air washers operating with treated water for elimination of sulfur dioxide and activated carbon for the absorption of sulfur dioxide and hydrogen sulfide [21]. These require consistent control and, in the case of activated carbon, expert processing.

Annex E
(informative)

Fire protection

Damage to photographic film records by high temperature can occur even if the film is not destroyed by fire. Photographic films show some physical distortion at 150 °C but the silver-gelatin image can withstand this temperature for several hours without significant loss in image quality. However, dye and diazo images can show some fading or change in colour balance. Vesicular images are generally destroyed in these severe conditions. In addition to image loss, photographic films can become severely distorted at high temperatures so that they can only be viewed, projected or printed with difficulty.

One danger to film, as a result of high temperature exposure, is that of sticking or blocking of adjacent sheets or laps, particularly with films having gelatin or special backings.

Steam generation and the resultant cooling effect is a design characteristic for the insulation of certain types of fire-resistant safes. Film should be protected against steam; otherwise sticking, gelatin emulsion melting and severe distortion will result. For this reason, insulated record containers designed to seal the contents against steam are recommended (see clause 8).

For very critical records and for greater fire protection, it is recommended that duplicate copies be stored in another location.

Annex F
(informative)

Microscopic blemishes

Some processed negative microfilms in storage for 2 to 20 years have developed microscopically-small coloured spots or blemishes. These have most frequently appeared in the fogged leader at the outside of the roll, but occasionally appear further into the roll in image areas [20].

These spots are caused by local oxidation of image silver, resulting in the formation of minute deposits of colloidal silver appearing as red or yellow spots. Possible oxidizing agents causing this degradation are aerial oxygen, whose action is accelerated by moisture, and atmospheric contaminants such as peroxides, ozone, sulfur dioxide, hydrogen sulfide and others occurring in industrial atmospheres [15] [22]. Peroxides can be present in some types of wood and can also be formed as a result of ageing of paper inserts and cardboard containers commonly used in storing film.

Processing and storage conditions play an important role in the development of the blemishes. Film should be carefully washed to provide uniform removal of thiosulfate and associated silver compounds as specified in ISO 10602. Drying should be uniform, with extremes of temperature avoided. The processed film should be free of water and chemical spots, dirt and scratches. Storage in cool, dry air that is free of oxidizing gases or vapours is usually an effective means for arresting or retarding the formation of blemishes [18] [23] [24].

Annex G
(informative)

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