
**Imaging materials — Unprocessed
photographic films and papers — Storage
practices**

*Matériaux pour l'image — Films et papiers photographiques non traités —
Pratiques de stockage*

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Contents

	Page
1 Scope	1
2 Term and definition	1
3 Storage conditions	1
3.1 General	1
3.2 Relative humidity	1
3.3 Temperature	2
3.4 Gases	2
3.5 Extraneous radiations	2
4 Temperature acclimatization	3
5 Mechanical requirements	3
6 Handling conditions	3

Annexes

A Numbering system for related International Standards	5
B Background radiation	7
Bibliography	8

[ISO 18928:2002](https://standards.iteh.ai/catalog/standards/sist/df3270bf-3e16-4474-92dc-e8c88c40e510/iso-18928-2002)
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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 18928 was prepared by Technical Committee ISO/TC 42, *Photography*.

This second edition cancels and replaces the first edition (ISO 10331:1991), which has been technically revised.

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).

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

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Introduction

International Standards have been written specifying the recommended practices for the storage of processed safety photographic film (ISO 18911), processed photographic reflection prints (ISO 18920), processed photographic plates (ISO 18918) and the specifications for safety film (ISO 18906).

This International Standard is concerned with the storage of unprocessed photographic materials. While many of the recommendations for unprocessed and processed storage are very similar, there are some important differences. These include the very beneficial effects of low temperature and the harmful effects of adverse storage and radiation.

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Imaging materials — Unprocessed photographic films and papers — Storage practices

1 Scope

This International Standard specifies recommended storage conditions for unprocessed photographic materials. It is not applicable to processed films and prints.

This International Standard is applicable to black-and-white and colour photographic materials (negative films, positive films, reversal films, positive papers, and X-ray films) as well as to safety films.

2 Term and definition

For the purposes of this International Standard, the following term and definition apply.

2.1

raw photographic material iTeh STANDARD PREVIEW
photographic material that has not been exposed to actinic radiation and has not been processed
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3 Storage conditions

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3.1 General

The photographic properties of imaging materials change during ageing. These changes result from high temperatures and high relative humidities and may also be influenced by plastics, papers, solvents, lacquers, varnishes, gases (see 3.4) and extraneous radiation (see 3.5). Frequent temperature changes may also have adverse effects.

Changes caused by unfavourable storage conditions may be much greater than those due to variations in original manufacture. It is important to comply with the manufacturer's recommended storage conditions and, where given, to an expiration date.

Films and papers should be exposed and processed as soon as possible after the original package has been opened. Opened packages should be resealed under recommended conditions for further storage.

3.2 Relative humidity

Photographic material should generally be kept in equilibrium with 40 % to 60 % relative humidity (RH). Containers shall be kept sealed until the material is used.

Films and papers are not usually stored for long periods between exposing and processing. Production schedules, customer needs, latent image fading or growth, etc., are important factors here. Furthermore, vesicular, diazo, thermally processed silver and electrographic type materials are normally processed immediately.

If conventional sheet films or papers are not to be processed immediately, they may be stored in commercially available light-tight "paper safes" or in the manufacturer's original container.

The relative humidity of the storage area shall be maintained below 65 % because higher humidities can damage containers (e.g. rust), cause labels, tapes and cartons to deteriorate and encourage the growth of fungi. It can also induce adhesion (blocking) between adjacent laps or layers.

Humidities below 30 % can make film and paper temporarily brittle and lead to unacceptable curl and possible emulsion cracking.

3.3 Temperature

Recommended temperatures during storage depend on the kind of photographic material and on the duration of storage. General guidelines are given in Table 1. In all cases, the information provided by the manufacturer shall be followed.

When storing for less than a month, photographic materials may be kept at approximately 25 °C. Most manufacturers recommend a maximum temperature of 13 °C for longer periods. Manufacturers' expiration dates can be extended by storing at still lower temperatures. Note that infrared-sensitive films shall be stored at –18 °C.

If films or papers are to be kept for several days or more between exposing and processing, many of the considerations in clause 3 apply. Storage temperatures should be the same for exposed as for unexposed material.

Table 1 — Storage temperature for films and papers

Sensitive layer of films and papers	Storage from 1 month to 6 months	Storage for more than 6 months
Wet-processable silver-gelatin	Below 21 °C	Below 13 °C
Thermally-processable silver		
Photoplastic		
Diazo		
Chromogenic colour	Below 13 °C	Below 13 °C
Infrared (IR)	–18 °C to –20 °C	–18 °C to –20 °C
NOTE 1 For very long storage of all types of photographic materials, the recommended storage temperature shall be between –18 °C and –20 °C.		
NOTE 2 The manufacturer's recommendations take precedence over the suggested guidelines of this table.		

3.4 Gases

Storage rooms shall be protected against harmful gases such as hydrogen sulphide, sulphur dioxide, formaldehyde, oxidizing gases, industrial emissions and mercury vapour. Any of these may penetrate the container seal and fog or desensitize the material.

Materials shall not be stored in the same area as developer or activator solution.

3.5 Extraneous radiations

Photographic materials shall be protected from extraneous penetrating radiation until they are processed. Storage rooms and housings shall be measured for their radiation level before being used. For most materials, a maximum of $1,29 \times 10^{-4}$ C/kg is recommended. However, the maximum may be $0,129 \times 10^{-4}$ C/kg for X-ray materials and certain other films (see [5] in the Bibliography).

Some stones or stone aggregates in concrete can emit sufficient radiation (average up to $0,516 \times 10^{-4}$ C/kg/yr) to fog very sensitive films after long storage. However, most films and papers are not damaged under normal conditions.

The radiation exposure during airport inspection of carry-on baggage is usually small (see [6] in the Bibliography). Recently, new technology for inspection of checked baggage at airports uses radiation that fogs many, if not most, unprocessed photographic products. This has been a special problem with international flights, but may also be serious for flights within national borders (see [7], [8] in the Bibliography).

Government regulations in many countries provide for hand inspection of photographic materials which is strongly recommended, thus avoiding the X-ray inspection. Repeated X-ray exposures can damage films faster than ISO 400, scientific films and X-ray films.

4 Temperature acclimatization

Packages of radiation sensitive films and papers should be opened only immediately before use. If materials have been stored at low temperatures, a warm-up period is necessary to prevent condensation on film or paper.

The required warm-up period depends on the size of the package, its isolation, the temperature difference between storage and surround and the dew-point of the surround. Recommended periods are given in Table 2. All values are for individual packages separated from each other, except for a carton containing ten 35 mm rolls. The length of material on a roll is less important than the thickness and the insulation of the package.

Table 2 — Minimum recommended warm-up times

Films and papers	Warm-up hours for the difference between storage and surround temperatures	
	15 °C	40 °C
Short roll films ^a		
Magazines	1 to 1,5	1 to 2
Cartridges		
Packages with 50 sheets	2	3
Single 16 mm rolls	0,5 to 1,5	1 to 2
Single 35 mm rolls	1,5 to 3	3 to 5
70 mm and 105 mm rolls	3 to 5	5 to 8
Aerial films	2 to 6	8 to 25
Large packages	10 to 25	15 to 25
Large rolls		
Carton with ten 35 mm rolls	10 to 30	30 to 45
X-ray films	10	25

^a 120-size and 220-size rolls have the same times as the short film rolls.

5 Mechanical requirements

Rolls, mounted on cores and packed in specially designed containers, shall be stored with the radius of the roll in the horizontal position, in order to avoid the weight of the roll exerting a pressure on the lower part of the roll and thereby causing physical damage.

If sheet materials are unopened and are 203 mm × 250 mm or larger, they should be stored in the vertical position. If the boxes have been opened, they should be stored in the horizontal position. Smaller boxes of sheet materials can be stored in either way.

6 Handling conditions

Climatic conditions of 20 °C to 24 °C and 40 % to 65 % RH are recommended for handling in laboratories. In printing rooms, the RH should not be too low in order to prevent static discharges and attraction of dirt. In these cases, low humidity can also cause curl and temporary dimensional changes so that proper handling is no longer possible.

Excessive exposure to recommended safelights may degrade the sensitometry of some products. The manufacturer's literature should be consulted for recommended maximum cumulative exposure.

Air-conditioning systems in laboratories should be equipped with suitable dust filters.