
**Imaging materials — Ammonia-processed
diaz photographic film — Specifications
for stability**

*Matériaux pour l'image — Film photographique diazoïque traité à
l'ammoniac — Spécifications relatives à la stabilité*

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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.

The main task of technical committees is to prepare International Standards. 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.

ISO 18905 was prepared by Technical Committee ISO/TC 42, *Photography*.

ISO 18905 cancels and replaces ISO 8225:1995, of which it constitutes a technical revision.

This International Standard is one of a series of International 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 - 18999 (see annex A).

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

Introduction

Since 1930, great advances have been made in the use of photographic films for the preservation of records. The preservation of records on film by national, state and municipal governments, by banks, insurance companies, industry and other enterprises has been stimulated by recognition of the resultant economies in storage space, organization, accessibility and ease of reproduction. The safe-keeping of pictorial film records having legal, scientific, industrial, medical, historical, military or other values has also become increasingly important.

The use of film for records having long-term values necessitated the development of International Standards to specify the characteristics of film suitable for this purpose. ISO 18901 specifies the requirements for silver-gelatin films which are suitable for storage. This International Standard (for diazo film) and ISO 18912 (for vesicular film) give the requirements for photographic duplicate films suitable for storage.

The term "archival film" has been discontinued and the new concept of "life expectancy" is introduced. Film life is classified by the LE or life expectancy rating as defined in this International Standard. For example, LE-100 represents film with a life expectancy of 100 years when stored at 21 °C and 50 % RH.

Criteria for properties of LE-10 and LE-100 diazo films are based upon the dark-ageing stability of diazo images. Different dark-incubation tests are specified for LE-10 and LE-100 films. All other properties and processing requirements for medium and long-term diazo films are identical.

It is recognized that diazo images may show density changes after exposure to light. However, this International Standard covers only films used as storage copies, not as work copies (as defined in annex B). The light-fading requirements specified in this International Standard ensure satisfactory behaviour for storage copies that are not intended to be subjected to frequent light exposure.

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In addition to the characterization of films with respect to their expected storage life, diazo films are also separated into two classes (A and B) which are dependent upon their intended use. Class A films are those which retain density in both the visual and actinic region (printing) after storage. Such films can be viewed directly or reprinted onto ultraviolet (UV)-sensitive materials. However, some diazo films are not intended to be reprinted onto UV-sensitive materials and require only visual capabilities after storage. Such films are designated as Class B films. Obviously, both Class A and Class B films can fall into the LE-10 and LE-100 categories. The requirements for Class A and Class B films are identical, with the exception of image-stability tests after dark-ageing and after light-fading.

Everyone concerned with the preservation of records on photographic film should realize that specifying the chemical and physical characteristics of the material does not, by itself, assure satisfactory behaviour. It is also essential to provide the correct storage temperature and humidity, as well as protection from the hazards of fire, water, light and certain atmospheric pollutants. Conditions for the storage of record films are specified in ISO 18902 and ISO 18911.

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Imaging materials — Ammonia-processed diazo photographic film — Specifications for stability

1 Scope

This International Standard establishes specifications for the stability of polyester-base safety film which has an ammonia-processed diazo photographic image. It is applicable only to diazo photographic films intended for and used as LE-10 and LE-100 storage copies, which shall be stored in accordance with ISO 18902 and ISO 18911.

This document characterizes only the inherent keeping behaviour of the film. However, the suitability of a film record after extended storage depends on both the inherent ageing characteristics of the film and the original image quality. The latter is discussed in annex C.

This International Standard is applicable to photographic film in which the image layer is a discrete layer attached to a transparent support, and it applies to roll film and sheet film.

This International Standard is not applicable to diazo film records intended and used as “work” or “use” copies as discussed in annex B.

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2 Normative references

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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 5-2:2001, *Photography — Density measurements — Part 2: Geometric conditions for transmission density*

ISO 5-3:1995, *Photography — Density measurements — Part 3: Spectral conditions*

ISO 527-3:1995, *Plastics — Determination of tensile properties — Part 3: Test conditions for films and sheets*

ISO 18902:2001, *Imaging materials — Processed photographic films, plates and papers — Filing enclosures and storage containers*

ISO 18906:2000, *Imaging materials — Photographic films — Specifications for safety film*

ISO 18907:2000, *Imaging materials — Photographic films and papers — Wedge test for brittleness*

ISO 18911:2000, *Imaging materials — Processed safety photographic films — 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
blocking**

sticking together of similar or dissimilar materials in physical contact

**3.3
Class A films**

films which are usable both visually and for printing onto ultraviolet-sensitive materials

**3.4
Class B films**

films which are usable visually but do not have any density requirements for printing onto ultraviolet-sensitive materials

**3.5
density**

<optical> degree of light absorption, reflection or scattering characteristics of a photographic image, expressed as the logarithm to the base 10 of the ratio of incident radiant flux to the transmitted, reflected or scattered flux

NOTE See ISO 5-3.

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**3.5.1
printing density**

optical density in which the incident radiant flux has the same spectral energy distribution as the printer light source and the transmitted density is evaluated by a receiver having the same spectral response as the print material

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**3.5.2
projection density**

optical density of a processed photographic image in which the angular distributions of the incident and transmitted radiant flux are equal and specified

NOTE For microfilm applications, the angular distribution is a nominal half-angle of $6,4^\circ$, which corresponds to an f -number of $f/4,5$ and simulates a microfilm reader.

**3.5.3
visual density**

optical density of a processed photographic image in which the incident radiant flux has a spectral energy distribution as defined in ISO 5-3, and the transmitted or reflected flux is evaluated by the human eye or by a receiver having the same spectral receiver as the human eye

**3.6
emulsion layer(s)**

image or image-forming layers(s) of photographic films, papers, and plates

**3.7
extended-term storage conditions**

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

**3.8
film base**

plastic support for the emulsion and backing layers

3.9**LE designation**

rating for the "life expectancy" 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 at 21 °C and 50 % RH, e.g. LE-100 indicates that information can be retrieved after at least 100 years storage.

3.10**life expectancy****LE**

length of time that information is predicted to be acceptable in a system after dark storage at 23 °C and 50 % RH

3.11**medium-term storage conditions**

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

3.12**polyester base**

base for recording materials composed mainly of a polymer of ethylene glycol and terephthalic acid (also referred to as polyethylene terephthalate), or a polymer of ethylene glycol and 2,6 naphthalene dicarboxylic acid (also referred to as polyethylene naphthalate)

3.13**poly (ethylene terephthalate) base**

polyester base for recording materials composed mainly of a polymer of ethylene glycol and terephthalic acid

3.14**safety photographic film**

photographic film which passes the ignition-time test and burning-time test specified in ISO 18906

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4 Film base requirements

The base used for record films, as specified in this International Standard, shall be of a safety polyester type and can be identified by the method described in 8.1.

Films can have a maximum LE rating of 500.

5 Processed film requirements**5.1 Safety film**

Film shall meet the requirements specified in ISO 18906.

5.2 Tensile properties and loss in tensile properties

Film samples shall be processed and dried under the conditions used for the film records.

Processed films shall be tested for tensile properties as described in 8.3 and shall have a tensile stress and elongation at break as specified in Table 1 (unheated film). The loss in tensile properties after accelerated ageing as described in 8.2 shall not exceed the percentage specified in Table 1 (heated film).

Table 1 — Limits for tensile properties and loss in tensile properties on accelerated ageing of polyester-base film

Film type	Tensile stress at break	Elongation at break
Unheated film Minimum permissible tensile properties	140 MPa	75 %
Heated film Maximum permissible loss in tensile properties compared with unheated film	15 %	30 %
NOTE 1 MPa = 10 ⁶ N/m ²		

6 Requirements for the emulsion and backing layers of processed film

6.1 Layer adhesion

6.1.1 Tape-stripping adhesion

Processed film shall not show any removal of the emulsion layer or backing layer when tested as described in 8.4.

6.1.2 Humidity-cycling adhesion

The emulsion layer or backing layer of the processed film shall not show separation or cracking that can impair its intended use when tested as described in 8.5.

6.2 Blocking

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Processed film shall show no evidence of blocking (sticking), delamination or surface damage when tested as described in 8.6. A slight sticking of the film specimens that does not result in physical damage or a change in gloss of the surface shall be acceptable.

6.3 Binder stability

Processed film shall not exceed a 1 mm increase in brittleness after accelerated ageing as specified in 8.2. Brittleness shall be determined at 50 % RH and shall be tested in accordance with ISO 18907.

Films shall be tested preferably in low-density areas.

6.4 Thermal sticking

Processed film shall show no evidence of blocking (sticking), delamination or surface damage at high temperature when tested before and after accelerated ageing as described in 8.2.

Thermal sticking shall be tested as specified in 8.7. A slight sticking of film to glass that does not result in physical damage shall be acceptable.

7 Image stability requirements

7.1 Proper development

Processed film shall not show a visual transmission density decrease greater than 30 % when tested as specified in 9.2.

7.2 Light-fading

Low-density and high-density patches of processed film shall be tested in a light-exposure apparatus as described in 9.3.2.

After testing, the low-density patches shall have a diffuse density of 0,4 or less, and the difference between the high-density and low-density patches shall be 0,8 or greater (see Table 2).

These density requirements shall apply to both visual and printing densities for Class A films and to visual density only for Class B films (see annex D). The same density requirements shall apply for both LE-10 and LE-100 films.

7.3 Dark-ageing

Low-density and high-density patches of processed film shall be incubated as specified in 9.4 under the conditions specified for either LE-10 or LE-100 film. After incubation, the low-density patch shall have a diffuse density of 0,4 or less, and the difference between the high-density and low-density patches shall be 0,8 or greater (see Table 2).

These density requirements shall apply to both visual and printing densities for Class A films and to visual density only for Class B films.

Table 2 — Limits for the change in diffuse density of the image after accelerated testing

Diazo density levels	LE-10 and LE-100 film
Original	
Low density	0,10 ± 0,05
High density	1,2 ± 0,1
Final^a	
Low density	≤ 0,4
High density — low density	≥ 0,8
^a That is, after the light-fading test (see 9.3) or the dark-ageing test (see 9.4).	

8 Test methods

8.1 Identification of film base

Remove all emulsion and backing layers from a sample of the unknown film by scraping and then remove all sublayers by scraping.

Prepare a specimen of the base material by scuffing the surface with a suitable tool such as a razor blade. The general procedure is to move the scuffing device back and forth over the specimen manually while exerting a very slight pressure. This removes the top layer of the base as a very fine dust. Carefully brush this into a mortar.

Mix the specimen with about 100 times its mass of potassium bromide, previously ground to about 75 µm. Prepare a strip or pellet as described in [1] in the bibliography.

Obtain an infrared absorption curve from the prepared strip or pellet by means of an infrared absorption spectrometer. By comparing the infrared absorption curve for the unknown with curves for known polymers, the identity of the unknown can be established (see [2] in the bibliography).