
INTERNATIONAL STANDARD



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Photography — Silver-gelatin type microfilms — Processing and storage for archival purposes

Photographie — Microcopies gélatino-argentiques sur film — Traitement et conservation pour archivage

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up 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.

Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 2803 was drawn up by Technical Committee ISO/TC 42, *Photography*, and circulated to the Member Bodies in August 1972.

It has been approved by the Member Bodies of the following countries :

Australia	Hungary	Spain
Canada	Italy	Switzerland
Czechoslovakia	Japan	Thailand
Egypt, Arab Rep. of	Mexico	United Kingdom
Finland	New Zealand	U.S.A.
France	Romania	U.S.S.R.
Germany	South Africa, Rep. of	

The Member Body of the following country expressed disapproval of the document on technical grounds :

Belgium

Photography — Silver-gelatin type microfilms — Processing and storage for archival purposes

1 SCOPE AND FIELD OF APPLICATION

1.1 This International Standard specifies the conditions of processing and storage which will give microcopies stored in archives the longest possible preservation.

1.2 It applies to the preservation of microcopies on film (in roll, sheet, strip or card form, mounted or unmounted, without dimensional limitations), whose support is of cellulose ester or polyester coated with a gelatin layer containing a silver image prepared by the use of a liquid developer, fixer and wash solutions; but excluding processes such as :

- a) vesicular images;
- b) diazo images;
- c) dry-processed silver images;
- d) diffusion transfer processes.

This International Standard applies only to the storage of microcopies made on safety supports in accordance with ISO 543.¹

1.3 Storage for short periods is excluded from this International Standard as the conditions of processing and storage are then less critical.

2 REFERENCES

ISO/R 417, *Methods for determining thiosulphate and tetrathionate in processed black-and-white photographic film, plates and papers.*¹⁾

ISO/R 421, *Method for indicating the stability of the images of processed black-and-white films, plates and papers.*¹⁾

ISO 543, *Cinematography — Motion-picture safety film — Definition, testing and marking*

3 GENERAL CONSIDERATIONS

3.1 The important factors which affect the storage and preservation of microcopies are :

- a) the choice of the photo-sensitive product;
- b) the technique of chemical processing;
- c) the relative humidity and the temperature of the air which is in close contact with the film;
- d) contact with chemical materials in liquid, solid or gaseous form;
- e) fungal and bacterial growth.

3.2 This International Standard emphasizes the limitations of the existing knowledge in the field of application defined in 1.2. It will need to be modified or amplified as justified by new discoveries.²⁾

4 PROCESSING

4.1 General

For a large part, the preservation of silver microcopies on film depends on the products which remain in the emulsion after washing. The maximum contents of these various residual products shall not exceed the values given in 5.1 and 5.2. The recommendations given below concerning processing are simply indications of how the requirements can be achieved; they are not the only ways of obtaining them.

4.2 Fixing

4.2.1 The fixing bath shall have been used as little as possible. As an indication of its suitability, it is recommended that the amount of silver in the bath be less than 0,5 % in the case of crystallized sodium thiosulphate, $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$; or less than 0,8 % in the case of anhydrous ammonium thiosulphate, $(\text{NH}_4)_2\text{S}_2\text{O}_3$.

1) Currently under revision.

2) Attention is drawn to research reported in the articles by R.W. HENN and D.G. WIEST in *Photographic Science and Engineering* 7, No. 5 (1963) pp 253-261; by C.S. McCAMY, U.S. Dept. of Commerce — National Bureau of Standards 96, January 24, 1964, and by C.S. McCAMY and V.L. POPE, *Journal of Research of the N.B.S. in Physics and Chemistry* 69A, No. 5 (1965), pp 385-395.

4.2.2 In order to minimize defects known as "ageing blemish microspots", the iodide content in the fixing bath shall be between 0,1 and 0,5 g/l (expressed as KI).

4.3 Washing

4.3.1 Water used for washing¹⁾ shall be colourless and free from substances in suspension.

A washing water temperature maintained at a level between 15 and 25 °C is generally suitable and minimizes the danger of

- a) swelling, which occurs at higher temperatures, and
- b) a decrease in the rate of solution of the salts being removed, which occurs at lower temperatures.

15 min washing in well-agitated running water at 20 °C is generally satisfactory provided the microfilms are not in contact with one another and means for renewing the water at their surfaces are provided.²⁾

4.3.2 Ion exchange washing accelerators may be used. For instance, films may be soaked in a 2 % anhydrous sodium sulphite bath before washing, but thiosulphate-destructive washing accelerators such as oxidizing agents shall not be permitted.

NOTE — Indications concerning washing (4.3.1 and 4.3.2) are simply good advice to users in order to get the results which are necessary for good preservation. Users who, for economy's sake, believe it possible to shorten the duration of washing should, more than others, check that the recommended limits for silver content in the fixing bath and residual thiosulphate content in the processed microcopies are not exceeded.

5 PROPERTIES OF THE PROCESSED FILM

5.1 Residual thiosulphate

The residual S₂O₃²⁻ ion content in the microfilm after processing shall be below 7 mg/m².³⁾

The method to be used for determining the residual thiosulphate is that specified in ISO/R 417.

5.2 Residual silver compounds

It is essential that the test for residual silver by the sulphide test specified in ISO/R 421 gives a negative result.

5.3 Resistance test to a non-destructive fire

A film, after having been conditioned at 21 to 24 °C and 38 to 42 % relative humidity and placed in a closed or sealed container, shall tolerate a dry heat at 120 °C for 24 h without appreciable loss of legibility or printability.

5.4 Splices

Splices shall be avoided whenever possible. If splicing is found to be necessary, an excellent quality cement, chemically neutral and free from unstable solvent or nitrocellulose, shall be used. The use of pressure adhesive tape shall be avoided. Attention is drawn to the advantages presented by dielectric hot fusion.

5.5 Reels and cores

Reels and cores for microfilm in rolls shall be made of corrosion resisting material such as non-ferrous metals or plastics; steel reels are suitable if they have been protected from corrosion risk by appropriate treatment: lacquering, tinning, etc. Adverse effects may be caused by the fumes from freshly lacquered surfaces.

Materials used in the production or protection of reels or cores shall neither be more flammable nor more decomposable than the film which is stored on them and shall not release more reactive fumes or vapours than the film or be liable to cause the film to deteriorate when heated for 4 h at 150 °C.

6 ARCHIVAL PREMISES AND CONTAINERS

6.1 Air purification

It is recommended that air be filtered, purified from noxious gases and circulated by means of forced draught.

6.2 Relative humidity

If the containers are not airtight, the air in the archival storage area shall be conditioned so as to maintain the relative humidity at a level between 30 and 40 %.

6.3 Temperature of the archival premises

It is recommended that the temperature in the archival storage area be maintained at a level between 15 and 25 °C and preferably not in excess of 20 °C.

6.4 Chemical contamination

Various noxious emanations can cause slow deterioration and a gradual fading of the image. They are especially to be feared if microfilms are not stored in sealed containers. However, even if the containers are sealed, such emanations shall be eliminated to avoid damage to the containers themselves. Attention is drawn to the danger presented by peroxides which may originate from bleaching agents, glues, varnishes and various products used in the manufacture of the storage cabinets.

1) Drinking water is generally pure enough for washing purposes.
 2) The washing time is considerably shortened and the temperature is higher (35 °C) in most automatic machines (droplet jets, etc.).
 3) The influence of the thickness of the emulsion layer is practically negligible, hence the use of an area.

Hydrogen sulphide, sulphur dioxide, sulphur trioxide, ammonia and nitrogen oxides are the most common atmospheric gases which harm film, but these are not the only ones. Chemical products in the immediate vicinity may cause the presence of other impurities in the atmosphere. In each particular case, a specialist should be asked to determine means for eliminating their effects.

It is further to be noted that dust and other solid or liquid particles suspended in the air are causes of deterioration; they deposit on the preserved microfilm, impairing its legibility, and may cause permanent scratches.

Silver microcopies on film shall not be kept in contact with other photographic records prepared by processes excluded by 1.2.

6.5 Protection against fire and water

Microfilms using safety film are difficult to ignite, and combustion speed is low.

To provide effective protection of microfilms against fire, as much attention shall be paid to the presence of steam as to high temperatures. Investigation of the protection to be available in a given room shall take into consideration conditions specific to that room, and also the following general conditions: a film stored at 40 % relative humidity can usually withstand a dry heat at 120 °C for a period of 24 h, without appreciable loss of its readability and printability; at a dry heat of 150 °C some distortion may take place after 6 h but individual microfilms of texts or figures are still printable. The action of a dry heat at 180 °C for at least 6 h causes deformation of microfilms and reproduction becomes generally impossible. However, in the presence of water vapour, temperatures as low as 90 to 110 °C will produce serious distortion, cause adhesion of coils or surfaces in contact and, after prolonged action or due to condensation, eventually melt the emulsion. Therefore, fireproof cabinets and safes whose thermal insulation is obtained by water vapour production are not suitable for storing microcopies, unless the films are placed inside suitably sealed containers. To obtain complete protection from fire, safes or cabinets shall be placed in premises which are themselves fireproof.

Microfilms shall be protected from the action of water, whatever its origin.

7 CONTAINERS

7.1 Types of containers

There may be two types of containers:

- closed non-airtight containers,
- sealed airtight containers.

The sealed airtight containers are recommended when no other means can ensure protection against the danger of an ambient atmosphere whose relative humidity goes beyond the limits recommended in 6.2 or which contains chemical impurities (gases or vapours) or dust (sand carried by wind).

7.1.1 If the requirements concerning the relative humidity and temperature of the archival premises recommended in 6.2 and 6.3 are observed, the containers for storage of the microfilms need only be of the closed non-airtight type. If, on the contrary, these requirements cannot be observed, sealed airtight containers shall be used in which microfilms shall be stored according to the rules of 7.5.

7.1.2 It is recommended that microcopies be kept in metal or plastics containers provided the materials used in their construction or protection meet the requirements of 5.5. The containers can be placed in cardboard boxes if such boxes are thought to facilitate filing or identification, but cardboard boxes alone shall not be used as containers.

7.2 General precautions relative to containers

7.2.1 The use of non-corrosive materials is recommended but, whatever materials are used for the production of containers, their corrosion protecting coating and their airtight seals shall neither melt, ignite, decompose, develop fumes, nor distort or be subject to excessive dimensional changes when heated at 150 °C for 4 h.

7.2.2 Care shall be taken regarding the dangers of rust, rubber joints, rubber bands and gum on certain types of envelopes, and of lignin and other oxidizable substances contained in certain cardboards. The introduction of silica gel into storage containers is not advisable but this material can be used for drying the air in archival premises.

7.2.3 Microcopies, when stored in roll form, may be mounted either on reels or on cores. Rolls above 30 m long mounted on cores shall be laid flat unless the core itself is carried on a horizontal spindle which prevents the lower part of the film supporting the load of the core and of its reel.

7.3 Special precautions for sealed airtight containers

The use of sealed containers involves some precautions as indicated in 7.3.1, 7.3.2, 7.4 and 7.5.

7.3.1 Fire

In storage areas subject to possible fire, it is recommended that the containers be of a type preventing steam from reaching the film. Metal containers with a high resistance to corrosion are recommended.

The container and its airtight seal shall withstand an excess pressure inside the container of 70 kPa (approximately 0,7 kgf/cm²) without rupture of the seal or other injurious effects.

7.3.2 Air contained inside the sealed container

The number *V*, expressing in cubic centimetres the amount of air volume enclosed inside the sealed containers, shall be less than the number *A*, expressing in square centimetres the area of microfilm enclosed in it. The purpose of this rule is to prevent excessive transfer to the microfilm of the

moisture in the air in the container when the latter is subjected to a temperature below that which existed at the time of sealing. It is also justified by the necessity to prevent microfilms from releasing to the surrounding air too great a portion of their water content in the case of a substantial rise of temperature.

7.4 Relative humidity

It is recommended that, except for short periods, the relative humidity inside the containers with stored microfilms shall neither exceed 40 % nor be less than 30 %. A relative humidity exceeding 60 % causes formation of mould which, in time, can completely destroy the image. At relative humidities below 15 % the film tends to curl and become more brittle as the relative humidity decreases.

7.5 Adjustment of microfilms to the atmosphere inside the container

Before closing sealed containers, microcopies shall be adjusted to the atmosphere that will enclose them. This atmosphere shall be kept within the limits of relative humidity and temperature specified in 6.2 and 6.3. Re-adjustment is necessary whenever a microfilm is removed from its container and is placed in an atmosphere whose temperature or relative humidity are not in accordance with the recommended limits. This applies in particular when a film is subjected to heat from the lamp of a copying or projecting apparatus.

An indication of the times needed for reconditioning the microfilms is given in the table below.

Microfilm form	Time for	
	80 % readjustment	practically 100 % readjustment
Single strip or slide	30 min	90 min
16 mm roll	5 days	3 weeks
35 mm roll	1 week	4 weeks

An adjustment time resulting in 80 % reconditioning is considered sufficient in the following two instances :

- 1) when the film comes from a room which is too dry (relative humidity < 30 %) and has to be humidified in a room where the relative humidity is between 35 and 40 %;

- 2) when the film comes from a room which is too humid (relative humidity > 40 %) and has to be dried in a room where the relative humidity is between 30 and 35 %.

8 MICROFILM INSPECTION AND READING

8.1 Precautions

Precautions to be taken in the case of inspection or reading are the following :

- avoid finger marks by the reader or operator (use gloves, etc.);
- during microfilm manipulation, avoid dust (taking special care in regions exposed to dust storms, etc.);
- avoid scratches due to fingering or to malfunction of a defective reading apparatus;
- when, against the recommendations given in this International Standard, the microfilms have been stored at a temperature below the dew point of the atmosphere in the premises where their inspection or reading is to take place, avoid condensation on the microfilms by bringing, before opening, the microfilm containers to a temperature a few degrees above that of the inspection or reading room. The period required for reheating will necessarily be longer the greater the volume of the archival microfilms in the same container, the greater the difference in temperature, etc.;
- in the case of sealed containers, reconditioning of the films may be necessary after reading or inspection, to the atmosphere inside the containers, as stated in 7.5.

Furthermore, it is recommended that working copies be made of films which are frequently consulted.

8.2 Frequency of inspection

It is recommended practice to inspect a representative sample of microfilm consisting of 20 % of each film form (16 mm; 35 mm; microfiche; aperture card, etc.) every 2 years. 2 % of each representative sample shall be from that material previously inspected.

Inspection shall be increased, however, if deterioration of the microfilms is observed. The cause of such deterioration shall be traced and remedied.