International Standard ISO 6051

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Photography — Processed photographic paper prints — Storage practices

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Foreword

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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. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 6051 was prepared by Technical Committee ISO/TC 42, *Photography*.

This second edition cancels and replaces the first edition (ISO 6051-1980), of which it constitutes a technical revision.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Photography — Processed photographic paper prints — Storage practices

0 Introduction

Photographic paper prints are important documentary and pictorial materials. There is a recognized need for information on safeguarding photographic prints having legal, scientific, industrial, 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].

Photographic prints are susceptible to degradation from many sources. These factors may be divided into three general categories:

a) Nature of the photographic print.

The stability of photographic print records depends on the physical and chemical nature of the print. Excellent keeping experience has been obtained with numerous photographic prints for a great many years. However, as yet no International Standard has been drafted on the stability of different types of photographic prints.

b) Photographic processing of the print.

For silver-gelatin type paper prints, the effect of residual thiosulfate will form the subject of a future International Standard.

c) Storage conditions.

The conditions under which photographic paper prints should be stored are extremely important for the preservation of the print.

The important elements affecting preservation of processed prints are humidity and temperature of the air, as well as the hazards of water, light, fungal growth, insects, microbiological attack, contact with certain chemicals in solid, liquid or gaseous form, and physical damage. The extent to which humidity, temperature, or variations of both, 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 print surfaces.

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

1 Scope and field of application

1.1 This International Standard gives recommendations concerning the storage conditions, storage facilities, handling and inspection for all processed photographic paper prints in roll, strip, or sheet form, regardless of size.

1.2 The storage of photographic film and photographic plates requires different considerations and these are not covered in this International Standard.

1.3 This International Standard applies to photographic paper records intended as storage copies; these copies being used only infrequently. It does not apply to work copies. If more frequent use or display is required, duplicate copies of the records shall be made.

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 paper prints whose processing conditions are unknown, or that have been toned, mounted, retouched or bear markings with materials of uncertain or unknown stability. It is not intended to predict or assign a useful lifetime to photographic prints stored in accordance with the specifications of this International Standard.

2 References

ISO 3897, *Photography — Silver image photographic plates for record purposes — Storage conditions.*

ISO 5466, *Photography — Processed safety photographic film — Storage conditions.*

3 Definitions

For the purpose of this International Standard the following definitions apply.

3.1 photographic paper print: Paper sheet having an image in a photographic layer on a base consisting largely of cellulose fibres.

NOTE — The photographic layer is coated either directly on the paper, or on a pigmented layer previously applied to the paper, or on a resin layer previously applied to the paper.

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

3.3 insulated record containers: Containers as defined in appropriate national standards and regulations [1].

3.4 fire-resistive vaults: Vaults as defined in appropriate national standards and regulations [2].

3.5 open enclosure: Enclosure which is intended for the physical protection against mechanical damage but is neither light-tight nor air-tight; such enclosures may be folders, envelopes, cartons, sleeves, albums, wrappers or jackets.

3.6 protective enclosure: Light-tight, impermeable container used for protection from outside factors such as reactive gases, and moisture, including relative humidity changes; such enclosures may be sealed envelopes.

4 Composition of enclosure materials

4.1 General

The enclosure material shall be free from acidic, oxidizing and reducing agents which may be released slowly with time and cause image instability or chemical decomposition of the print. For example, ageing blemishes in processed images may be caused by peroxide released from enclosure materials. Likewise, the presence of acid in paper that is in contact with photographic materials can cause degradation.

The enclosure itself shall be chemically stable, otherwise the decomposition products might be harmful to the photographic material, and dirt or dust might be produced that could scratch or become embedded in the image surface.

Cellulose nitrate and glassine sheeting are examples of unsatisfactory enclosure materials because of their own instability [1] [4].

The physical surface of the enclosure material is also important. A very smooth glossy surface can result in sticking or ferrotyping of the image surface. A slightly rough or matt surface is recommended for the filing enclosure, but a very rough surface can produce abrasion problems.

The enclosure material and the photographic material to be stored shall meet the requirements of the photographic activity test as described in 11.1. This incubation test determines whether there is a chemical interaction between the particular components of the package. The adhesive used for seams and joints shall also meet this requirement.

4.2 Paper

The paper shall be made from rag, bleached sulfite, or bleached kraft pulp with an alpha-cellulose content greater than 87 % [5]. It shall be free from highly-lignified fibres such as ground wood, as determined by the phloroglucinol spot test.

The pH shall be between 7,5 and 9,5 [6] for paper in direct contact with black-and-white photographic materials, other than albumen prints. The pH shall be close to 7,0 when in direct contact with colour material. An alkali reserve shall be at least 2 % as determined by the alkali reserve test described in 11.2 [7]. The alkali reserve shall be accomplished by the incorporation of an alkaline earth carbonate.

A minimum of sizing chemicals shall be used, the amount being dictated by the requirements of the end-use (enclosures, overwraps, interleaving, etc.).

Neutral or alkaline sizing chemicals shall be employed. The material shall essentially be free from particles of metal. Surface fibres which might offset on to photographic layers should not be present. The paper shall not contain waxes, plasticizers, or other ingredients that may transfer to the photographic material during storage. Glassine envelopes [1] shall not be used. The paper shall meet the physical tests required for the particular application; these include stability [8], folding endurance [9], and tear resistance [10].

Where the high-humidity conditions favourable for fungus growth may occur, the user should provide controlled conditions of lower humidity. This will eliminate the need for a fungicide treatment. Where it is not possible to provide lower humidity storage, the paper used for the enclosure should be relatively non-porous and treated with a fungicide.

The effectiveness of such a fungus-resistant treatment should be determined [11]. Additive treatments for fungus protection should be used with extreme caution. There may be long-term effects of the fungicide with respect to its efficiency and safety, as well as an interaction with the photographic material.

1) Example: Class 150 UL72-1977 [2].

2) Example: Publication NFPA No. 232, 1975 [3].

4.3 Plastic

Suitable plastic enclosure materials are photographic film support materials such as uncoated polyester (polyethylene terephthalate) and uncoated cellulose acetate. Uncoated polyethylene has been found suitable as it is generally inert, unplasticized, and has good chemical stability. Other plastics may be satisfactory, but there has been no long-term experience with such materials.

Chlorinated or nitrated sheeting shall not be used, and cellulose nitrate in particular shall be avoided. Polyurethane foam shall not be used [1].

Highly-plasticized sheetings or coatings shall not be employed as this might result in either sticking or ferrotyping of the image surface. Plastics of unknown quality containing residual solvents or plasticizers are suspect because such solvents may escape and have a harmful effect on the photographic image. The plastic materials shall be free of peroxides.

The plastic shall meet the physical tests required for the particular application. These include folding endurance [9], tear resistance [12], and tensile strength [13].

4.4 Metal

Metals shall be non-corrodible such as anodized aluminium or stainless steel. The use of steel is permissible provided the surface is well protected by lacquer, enamel, tinning, plating or some other corrosion-resistant finish. Lacquer which might give off reactive fumes, peroxides or exudations during storage shall not be used (see annex C). Cabinets painted with oil base paints shall not be used for 3 months as they may give off peroxides.

4.5 Adhesive

If an adhesive is used, it shall have no harmful effect on the photographic image or enclosure when tested by the photographic activity test described in 11.1. Some photographic images can be damaged by adhesives incorporating impurities such as sulfur, iron, copper, or other ingredients that might react with image silver or gelatin. Pressure-sensitive adhesives and ether-linked products shall be avoided. If a particular brand of commercially-made adhesive is found to be safe for long-term storage purposes, there is no assurance that subsequent batches will contain ingredients of the same purity. Rubber-based products such as rubber cement shall not be used. Not only might they contain harmful solvents or plasticizers, but they might be compounded with photographically-damaging sulfur, usually as a vulcanizer, accelerator, or stabilizer. Even some "low-desensitizing" or "sulfur-free" rubbers contain sulfur.

Photographic quality gelatin and many polyvinyl acetate and cellulose ester adhesives are suitable for use with paper enclosures. Heat sealing and mechanical sealing should be used when possible.

4.6 Printing inks

The printing ink shall have no harmful effect on the photographic image when tested by the photographic activity test described in 11.1. Printing inks have been known to cause microscopic spots in fine grain silver microfilm [14]; consequently, there shall be no printed matter on the inside of the filing enclosure. The ink used for imprinting the outside of filing enclosures shall not bleed, spread, or transfer, nor shall it be a source of products that attack the photograph or the enclosure itself.

5 Print enclosures

5.1 Classification of enclosures

Enclosures used for long-term storage of sheets or rolls of processed photographic paper prints may be divided into two broad classifications; open enclosures and protective enclosures.

5.2 Open enclosures

The purpose of open enclosures is to exclude dirt, to protect the print against mechanical damage and to facilitate identification and handling. They give limited access to ambient air. Therefore, the conditions of the surrounding air should be within the recommended limits of 8.1, 8.2 and 8.3.

Prints in sheet form may be stored in envelopes of paper or plastic foil, folding cartons, file folders, or in strip jackets. Colour prints shall be stored in opaque envelopes or folders or otherwise protected from light exposure. When in direct contact with the surface of the photographic print, the paper or plastic material used for envelopes, sleeves, jackets, folders, and cartons shall meet as a minimum requirement the specifications described in 4.2 and 4.3. Adhesives used in open enclosures shall meet the requirements described in 4.5. 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 print surface. For maximum storage life, photographic prints shall be in a clean condition before being placed in storage.

Rolls of photographic paper should be stored, preferably, in closed enclosures to provide protection against dirt and physical damage. Suitable enclosures are those with telescoping, slip-type, or threaded twist-on lids. Closed enclosures are not necessarily air-tight 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. Enclosures shall be non-corrodible, peroxide-free and not highly plasticized as described in 4.3 and 4.4. Rubber bands shall not be used for confining paper on reels or cores. If paper bands are used, the paper shall meet as a minimum requirement the specifications described in 4.2.

5.3 Protective enclosures

Protective enclosures shall be used where needed, to maintain humidity within the limits specified (see clause 8), 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.

Suitable enclosures for rolls of photographic paper are closed containers made from impermeable materials 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.

6 Storage housing

Photographic prints 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 prints are in closed containers. The storage housing materials shall be non-combustible and non-corrodible as described in 4.4. 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 should be durable and not contribute deleterious effects to the stored photographic prints. Adverse effects may be produced by finishes containing chlorinated or highly-plasticized resins, or by freshly-painted or lacquered surfaces.

When air-conditioned individually, storage housings shall be arranged to permit interior circulation of air to all shelves and drawers holding prints to allow uniform humidity conditions. Storage housings located in rooms conditioned in accordance with 8.1 shall be provided with ventilation openings permitting access of air to the interior. Such openings shall not interfere with requirements for fire-protective storage or water protection.

Caution should be exercised in storing paper prints whose processing conditions are unknown or which have been treated or marked with materials of unknown stability. Intermixing of such prints with unaltered prints known to have been subjected to good processing in the same storage housing should be avoided.

7 Storage rooms

Rooms and areas used for print storage should be associated with rooms allowing facilities for inspection and viewing of the print. The inspection area should be maintained at the same temperature and humidity as the storage room, to avoid curling or distortion. 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 may be cooled below the dew point of the air. Provisions shall be made against print damage by water from floods, leaks, sprinklers, etc. Storage rooms or vaults should be located above basement level, where possible.

The value of photographic prints kept for long periods of time makes it advisable to provide a storage room or vault separate from temporary storage facilities, offices or work areas. It should be located as far as possible from an urban or industrial area where contaminants (see 8.3) may be present in harmful concentrations.

Storage rooms have been constructed in caves and mines and have proven very satisfactory when accepted requirements for the environmental conditions and air purity (see 8.3) are met.

8 Environmental conditions

8.1 Humidity and temperature limits (see annexes A and B)

The optimum limits for relative humidity of the surrounding air are 30 to 50 % but short-term cycling between these extremes shall be avoided. Relative humidities above 60 % shall be avoided. High moisture content of the air is conducive to mould growth which can completely destroy the image in time; and also the higher the moisture level, the greater is the effect of residual chemicals. A relative humidity lower than 30 % will minimize chemical deterioration, but can cause emulsion brittleness and print curl in the material stored. These latter effects may, however, be partially reversed by reconditioning at the proper humidity level.

Probably the most important aspect of temperature is its effects on relative humidity, since a temperature variation may take the relative humidity beyond the acceptable range. Photographic papers shall not be stored above 30 °C for a prolonged period. This high temperature will accelerate the reactions that degrade the image. A temperature in the range 15 to 20 °C is acceptable but daily cycling greater than 4 °C shall be avoided, by thermostatic means if necessary.

Added protection may be obtained for all prints by low temperature storage. A storage temperature of 2 °C or below is strongly recommended for colour images [15] [16]. Two methods may be used:

a) The prints may be conditioned to the recommended relative humidity, placed in hermetically-sealed enclosures after excluding as much air as possible, and then placed in below-freezing storage. Prints may be placed within two heat-sealed bags to provide good moisture protection. 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 enclosure.

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

The enclosure should be allowed to warm up to room temperature prior to opening, to avoid moisture condensing on the print (see annex B). Cycling of temperatures should be avoided.

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

8.2 Air-conditioning requirements

Properly controlled air conditioning may be necessary for maintaining humidity and temperature within the limits specified for optimum 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[1)]. They shall also follow recommendations for fire-resistive file rooms contained in appropriate national standards and regulations[2)].

Automatic control systems are recommended and they shall be checked frequently. Where air conditioning is not practical, high humidities may be lowered by electrical refrigeration-type dehumidifiers, controlled with a hygrostat. Inert desiccants such as chemically pure silica gel may be used, provided 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 8.1. Dehumidification may 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 8.1 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.

8.3 Air purity (see annex C)

Solid particles, which may abrade the surface 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 dry-media type having an arrestance rating of not less than 85 % as determined by tests contained in appropriate national standards and regulations[3)]. Filters shall be of the non-combustible type, meeting the construction requirements of appropriate national standards and regulations[4)].

Gaseous impurities such as sulfur dioxide, hydrogen sulfide, peroxides, ozone, acidic fumes, ammonia and nitrogen oxides can cause degradation of the image[20]. They can be removed from the air by suitable washers or absorbers. An optimum storage vault should be located as far as possible from an urban or industrial area where contaminants may be present in harmful concentrations. Where practical, storage of prints in sealed enclosures in accordance with clause 5 will afford adequate protection.

As paint fumes may be a source of oxidizing contaminants, prints shall be removed from a storage area for a 3 month period when the area is freshly painted.

8.4 Light

Exposure to direct sunlight may lead to deterioration, especially in poorly-processed prints. Staining and fading may result. Light sources containing high levels of ultraviolet radiation should be avoided. Tungsten lights and ultraviolet-free fluorescent lamps are recommended for viewing or exhibiting.

9 Fire-protective storage (see annex D)

During heating for 4 h at 150 °C in the package that is to be stored, enclosure materials for fire-resistant storage shall not ignite or release fumes more reactive than the print 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 print or prevent it from being removed from the enclosure.

For protection against fire and associated hazards, the prints shall be placed in enclosures in either fire-resistive vaults or insulated record containers. If fire-resistive vaults are used, they shall be constructed in accordance with recommendations contained in appropriate national standards and regulations[2)].

When the quantity of prints is not too great, insulated record containers conforming to appropriate national standards and regulations[5)] may be used. They shall not exceed an interior temperature of 60 °C and an interior relative humidity of 85 % when given a fire exposure test from 1 to 4 h depending on the classification of the second 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.

1) Example: Publication NFPA No. 90A 1967.[17]

2) Example: Publication NFPA No. 232, 1970.[3]

3) Example: Stain test of ASHRAE Standard 52-68.[18]

4) Example: Class 1 construction of UL 900-1971.[19]

5) Example: Class 150 of UL72-1977.[2]

10 Paper handling and inspection

10.1 Handling

Proper handling of prints is important. Some prints may be used frequently, generating damage and imposing critical handling and filing requirements. Good housekeeping and cleanliness are essential. Prints should be handled by their edges and the wearing of thin cotton gloves by the handlers is recommended.

10.2 Inspection

A number of different representative samples of prints should be inspected at two-year intervals. If deviations from recommended temperature and relative humidity ranges have occurred, inspection should be made at more frequent intervals. A sampling plan established in advance should be used and a different lot should be inspected each time. Deterioration of either prints or enclosure materials shall be noted.

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

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

11 Test methods

11.1 Photographic activity test

The enclosure material and a representative sample of the processed photographic material to be stored shall be placed in close contact. Two such sandwiches shall be subjected to an accelerated ageing test, i.e. exposed to a temperature of 50 ± 2 °C and a relative humidity of 86 % for 30 days. No other materials shall be in the same environment as the test materials during this period. At the end of this test, no visual pattern shall be transferred from the enclosure material to the photographic material nor shall the image of the latter be affected. Any image change may be readily determined by having one-half of the photographic image against a piece of filter paper, having a pH between 7,0 and 7,7, during the incubation to serve as a control. Alternatively, paper conforming to the requirements of 4.2 may be used. Some types of photographic images may undergo a colour or density change due to the incubation conditions. The changes produced by contact with the enclosure material shall be no greater than that produced by the print in contact with a filter paper control.

These temperature and humidity conditions can be readily obtained by storing the materials in a glass laboratory desiccator jar that can be placed in a forced-air circulating oven at 50 °C. The 86 % relative humidity can be obtained by keeping a saturated solution of potassium nitrate in water [21] at the bottom of the jar [1]. Care shall be exercised so that the saturated solution contains an excess of undissolved crystals at 50 °C. The undissolved crystals shall be completely covered by a layer of saturated salt solution, and the surface area of the solution should be as large as practicable. The jar and salt solution shall be at a temperature of 50 °C for at least 20 h prior to use to ensure adequate equilibrium. Good circulation of air in the desiccator shall be accomplished by use of a built-in fan.

Alternatively, exposure to these temperatures and humidity conditions may be provided by means of a conditioning air cabinet.

11.2 Alkali reserve test for paper

Condition the paper enclosure material to 23 °C and 50 ± 2 % relative humidity. Weigh a specimen of approximately 2,5 g to the nearest 0,01 g then disperse it in 275 ml of water to form a slurry. Measure the pH and transfer by means of a pipette a sufficient volume of 0,1 mol/l acid into the slurry to lower the pH to 3,0. Prepare a blank with 275 ml of water, and transfer by means of a pipette the same volume of 0,1 mol/l acid as was used with the sample into the blank. Boil the sample and the blank solutions gently for about 1 min to expel carbon dioxide. After the sample and the blank solutions have cooled to room temperature, back titrate with 0,1 mol/l sodium hydroxide to a pH of 7,0.

Calculate the percent alkali reserve from the formula

$$\frac{0{,}050\,05\,C\,(V_2 - V_1) \times 100}{m}$$

where

V_1 is the volume, in millilitres, of the sodium hydroxide solution required for sample titration;

V_2 is the volume, in millilitres, of the sodium hydroxide solution required for blank titration;

C is the actual concentration, expressed in moles per litre, of the sodium hydroxide solution;

m is the mass, in grams, of the paper enclosure test specimen.

1) The relative humidity is based on the nominal vapour pressure of the salt solution but the tolerances of this relative humidity cannot be specified.

Annex A

Humidity during storage

(This annex does not form part of this International Standard.)

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

Prolonged exposure to conditions above 60 % relative humiditiy will tend to damage or destroy the gelatin emulsion layer due to growth of fungus, and will eventually cause sticking of the emulsion. High humidity exposure will also accelerate any effects of residual processing chemicals (for example, thiosulfate) on the stability of silver images and will impair the stability of dye images.

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

Annex B

Temperature during storage

(This annex does not form part of this International Standard.)

Continuous temperatures above approximately 40 °C may accelerate fading of dye images. While gelatin becomes brittle at low temperatures (below 0 °C), flexibility is restored upon return to room temperature. Storage temperatures below the dew point of air may produce condensation of moisture upon print surfaces unless enclosure and contents are brought above the dew point temperature before removal of the print. The required warm-up time might 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. Low storage temperature may raise the relative humidity if the storage area is not humidity controlled. This may cause conditions beyond the range of recommended humidities for proper storage, and therefore sealed containers must be used.