Designation: E1254 – 13 (Reapproved 2023)

Standard Guide for Storage of Radiographs and Unexposed Industrial Radiographic Films[1]

This standard is issued under the fixed designation E1254; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide may be used for the control and maintenance of industrial radiographs and unexposed films used for industrial radiography.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

NOTE 1—For information purposes, refer to Terminology E1316. The terms stated therein, however, are not specifically referenced in the text of this document.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E94 Guide for Radiographic Examination Using Industrial Radiographic Film

E746 Practice for Determining Relative Image Quality Response of Industrial Radiographic Imaging Systems

E1316 Terminology for Nondestructive Examinations

2.2 *ISO Standards:*[3]

ISO 18901 Imaging Materials—Processed silver-gelatin type black-and-white films - Specifications for stability

ISO 18902 Imaging Materials—Processed photographic films, plates, and papers - Filing enclosures and storage containers

ISO 18916 Processed Photographic Materials—Photographic activity test for enclosure materials

ISO 18917 Photography—Determination of residual thiosulfate and other related chemicals in processed photographic materials - Methods using iodine-amylose, methylene blue and silver sulfide

3. Significance and Use

3.1 The provisions of this guide are intended to control the quality of industrial radiographs and unexposed films only and are not intended for controlling the acceptability of the materials or products radiographed. It is further intended that this guide be used as an adjunct to Guide E94.

3.2 The necessity for applying specific control procedures such as those described in this guide is dependent to a certain extent, on the degree to which a user adheres to good processing and storage practices as a matter of routine procedure.

4. Unexposed Film Storage

4.1 *Unopened Containers:*

4.1.1 *Storage Recommendations*—Any films in containers sealed by the manufacturer and not opened should be stored with the films on edge, or as recommended by the specific manufacturer, to avoid container damage and possible film damage. Storage temperature should be between 40 °F (4.4 °C) and 75 °F (24 °C) at a relative humidity range of 30 % to 60 %.

4.1.2 *Higher Storage Temperatures*—When temperatures exceed 90 °F (32 °C) for 30 days, some unexposed films may be processed under normal existing conditions to test for fogging. The outside sheets in a pack of cut films or the ends of rolled films are most affected by heat. If excessive fogging is found on these samples, subsequent sampling may be done

[1] This guide is under the jurisdiction of ASTM Committee E07 on Nondestructive Testing and is the direct responsibility of Subcommittee E07.01 on Radiology (X and Gamma) Method.

Current edition approved June 1, 2023. Published June 2023. Originally approved in 1988. Last previous edition approved in 2018 as E1254 – 13 (2018). DOI: 10.1520/E1254-13R23.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

on inner sheets or further in on the rolls to avoid unnecessary scrap. A limit of 0.30 density units total for the base density and fog is acceptable (see 4.3) for industrial radiographic films.

4.1.3 *Lower Storage Temperatures*—The temperature can be lower than 40 °F (4.4 °C) as lower temperatures reduce the rate of heat and age fogging. However, lower temperatures will have no effect on background radiation fogging. Films stored at these lower temperatures in unopened containers should be allowed to stabilize at room temperature before opening the containers. The stabilization time varies with the bulk of the stored films and the temperature stored at. The lower the temperature and greater the bulk the longer the time required to reach room temperature. If the containers are opened too soon, condensation could cause the films to stick to whatever is touching their surfaces.

4.1.4 *Lower or Higher Storage Humidities*—If the relative humidity is below 30 % and the moisture in the films is reduced sufficiently, film emulsion cracking or damage can occur during handling after opening the sealed containers, and the films may be subjected to static electrical discharges. Storage humidities over 60 % can also cause the films to stick to whatever is touching their surfaces.

4.2 *Opened Containers*—The same considerations described in 4.1 for unopened containers apply. Opened containers are those on which the manufacturer's inner bag around the film itself has been opened. This can cause the unexposed film to stick and fog more rapidly when exposed to high humidity and temperature.

4.3 *Time-of-Use Usability*—Tests used to evaluate image quality in accordance with Test Method E746 showed that equivalent penetrameter sensitivity (EPS) of 1.4 % can be maintained for films with base plus-fog (B + Fog) up to 0.30.

4.3.1 If unexposed sheets or rolls are processed normally through the available processing system, and base plus-fog density exceeds 0.30, the film may still be suitable for use. However, specific agreement should be obtained between the purchaser and supplier if out-dated film or film stored under non-recommended conditions is to be used.

4.4 *Radiation Protection*—Storage facilities for unexposed films should provide adequate protection from penetrating radiation.

5. Radiograph Storage

5.1 *Introduction*—Radiographs are normally stored in some form of enclosures to exclude dirt and protect them against physical deterioration and damage. Storage conditions can be designed for archival preservation, normally considered to be for more than 100 years or for moderate time periods by using the guidelines in this standard; however, the radiographs must have been sufficiently fixed and washed and stored in suitable enclosures to ensure preservation.

5.2 *Residual Thiosulfate*—If radiographs are not fully fixed and washed, they can retain some fixer, or thiosulfate, and some residual silver in the lower density areas. During storage, these residual chemicals can generate permanent, brownish stains super-imposed on the radiographic image. Since the rate at which a stain is generated depends on both the amount of residual thiosulfate and radiograph storage conditions, factors such as the temperature, humidity, and air flow in the storage facility must be considered as they affect this rate (see ISO 18901). If radiographs are stored at or below the upper limits of the temperature and relative humidity ranges described in 4.1.1, stain generation will be minimized and lowered as these two parameters are lowered. Again, be aware of possible film emulsion cracking at very low humidities.

5.2.1 *Testing for Residual Thiosulfate*—The procedure described in ISO 18917 as the silver densitometric method for measuring residual thiosulfate details a silver nitrate-acetic acid reagent. A solution that can be used as a spot test for residual thiosulfate is as follows: Dissolve 10 g silver nitrate in a solution of 30 mL glacial acetic acid in 750 mL water. Dilute to 1 L and store in brown, glass-stoppered bottle. Discard if darkened. Two minutes after a drop of this solution has been placed on the lowest density area of a radiograph, a stain will appear if any residual thiosulfate is present. The intensity of the stain will approximate the maximum amount of discoloration that one side of the radiograph will ever reach during any kind of storage conditions of temperature and humidity. For a visual reference to the approximate maximum discoloration of both sides of a radiograph, both sides must be tested with superimposed drops. This spot test is not usually considered adequate where critical work or work to a strict code or specification is involved. Consequently, the methylene blue method or the complete silver densitometric method described in ISO 18917 would be preferred.

5.2.2 *Natural Aging Stain*—Practical long-time storage tests indicate that under normal "office" conditions of controlled, moderate temperature and humidity, approximately one third of the maximum stain indicated by such a spot test was actually generated over a 10 year period.

5.2.3 *Rewashing Radiographs*—If the spot test does generate a stain, the radiograph can be rewashed to lower the residual level and then retested to confirm the lower level. Immersion in a fixer neutralizer such as 2 % to 6 % solution of sodium sulfite can drastically reduce rewashing times.

5.3 *Enclosure Materials for Radiographs:*

5.3.1 *General*—Packaging enclosure materials, including corrugated boxes and interleaving paper, shall be chemically stable and have a slightly rough or matted surface. Guidelines for enclosure materials are described in ISO 18902. A photo activity test for suitability is described in ISO 18916.

5.4 *Storage Area Conditions:*

5.4.1 *Air Impurities*—Inert or inactive solid particles can be deposited on radiographs and interfere with readability and produce scratches. Reactive types of solids may cause fading or staining and gaseous impurities may cause base or image deterioration. Impurities such as peroxides, ammonia, paint fumes, sulfur dioxides, or compounds of sulfur, such as hydrogen sulfide, can be particularly harmful.

5.4.1.1 In addition to the impurities mentioned in 5.4.1, the presence of acetic acid fumes (commonly known as the vinegar syndrome) produced by the decay of cellulose acetate film base, can additionally cause degradation of films stored in close proximity to the decaying film. Monitoring of the level of acetic acid in film storage areas can be accomplished using