



Designation: E1453 – 20

Standard Guide for Storage of Magnetic Tape Media that Contains Analog or Digital Radioscopic Data¹

This standard is issued under the fixed designation E1453; 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 recorded and unrecorded magnetic and optical media of analog or digital electronic data from industrial radiology.

1.2 *Units*—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.

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.* For specific precautionary statements, see Section 6.

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
[E1000 Guide for Radiology](#)
[E1255 Practice for Radiology](#)

2.2 *Datasheets*:
[Environmental and Shipping Specifications for LTO Tape Cartridges](#)³

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 Dec. 1, 2020. Published December 2020. Originally approved in 1992. Last previous edition approved in 2014 as E1453 – 14. DOI: 10.1520/E1453-20.

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 the IBM website, https://www.ibm.com/support/knowledgecenter/en/STCMML8/com.ibm.storage.ts3500.doc/ipg_3584_meesi.html.

[Environmental and Shipping Specifications for 3592 Tape Cartridges](#)⁴

3. Significance and Use

3.1 The provisions of this guide are intended to control and maintain the quality of recorded industrial electronic data from radiology and unrecorded magnetic and optical media only, and are not intended to control the acceptability of the materials or products examined. It is further intended that this guide be used as an adjunct to Guide E1000 and Practice E1255.

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 the user adheres to good recording and storage practices as a matter of routine procedure. Such practices should follow the best-usage practices outlined by both the mechanism and media datasheets.

3.3 This guide has been updated to provide guidance on the LTO and IBM 3592 families of data storage tape formats. The LTO and 3592 family of tape formats are the only remaining actively developed data tape formats.⁵

3.4 While the above indicated media are the only active digital tape formats on the market, archives of older media, including those with analog data, remain under retention requirements. The changes made here are conservative and do not negatively impact the storage of older media formats.

3.5 The longevity in which the recorded data, either analog or digital, maintains its integrity on magnetic media varies greatly from one media to another. As such, it is considered best practice to duplicate the media at the manufacturer's suggested interval to prevent loss of the recorded data through degradation. On average, this is every five years.

4. Unrecorded Media Storage

4.1 *Un-Opened Containers*:

⁴ Available from the IBM website, https://www.ibm.com/support/knowledgecenter/en/STCMML8/com.ibm.storage.ts3500.doc/ipg_3584_meesij.html.

⁵ IBM 3592 is a trademark of IBM and has been found satisfactory for this purpose.

4.1.1 *Storage Recommendations*—Any media in containers sealed by the manufacturer and not opened should be stored as shipped, whenever possible, to avoid container damage and possible media damage. Storage temperature should be between 61 and 77 °F (16 to 25 °C), relative humidity range of 35 ± 15 %, at a pressure range of 12.5 ± 2.5 psi, and a maximum stray magnetic field strength of less than 50 Oe (4000 ampere/meter). The environmental conditions should also minimize the presence of ozone and oxidizers. The optimum storage conditions are 65 °F (18 °C) at 40 % relative humidity, 14.7 psi, and a maximum magnetic field strength of 30 Oe. Damaging stresses in the media can be produced by large temperature and humidity variations even if they remain within the specified ranges. Specific media manufacturer's recommendations should be consulted when large variations in temperature or humidity, or both, are anticipated or experienced.

4.1.2 *Higher or Lower Storage Conditions*—When temperature exceeds 90 °F (32 °C) or humidity exceeds 90 %, or pressure exceeds 15 psi, some unrecorded media should be used under normal existing conditions to test for degradation. If degradation is found on these samples, subsequent sampling may be done on other media to avoid unnecessary scrap. If storage temperature falls below 30 °F (–1 °C), media stored at these lower temperatures in unopened containers should be allowed to stabilize at a room temperature (60 to 90 °F (16 to 32 °C)) before opening the containers. The stabilization time will vary with the bulk of the stored media and the storage temperature. The lower the temperature and greater the bulk, the longer the time required to reach room temperature. If containers are opened too soon, condensation could cause the media to stick to whatever is touching their surfaces. If the relative humidity falls below 10 % and the moisture in the media is reduced sufficiently, damage can occur during handling after opening the sealed containers, and the media may be subjected to static electrical discharges which can damage manufacturer written servo tracks (if applicable to the media type) or drive components. Humidity levels over 80 % can also cause the media to stick to whatever is touching their surfaces including other layers of tape on the spindle or drive components leading to possible jamming or drive damage.

4.2 *Opened Containers*—The same considerations described in 4.1 for un-opened containers apply. Users must also prevent contamination of the media from particulates which can cause damage. Opened containers are those on which the manufacturer's seal has been opened. This can cause the unrecorded media to stick/degrade more rapidly when exposed to high humidity and temperature.

5. Recorded Media Storage

5.1 Recorded media are normally stored in some form of enclosures to exclude dust/dirt and protect them against physical deterioration and damage. Storage conditions can be designed for archival preservation, normally considered to be for at least 20 years, or for moderate time periods by using the guidelines in 4.1; however, the recorded media must have been sufficiently recorded in accordance with manufacturer's recommendations and stored in suitable enclosures to ensure

preservation. The storage enclosure should limit dust particles to 0.002 in. (0.05 mm) maximum.

5.1.1 *Enclosure Materials for Recorded Media:*

5.1.1.1 *General*—The enclosure material should be free of acids and corrosives, and be chemically stable.

5.1.1.2 *Activity Test for Enclosure Materials*—At least three representative samples of recorded media to be stored together with the proposed enclosures should be placed in close contact with each other and subjected to an accelerated aging test of 85 ± 5 °F (30 ± 3 °C), 70 ± 10 % relative humidity for 30 days. No materials should be transferred from the enclosure material to the media, and the recorded data should not be affected.

5.2 *Storage Area Conditions:*

5.2.1 *Air Impurities*—Inert or inactive solid particles can be deposited on recorded media and interfere with readability and produce degradation. Reactive types of solids may cause degradation of the media, and gaseous impurities may cause data deterioration. Never smoke, wax the floors, use steel wool pads on a buffer machine, eat or drink in the media storage area. Solvents should not come into contact with the media, because they may soften the coatings and cause degradation.

5.2.2 *Temperature*—Continuous temperatures above 120 °F (49 °C) may accelerate degradation, and temperatures below the dew point of the air may produce condensed moisture on the recorded data and cause sticking. In general, a moderate temperature range, as described in 4.1, along with the minimization of large variations, is recommended.

5.2.3 *Humidity*—The extremes must be avoided as prolonged exposures to relative humidities over 60 % will tend to damage the media and may cause fungus growth and sticking. Under conditions of low or changing humidity, defects in the media may occur. Low humidity will also increase the potential of static charges on the recorded media attracting solids that could harm them. In general, a relative humidity range of 30 to 60 % is recommended.

5.3 *Fire Resistance*—Recorded media can withstand temperatures as high as 120 °F (49 °C) without significant loss of data. Even if the external enclosure shows no signs of damage, the tape may have become distorted, contaminated with smoke particulates, or stuck to surfaces such as other layers of the tape or the enclosure material. Any recorded media which has survived a fire incident should never be operated normally and should be sent to a data recovery service for duplication. New media which has survived a fire should be discarded.

6. Special Precautions

6.1 Damaging stresses in a tape pack can be produced by large temperature and humidity variations even if they remain within the specified ranges. Excessive temperature and humidity conditions can also cause tape layer-to-layer adhesion (blocking) even if they are maintained constant. Extremely dry environment can cause layer-to-layer adhesion due to static build-up. Torn windings in the middle of a pack is a sure sign that the tape has been subjected to an extreme environment. The coatings on some storage media which have been subjected to very high humidities can breakdown and become gummy due to hydrolysis. This media coating deterioration can