Designation: D3611 – 06

# Standard Practice for Accelerated Aging of Pressure-Sensitive Tapes[1]

This standard is issued under the fixed designation D3611; 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.

*This standard has been approved for use by agencies of the Department of Defense.*

## 1. Scope

1.1 This practice provides one environment in which to expose finished pressure-sensitive tape material for the purpose of accelerating the aging of it. It is applicable to tape in roll form when the user observes the precautions detailed within the procedure. The practice does not provide for a conclusion within itself, but is for use in conjunction with appearance or physical property tests to follow the accelerated exposure. While this practice was developed using packaging type tapes, its use on other types of tape with similar construction is encouraged. It is not intended for use on electrical grade tapes (see Test Methods D1000).

1.2 *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 and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

2.1 *ASTM Standards:*[2]

D996 Terminology of Packaging and Distribution Environments

D1000 Test Methods for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications

D3330/D3330M Test Method for Peel Adhesion of Pressure-Sensitive Tape

D3715/D3715M Practice for Quality Assurance of Pressure-Sensitive Tapes

D4332 Practice for Conditioning Containers, Packages, or Packaging Components for Testing

## 3. Terminology

3.1 Terminology found in Terminology D996 shall apply.

## 4. Summary of Practice

4.1 The pressure-sensitive tape is exposed to an atmosphere of 80 % relative humidity at 150°F (66°C) for a period of 96 h. Following a period for returning to a standard atmosphere, the tape is ready for a prescribed examination using a method such as Test Methods D3330/D3330M.

## 5. Significance and Use

5.1 This practice accelerates the natural aging of pressure-sensitive tapes so that the response to the usual physical property tests changes to the same extent as with an exposure to approximately two years of natural aging when compared with the response to tests before aging.

5.1.1 Natural aging in this context means a continuous period of aging of tape in a closed fibreboard container (in darkness) in the variable climate of either the warm moist south, the warm dry southwest or the moderate midcontinent, USA.

5.2 The extent of change for one physical property should be expected to be different than for another property and so would also relate to different natural aging time.

5.3 An abnormal product lot may cause differences in testing response that throw off the expected time patterns.

5.4 Appearance of normal tape product will usually change only slightly on two years natural aging. This accelerated exposure usually produces an exaggerated change in appearance which would be seen under natural conditions only in abnormal product.

5.5 There is no present experience to relate this accelerated exposure to responses of tape in applications where the tape is under a use stress.

## 6. Apparatus

6.1 *Humidity Vessel in Oven Procedure*:

6.1.1 *Vessel*, to contain a solution of ammonium sulphate and tape undergoing exposure. The vessel must meet the following requirements:

6.1.1.1 Vented to allow equilibrium with an opening not to exceed 0.01 mm.[2]

6.1.1.2 The air volume over the solution to be not more than 10 % greater than the cube of the square root of the liquid surface area.

[1] This practice is under the jurisdiction of ASTM Committee D10 on Packaging and is the direct responsibility of Subcommittee D10.14 on Tape and Labels.

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[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.

6.1.1.3 The air depth of the vessel to the liquid surface to be not more than 10 % greater than the square root of the liquid surface area.

6.1.1.4 A desiccator assembly with a perforated plate can be a suitable vessel.

6.1.2 *Oven,* of the forced-convection type maintained at a mean of 66 ± 2°C (150 ± 4°F).

6.2 *Humidity chamber*, to contain rolls of tape maintained at a mean of 66 ± 2°C (150 ± 4°F) and 80 ± 5 % relative humidity.

## 7. Reagents (for Humidity Vessel in Oven procedure)

7.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specification of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.[3] Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

7.2 *Ammonium Sulfate* $(NH_4)_2SO_4$.

7.3 *Water,* distilled or demineralized.

7.4 The reagents of 7.2 and 7.3 are to be dissolved together in the proportion of 1 + 1 by weight. Use a volume (the units will be cubic centimetres) of water not less than that obtained by multiplying 500 times 132 times the vessel air volume in cubic metres. This gives 500 times the number of grams of water required to humidify the air volume to 80 % relative humidity at 150°F (66°C) and should supply the moisture required to accommodate the absorption by the sample rolls. This provides a saturated solution which will remain saturated at 150°F (66°C). This solution within the closed vessel both provides and controls the moisture content (humidity) within the vessel.

## 8. Sampling

8.1 Sampling of material for this practice should be in accordance with the requirements of the applicable material or commodity specification.

8.2 Lacking the previously mentioned specification, sampling should be as required in the physical property method applicable to the testing to follow the exposure.

8.3 When no other sampling requirement is applicable, sampling should be as set forth in Practice D3715/D3715M.

## 9. Sample

9.1 The sample should consist of rolls of tape.

9.1.1 The quantity of tape in any sample roll need not be more than necessary to supply the specimens for the physical property tests to follow the exposure.

9.1.2 No sample roll should be less than ½ in. (12 mm) in width.

9.1.3 Sample rolls should be originally wound, not rewound rolls.

## 10. Procedure

10.1 *Humidity Vessel in Oven*:

10.1.1 Place the sample rolls above the solution in the vessel so that roll edges lie in a horizontal plane (parallel with the liquid surface). Include no more sample rolls than will displace one fourth of the air volume in the vessel.

10.1.2 Arrange the sample rolls so that all surfaces are exposed to the humid air in the vessel. Use separators that allow free air space around and between the rolls and which are non-hygroscopic.

10.1.3 Close the assembly and place in the oven.

10.1.4 Assure that care is taken to prevent the solution from wetting any part of the assembly (including tape), other than the reservoir it occupies, when the assembly is moved in and out of the oven. This reduces salt deposition and crystalline build-up.

10.1.5 Remove the assembly from the oven after 96 h. Immediately remove the sample rolls from the assembly.

10.1.6 Condition the sample in the standard conditioning atmosphere described in Practice D4332 for a minimum of 4 h with free air space around the rolls.

10.1.7 Conditioning is intended to produce an equilibrium in both temperature and moisture of samples with the standard conditions. This may require 24 or 48 h for some materials.

10.1.8 Ascertain if the desired equilibrium is present by performing the physical property test(s) at 4 h and again at some later time. If no significant difference is found, the desired equilibrium is satisfied or it is of no importance to the test outcome.

10.1.9 Perform the physical examination(s) for which this accelerated aging exposure was preparatory.

NOTE 1—The environment for this practice cannot occur unless the vessel used as the environment container is vented so that pressure differences between the inside and the outside of the vessel can be balanced. The environment in the vessel is dependent on careful observation of the requirements of loading in relationship to vessel volume and liquid surface area in accordance with Section 7.

10.2 *Humidity Chamber*:

10.2.1 Place the sample rolls on a rack in the humidity chamber so that roll edges lie in a horizontal plane. Include no more sample rolls than will displace one fourth of the air volume in the chamber

10.2.2 Arrange the sample rolls so that all surfaces are exposed to the humid air in the chamber. Use separators that allow free air space around and between the rolls and which are non-hygroscopic.

10.2.3 Close humidity chamber.

10.2.4 Remove the tape from the humidity chamber after 96 h.

10.2.5 Condition the sample in the standard conditioning atmosphere described in Practice D4332 for a minimum of 4 h with free air space around the rolls.

10.2.6 Conditioning is intended to produce an equilibrium in both temperature and moisture of samples with the standard conditions. This may require 24 or 48 h for some materials.

[3] *Reagent Chemicals, American Chemical Society Specifications*, American Chemical Society, Washington, DC. For Suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals,* BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary,* U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.