



Standard Practice for Accelerated Aging of Pressure-Sensitive Tapes¹

This standard is issued under the fixed designation D 3611; 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 D 1000).

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:

- D 996 Terminology of Packaging and Distribution Environments²
- D 1000 Test Methods for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications³
- D 3330/D 3330M Test Methods for Peel Adhesion of Pressure-Sensitive Tape at 180° Angle²
- D 3715/D 3715M Practice for Quality Assurance of Pressure-Sensitive Tapes²
- D 4332 Practice for Conditioning Containers, Packages, or Packaging Components for Testing²

3. Terminology

3.1 Terminology found in Terminology D 996 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 D 3330/D 3330M.

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 at least 2 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. Interferences

6.1 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.

6.2 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.

¹ This practice is under the jurisdiction of ASTM Committee D10 on Packaging and is the direct responsibility of Subcommittee D10.14 on Closure and Reinforcement.

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² Annual Book of ASTM Standards, Vol 15.09.

³ Annual Book of ASTM Standards, Vol 10.01.

7. Apparatus

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

7.1.1 Vented to allow equilibrium with an opening not to exceed 0.01 mm.²

7.1.2 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.

7.1.3 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.

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

7.2 *Oven*, of the forced-convection type maintained at a mean of 150 ± 2°F (66 ± 1°C).

8. Reagents

8.1 *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.⁴ 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.

8.2 *Ammonium Sulfate* (NH₄)₂SO₄.

8.3 *Water*, distilled or demineralized.

8.4 The reagents of 8.2 and 8.3 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.

9. Sampling

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

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

9.3 When no other sampling requirement is applicable, sampling should be as set forth in Practice D 3715/D 3715M.

10. Sample

10.1 The sample should consist of rolls of tape.

10.1.1 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.

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

10.1.3 Sample rolls should be originally wound, not re-wound rolls.

11. Procedure

11.1 Place the sample rolls above the solution in the vessel so that roll edges lie in a horizontal plane (parallel with the liquid surface).

11.1.1 Include no more sample rolls than will displace one fourth of the air volume in the vessel.

11.1.2 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.

11.2 Close the assembly and place in the oven.

11.2.1 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.

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

11.4 Condition the sample in the standard conditioning atmosphere described in Practice D 4332 for a minimum of 4 h with free air space around the rolls.

11.4.1 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.

11.4.2 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.

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

12. Report

12.1 In reporting data obtained by any examination following this exposure, make reference to this practice by designation. Use the form: Performance of test data reported here followed exposure by ASTM Practice D 3611.

13. Keywords

13.1 accelerated aging; pressure-sensitive tape

⁴ "Reagent Chemicals, American Chemical Society Specification," Am. Chemical Soc., Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see "Reagent Chemicals and Standards," by Joseph Rosin, D. Van Nostrand Co., Inc., New York, NY, and the "United States Pharmacopeia."

APPENDIX**(Nonmandatory Information)****X1. NOTES ON THE EFFECT OF THIS EXPOSURE ON PHYSICAL PROPERTY TEST VARIABILITY AND THE EXPOSURE'S RELATIONSHIP TO NATURAL AGING**

X1.1 Industry experience shows that this exposure can have a variable effect on the tape. This is like the variability in any test method that we commonly term its precision. It is an effect due to the small differences that occur in performing any step of a process. For instance, when repeating this conditioning one might not set the temperature exactly the same or the atmospheric pressure might vary or the purity of the salt might differ from different vendors. These small differences result in slightly different aging of the tape from time to time. This variation does not appear as something we can measure directly on its own. It is superimposed on the variability inherent in performance of the subsequent physical property test for which this conditioning was preparatory. We do not expect this superimposed (added) variability effect to be great. Since it is seen as a change in the apparent variability of the physical property test results, we can relate it to the expected precision of the test by making the following statement:

X1.2 The effect of this exposure on the inter-laboratory precision of any physical property test performed on the same lot of product is expected to be no more than 25 % increase in dispersion over that expected from the test without first performing the accelerated aging exposure. An illustration of this can be made with the peel adhesion test. If that test had a precision statement reading, "The multi-laboratory precision of the peel adhesion method is ± 12 % of the mean at the 95 % confidence level," we would expect that after this conditioning

the response to the peel test would make that precision to appear to have lessened to ± 15 % of the mean.

X1.3 It should be explained that with pressure-sensitive tapes, as with other materials which are "destroyed" during the testing process, one can never measure the same physical property more than once on the same specimen of tape. This means that a measurement of precision for a physical property test on tape always has as one of its components the inherent variability between tape specimens. Aging reduces this inherent variability between specimens for some types of tape and some tests. Therefore this conditioning does not always cause an increase in dispersion.

X1.4 ASTM subgroup studies show that the relationship between this exposure and any natural aging is irregular and varies not only with the test but also the tape product.⁵ It was said in 5.1 that this exposure produces an effect in the response which would occur with at least two years of natural aging. For a given type of tape a specified physical property test might yield data obtained at 2.5 years of natural aging. A different type of tape could yield data obtained at three years of natural aging.

⁵ ASTM Research Report is available from ASTM Headquarters. Request RR: D-10-1001.

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