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Standard ~~Test Methods~~ Practices for Resistance of Adhesives to Cyclic Laboratory Aging Conditions[1]

This standard is issued under the fixed designation D 1183; 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.

~~ε[1] NOTE — Editorial changes were made in June 1997.~~

[1] These ~~test methods~~ practices are under the jurisdiction of ASTM Committee D-14 on Adhesives and are the direct responsibility of Subcommittee D 14.80 on Metal Bonding Adhesives.

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1. Scope

1.1 These ~~test methods~~ practices cover the determination of the resistance of adhesives to cyclic accelerated service conditions by exposing bonded specimens to conditions of high and low temperatures and high and low relative humidities. The extent of degradation is determined from changes in strength properties as a result of exposure to the test conditions (Note 1). It is recognized that no accelerated procedure for degrading materials correlates perfectly with actual service conditions, and that no single or small group of laboratory test conditions will simulate all actual service conditions. Consequently, care must be exercised in the interpretation and use of data obtained in this ~~test method.~~ practice. The test ~~procedure,~~ condition, the number of cycles of the test ~~procedure~~ condition to be used, the particular strength property to be used to determine the extent of degradation, and whether test specimens or test panels are to be used, is specified in the material specification.

NOTE 1—These ~~test methods~~ practices/conditions are intended for use with specimens described in the approved ASTM strength test methods for adhesives as follows:
Test Methods D 897, D 903, D 906, D 950, D 1002, D 1062, and Method D 1344.

1.2 The values stated in SI units are to be regarded as the 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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*
D 897 Test Method for Tensile Properties of Adhesive Bonds[2]
D 903 Test Method for Peel or Stripping Strength of Adhesive Bonds[2]
D 906 Test Method for Strength Properties of Adhesives in Plywood Type Construction in Shear by Tension Loading[2]
D 907 Terminology of Adhesives[2]
D 950 Test Method for Impact Strength of Adhesive Bonds[2]
D 1002 Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal)[2]
D 1062 Test Method for Cleavage Strength of Metal-to-Metal Adhesive Bonds[2]
D 1141 Specification for Substitute Ocean Water[3]
D 1344 Methods of Testing Cross-Lap Specimens for Tensile Properties of Adhesives[4]

3. Terminology

3.1 *Definitions*—Many terms in these ~~test methods~~ practices are defined in Terminology D 907.

[2] *Annual Book of ASTM Standards,* Vol 15.06.
[3] *Annual Book of ASTM Standards,* Vol 11.02.
[4] Discontinued—see *1986 Annual Book of ASTM Standards,* Vol 15.06.

4. Significance and Use

4.1 This ~~test method~~ practice provides information on the resistance to cyclic laboratory aging.

5. Apparatus

5.1 *Circulating Air Ovens*, capable of being controlled at the required temperatures.

5.2 *Rooms, Cabinets, or Desiccators* , with means for controlling the relative humidity of the air in them at the required values.

NOTE 2—The following saturated salt solutions give 85 to 90 % relative humidity:

(1) Potassium chloride at 23°C

(2) Manganous sulfate at 38.5°C

5.3 *Vessels with Water*, for immersion tests.

5.4 *Substitute Ocean Water*, with the following composition (Note 3):

Compound	Concentration, g/L
NaCl	24.53
$MgCl_2 \cdot 6H_2O$	11.11
Na_2SO_4	4.09
$CaCl_2$	1.16
KCl	0.695
$NaHCO_3$	0.201
KBr	0.101
H_3BO_3	0.027
$SrCl_2 \cdot 6H_2O$	0.042
NaF	0.003

NOTE 3—These requirements for composition of substitute ocean water are identical with those prescribed for substitute ocean water, without heavy metals, in Specification D 1141.

5.5 *Other Apparatus* as required by the ASTM method for the particular strength property used to evaluate the extent of degradation.

6. Test Specimens

6.1 The number and type of test specimens meet the requirements of the particular strength method used to evaluate the extent of degradation. Test panels may also be exposed to those conditions, after which the specified test specimens shall be cut from the panels. One set of specimens shall be tested without exposure to the accelerated service ~~tests,~~ condition, and another set after exposure.

7. Conditioning

7.1 Condition all specimens for 7 days at a relative humidity of 50 ± 2 % at 23 ± 1°C.

8. Procedure

8.1 Subject specimens or panels to the number of cycles of one of the test ~~procedures~~ conditions listed in Table 1, as specified in the material specifications.

8.2 Place the specimens or panels in the containers so that free access of the controlled atmosphere is obtained for at least 75 % of the total area of each test specimen or panel.

8.3 After completion of the exposure of the test specimens or panels to one of the ~~procedures~~ test conditions in Table 1, condition the test specimens or panels for 7 days at a relative humidity of 50 % at 23 ± 1°C (73.4 ± 2°F) and then test them immediately for the specified strength properties, unless otherwise stated in the material specifications.

9. Calculations

9.1 The average strength value determined in accordance with the designated method of test is used to calculate the change in strength, as follows:

$$R = [(Y - X)/X] \times 100 \quad (1)$$

where:

R = percent change in strength as a result of exposure to the test conditions,

X = initial strength, and

Y = strength after exposure to the test conditions.

The sign of the result will indicate whether there is a gain (+) or loss (−) in strength.

9.2 Specimens or panels that delaminate during the tests have a change in strength of − 100 %. Specimens that delaminate during the tests before the strength test can be made have a strength of 0, included in calculating the average strength and standard deviation.

10. Report

10.1 Report the following information:

10.1.1 Title and designation of strength method used,
10.1.2 Information required in particular strength method used,
10.1.3 Test ~~procedure,~~ condition,
10.1.4 Number of cycles,
10.1.5 Whether test specimens or panels were used,
10.1.6 Percentage change in strength,
10.1.7 Changes in appearance of test specimens or panels,
10.1.8 Number of specimens which delaminated and percent delamination during the test before the strength tests were made,
10.1.9 Standard deviation, and
10.1.10 Average wood failure, in percent, for bonded wood specimens.

11. Precision and Bias

11.1 Precision and bias ~~does not exist for these~~ is a function of the test ~~methods because resources necessary for round-robin testing have not been forthcoming.~~ method used.

12. Keywords

12.1 adhesives; humidity; laboratory aging; temperature; test conditions

TABLE 1 Test ~~Pr~~ Cocendureitions

~~Proc~~Test Condureition Designation	Name	Period, h	Temperature °C	Relative Humidity, %
A	Interior	24	23 ± 1	85 to 90
		24	48.5± 3	<25
		72	23 ± 1	85 to 90
		48	48.5 ± 3	<25
B	Interior	48	60 ± 3	<15
		48	38.5 ± 2	85 to 90
		8	− 18 ± 2	about 100
		64	38.5 ± 2	85 to 90
C	Exterior, land and air	48	71 ± 3	<10
		48	23± 1	immersed in water
		8	−57 ± 3	about 100
		64	38.5 ± 2	about 100
D	Exterior, marine	48	71 ± 3	<10
		48	23 ± 1	immersed in substitute ocean water
		8	−57 ± 3	about 100
		64	23 ± 1	immersed in substitute ocean water

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