Designation: D3855 – 84 (Reapproved 2010)

Standard Test Method for Rubber Thread—Deterioration Due to Standard Washing Solution Treatment[1]

This standard is issued under the fixed designation D3855; 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 test method covers the measurement of the relative deterioration resistance of bare rubber threads subjected to a standard washing solution when they are dried at room temperature and heat aged.

1.2 The results obtained by this test method are only comparative since it may not be possible to absolutely correlate such results with actual service life of the threads or of an article containing the threads.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 *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]

D2433 Test Methods for Rubber Thread (Withdrawn 2012)[3]

E145 Specification for Gravity-Convection and Forced-Ventilation Ovens

3. Summary of Test Method

3.1 The initial properties of the thread are determined by the appropriate test methods in accordance with Test Methods D2433. The same test specimens, extended to 100 % elongation, are subjected to one cycle of washing, drying, and air-oven aging.

3.2 The physical property measured in the test may be any one of those described in Sections 18 to 37 of Test Methods D2433; however, the most suitable are the Schwartz value (Section 25) or stress retention (Section 35).

4. Significance and Use

4.1 Rubber threads or garments containing rubber threads are very often subjected to washing treatments that differ considerably in the composition and temperature of the washing solution used. Information on the composition of commercial detergents used is not readily available, and the same brand name may contain variations in composition.

5. Apparatus

5.1 *Constant-Rate-Of-Extension (CRE) Type Tensile Testing Machine,* with a load capacity from 0.1 to 20 N (10 to 2000 gf), equipped with hooks.

5.2 *Masonite and a Stainless Steel or Glass Form,* of suitable dimensions to hold the thread loops elongated to 100 %.

NOTE 1—If the Schwartz value is used, it is advisable to restrict the maximum massaging extension to 300 % to avoid excessive specimen breakage during massaging after aging. If the stress retention at 100 % elongation is used, massage the thread to 300 % extension for six cycles immediately before extending to the stress to be measured.

5.2.1 *Form*—A form, 100 by 300 by 3 mm (4 by 12 by ⅛ in.), with the center section cut out as illustrated in Fig. 1, and with the outside edges rounded, is suitable for this purpose.

5.3 *Constant-Temperature Water Bath.*

5.4 *Thermometer,* with a range from 0 to 100°C in 0.2°C divisions.

5.5 *Circulating Hot-Air Oven,* conforming to Specification E145, capable of maintaining a temperature of 125 ± 2°C.

5.6 *Beakers,* 1500-cm^3.

6. Standard Washing Solution

6.1 The standard washing solution shall be prepared as follows:

6.1.1 Dissolve the following ingredients in 1 L of distilled water:

[1] This test method is under the jurisdiction of ASTM Committee D11 on Rubber and is the direct responsibility of Subcommittee D11.37 on Coated Fabrics, Rubber Threads and Seals.

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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.

[3] The last approved version of this historical standard is referenced on www.astm.org.

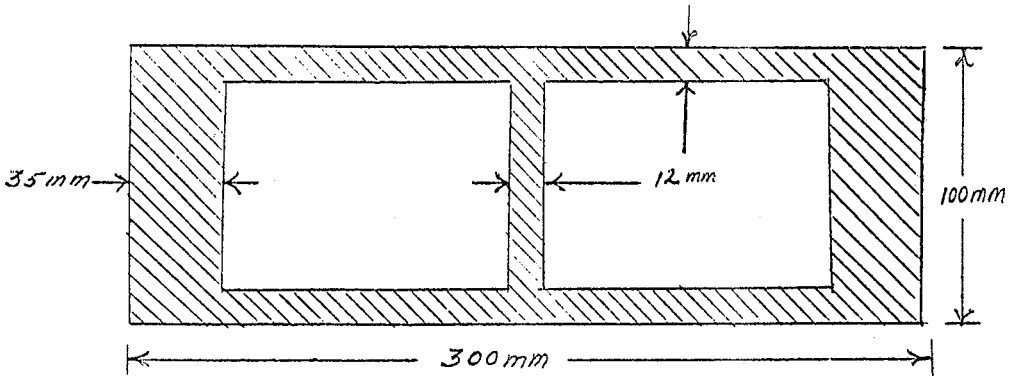

FIG. 1 Stretch Form

dodecyl benzene sodium sulfonate	1.0 g
anhydrous sodium tripolyphosphate	1.5 g
sodium perborate	0.5 g
sodium silicate ($Na_2O:SiO_2$ = 1:2 anhydrous)	0.5 g
anhydrous sodium sulfate	1.0 g
cupric sulfate pentahydrate	0.0086 g

6.1.2 Within 1 h prior to the wash test, dissolve 2.0 g of sodium perborate in 98.0 g of distilled water at room temperature. Add 25 g of this solution to 975 g of the solution described in 6.1.1 heated to the wash temperature immediately before immersing the specimens.

6.2 Use 100 g of the standard wash solution for each gram of thread under test. When the amount of wash solution needed to cover the samples exceeds this ratio, add to the bath more thread of the same class to make up the deficiency.

7. Test Specimens

7.1 Prepare three test specimens from each sample of relaxed and conditioned rubber thread. Condition the test specimens in accordance with Section 5 on Sample Preparation of Test Methods D2433.

7.2 Each test piece shall consist of five 50-mm (2-in.) loops (10 ends) formed from a single end of thread 500 mm (20 in.) long at the knot.

7.3 Equalize the length of each loop by rotating the test specimen around the first finger of each hand.

8. Preparation of Apparatus

8.1 Adjust the tension testing machine as follows:

8.1.1 Gage length to 50 mm (2 in.).

8.1.2 Cross-head speed 0.5 m (20 in.)/min.

8.1.3 Chart speed 0.5 m (20 in.)/min.

8.1.4 Calibrate the instrument with the proper load cell and hooks installed.

8.1.5 Set the full-scale load on the tester so that the estimated load on the test specimen at 300 % elongation (Note 1) falls between 50 and 90 % of full-scale deflection.

9. Procedure

9.1 *Original Property*—Determine the initial selected physical property in accordance with the appropriate section of Test Methods D2433, using the recommended number of test specimens.

9.2 Place the loops of one end of a test specimen onto a stationary hook. Grip the loops at the opposite end with a hand-held hook. Gently massage the test specimen by extending for six times to the chosen maximum extension (Note 1) immediately before being extended for the stress to be measured.

9.3 On the fourth cycle, stop at 300 % elongation and hold for 1 min. Transfer to the hooks of the tension testing machine. Cycle the machine to 300 % elongation and return while recording the stress curve on the chart.

9.4 Remove the test specimens from the hooks. Extend to 100 mm (4 in.) and place on the glass or stainless steel form over a cutout area. Rotate the test specimen on the form to equalize the tension between loops.

9.5 Repeat 9.2 and 9.3 for the remaining test specimens. If a test specimen should break or the knot slip, substitute another test specimen.

9.6 After the last specimen has been placed on the stainless steel or glass form, allow a rest period of 60 ± 10 min.

9.7 *Washing Procedure*—Immerse the stainless steel form in the standard wash solution, prepared in accordance with Section 6, at 85 ± 2°C for 1 h with mild agitation. Keep the standard wash solution in a 1500-cm^3 beaker immersed in a hot water bath controlled to a temperature that will maintain the wash solution at 85± 2°C (185 ± 3.6°F) for 1 h.

9.8 Remove the forms from the solution, rinse the test specimens on the form for 10 min with running lukewarm water, blot free of excess water with an absorbent towel, and dry at room temperature for 110 min.

9.9 Transfer the test specimens, still at 100 % elongation, to a Masonite form and equalize the tension in the loops by rotating them around the form.

9.10 *Heat Aging*—Heat age the test specimens in the circulating air oven, previously set at 125 ± 2°C, for 4 h.

9.11 Remove the forms from the oven and condition the test specimens on a Masonite form for a minimum of 16 h in accordance with Section 5 on Sample Preparation of Test Methods D2433.

9.12 *Final Measurement*—Measure the residual values of the selected physical properties by the method used for the initial value in accordance with 9.2 and 9.3.

10. Calculation

10.1 Express the performance of the thread as the percent retention of the initial value of the selected physical property calculated as follows:

$$SR_W = \frac{L_2}{L_1} \times 100 \quad (1)$$

where:

SR_W = percent of original value of any property retained by the test specimen after washing and heat treatment,
L_1 = average initial value of the selected physical property, and
L_2 = average residual value of that property after the washing and aging treatment.

11. Report

11.1 Report the following information:

11.1.1 Full description of the sample and its origin,

11.1.2 Physical property selected, the test apparatus utilized to perform the specific test, and

11.1.3 Percent retention of the initial value for physical property selected.

12. Precision and Bias

12.1 The precision and bias of this test method have not yet been determined. Interlaboratory testing has not been done, as laboratories to do the work have not been located.

13. Keywords

13.1 deterioration; rubber thread; standard washing solution