



Standard Test Method for Rubber Thread—Deterioration Due to Standard Washing Solution Treatment¹

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1. Scope

1.1 This test method is used to measure 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:

D 2433 Test Methods for Testing Rubber Thread²

E 145 Specification for Gravity-Convection and Forced-Ventilation Ovens³

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 D 2433. 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 D 2433; 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 1/8 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 E 145, capable of maintaining a temperature of 125 ± 2°C.

5.6 *Beakers*, 1500-cm³.

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:

dodecyl benzene sodium sulfonate	1.0 g
anhydrous sodium tripolyphosphate	1.5 g
sodium perborate	0.5 g
sodium silicate (Na ₂ O: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

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² *Annual Book of ASTM Standards*, Vol 09.02.

³ *Annual Book of ASTM Standards*, Vol 14.02.

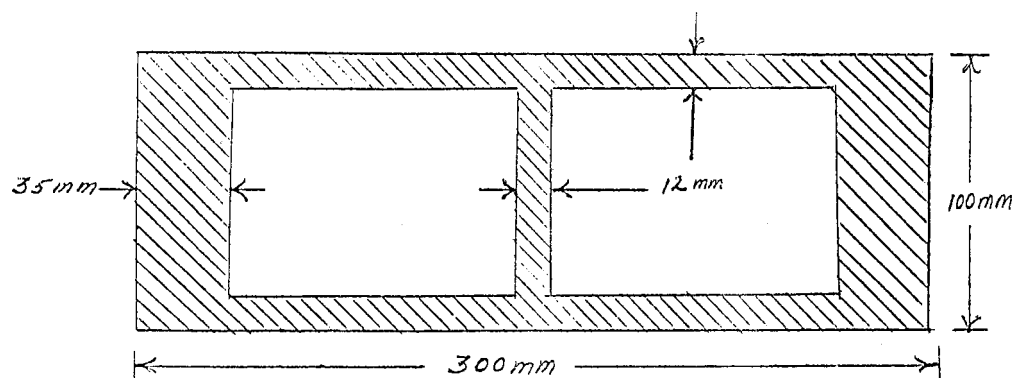


FIG. 1 Stretch Form

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 of Test Methods D 2433.

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 D 2433, 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 $85 \pm 2^\circ\text{C}$ for 1 h with mild agitation. Keep the standard wash solution in a 1500-cm³ beaker immersed in a hot water bath controlled to a temperature that will maintain the wash solution at $85 \pm 2^\circ\text{C}$ ($185 \pm 3.6^\circ\text{F}$) 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 $125 \pm 2^\circ\text{C}$, 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 of Test Methods D 2433.

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 The report shall include the following:

- 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.

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

12. Precision and Bias

- 12.1 The precision and bias of this test method have not yet

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