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AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Test Methods for Rubber Thread¹

This standard is issued under the fixed designation D 2433; 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 These test methods cover the testing of both round extruded latex and rectangular cut rubber thread products in which the base material used in manufacture may be natural rubber or synthetic rubber, alone or in combination. These tests are to be made only on the bare uncovered rubber thread.

1.2 Owing to the comparatively small cross section of the material and also because of the unusual conditions of service of this material, certain special test methods have been developed and take the place of the tests for other rubber products.

1.3 Comparisons may only be made on new rubber threads or those of identical processing histories. In the interpretation of results from threads which have been subjected to spooling, fabrication, or other process, the previous history is important, and what is known of this and any relaxation treatments used should be stated.

1.4 The test methods appear in the following sections:

	Sections
Density	7-11
Count	12-16
Metric Yield (Length per Unit Weight)	17-19
Tensile Strength	20-22
Elongation at Break	23 and 24
Stress at Predetermined Elongation	25-27
Elongation Under Fixed Force (Method A)	28-30
Elongation Under Fixed Force (Method B)	31-34
Stress Retention	35-39

1.5 *This standard does not purport to address all of the safety problems, 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 1566 Terminology Relating to Rubber²

D 4483 Practice for Determining Precision for Test Method Standards in the Rubber and Carbon Black Industries²

E 171 Specification for Standard Atmospheres for Condi-

tioning and Testing Flexible Barrier Materials³

3. Significance and Use

3.1 For adequate service performance, rubber threads must be tested by appropriate test methods. This standard gives a number of test methods that are known to be important in rubber thread technology.

4. Interferences

4.1 Samples or test specimens shall not be allowed to come into contact with copper, manganese, or their compounds during sample preparation or testing.

5. Sample Preparation

5.1 The samples and test specimens derived therefrom shall be kept in a relaxed state and conditioned for not less than 16 h before testing. The test specimen selected should be clean, dry, and free from any visual defects.

6. Test Conditions

6.1 The test shall be performed in a standard atmosphere having a temperature of $23 \pm 1^\circ\text{C}$ ($73.4 \pm 1.8^\circ\text{F}$) and a relative humidity of $50 \pm 2\%$, as defined in Specification E 171.

DENSITY

7. Terminology

7.1 *Definitions of Terms Specific to This Standard:*

7.1.1 *density of a rubber thread*—the mass of a unit volume of thread measured at a temperature of $23 \pm 1^\circ\text{C}$ ($73.4 \pm 1.8^\circ\text{F}$) expressed as megagrams per cubic metre.

8. Summary of Test Method

8.1 The density of a rubber thread is determined by employing two liquids of known density. These liquids are mixed together in such a proportion that, during immersion, a test specimen of the thread under examination remains suspended, that is, neither floats nor sinks. The density of this mixture is measured and this value taken as the density of the specimen.

9. Apparatus

9.1 *Glass Cylinder*, having a capacity of about 1000 cm^3 .

9.2 *Hydrometer or Hydrostatic Balance* (0.001 m^3), to

¹ These test methods are under the jurisdiction of ASTM Committee D-11 on Rubber and are the direct responsibility of Subcommittee D11.37 on Coated Fabrics and Rubber Thread.

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² *Annual Book of ASTM Standards*, Vol 09.01.

³ *Annual Book of ASTM Standards*, Vol 15.09.

measure the density of the liquids to an accuracy of not less than 0.005 Mg/m^3 .

10. Suitable Mixtures

10.1 Most of the rubber threads on the market have a density in the range from 0.90 to 1.11 Mg/m^3 . It is necessary, therefore, to have a series of liquids having densities within this range. Mixtures of ethanol (0.79 Mg/m^3) and distilled water are suitable. A saturated solution of zinc chloride in distilled water is suitable for densities greater than 1.00 Mg/m^3 .

10.1.1 Before the mixtures are used they shall be homogeneous and free from air bubbles. They shall be kept in closed containers so as to avoid evaporation. They should be used at a temperature of $23 \pm 2^\circ\text{C}$.

11. Procedure

11.1 Take four test specimens approximately 10 mm long from the thread. Dip each specimen in ethanol and rub between the fingers to remove dusting powder and to eliminate any air bubbles from the surface.

11.2 Take a sufficient quantity of suitable liquids and thoroughly mix. Take care not to form air bubbles. Introduce a test specimen of thread and by small additions of one or the other of the liquids, obtain the mixture in which the specimen remains suspended, that is, neither floats nor sinks.

11.3 Introduce a further three specimens, treated as in 11.1 into this mixture. If at least two specimens reach equilibrium between 3 and 10 min after immersion, assume that the thread has the same density as that of the mixture. Determine the density of the mixture to the nearest 0.005 Mg/m^3 .

COUNT

12. Terminology

12.1 *Description of Term Specific to This Standard and Commercial Usage:*

12.1.1 *count of a rubber thread*—the number of threads that when placed side by side measures 25.4 mm (1 in.). The count of a round thread is calculated by dividing 25.4 by its diameter in millimetres. The count of a square thread is calculated by dividing 25.4 by the length of one of its sides expressed in millimetres. The count of a rectangular thread is generally quoted as the count of a square thread of equivalent cross-sectional area. Thus, in the case of a round thread, the number 100 is the count of a thread having its diameter equal to 0.254 mm ($\frac{1}{100}$ in.); in the case of a square thread, the number 40 is the count of a thread having its sides equal to 0.635 mm ($\frac{1}{40}$ in.).

12.2 It is customary to quote the count of round thread, followed by the whole even number which is nearest to the actual count of the square thread of equivalent cross-sectional area (count of round thread $\times 1.13$ = the actual count of the square thread). For example, a round thread of count 50 is indicated as 50/56.

12.3 The count of a multifilament round thread is expressed by stating successively, the number of components, the count of the single round thread which would have the same total cross-sectional area as the component threads, and the count of the corresponding square thread. Thus, the count of a thread

made up of three components equal in total cross-sectional area to a round thread of count 32 is indicated as 3/32/36.

13. Summary of Test Method

13.1 The count of a rubber thread is calculated as described in Section 16, based on the density and weight of 1 m of thread.

13.2 The density is determined by the test method described in Section 11.

14. Test Specimens

14.1 The specified number of straight thread samples shall be cut to approximately 1.05 m in length.

NOTE 1—Kinked or curved thread will introduce errors.

14.2 If these samples are taken from bobbins or from any other type of presentation in which the thread is under tension, they should be heat treated for 30 min in a thermostatically controlled oven at a temperature of $60 \pm 5^\circ\text{C}$. Where greater accuracy is required, the sample should then be allowed to relax for at least 48 h in accordance with the conditions in 6.1.

14.3 *Cutting*—Two types of apparatus may be used for cutting to size. With the first (Test Method A) the cut is made with the test piece placed in a groove of a horizontal base. With the second (Test Method B) the thread is suspended and maintained in a vertical position by its own weight.

14.4 *Test Method A* (see Fig. 1):

14.4.1 *Apparatus:*

14.4.1.1 *Horizontal Flat Metallic Base*, rectangular in shape, having one or more longitudinal grooves.

14.4.1.2 *Clamp*, fixed at a position a few centimetres from the end of the groove. The grooves should have an equilateral triangular cross section with a base not less than 2 mm.

14.4.1.3 *Cutting Device*, fitted to each end of the groove such that the distance between the cutting device blades is $1 \text{ m} \pm 1 \text{ mm}$.

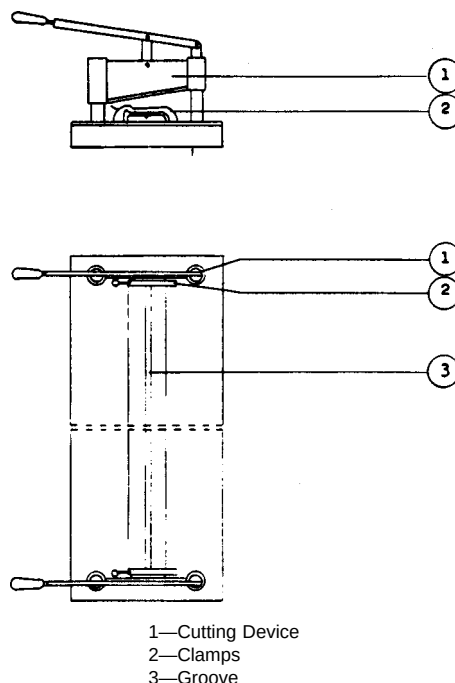


FIG. 1 Apparatus for Cutting Test Specimens (Test Method A)