

Methods of test for

Elastomeric threads —

Part 1: Rubber threads

[ISO title: Rubber threads — Methods of test]

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- British Association of Synthetic Rubber Manufacturers
- British Rubber Manufacturers' Association Limited
- Department of Industry
- Malaysian Rubber Producers' Research Association*
- Ministry of Defence
- Rubber & Plastics Research Association of Great Britain
- Rubber Growers' Association
- Society of Motor Manufacturers & Traders Limited
- Institution of Production Engineers

The scientific organization marked with an asterisk in the above list, together with the following, was directly represented on the committee entrusted with the preparation of this British Standard.

- Hosiery and Allied Trades Research Association
- Narrow Fabrics Federation
- Individual experts

This British Standard, having been prepared under the direction of the Rubber Industry Standards Committee, was published under the authority of the Executive Board on 29 October 1976

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Foreword

This British Standard has been prepared under the authority of the Rubber Industry Standards Committee. It is identical with ISO 2321 *“Rubber threads — Methods of test”* (including Addendum 1, which constitutes clause 13 of ISO 2321).

This British Standard supersedes BS 903 *“Methods of testing vulcanized rubber”*, Parts H1 to H11 *“Methods of testing rubber threads”*; that publication is therefore withdrawn.

Work is in progress to produce a Part 2 to this standard covering methods of test for polyurethane thread.

For the purposes of this British Standard the text of ISO 2321 given in this publication should be modified as follows.

Terminology. The words “British Standard” should replace “International Standard” wherever they appear.

The decimal point should replace the decimal comma wherever it appears.

Cross-references. The references to other International Standards should be replaced by references to British Standards as follows.

Reference to ISO publication	Appropriate British Standard
ISO/R 37:1968 <i>“Determination of tensile stress-strain properties of vulcanized rubbers”</i>	BS 903 <i>“Methods of testing vulcanized rubber”</i> Part A2:1971 <i>“Determination of tensile stress-strain properties”</i>
ISO/R 188:1971 <i>“Vulcanized rubbers — Accelerated ageing or heat resistance tests”</i>	BS 903-A19:1975 <i>“Heat resistance and accelerated air ageing tests”</i>
ISO/R 471:1966 <i>“Standard atmospheres for the conditioning and testing of rubber test pieces”</i>	No equivalent

Additional information. It is customary in the UK to condition and test rubber threads at 20 ± 2 °C and 65 ± 5 % r.h. [one of the standard atmospheres (see clause 3 of this standard) described in ISO/R 471] this being the preferred usage in the textile industry.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 12 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope and field of application

This International Standard specifies methods of test for determining certain physical and mechanical properties of rubber threads. Owing to the comparatively small cross-section and the unusual conditions of service of this material, certain special methods have been developed.

Some of the tests included in this International Standard may not be entirely suitable for thread made from certain synthetic rubbers, for example urethane rubber, these tests being intended for natural or synthetic polyisoprene rubbers.

It is pointed out that comparisons may only be made on new rubber threads or on those with identical processing histories. In the interpretation of results from threads which have been subjected to spooling, fabrication or any other process, it must be borne in mind that the previous history is important, and what is known of this and of any relaxation treatments used shall be stated in the test report.

2 References

ISO/R 37, *Determination of tensile stress-strain properties of vulcanized rubbers.*

ISO/R 188, *Vulcanized rubbers — Accelerated ageing or heat resistance tests.*

ISO/R 471, *Standard atmospheres for the conditioning and testing of rubber test pieces.*

3 Conditioning of samples or test pieces

The samples or test pieces shall be kept in a relaxed state in the dark in one of the standard atmospheres described in ISO/R 471, for not less than 16 h before testing. The tests shall be carried out under similar atmospheric conditions. The test piece selected shall be clean, dry and free from any visual defects.

Samples or test pieces shall not be allowed to come into contact with copper or manganese or their compounds during conditioning or testing.

4 Count

4.1 Sectional count

The sectional count of a rubber thread is given by the value of its cross-sectional area, expressed in square millimetres, multiplied by 1 000.

NOTE The sectional count corresponds to the tex count for a nominal density of 1 Mg/m³ (= 1 g/cm³). The use of the sectional count is recommended.

4.2 Conventional count (size number)

4.2.1 The conventional count of a rubber thread is the number of threads which, when placed side by side, measure 25,4 mm.

The conventional count of a round thread is calculated by dividing 25,4 by the diameter of the thread in millimetres.

The conventional count of a square thread is calculated by dividing 25,4 by the length of one of the sides of the thread expressed in millimetres.

The conventional 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 conventional count of a thread having its diameter equal to 0,254 mm; in the case of a square thread, the number 40 is the conventional count of a thread having its sides equal to 0,635 mm.

4.2.2 It is customary to quote the conventional count of a round thread, followed by the whole even number which is nearest to the actual conventional count of the square thread of equivalent cross-sectional area (count of round thread $\times 1,13$ = actual count of square thread); for example a round thread of count 50 is indicated as 50/56.

4.2.3 The conventional count of a multi-filament 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 conventional count of a multi-filament round 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.

4.3 Procedure

4.3.1 Cutting of test pieces

Take five straight thread samples and cut them to a length of approximately 1 050 mm.

NOTE Kinked or curved thread will introduce errors.

If these threads are taken from bobbins or from any other type of presentation in which the thread is under tension, heat treat them for 30 min in a thermostatically controlled oven at a temperature of 70 ± 2 °C. After this heat treatment, condition the thread as specified in clause 3. For threads taken from forms of presentation where no tension is applied to the thread, condition as specified in clause 3.

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

Method A (see Figure 1)

The apparatus consists of a horizontal, flat, metallic base, rectangular in shape and having one or more longitudinal grooves. A clamp is fixed at a position a few centimetres from the end of the groove. A cutting device is fitted to each end of the groove such that the distance between the cutting devices is $1\,000 \pm 1$ mm. The grooves shall have an equilateral triangular section with a base not less than 2 mm.

Lay each conditioned thread in a groove of the apparatus, carefully avoiding stretching. Clamp it and cut to length by means of the cutting devices.

Method B (see Figure 2)

The apparatus consists of a rectangular vertical frame at the upper and lower ends of which are mounted two metallic plates having the inside edges parallel and sharp. Two cutting devices (the fixed blade of which consists of the inside edge of the metallic plate) and two external clamps are provided. The clamps shall be of a spring-loaded type and distance between the internal edges of the metallic plates shall be $1\,000 \pm 1$ mm.

Suspend each conditioned thread from the upper clamp. When it has settled in the vertical position without stretch, fix it by means of the lower clamp. Cut the thread to length with the two cutting devices, using the lower one first.

4.3.2 Weighing of test pieces

Free the cut threads from any loose dusting powder by shaking or brushing them gently, and weigh to an accuracy of $\pm 1\%$.

4.4 Expression of results

4.4.1 Calculate the sectional count S , using the following formula:

$$S = 1\,000 \frac{m}{\rho}$$

where

ρ is the density of the thread, in megagrams per cubic metre, determined as specified in clause 6;

m is the mass, in grams, of 1 000 mm of thread.

4.4.2 Calculate the conventional count of rubber thread, C , using the following formulae:

$$\text{— for round thread:} \quad C = 22,51 \sqrt{\frac{\rho}{m}}$$

$$\text{— for square thread:} \quad C = 25,40 \sqrt{\frac{\rho}{m}}$$

where

ρ is the density of the thread, in megagrams per cubic metre, determined as specified in clause 6;

m is the mass, in grams, of 1 000 mm of thread.

4.4.3 Express the count of the thread as the median of the values for the five test pieces as indicated in 4.2.3. The maximum and minimum values obtained shall also be stated.

5 Metric yield

5.1 Definition

metric yield

the unstretched length, in metres, of 1 000 g of the thread

5.2 Procedure

Determine the mass of each of five test pieces as specified in 4.3.2.

5.3 Expression of results

5.3.1 Calculate the metric yield of rubber thread, in metres per kilogram, using the following formula:

$$\text{Metric yield} = \frac{1\,000}{m}$$

where m is the mass, in grams, of 1 000 mm of thread.

5.3.2 Express the metric yield of the thread as the median of the values for the five test pieces.

6 Density

6.1 Definition

density

the mass per unit volume of a test piece of thread measured at a standard laboratory temperature and expressed in megagrams per cubic metre

the standard laboratory temperatures are given in ISO/R 471

6.2 Principle

Test pieces are placed in a suitable mixture of liquids, the density of which is adjusted until the test pieces neither float nor sink; this density is determined.

6.3 Immersion liquids

6.3.1 Most of the rubber threads on the market have a density in the range of 0,90 to 1,11 Mg/m³. It is necessary, therefore, to have a series of liquids having densities within this range. Mixtures of ethanol (0,79 Mg/m³) and ethylene glycol (1,11 Mg/m³) are suitable.

For threads of greater density, a suitable inorganic salt solution may be used. A solution of sodium chloride is suitable.

6.3.2 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 shall be used at a temperature of 20 ± 2 °C.