METHODS FOR ANALYSIS OF THE ELASTOMERIC THREAD IN AN ELASTIC FABRIC

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THIS BRITISH STANDARD, having been approved by the Narrow Fabrics Committee and the Rubber Industry Standards Committee and endorsed by the Chairman of the Textile Divisional Council, was published under the authority of the General Council on 31 December, 1968.

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This standard makes reference to the following British Standards:

BS 903. Methods of testing vulcanized rubber. Parts H1 to H11. Methods of testing rubber threads.

BS 947. Yarn count systems and their conversions.

BS 1051. Terms relating to the conditioning of textiles and method for the determination of correct invoice weight.

BS 2861-66. Methods for the analysis of woven fabric construction.

BS Handbook No.11. Methods of test for textiles.

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The following BSI references relate to the work on this standard:
Committee reference T/2/1 Draft for comment 67/19645

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The Textile Divisional Council, under whose supervision this British Standard was prepared, consists of representatives from the following Government department and scientific and industrial organizations:

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Consumer Council
Cotton Industry Standards Committee
Jute Industry Standards Committee
Linen Industry Standards Committee
London Transport Board
Man-made Fibres Industry Standards Committee
Ministry of Defence
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Silk Industry Standards Committee
Society of Dyers and Colourists
*Textile Institute
Textile Machinery Industry Standards Committee
Trades Union Congress
Wool Industry Standards Committee

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

Association of Solid Woven Belting Manufacturers
British Federation of Elastic Web and Fabric Manufacturers
British Federation of Textile Smallware Manufacturers
British Launderers' Research Association
British Man-made Fibres Federation
Corsetry Manufacturers' Association
Cotton, Silk and Man-made Fibres Research Association
Hosiery and Allied Trades Research Association
Linen Industry Research Association
Ministry of Defence, Army Department
Retail Trading-Standards Association Incorporated
Silk and Man-made Fibre Users' Association
Tape Manufacturers' Association
Webbing Manufacturers' Association
Individual manufacturers

BRITISH STANDARD METHODS FOR ANALYSIS OF THE ELASTOMERIC THREAD IN AN ELASTIC FABRIC

FOREWORD

British Standard methods of test are already available for the analysis of non-elastic fabrics and it is proposed that this method shall augment them.

The test methods already available are published in BS 2861-66, 'Methods for the analysis of woven fabric construction' and in BS Handbook No.11, 'Methods of test for textiles'.

METHODS

1. SCOPE

This British Standard gives methods for the extraction of elastomeric threads and covered elastomeric threads from elastic fabrics of all types, i.e. woven, knitted and braided, but is not applicable to covered elastomeric threads produced on ring-spinning frames which are referred to as 'core spun yarns'. Methods are given for the determination of length, weight and count of the elastomeric component, and of the textile covering of covered elastomeric threads.

2. DEFINITIONS

For the purposes of this British Standard the following definitions apply:

(1) *Elastomeric thread.* The component conferring the elastic properties on the fabric, i.e. natural or synthetic rubber, or polyurethane.

(2) *Covered elastomeric thread.* An elastomeric thread wrapped in one or both directions by textile yarn(s).

(3) *Textile covering.* Non-elastomeric yarns, such as polyamide, cotton etc., used as a covering for elastomeric threads.

3. PRINCIPLE

After extraction of the elastomeric threads (naked or covered) from the fabric, and removal of the textile coverings of covered elastomeric threads, the components are relaxed in the standard atmosphere for testing textiles. Length and weight of the components are determined and these values used to calculate the count.

4. APPARATUS

The following apparatus is required:

(1) Means of providing the standard atmosphere for testing textiles.
(2) A steel rule graduated in millimetres.
(3) Means of straightening threads by tension (see Appendix A).
(4) Pair of sharp scissors.
(5) Spring clips.
(6) Balance sensitive to 0·5% of the smallest quantity to be weighed (this may be less than 10 mg).

5. ATMOSPHERE FOR CONDITIONING AND TESTING

The atmosphere required for conditioning and testing is the standard atmosphere for testing textiles as specified in BS 1051*, i.e. a temperature of 20 ± 2°C and a relative humidity of 65 ± 2%.

6. FABRIC FOR TEST

6.1 Relaxation. The fabric samples shall be relaxed in the standard atmosphere for testing textiles for 24 h.

6.2 Methods of marking. Reference marks shall be drawn on the fabric at right angles to the general direction of the elastomeric threads or to the covered elastomeric threads in such a manner that the marking penetrates to the elastomeric thread or the covered elastomeric thread.

6.3 For measurement of length and weight the reference marks shall be approximately 350 mm apart on the relaxed fabric.

Where the fabric sample is not large enough to allow marks 350 mm apart, a shorter length may be taken, and details of the dimensions shall be included in the report.

7. EXTRACTION OF COVERED ELASTOMERIC THREAD OR ELASTOMERIC THREAD FROM THE FABRIC

7.1 Number of test specimens. Extract and test at least three threads.

7.2 Covered elastomeric threads

7.2.1 *Woven fabrics.* Cut the fabric at right angles to the general direction of the covered elastomeric threads, approximately 20 mm outside the reference marks. Remove the component yarns of the fabric at right angles to the covered elastomeric threads between both cut edges of the fabric and the reference marks.

*BS 1051, 'Terms relating to the conditioning of textiles and method for the determination of correct invoice weight'.

If the elastomeric threads have only a single covering attach clamps to the now exposed ends prior to removal of the threads from the fabric.

7.2.2 *Braids.* Two methods of extracting covered elastomeric threads are possible. Where the braided yarns composing the fabric are not required, and where the covered elastomeric threads lie parallel and straight in the fabric, the procedure given in 7.2.3 is used. Where this method is not permissible the braided yarns shall be unplaited.

7.2.3 *Warp-knitted fabric (elastic nets).* The covered elastomeric threads cannot easily be removed from this type of fabric unless the knitting yarns connecting them are cut. This method is therefore unsuitable when it is required to remove the knitting yarn intact.

Cut the fabric each side of the required covered elastomeric thread, continuing the cuts 20 mm beyond the reference marks. Remove the remaining knitting yarn by tensioning the covered elastomeric thread slightly and flicking it with the fingers.

7.2.4 *Weft-knitted fabric.* Covered elastomeric threads extracted from weft-knitted fabrics may show a high degree of crimp and these threads cannot be correctly measured for length because the elastomeric core begins to elongate before the crimp can be completely removed by tensioning.

An approximation can be obtained using the apparatus described in Appendix A with a recommended tension of 1 g. The results so obtained, although not absolute, are reproducible and may therefore be used for purposes of comparison.

NOTE. Precautions should be taken to see that the twist in single covered elastomeric thread is not released.

7.3 Elastomeric threads. Remove uncovered elastomeric threads in a manner similar to that given for covered elastomeric threads in 7.2.1 to 7.2.3.

7.4 Treatment of all specimens. After extraction from all types of fabric, expose the elastomeric or covered elastomeric threads to the standard atmosphere for testing textiles for at least 30 min in order to offset the effects of previous stretching. Continue to keep the single covered elastomeric threads firmly clamped at both ends to prevent untwisting during this period, ensuring that relaxation is not impeded.

8. MEASUREMENT OF LENGTH OF COVERED ELASTOMERIC THREAD OR ELASTOMERIC THREAD

8.1 Single covered elastomeric threads may have to be tensioned

slightly to prevent them from snarling, but tension shall be as little as possible. A suitable method is to stretch the covered elastomeric thread until all the snarls have been removed and then to allow it to retract until the snarls just begin to reappear. During this procedure securely clamp both ends of the covered elastomeric thread to prevent twist from being removed. Carry out the retraction alongside a ruler.

8.2 Measure the length of elastomeric threads and two-way covered elastomeric threads showing little or no crimp, such as those from elastic batistes and net fabrics, by laying them in a straight but unstretched condition along a ruler.

8.3 For all specimens read off the length between the reference marks to an accuracy of 1%.

9. MEASUREMENT OF WEIGHT OF COVERED ELASTOMERIC THREAD OR ELASTOMERIC THREAD

9.1 Cut the thread specimens at the reference marks prior to weighing and discard the two end pieces. In addition, single covered elastomeric threads should be marked in preparation for dissection as specified in 11.1, prior to cutting.

9.2 Condition the specimens for 24 h in the standard atmosphere for testing textiles.

9.3 Weigh the specimens in the standard atmosphere for testing textiles to an accuracy of 0·5%.

10. DETERMINATION OF TEX OF COVERED ELASTOMERIC THREAD OR ELASTOMERIC THREAD

Where desired, calculate for each thread the count of the covered elastomeric thread or elastomeric thread from the relaxed length and weight using the following formula:

$$T = \frac{10^6 W}{L}$$

where T = tex,
W = weight of specimen in g,
L = length of specimen in mm.

11. DETERMINATION OF THE COMPONENT LENGTHS, WEIGHT AND COUNTS OF THE TEXTILE COVERINGS AND OF THE ELASTOMERIC CORE OF THE COVERED ELASTOMERIC THREAD

11.1 **Preparation of specimens.** Lay each specimen, prepared as

described in 9.1, alongside a ruler and measure a 250 mm length to an accuracy of 1%. Indicate the length by marking the specimen as described in 6.2.

NOTE. A length of covered elastomeric thread of less than 250 mm may be used if this is unavoidable.

Having marked the required length of covered elastomeric thread, cut the thread at each reference mark and weigh the marked length to an accuracy of 0·5%.

11.2 Removal of textile coverings. Carefully remove the textile covering, taking care not to handle the textile yarn unduly. A specially constructed unwinding machine is ideal (see Appendix B), but where no such machine is available the following method is recommended.

Fix a small spring clip to the bench and having started to unwind the end of the covering, clamp it in the clip. Holding each end of the covered thread, one end in each forefinger and thumb, twist the thread in the appropriate direction so that the outermost textile yarn, one end of which is in the clip, is unwound from the covered thread. This operation is facilitated if the yarn being unwound is tensioned slightly by the action of moving the hands, and the covered thread horizontally held between them, away from the clip fastened to the bench.

NOTE. The textile coverings of two-way covered elastomeric threads, after removal, should be referred to as outer and inner coverings. Either of these may consist of one or more yarns.

11.3 Conditioning. After removal of the textile coverings from the covered elastomeric threads expose all components to the standard atmosphere for testing textiles for at least 30 min. This period is required to offset the effects of previous stretching on the elastomeric thread and possible changes in the moisture content in the textile coverings as a result of handling.

11.4 Measurement of component length

11.4.1 *Textile coverings.* Determine the lengths of the outer and inner coverings separately to an accuracy of 1% by tensioning the yarn until it is straight alongside a ruler, or by use of the apparatus described in BS 2863*.

11.4.2 *Elastomeric component.* Measure the length of the elastic component to an accuracy of 1% by laying it in an unstretched condition alongside a ruler.

*BS 2863, 'Determination of crimp of yarn in cloth' (included in BS 2861-66).

11.5 Determination of component weight. Weigh each component separately to an accuracy of 0·5% and check that the total weight of all components is within ± 2% of the weight of the original 250 mm length of covered elastomeric thread prior to removal of the textile coverings.

11.6 Calculation for the separate components. Calculate for each component of each specimen the count and denier*, and rubber count†, using the following formulae.

For indirect cotton system $$C = \frac{L \times 453{\cdot}6N}{W \times 840 \times 36 \times 24{\cdot}5} = \frac{L \times 0{\cdot}00059 \times N}{W},$$

For continuous filament textiles using denier system $$D = \frac{9 \times 10^6 \times W}{L \times N}$$

For the tex system $$T = \frac{10^6 W}{L \times N}$$

For the elastomeric component using the rubber round count system

$$R = \sqrt{\frac{3{\cdot}1416 \times 2{\cdot}54^2 \times d \times L}{40 \times W}} = 0{\cdot}712\sqrt{\frac{d \times L}{W}}$$

where C = cotton count for single end,
L = length in mm,
N = number of constituent yarns forming the outer or inner covering,
W = weight in g,
D = denier for a single end,
T = tex,
R = rubber count,
d = relative density.

NOTE 1. For square elastomeric threads the round thread formula may be used and the answer multiplied by 1·13 to obtain the square cut count.

NOTE 2. Where the relative density of the elastic thread is not known, it may be determined as described in BS 903, 'Methods of testing vulcanized rubber', Part H3, 'Density' (included in Parts H1 to H11).

*BS 947, 'Yarn count systems and their conversions'.
†BS 903, 'Methods of testing vulcanized rubber', Part H2, 'Determination of count' (included in Parts H1 to H11).

12. REPORT

The report shall state that the tests were performed in accordance with this standard method, and shall give the following information:

(1) the number of specimens tested;

(2) whether the fabric contained elastomeric threads or covered elastomeric threads;

(3) whether covered elastomeric threads were single or two-way covered;

(4) the length to an accuracy of 1% and weight to an accuracy of 0·5% of the elastomeric threads and covered elastomeric threads after extraction from the fabric;

(5) if a specimen of length less than 250 mm is used, state the length of the specimen, and give the results corrected to a specimen length of 250 mm;

(6) length of both the elastomeric and textile yarn components (both outer and inner coverings) to an accuracy of 1%;

(7) weight of both elastomeric and textile yarn components (both outer and inner coverings) to an accuracy of 0·5%;

(8) count of specimens and count of both elastomeric thread and textile yarn(s) (both outer and inner coverings).

APPENDIX A

APPARATUS FOR STRAIGHTENING THREADS

The apparatus for straightening the threads may be horizontal or vertical and may take any form provided that:

(1) there are two yarn grips, each of which closes at its rear end first and when closed has parallel gripping-surfaces;
(2) the distance between the grips can be altered;
(3) the distance between the grips can be measured;
(4) the recommended tension can be applied to the yarns through one of the grips.

APPENDIX B

UNWINDING MACHINE FOR REMOVAL OF TEXTILE COVERINGS

The machine consists essentially of a pair of jaws which are similar in construction to those found on twist testers.

Both jaws are rotated in the same direction and at the same speed by a common motor-driven counter shaft. The speed of rotation can be varied by means of a foot control.

In operation, the jaws are set several inches further apart than the relaxed length of the covered elastomeric thread so that the latter is held under tension thus facilitating the removal of the covers.

The covering to be removed is carefully unwound at one end of the covered elastomeric thread for a distance of approximately 25 mm. The rest of this end is then clamped in that jaw which rotates in the correct direction for unwinding the partially removed cover.

The other end is clamped complete in the other jaw. The end of the covering to be removed is gripped between the thumb and forefinger of the left hand whether unwinding from the left or right. The right hand, through the agency of a dissection needle, is used to ease the cover away if it shows a tendency to stick, as often is the case with spun yarns.

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Methods for analysis of the elastomeric thread in an elastic fabric

Revised text

New clause. Insert the following new clause after 8.3:

'8.4 A class of very fine covered polyurethane elastomeric threads containing polyurethane core yarns from 22 dtex to 156 dtex, both single and double covered, is extremely unstable in a relaxed state and cannot accurately be measured for length. This class of thread is, therefore, measured in an extended condition under a specified mass, and the following masses have been found to be acceptable for this purpose:

Polyurethane core	
156 dtex to 78 dtex	75 g per thread
77 dtex to 45 dtex	50 g per thread
44 dtex to 23 dtex	25 g per thread
22 dtex and finer	12·5 g per thread

The above linear densities are those obtained after boiling the polyurethane thread in water for 30 minutes. This relaxes the thread to a point approaching its original relaxed linear density.'

Clause 11.1 Preparation of specimens. In the second line delete 'measure a 250 mm length to an accuracy of 1 %' and substitute: 'and measure 250 ± 1 mm'.

At the end of the clause insert the following:

'For the class of yarn referred to in 8.4, measure 500 ± 1 mm while under tension and mark the specimen as described in 6.2.

NOTE. 500 mm is used in this instance because the covered thread is in a stretched state.'