

Specification for light duty braided rubber cord

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Aerospace Standards Policy Committee (ACE/-) to Technical Committee ACE/25, upon which the following bodies were represented:

British Adhesives and Sealants' Association
British Hydromechanics Research Association
British Narrow Fabrics' Association
British Rubber Manufacturers' Association
Ministry of Defence
Society of British Aerospace Companies Ltd.

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Amendments issued since publication

Amd. No.	Date	Comments
13603	05 March 2002	Addition to Table 5

The following BSI references relate to the work on this standard:
Committee reference ACE/25
Draft for comment 90/76881 DC

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Foreword

This British Standard, prepared under the direction of the Aerospace Standards Policy Committee, was revised in 1983 to allow for the inclusion of a high temperature resistant aramid fibre outer covering of braided rubber cords owing to the increased requirement for high temperature resistant materials by the aerospace industry. The additional sizes 4 mm, 5.5 mm and 11 mm were introduced.

When the cord is covered with aramid fibre, the designation of the product includes the letter "A" (see clause 8).

The loadings given in this specification are based on the power rating of the unit area of the rubber cord.

Reference to cord manufactured from natural rubber latex has been deleted.

This British Standard supersedes BS 2F 71:1983 which is withdrawn.

This edition introduces technical changes, notably additional colour indications for 5 year groups, to bring the standard up to date, but it does not reflect a full review of the standard, which will be undertaken in due course.

WARNING NOTE 1. This British Standard calls for the use of substances and/or test procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and in no way absolves either the supplier or the user from statutory obligations relating to health and safety at any stage of manufacture or use.

WARNING NOTE 2. This British Standard specifies pentachlorophenyl laurate (PCPL) as the only approved rot-proofing treatment for aerospace materials. Alternative treatments are under development, and this standard will be updated to delete PCPL as soon as an approved alternative treatment for aerospace materials is available.

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.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 6, an inside back cover and a back cover.

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1 Scope

This British Standard specifies requirements for light duty braided rubber cords in eight sizes from 3 mm to 11 mm in diameter.

These cords are suitable, when cut into unit lengths, for parachute pack opening devices, light-weight suspensions and other aeronautical purposes.

It is intended that these cords are used for cord assemblies manufactured in accordance with BS SP 170-171.

NOTE 1 The titles of the publications referred to in this standard are listed on the inside back cover.

NOTE 2 The latest revision of an Aerospace Series standard is indicated by a prefix number.

2 Construction

The cord shall be of multiple threads of rubber, under tension, tightly encased in braid, and shall be smooth and uniform.

3 Diameter

When measured by a micrometer or slide gauge, the overall diameter of the cord, including the braid, shall be 3, 4, 5, 5.5, 6.5, 8, 9.5 or 11 mm, and the tolerance on each of these diameters shall be $\pm 5\%$.

4 Rubber thread

4.1 Quality

The thread shall be made from first grade natural rubber, not lower than Grade 5 of ISO 2000, suitably compounded with accelerators and non-bleeding antioxidants, and heat vulcanized, and shall be as given in Table 1. No reclaim, vulcanized oils (factice) or other rubber substitute shall be used.

4.2 Size and number

Only one size of thread shall be used in any one cord. The number of rubber threads used in any cord shall be as given in Table 2.

Table 1 — Properties of rubber thread

Property	Requirement	Method of test
Density ^a	± 0.02 Mg/m ³ of nominal	BS 5421-1
Ash (% of total mass)	15 % max.	BS 5923-1
Free sulfur	1 % max.	BS 903-B7.2
Variation between any mean and nominal Schwartz value ^a at 300 % elongation	± 10 % max.	BS 5421-1
Retained stress after oven ageing at $70 \pm 1^\circ\text{C}$ for 7 days at 100 % elongation	0.25 MPa min.	BS 5421-1

^a Density and Schwartz value are not specified; they should be established for each composition and should be agreed between the cord and the thread manufacturers for use in controlling the consistency of quality when a series of batches of the same composition has to be tested for compliance with this standard.

Table 2 — Sizes of cord and number of threads

Size of cord (diameter) mm	Minimum number of rubber threads
3	6
4	10
5	15
5.5	17
6.5	23
8	38
9.5	55
11	75

5 Braiding

5.1 Materials

5.1.1 Cotton braid

Cotton braid shall be made of folded undyed cotton yarn rot-proofed with pentachlorophenyl laurate in accordance with BS 2087, normal process. The type of finish shall be as given in Table 3.

5.1.2 Aramid fibre braid

Aramid fibre braid shall be made of folded undyed high temperature resistant non-melt aramid fibre yarn. The type of finish shall be as given in Table 3.

Health warning. During manufacture and subsequent cutting and handling of materials containing aramid fibre, dust will be released into the workroom atmosphere. Some of this dust will be in the respirable size range. Health and safety legislation requires this dust to be controlled, preferably at source, so as to minimize the risk of inhalation so far as is reasonably practicable.

5.2 Construction

5.2.1 The construction of the braid shall be as given in Table 3 and be such that, when the cord is stretched to 125 % extension as described in Appendix A, the rubber shall not be visible.

5.2.2 For the 6.5, 8, 9.5 and 11 mm diameter cords, where inner and outer coverings are required, the construction shall be one of the following:

- a) inner and outer coverings of cotton;
- b) inner and outer coverings of aramid fibre;
- c) inner covering of soft cotton, outer covering of aramid fibre.

Table 3 — Construction of braid

Size of cord (diameter) mm	Number of coverings	Type of finish	
		Cotton	Aramid fibre
3, 4, 5, 5.5	1	Soft	} Natural
6.5, 8, 9.5, 11	2 (see 5.2.2)	Inner: soft Outer: polished glacé	

5.2.3 The pitch of the braiding shall be uniform throughout the length of the cord.

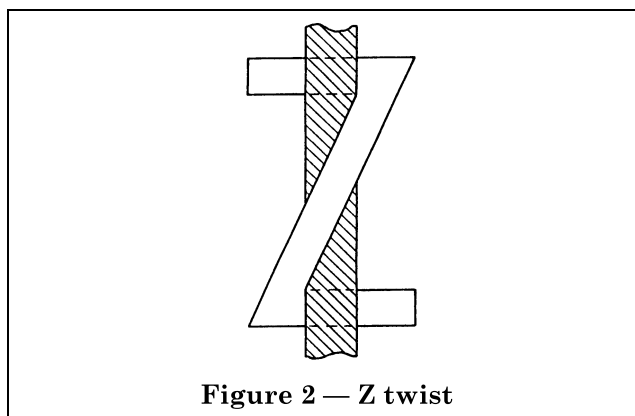
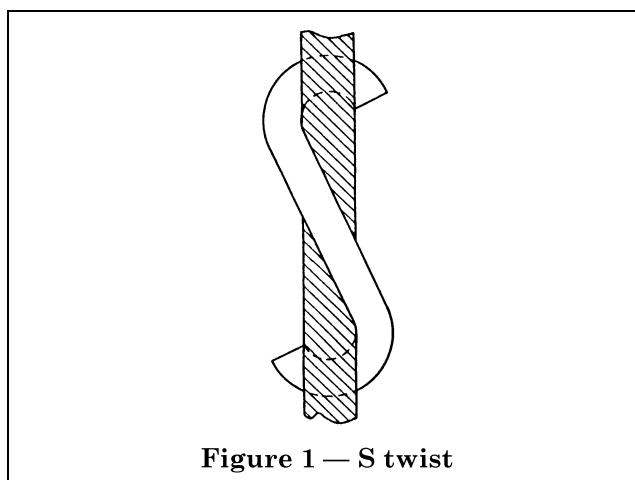
5.2.4 The covering of the 3, 4, 5 and 5.5 mm diameter cords and the inner covering of the 6.5, 8, 9.5 and 11 mm diameter cords shall have a helix of thread of agreed¹⁾ colour running throughout its length to denote the manufacturer of the cord. For the 3, 4, 5 and 5.5 mm diameter cords, this coloured thread shall run S-wise (see Figure 1).

5.2.5 The cover of all the cords shall have a helix of coloured thread approximating to BS 381C reference number 166 French blue running Z-wise (see Figure 2) throughout its length to identify it with this standard.

NOTE Refer to 5.3.1 for the application of a second coloured thread to indicate the 5 year group given in Table 5.

5.2.6 Aramid fibre covering shall have an additional helix of coloured thread approximating to BS 381C reference number 592 International orange running S-wise (see Figure 1) throughout its outer cover to identify it as an aramid fibre covered cord.

¹⁾ Applications for agreement should be addressed to the DGD(QA) Royal Arsenal East, Woolwich, London SE18 6TD.



5.3 Date and markings

5.3.1 In the covering of the 3, 4, 5 and 5.5 mm diameter cords and the outer covering of the 6.5, 8, 9.5 and 11 mm diameter cords, one or more of the undyed threads shall be replaced by threads, running Z-wise and spaced apart, of the colour given in Table 4, approximating to those specified in BS 381C, to indicate the year of manufacture of the finished cord.

After 1991 the colours shall be repeated in the same sequence as given in Table 4 for each group of 5 years. A second coloured thread, spaced by one helix of undyed thread from the French blue thread specified in 5.2.5, shall be added to identify the 5 year group. The colour shall be that given in Table 5.

5.3.2 The number of coloured threads to indicate the year and quarter of manufacture shall be as given in Table 6.

Table 4 — Colour indication of year of manufacture

Year	BS 381C reference number	Colour
1987	642	Night (black)
1988	285	NATO green
1989	499	Service brown
1990	309	Canary yellow
1991	166	French blue

Table 5 — Colour indication of 5 year groups

Group	Years	BS 381C reference number	Colour
2	1987 to 1991	166	French blue
3	1992 to 1996	309	Canary yellow
4	1997 to 2001	642	Night (black)
5	2002 to 2006	285	NATO green
6	2007 to 2011	499	Service brown

NOTE The extension of the period of identification does not imply any extension to the life of the cord. Attention is drawn to the note to Table 7 and to clause 9.

Table 6 — Number of coloured threads

For cord made between	Number of threads
1 January and 31 March inclusive	1
1 April and 30 June inclusive	2
1 July and 30 September inclusive	3
1 October and 31 December inclusive	4

6 Mechanical properties

When determined as described in Appendix A, the mechanical properties of each test specimen of the finished cord shall comply with Table 7.

Table 7 — Mechanical properties

Size of cord (diameter) mm	Load to give extension of:				Minimum total extension (without failure of braid) %
	50 %		100 %		
	min. N	max. N	min. N	max. N	
3	5	7.5	7.5	11	150
4	9	14	14	20	150
5	14	22	22	31	150
5.5	17	26	26	40	150
6.5	25	36	36	53	125
8	37	55	55	80	125
9.5	54	78	78	114	125
11	70	104	104	152	125

NOTE The values given in Table 7 relate to newly manufactured cords. These contain rubber under tension and a reduction of the load to produce any specified elongation will take place during the life of the cords, either in service or in storage. This does not, provided the storage conditions have been satisfactory, imply that the cords are unserviceable for general purposes. For any applications where the loads are critical, however, cords less than 2 years old should be used.

7 Testing

The finished cord after manufacture shall be tested once every manufactured length for compliance with clause 3, 5.2.1 and clause 6. When this length exceeds 100 m, the cord shall be tested at the beginning and end of each length. No mechanical test shall be made within 1 m of either end or before the elapse of 3 days from the time of manufacture.

8 Designation

The cord shall be identified by the number of this British Standard together with the diameter, length and type of outer covering required. When the cord is covered by aramid fibre, the number of this British Standard shall be suffixed with the letter "A".

For example, 6.5 mm diameter cord 50 m long shall be identified as "BS 3F 71/6.5/50 m"²⁾, when braided with cotton covering, or as "BS 3F 71/A/6.5/50 m", when braided with aramid fibre covering.

9 Packaging, storage and use

9.1 Finished cord shall be packaged in accordance with BS 3F 69 and shall be stored in accordance with BS 3F 68.

9.2 For critical applications cord shall not be used that is more than 10 years old.

NOTE Additional limitations may be applied by the user.

²⁾ Marking BS 3F 71 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is therefore solely the responsibility of the person making the claim. Such a declaration is not to be confused with third party certification of conformity, which may also be desirable.

Appendix A Determination of mechanical properties

A.1 Test specimen and its preparation

Select a test length of 100 mm from each length of finished cord in accordance with clause 7. Mark each end of the test length by a pin inserted into the outer braid (taking care not to damage the rubber thread), or by another suitable method, e.g. extensometer.

A.2 Test conditions

Carry out the test at a temperature of 20 ± 5 °C or, in cases of dispute, at a temperature of 23 ± 2 °C and in a relative humidity of 50 ± 5 %.

A.3 Apparatus

Use a testing machine complying with the following:

- a) The tensile testing machine shall comply with grade B of BS 1610, and shall be used in accordance with method 1 of BS 1610.
- b) The scale range shall be such that loads developed during the test lie between 15 % and 85 % of the full load reading of the scale.
- c) The grips shall be capable of holding the specimen firmly without damaging the structure of the cord.
- d) The testing machine shall elongate the specimen at a reasonably constant rate, through the full range of extension required by the test.

A.4 Procedure

A.4.1 Keep the cord at the test conditions (see **A.2**) for not less than 24 h before the test.

A.4.2 Grip the test specimen in the testing machine with the test length lying between the grips such that each marker is clear of the corresponding grip by not less than 40 mm, stretch it until the distance between the markers is 225 mm, examine for compliance with **5.2.1** and Table 4; for sizes up to and including 5.5 mm, continue the extension to 250 mm and re-examine in compliance with Table 4, then immediately remove the load.

A.4.3 After a rest period of 1 min, reset the markers on the original test specimen to give a test length of 100 mm.

A.4.4 Apply the load given in **A.3** at such a rate that the time to extend from 0 % to 125 % is 100 ± 30 s, taking readings at 50 % and 100 % extensions.

Publication(s) referred to

BS 381 C, *Specification for colours for identification, coding and special purposes.*

BS 903, *Physical testing of rubber.*

BS 903-B7, *Extractable sulphur*³⁾.

BS 1610, *Materials testing machines and force verification equipment.*

BS 2087, *Preservative treatments for textiles.*

BS 5421, *Methods of test for elastomeric threads.*

BS 5421-1, *Rubber threads.*

BS 5923, *Methods for chemical analysis of rubber.*

BS 5923-1, *Determination of ash.*

BS 3F 68, *Specification for controlled storage of vulcanized rubbers for use in aerospace applications.*

BS 3F 69, *Specification for packaging and identification of vulcanized rubber items.*

BS SP 170-171, *Specification for braided rubber cord assemblies for aerospace use.*

ISO 2000, *Rubber, raw natural — Specification.*

³⁾ Included in BS 903-B6 to BS 903-B10.

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