

**BS 5F 100 :
1991**

*(Superseding British Standard
4F 100)*

Procedure for

Inspection and testing of textiles for aerospace purposes

Foreword

This British Standard covers the inspection and testing requirements and certain basic quality requirements for textiles for aerospace purposes including aircrew clothing. The requirements specified in this British Standard are for use in conjunction with the relevant specifications in the British Standard (Aerospace Series) group F and are also applicable to other specifications for textiles for aerospace purposes, where appropriate.

The principal changes in this revision include the revision of definitions, the introduction of the test methods for freedom from microbiological growth, total hole count for plain (bobbin) netting, tearing strength by the wounded tear method, detection and determination of silicone and silicon and a test for freedom from corrosive action. Acceptance limits for faults in sewing threads and plain (bobbin) netting are now included. The opportunity has also been taken to revise the standard, where appropriate, in keeping with the changes resulting from the revision of other British Standards.

For flammability testing the horizontal test method required by the Civil Aviation Authority has been restored. Tests for the measurement of smoke density of gases generated by burning textiles and the amount of heat released by textiles exposed to radiant heat have also been introduced.

WARNING. This British Standard calls for the use of substances and/or procedures that may be injurious to health if adequate precautions are not taken. It refers only to the 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.

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

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Section 1. General

1 Scope

This British Standard specifies procedures for the inspection and testing of materials covered by specifications for textiles for aerospace purposes. Details of the classification, methods of marking and acceptance limits for the more common faults in certain broad groups of textiles are given in appendix A. Permitted tolerances are stated where applicable.

NOTE 1. This British Standard does not purport to cover all quality requirements for subsequent processing or the end use of any textile.

NOTE 2. The titles of the publications referred to in this standard are listed on page 56.

NOTE 3. The latest revision of an Aerospace Series standard is indicated by a prefix number.

2 Information to be supplied by the purchaser

A list (to be supplied by the purchaser) of the tests required for a material covered by a British Standard specification for textiles for aerospace purposes shall be fully documented in the contract or order.

3 Definitions

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

3.1 textile

Any fabric (however constructed), sewing thread or cordage made from natural or man-made fibres and/or yarns or blends of these.

3.2 fabric

A manufactured assembly of fibres and/or yarns that has substantial surface area in relation to its thickness and sufficient mechanical strength to give the assembly inherent cohesion.

3.3 wide fabric

A fabric constructed at more than 450 mm width between selvages.

3.4 narrow fabric

A fabric constructed at 450 mm width or less between selvages and not obtained by slitting wide fabric.

3.5 coated fabric

A fabric coated by spreading, calendering, hot melt or transfer techniques.

3.6 plain (bobbin) netting

A hexagonal mesh fabric in which the bobbin threads twist round the warp threads and traverse diagonally across the netting.

3.7 sewing thread

The result of twisting together, in one or more operations, two or more single, folded or cabled yarns intended principally for sewing purposes.

3.8 braided cordage

Cordage of braided or plaited construction independent of size.

3.9 laid cordage

Cordage constructed by twisting three or more strands about each other to form a helix round a central axis.

3.10 rope

Cordage of 4 mm diameter or more.

3.11 cord or line

Cordage of less than 4 mm diameter.

3.12 water repellency

The resistance of textile fabrics to absorbing rain shower water. The criterion is the amount of water absorbed following the effects of a defined simulated rain shower for a specific duration. In addition, the amount of water penetrating the textile fabrics and the water run off can be used for the assessment.

3.13 standard atmosphere

An atmosphere which has a relative humidity of $65 \pm 2\%$ and a temperature of $20 \pm 2^\circ\text{C}$.

3.14 manufacturer

The firm making the material into the form (yarn, loomstate fabric, finished fabric, etc.) in which it is consigned to the purchaser.

3.15 supplier

The firm consigning the material to the purchaser.

3.16 quality assurance authority

The body responsible for authorizing the manufacturer or supplier to issue certification, when to certify means to attest as meeting a standard.

4 Certification

4.1 With each delivery of material, the manufacturer shall supply consignment documentation (e.g. a certificate of conformity, declaration) containing the following minimum information.

- Consignee's name and address.
- Consignor's name and address.
- Reference number and date of document.
- Contract and/or order number.
- Description of supplies and quantity.
- The numbers of the relevant British Standards and of other relevant specifications.
- Identification marks (e.g. batch number, piece numbers).
- Reference to a test report giving the date of testing.

(i) Non-conformance (e.g. concessions or production permits).

(j) A certificate signed by a duly authorized employee of the company, in the following form unless otherwise required by the quality assurance authority.

'Certified that the whole of the supplies detailed hereon have been inspected, tested and, unless otherwise stated above, conform in all respects with the requirements of the contract or order.'

4.2 For material consigned by a supplier other than the manufacturer, all the information required by 4.1, as provided by the manufacturer, shall form part of the supplier's consignment documentation.

4.3 If a batch of material consigned by the manufacturer is subdivided by a stockist or other non-manufacturer before reconsignment, he shall carry out any consequent additional dimensional inspection and identification marking and shall certify accordingly.

5 Sampling and testing

5.1 General

Except where otherwise specified in the individual textile specification, testing to the requirements specified for the textile in the condition as sampled shall be carried out in accordance with this standard on properly identified samples taken as directed in 5.2, 5.3, and 5.4, as appropriate.

5.2 Special sampling frequency

For new production (i.e. with a manufacturer working for the first time on a particular type of textile), the frequency of sampling shall be increased above the normal sampling frequency given in table 1 until such time as the quality assurance authority is satisfied with the degree of uniformity within batches.

5.3 Normal sampling frequency

5.3.1 For production by a manufacturer conversant by experience with a particular type of textile, sampling procedures shall be in accordance with 5.3.2 and table 1.

5.3.2 For coated fabrics, samples shall not include the inevitable coating imperfections which occur at the extreme ends. For other textiles, samples shall not be taken from the first few metres manufactured. All fabric samples shall be full width.

5.4 Special arrangements for type testing

Where a specification provides for the performance of special tests (type tests) at the outset of new production and requires repeats of those tests on an infrequent, as distinct from a batch basis, the particular textile specification shall define the frequency of sampling to be applied.

5.5 Testing

5.5.1 Except where otherwise required as part of the procedure of an individual test given in this standard, all test samples or specimens cut from the test samples shall be conditioned in accordance with clause 6.

5.5.2 For fabrics having a mass per unit area less than 240 g/m² manufactured wholly or partly from natural fibre and for all sewing threads, testing shall be completed without removal from the atmosphere specified in clause 6.

5.5.3 For all other textiles, if the test samples or specimens are removed from the conditioning atmosphere for test purposes testing shall be completed within 15 min of such removal and the temperature shall be maintained in a draught free environment.

5.5.4 In cases of dispute all testing shall be completed in the atmosphere specified in clause 6.

6 Conditioning

Unless otherwise specified in the individual test procedure in this standard, all test samples or specimens cut from the test samples shall be freely exposed in an atmosphere of 65 ± 2 % r.h. at a temperature of 20 ± 2 °C for the following periods:

uncoated fabrics having a mass per unit area less than 240 g/m ²	} ≥ 6 h
sewing threads	
other textiles	} ≥ 16 h

7 Maintenance of identity

7.1 All textiles shall be kept identifiable during manufacture to enable final marking to be made in accordance with clause 8.

7.2 Test samples shall be kept identifiable with the textiles that they represent.

Table 1. Normal sampling frequency

Textile	Normal sampling frequency
Woven fabrics including narrow fabrics: loomstate ¹⁾	For fabrics woven from beams take one sample from one piece per beam. For fabrics woven from creels take one sample from one piece from each continuously woven length not exceeding 5000 m. If several narrow fabrics are woven simultaneously in the same loom, take one sample from each continuously woven length not exceeding 5000 m.
Knitted fabrics including narrow fabrics: loomstate	For warp knitted fabrics, take one sample from one piece per set of beams (i.e. each time a beam in a set is changed, take a further sample). For weft knitted fabrics, take one sample from one piece from each continuously knitted length not exceeding 500 m.
Woven or knitted fabrics including narrow fabrics: piece treated ^{1) 2)}	For woven or knitted fabrics already proved by test in loomstate, take one sample from one piece per finisher's batch per fabric type and manufacturer. For woven or knitted fabrics not subject to test in loomstate, taken one sample from one piece per weaver's or warp knitter's beam or each continuously woven or knitted length not exceeding 5000 m per finisher's batch. If a finisher's batch consists only of further pieces from a weaver's or a knitter's beams, or from continuously woven or knitted lengths previously proved by test in the finished condition, take one sample from one piece from the finisher's batch.
Plain (bobbin) netting	Take one sample from each piece of continuously manufactured netting.
Coated fabrics, including narrow fabrics	Take one sample from one piece from each continuously coated length not exceeding 1000 m. If a continuously coated length comprises pieces from two or more weaver's or knitter's beams or continuously woven or knitted lengths, take one sample per beam or continuously woven or knitted length per continuously coated length.
Ropes	Take from each machine the number of samples given by: $S = 0.4 \sqrt{N}$ where S is the number of samples (to the nearest integer); N is the number of 220 m lengths from a machine. Take a minimum of one sample from each machine.
Cords and lines	Take from each machine the number of samples given by: $S = 0.25 \sqrt{N}$ where S is the number of samples (to the nearest integer); N is the number of 250 m lengths from a machine. Take a minimum of one sample from each machine.
Sewing threads	Take one sample from each thread batch or from each 25 kg whichever gives the greater number of samples.

¹⁾ The quantity of fabric produced from one weaver's beam or from a creel contains the same warp yarns throughout and is woven in one particular loom. As such it constitutes a unique batch or unit of production, provided that weft of substantially consistent quality has been used. If a fresh delivery of weft yarn of unproved quality is introduced during weaving the warp, a fresh batch has been created and further samples for complete fabric tests become necessary. Manufacturers should maintain continuous quality control of weft yarn in respect of the relevant properties, e.g. type of fibre, yarn count, strength.

²⁾ If a fresh delivery of yarn of unproved quality is introduced during weft knitting, a fresh batch has been created and further samples for complete fabric tests become necessary. Manufacturers should maintain continuous quality control of yarn in respect of the relevant properties, e.g. type of fibre, yarn count, strength.

8 Final marking

8.1 All textiles approved by the inspector shall bear the mark of the inspector, together with markings as given in table 2 to be identified and any additional markings specified in the individual textile specification.

NOTE. In addition to the markings specified in 8.1 textiles may also bear markings as specified in the contract or order.

8.2 For woven or knitted fabrics and plain (bobbin) netting, the piece number shall also identify the weaver's or knitter's beam or warp or continuously manufactured 5000 m length, as appropriate, together with the position on the beam or warp or in the continuously manufactured length. For multi-width weaving the transverse position as well as the normal longitudinal position shall be identified.

8.3 For coated fabrics the constituent textile pieces shall be identifiable from the piece number.

8.4 For wide fabrics, the markings shall be on each piece, near to the outermost end.

8.5 For narrow fabrics, the markings shall be on either the fabric or a durable label which shall be securely attached to each separate roll.

8.6 For sewing threads supplied in packages of 300 g and above, the markings shall be on each individual package. Packages less than 300 g shall be boxed and the markings shall be on the outside of the box.

8.7 For all other textiles, the markings shall be on a durable label which shall be securely attached to each separate length or package.

8.8 Marking media used for the final identification or other marking of textiles shall comply with appendix B.

8.9 All markings shall be legible and permanent.

Table 2. Marking

	Loomstate fabrics	Finished fabrics	Coated fabrics	Braided cordage	Laid cordage	Sewing threads
Textile specification	×	×	×	×	×	×
Type or designation ¹⁾	×	×	×	×	×	×
Firm(s) involved in manufacture	×	×	×	×	×	×
Piece number (see 8.1)	×	×	×			
Number of metres defective ²⁾	×	×				
Finisher's batch		×		×		
Number of faults marked in accordance with appendix A			×			
Identification of cordage machine				×	×	
Batch or serial number				×	×	×
Number of portions (if more than one)	×	×	×			
Date (month and year) of coating			×			

¹⁾ If applicable.
²⁾ Applicable to parachute fabrics only, see A.1.

Section 2. Quality requirements

9 Manufacture

9.1 Wide fabrics and netting

9.1.1 The fabric shall be uniformly manufactured.

9.1.2 The edges shall be straight and even and shall not be substantially thicker than the body of the fabric.

NOTE. Certain weaving processes generate selvages that may be slightly thicker than the body of the fabric. Any difference in thickness should be kept to a minimum so as not to hinder the accurate cutting of panels from multiple layers of fabric.

9.1.3 The fabric shall lie flat on a table.

9.1.4 Fabric supplied for subsequent coating shall continue to lie flat on a table when subjected to lengthways tension, and weft skew and bow shall comply with the individual textile specification.

9.2 Narrow fabrics

9.2.1 The fabric shall be uniformly manufactured.

9.2.2 The edges shall be straight and even.

9.2.3 If the edge structure is not specified in the individual textile specification the edges shall not be substantially thicker than the body of the fabric.

NOTE. Certain weaving processes generate selvages that may be slightly thicker than the body of the fabric. Any difference in thickness should be kept to a minimum so as not to hinder the subsequent manufacturing process.

9.2.4 In fabric of multi-ply construction containing binder warp threads, the binders shall be uniformly spaced in the width of the fabric.

9.3 Cordage

9.3.1 The strands of laid cordage shall be well formed and free from grooves and sunken yarns.

9.3.2 Each strand of laid cordage shall contain the same number of yarns.

9.3.3 Unless otherwise specified in the individual textile specification, laid cordage shall have Z lay.

9.3.4 Braided cordage shall be uniform in construction.

9.4 Sewing threads

9.4.1 Threads shall have uniformity of thickness, construction and component ply tension so that there are no visually irregular twist faults.

9.4.2 Threads of length per unit mass less than 9000 m/kg shall not contain thread knots.

9.4.3 Threads of length per unit mass greater than 9000 m/kg shall not contain more than two thread knots per package.

10 Dyed textiles

10.1 Coloured textiles shall be dyed in accordance with the individual textile specification.

10.2 Sulphur dyes shall not be used.

10.3 Dyes known to accelerate actinic damage shall not be used.

NOTE 1. The following are the colour index (C.I.) numbers of some of the dyestuffs that are known to accelerate actinic damage:

(a) to cellulose:	
vat yellows	2, 3, 4, 9, 11, 14, 18, 21, 26 and 28
vat oranges	1, 2, 5 and 8
vat reds	1, 2, 42, 47 and 48
vat brown	5
vat violet	2
(b) to nylon 6,6 :	
acid red	211
mordant blue	49
disperse black	1

NOTE 2. The following are the colour index (C.I.) numbers of dyestuffs that, either alone or mixed together, are known to have a protective effect on nylon 6,6 :

acid black	132
acid green	43
disperse yellow	3
disperse orange	3
mordant yellow	34

10.4 Unless otherwise specified in the individual textile specification, the minimum colour fastness ratings detailed in table 3 shall apply.

10.5 The test for fastness of the colour to light shall be as given in table 3 and is designated as a type test and shall be carried out to the satisfaction of the quality assurance authority.

NOTE. This test is not required on mineral khaki treated fabrics.

10.6 The tests for fastness of the colour to water or washing shall be as given in table 3 and are designated as type tests and shall be carried out to the satisfaction of the quality assurance authority.

NOTE. These tests are not required on mineral khaki treated fabrics.

10.7 After initial satisfaction of the type tests, no changes in respect of the materials, dyeing formulation or processing conditions used shall be made without the type tests being repeated to the satisfaction of the quality assurance authority.

NOTE. The determination of the fastness of the colour to light, water or washing may be made on one sample taken from the first batch of a contract. Provided that this sample is in accordance with table 3 and, subject to 10.7, no further testing of fastness to light, water or washing need be made.

10.8 The manufacturer's records of the type tests shall be made available to the quality assurance authority on request.

Table 3. Dye fastness

Application	Textile	Property		Fastness to washing			Fastness to water			Fastness to rubbing ²⁾			Fastness to vulcanization in open steam ³⁾	
		Fastness to light		Fastness to washing			Fastness to water			Fastness to rubbing ²⁾			Fastness to vulcanization in open steam ³⁾	
		Method	Minimum rating	Method	Change of colour	Minimum rating	Method	Change of colour	Staining adjacent fabric	Method	Dry staining	Wet staining	Method	Minimum rating
All materials used for manufacture of clothing	Cellulosic and wool Wholly or partly synthetic	BS 1006, method BO2 ¹⁾	6	BS 1006, method CO2	4	4				BS 1006, method X14	4	3	BS 1006, method SO3, method A	5
			4		4	4					4	3		5
All materials used for non-clothing applications	Cellulosic and wool Wholly or partly synthetic	BS 1006, method BO2 ¹⁾	5				BS 1006, method EO1	3	3				BS 1006, method SO3, method A	5
			4					4	4					5

¹⁾ BS 1006, method BO2, method 1 to be used in cases of dispute.

²⁾ Not applicable to sewing threads.

³⁾ Only applicable to fabrics intended for coating.

NOTE. A blank denotes that the test is not required.

11 Flammability, smoke density, toxic gas emission and heat release¹⁾

11.1 General

Unless otherwise specified in the individual textile specification tests for flammability, smoke density, toxic gas emission and heat release shall comply with 11.2.1 to 11.2.5 as appropriate.

NOTE 1. The Civil Aviation Authority requires textiles for use in aircraft to be tested according to their category of application in aircraft (see notes 2 and 3).

NOTE 2. The following textiles should be tested in accordance with 11.2.1:

- floor covering
- textiles (including draperies and upholstery)
- decorative and non-decorative coated fabrics
- textile thermal and acoustic insulation covering
- textile cargo covers.

NOTE 3. The following textiles should be tested in accordance with 11.2.2:

- seat belts
- shoulder harnesses
- baggage tie-down equipment.

11.2 Tests

11.2.1 Vertical strip test for flammability of textiles greater than 70 mm in width²⁾

When tested in accordance with 32.1 the textile shall comply with 11.3.1.

11.2.2 Horizontal strip test for flammability of textiles less than 70 mm in width³⁾

When tested in accordance with 32.2 the textile shall comply with 11.3.2.

11.2.3 Smoke density test

When tested in accordance with BS 6401 the textile shall comply with 11.3.3.

11.2.4 Heat release test

When tested in accordance with JAR 25.853 (a-1) the textile shall comply with 11.3.4.

11.2.5 Toxic gas emission

NOTE. The measurement of toxic gas emission from the combustion of textiles for use in aircraft has no established national or international standard for test or acceptance criteria.

Pending issue of a standard, when testing is required, unless otherwise specified in the individual textile specification, details of such requirements shall be fully documented in the appropriate contract or order.

11.3 Performance

11.3.1 Vertical strip test

11.3.1.1 The average burn length for the vertical strip test shall not exceed 200 mm.

11.3.1.2 The average of the sum of the after-flame and after-glow times shall not exceed 15 s.

11.3.1.3 The average flaming time of droplets from the specimen shall not exceed 5 s.

11.3.1.4 Except for the flaming time of droplets no individual test result shall exceed the average specified in the individual textile specification by more than 25 %.

11.3.1.5 Unless otherwise specified in the individual textile specification, a textile that has been subjected to a flame retardant treatment shall continue to comply with 11.3.1.1 to 11.3.1.4 after being subjected to domestic wash procedure 50 of BS 5651 : 1978.

11.3.1.6 Unless otherwise specified in the individual textile specification, a textile that has been subjected to a flame retardant treatment shall continue to comply with 11.3.1.1 to 11.3.1.4 after being subjected to the dry cleaning procedure described in BS 5651 : 1978.

11.3.2 Horizontal strip test

11.3.2.1 The average burn rate shall not exceed 63 mm/min.

11.3.2.2 The average of the sum of the after-flame and after-glow time shall not exceed 15 s.

11.3.2.3 The average flaming time of droplets from the specimen shall not exceed 5 s.

11.3.2.4 Except for the flaming time of droplets no individual test result shall exceed the average specified in the individual textile specification by more than 25 %.

11.3.2.5 Unless otherwise specified in the individual textile specification, a textile that has been subjected to a flame retardant treatment shall continue to comply with 11.3.2.1 to 11.3.2.4 after being subjected to domestic wash procedure 50 of BS 5651 : 1978.

11.3.2.6 Unless otherwise specified in the individual textile specification, a textile that has been subjected to a flame retardant treatment shall continue to comply with 11.3.2.1 to 11.3.2.4 after being subjected to the dry cleaning procedure described in BS 5651 : 1978.

¹⁾ The performance requirements specified in this clause relate to the behaviour of specimens under the particular conditions of test and do not take into consideration the effects of ageing, washing, soiling, etc. that may be encountered during the life of the product. It has to be recognized that they do not give a full assessment of fire properties in all situations.

²⁾ This method is in accordance with that required by the Civil Aviation Authority, Specification No. 8 : Issue 2, and JAR 25.853(b).

³⁾ This method is in accordance with that required by the Civil Aviation Authority, Specification No. 8 : Issue 2, and JAR 25.853(b)(2).

11.3.3 Smoke density test

11.3.3.1 During the first 90 s the maximum smoke specific optical density expressed as D_s shall not exceed 100 in both the radiant and flaming modes.

11.3.3.2 During the first 4 min the maximum smoke specific optical density expressed as D_s shall not exceed 200 in both the radiant and flaming modes.

11.3.4 Heat release test

11.3.4.1 The average total heat release shall not exceed $65 \text{ kW} \cdot \text{min/m}^2$.

11.3.4.2 The average peak release rate shall not exceed $65 \text{ kW} \cdot \text{min/m}^2$.

12 Dimensions and tolerances

12.1 General

Unless otherwise specified in the individual textile specification, the material shall comply with **12.2**, **12.3** or **12.4**, as appropriate.

12.2 Wide fabrics

NOTE. If loomstate wide fabric and netting is subsequently to be processed, e.g. scoured, dyed or coated, allowance should be made for the consequent shrinkage.

12.2.1 Overall width

When measured in accordance with BS 1930 the width of the fabric shall be not less than that specified in the individual textile specification. The variation in width shall not exceed 15 mm.

12.2.2 Length

When measured in accordance with BS 1931 the length of the fabric shall comply with the following.

- (a) Fabric for coating shall consist of continuous lengths without gross defects and with not more than one butt seam per 200 m length. No part shall be less than 40 m long.
- (b) For plain (bobbin) netting, the minimum length of the loomstate piece shall be 50 m.
- (c) For other fabrics the minimum length of the loomstate piece shall be 100 m for those having a mass per unit area of 450 g/m^2 or less, and 50 m for those having a mass per unit area of more than 450 g/m^2 . Not more than 5 % of the pieces shall be in three parts, not more than 25 % of the remainder shall be in two parts and no part shall be less than 15 m long.

12.2.3 Weft skew and bow

When measured in accordance with BS 2819 the weft deviation from a straight line drawn perpendicular to the selvage shall not exceed 25 mm/m width of fabric for fabrics of 100 g/m^2 or less and shall not exceed 50 mm/m width of fabric for fabrics of more than 100 g/m^2 .

12.2.4 Warp bow

When measured in accordance with BS 2819 the warp bow shall not exceed 20 mm/10 m length of fabric.

12.3 Narrow fabrics

NOTE. If a loomstate narrow fabric is subsequently to be processed, e.g. scoured, dyed or coated, allowance should be made for consequent shrinkage.

12.3.1 Width

When measured in accordance with BS 1664-8 the width of any part shall be as specified in the individual textile specification, with the tolerances given in table 4.

Table 4. Width tolerances of narrow fabrics

Nominal width	Tolerance
mm	mm
Less than 12	± 1.0
12 to less than 55	± 1.5
55 and over	$\pm 4 \%^{1)}$

¹⁾ Rounded up to nearest 1.0 mm.

12.3.2 Length

The length of each roll shall be:

- (a) not less than 100 m for fabric weighing 50 g/m or less;
- (b) not less than 50 m for fabric weighing more than 50 g/m.

NOTE. Length measurement by means of a roller yardage counter has been found suitable.

In each roll there shall be not more than four cuts per 100 m which shall not be joined by pins, metal fasteners or other means. No individual part shall be less than 10 m long. The total number of cuts in a consignment shall not exceed four times the number of rolls for fabrics of 50 g/m or less, or twice the number of rolls for fabrics exceeding 50 g/m.

12.3.3 Warp bow

The warp bow shall not exceed 10 mm/m length.

12.4 Length of cordage

12.4.1 Braided cordage

Braided cordage shall be supplied in continuous lengths and shall be free from faults (see clause 15 and A.3). Braided cordage shall be made up with minimum tension, such that when it is drawn from the package the twist in the cordage does not exceed one-third of a turn per metre.

12.4.2 Laid cordage

Laid ropes shall be supplied in continuous minimum lengths of 220 m neatly made into coils and tied with four or more clean lashings. Laid cords shall be supplied made up in wound packages.

13 Freedom from corrosive impurities

13.1 When tested in accordance with clause 43 the conductivity of the aqueous extract shall not exceed 15 mS/m.

13.2 If this value is exceeded, e.g. owing to the presence of adventitious conducting but not specially corrosive material then the following shall apply:

- (a) the pH value of the aqueous extract shall be not less than 5.0 nor more than 8.0 (see clause 44); and
- (b) water soluble chloride expressed as sodium chloride, shall not exceed 0.10 % (see clause 46); and
- (c) water soluble sulphate expressed as anhydrous sodium sulphate shall not exceed 0.25 % (see clause 47).

14 Freedom from microbiological growth

Where a material specification has a requirement that the fibre, finish or any required agents shall not contain substances that promote microbiological growth, a sample shall be type tested by the method detailed in BS 2011 : Part 2.1J, using variant 1 and a severity of 28 days. The pass limit for the extent of growth shall be scale 1.

15 Freedom from faults

15.1 Faults

All textiles shall be examined for the presence of faults. Classification of the more common faults for certain broad groups of textiles shall be as given in appendix A as follows:

- A.1 wide fabrics (other than coated fabrics)
- A.2 coated fabrics
- A.3 cordage
- A.4 woven narrow fabrics.

The method of marking and acceptance limits for each of these groups of textiles shall be in accordance with the appropriate clause of appendix A, unless otherwise agreed by the quality assurance authority.

15.2 Examination

With uncoated translucent fabric, one examination by transmitted light shall be sufficient. Coated fabric required to be opaque shall be examined by transmitted light.

16 Freedom from corrosive action

When tested in accordance with clause 53 the average loss in mass of the metal panels tested in the solution in which the textile has been soaked (W_f) shall not exceed the average mass loss of the metal panels tested in distilled water (W_d) by more than 3 mg, so that $W_f - W_d < 3$ mg.

Section 3. Physical tests

17 Determination of the number of threads, wales or courses per unit length in fabrics, and total hole count for plain (bobbin) netting

17.1 Woven fabrics

17.1.1 Procedure

Determine the number of warp and weft threads using any one of the methods described in BS 2862 suitable for the textile under test.

17.1.2 Report

Calculate and report the results in accordance with BS 2862 and the individual textile specification.

17.2 Knitted fabrics

17.2.1 Procedure

Determine the number of visible wales and courses using any one of the methods described in BS 5441 suitable for the textile under test.

17.2.2 Report

Calculate and report the results in accordance with BS 5441 and the individual textile specification.

17.3 Plain (bobbin) netting

17.3.1 Principle

The finished quality of plain netting is expressed as the sum of the hole count warp way and bobbin way within a 25.0 mm square.

17.3.2 Apparatus

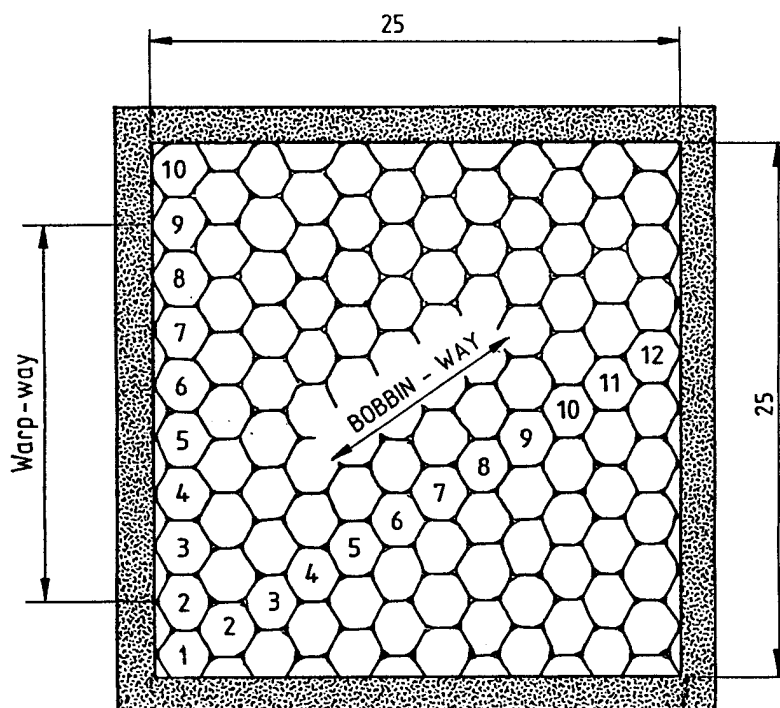
17.3.2.1 Measuring gauge, having an aperture 25.0 mm × 25.0 mm square.

17.3.3 Procedure

17.3.3.1 Condition in accordance with clause 6 for at least 16 h.

17.3.3.2 Lay the netting flat on a horizontal surface and place the measuring gauge on the netting so that one of the edges of its aperture is tangential to a row of holes in the warp direction and such that the selected row commences with a complete hole (see figure 1).

17.3.3.3 Count the number of holes in the warp way and the number of holes in the bobbin way. Determine the total hole count by adding the warp way and bobbin way hole counts together.



NOTE 1. All dimensions are in millimetres.

NOTE 2. The example shows a 22 hole net i.e. 10 holes warp way and 12 holes bobbin way.

Figure 1. Determination of total hole count

17.3.3.4 Incomplete holes are to be included in the count by attributing to them a fractional part of a complete hole i.e. either $\frac{1}{4}$, $\frac{1}{2}$ or $\frac{3}{4}$.

17.3.3.5 Repeat the procedure at not less than five different positions to obtain a representative value.

17.3.4 Report

Report the total hole count of each individual point selected and the average of these values.

18 Mass and mass variation across the width

18.1 Wide fabrics and plain (bobbin) netting

18.1.1 Procedure

With the sample laid flat and free from applied tension, either cut one specimen from the full width of the fabric and not less than 500 mm long, or cut four specimens, each 200 mm square, spaced roughly equally across the width, but with no specimen nearer than 50 mm to a selvedge. Use the latter method if the mass variation across the width is required. Avoid creased areas. For each specimen, measure the dimensions, and determine the mass to an accuracy of 0.5 %. Calculate the mass per unit area in grams per square metre, taking the average when four specimens are used. If required, calculate the mass variation across the width as the difference, in grams per square metre, between the specimens with the lowest and the highest mass per unit area.

18.1.2 Report

Report as required by the individual textile specification.

18.2 Narrow fabrics

18.2.1 Procedure

18.2.1.1 Smooth by hand on a flat surface a suitable length of the fabric.

18.2.1.2 Mark and accurately measure a specimen at least 1 m in length.

18.2.1.3 Cut out the specimen and weigh it.

18.2.2 Report

Report as required by the individual textile specification.

18.3 Cord, line and flat braided construction

18.3.1 Procedure

18.3.1.1 Subject a suitable length of the sample to a tension equivalent to 1 % of the minimum breaking strength specified in the individual textile specification.

18.3.1.2 After 60 ± 5 s, mark and accurately measure along the length in tension, a specimen at least 1 m in length.

18.3.1.3 Release the tension, cut out the specimen and weigh it.

18.3.2 Report

Report as required by the individual textile specification.

18.4 Rope

18.4.1 Procedure

18.4.1.1 Subject a suitable length of the sample to a tension t equivalent to that exerted by a gravitational load in kilograms calculated from the following equations:

(a) for three strand rope or circular cross section braided rope

$$t = d^2/8$$

where

d is the nominal diameter

(b) for eight strand plaited ropes

$$t = 8n^2$$

where

n is the size number.

18.4.1.2 Repeat 18.3.1.2 and 18.3.1.3.

18.4.2 Report as required by the individual textile specification.

19 Breaking strength and extension under force

19.1 General

19.1.1 All testing machines shall be of a suitable capacity and shall comply with BS 1610 : Part 1 for a machine graded 1.0 or higher in respect of accuracy.

NOTE 1. Testing machines having constant rate of crosshead movement, constant rate of load or constant rate of traverse of the straining mechanism are acceptable.

NOTE 2. Any method of test agreed with the quality assurance authority may be used.

19.1.2 In cases of dispute the methods detailed in 19.2 to 19.5 as appropriate, shall be used.

19.2 Apparatus

19.2.1 *Tensile testing machine* complying with BS 1610 : Part 1 for a machine graded 1.0 or higher in respect of accuracy and with the following.

(a) The machine shall have a constant rate of crosshead movement.

(b) The rate shall be adjustable so as to apply the required specified breaking force in 60 ± 10 s.

(c) The breaking force shall fall within that part of the range that is verified correct within 1 % of that force.

(d) For fabrics, narrow fabrics, cords, lines, sewing threads and ropes, the grips shall be wider than the specimen.

(e) For fabrics, the grips shall have edges parallel to each other and at right angles to the direction of pull, and shall be split matching halves, with serrated or wave profile, capable of receiving soft packing sheets to assist in gripping the specimen without causing damage, or shall be rubber faced.

(f) For narrow fabrics, cords, lines and sewing threads the grips may be self-tightening bollards, or wedge grips with flat or wave profile, with provision for soft packings.

(g) For ropes, the grips are normally grooved bollards of diameter appropriate to the specimen, or self-tightening wedges in split halves with inserts of diameter appropriate to the specimen and facilities for soft packings.

NOTE. For synthetic ropes, sheet lead packings are recommended.

(h) The grips shall be adjustable in position to give initial test lengths as detailed in 19.4.

19.3 Preparation of specimens

19.3.1 Wide fabrics

19.3.1.1 Select the specimens from positions across the full width and length of the test sample on the principle illustrated in figure 2.

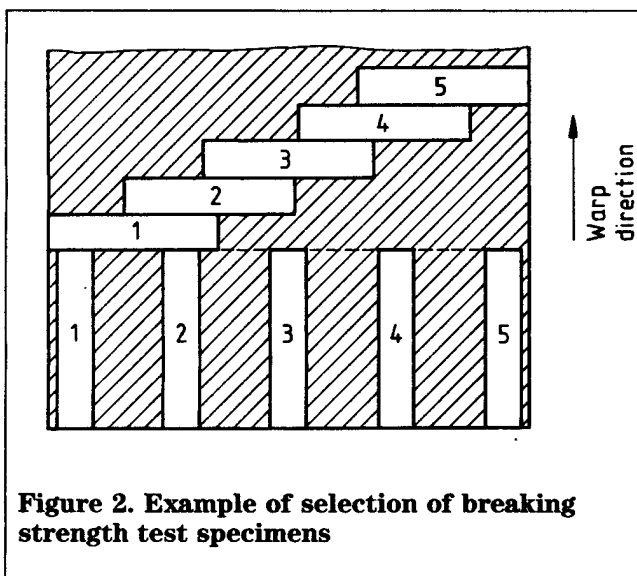


Figure 2. Example of selection of breaking strength test specimens

19.3.1.2 For uncoated fabrics, cut from the test sample 10 rectangular specimens 55 mm wide and between 300 mm to 400 mm long, as convenient, five each with the longer side closely parallel to the warp and to the weft thread directions, and remove lengthways threads equally from each side of each specimen until the width is reduced to 50 mm, leaving the cross threads undisturbed.

19.3.1.3 If the number of widthway threads is fewer than 48 threads per centimetre, cut specimens 65 mm or wider in steps of 5 mm so that

the specimen width is 50 mm plus at least 2×15 thread spaces or 25 mm, whichever is the less.

19.3.1.4 For coated fabrics obtain from the test sample 10 rectangular specimens 50 mm wide and between 300 mm to 400 mm long, as convenient, five each with the longer side closely parallel to the warp and to the weft thread directions.

19.3.2 Narrow fabrics

19.3.2.1 For fabrics up to 100 mm wide, cut from the test sample one full width specimen 300 mm to 400 mm long, as convenient.

19.3.2.2 For fabrics over 100 mm wide, cut from the test sample one specimen 55 mm wide and between 300 mm to 400 mm long, as convenient, with the longer side closely parallel to the warp thread direction, and remove lengthways threads equally from each side of the specimen until the width is reduced to 50 mm.

19.3.3 Cord or line

Test five specimens per test sample. If it is necessary to cut off the specimens from the test sample, avoid unravelling or distortion of the ends, e.g. by knotting, whipping or protecting the ends with wax or rubber tubing.

19.3.4 Rope

Test one specimen per test sample. If it is necessary to cut off the specimen from the test sample, avoid unravelling or distortion of the ends, e.g. by knotting, whipping or protecting the ends with wax or rubber tubing.

19.3.5 Sewing threads

Test five specimens per test sample. Draw off enough thread for the complete test length, first discarding 600 mm to 1 m at each end and also between each specimen. Avoid handling the central test length and take care not to insert or remove twist.

NOTE. When testing directly from packages using automatic specimen mounting, it is not necessary to discard thread between each specimen.

19.4 Procedure

19.4.1 Test the appropriate number of specimens, using for each specimen the procedure described in 19.4.2 to 19.4.5.

19.4.2 Clamp the specimen securely and evenly in the grips, set at the appropriate initial distance apart as follows, so that the specimen is aligned parallel to the direction of pull.

Fabrics	200 mm
Silk and man-made continuous filament cords, lines and sewing threads	150 mm
Other cords, lines and sewing threads	250 mm
Natural fibre ropes	2 ± 0.2 m
Man-made fibre ropes	1 ± 0.1 m

19.4.3 If the breaking extension is to be determined, mark two gauge points on the length between the grips, put the specimen in tension as described in 18.3.1.1 and measure the distance between the gauge points.

19.4.4 Operate the machine, in accordance with 19.2.1, so that the minimum breaking strength specified in the individual textile specification is applied in 60 ± 10 s. Record the maximum indicated force.

NOTE. Preliminary tests may be required.

19.4.5 Measure the extension under load, if required, as the increase in the distance between the gauge points.

19.4.6 A result obtained with any specimen observed to slip or break in a grip or break at the jaw of the grip or within 5 mm of the jaw, and giving a lower figure than that specified in the individual textile specification shall be deemed invalid and a further specimen shall be taken and tested which, in the case of fabrics, contains the same longitudinal threads.

NOTE. For testing using bollard grips, movement around the bollards during tightening of the specimen should be ignored.

19.5 Report

Report the results, including any deemed invalid, as required by the individual textile specification. If the textile specification specifies a minimum for the average breaking strength(s), report the average breaking strength(s) as follows.

- (a) *For wide fabrics:* the average of five valid results obtained along the warp direction or of five valid results obtained along the weft

direction. If the specimen width is other than 50 mm (see 19.3.1.3), measure this width and the breaking strength reported for this width.

(b) *For cord or line:* the average of five valid results.

(c) *For sewing threads:* the average of five valid results.

20 Bursting strength

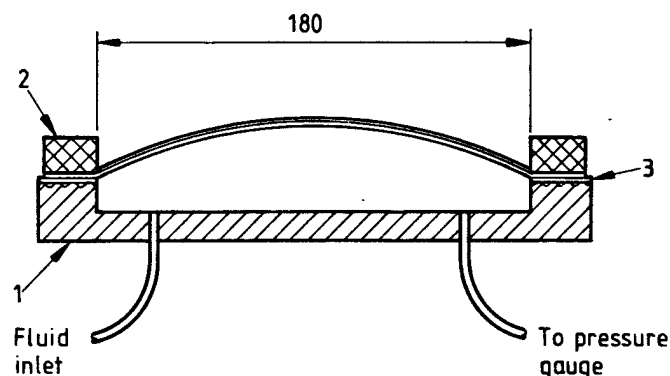
20.1 180 mm diameter clamping ring method

20.1.1 Apparatus

20.1.1.1 A suitable apparatus, as shown in figure 3 consisting of a cylindrical brass pressure vessel (1) of 180 mm internal diameter, the top of which is closed by a thin sheet of rubber (3) of thickness 0.8 mm, on which a fibre ring (2), also of 180 mm internal diameter, can be clamped. Provision is made for a supply of air or water under pressure and for a gauge for indicating the pressure.

20.1.2 Preparation of specimens

Cut from the test sample six specimens, each 230 mm square. Select the specimens from positions across the full width and length of the sample. If a wounded burst test is specified, make a cut across the centre of three specimens with a clean, sharp 12.5 mm chisel to sever the threads parallel to the warp direction, and similarly make a cut in three specimens to sever the threads perpendicular to the warp direction.



1. Base plate with air or water inlet and connection to gauge.
2. Hard fibre ring 180 mm internal diameter.
3. Disc of rubber sheeting 0.8 mm thick between base plate and fabric specimen. The fabric may be gripped tightly between base plate and fibre ring by using G-clamps or by single book-press clamp.

NOTE. Dimension is in millimetres.

Figure 3. Bursting strength apparatus