

BRITISH STANDARD

Pressed wool felts – Specification

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BSi
British Standards

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Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution.

This British Standard has been prepared by Technical Committee TCI/24. It supersedes BS 4060:1989, which is withdrawn.

Information about this document

In this revision, the following principal changes have been made.

- a) References to current test methods/standards have been updated.
- b) Reference to pentachlorophenol laurate (PCPL) has been removed, as this is no longer recommended as a suitable rot-proofing treatment.
- c) Appendix B and Table 8 have been removed.
- d) The majority of Appendix C, as obsolescent, has been removed. Table 9, containing cross references between BS 4060 and MOD Defence Standard 83-19, has been retained, as Table B.1.

Text introduced or altered by Corrigendum No. 1 is indicated in the text by tags C1 C1. Minor editorial corrections are not tagged.

Contractual and legal considerations

This publication does not purport to include all of the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

In particular, attention is drawn to the following statutory regulations.

- The Textile Products (Indications of Fibre Content) Regulations 1986 [1]
- The Textile Products (Indications of Fibre Content) Regulations 1988 [2]
- The Textile Products (Indications of Fibre Content) Regulations 1994 [3].

1 Scope

This British Standard specifies requirements for general purpose felts including packaging felts, and decorative felts and precision felts.

Methods of test for chemical and physical properties are given in normative annexes C and D, respectively.

This standard applies to either white felt or grey felt, with a minimum wool content of 75%, 90% or 97%, except for A97/7D felt, which is dyed (see Table 1).

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 572, *Specification for interchangeable conical ground glass joints.*

BS 1752:1983, *Specification for laboratory sintered or fritted filters including porosity grading.*

BS 2087-1, *Preservative textile treatments – Part 1: Specification for treatments.*

BS 8459, *Determination of extractable matter in textiles – Method.*

BS 3591, *Specification for industrial methylated spirits.*

BS 4407:1988, *Methods for quantitative analysis of fibre mixtures.*

BS 4475:2000, *Specification for straight mineral lubricating oils.*

BS 4736, *Method for determination of dimensional changes of fabrics induced by cold-water immersion.*

BS 6810-2:2005, *Determination of metals in textiles – Part 2: Analysis by atomic emission spectroscopy.*

BS EN 1413:1998, *Textiles – Determination of pH of aqueous extract.*¹⁾

BS EN 20105-C01/ISO 105-C01, *Textiles – Tests for colour fastness – Part C01: Colour fastness to washing – Test 1.*

BS EN ISO 105-B02, *Textiles – Tests for colour fastness – Part B02: Colour fastness to artificial light – Xenon arc fading lamp test.*

BS EN ISO 105-X12, *Textiles – Tests for colour fastness – Part X12: Colour fastness to rubbing.*

BS EN ISO 139:2005, *Textiles – Standard atmospheres for conditioning and testing.*

BS EN ISO 3696, *Water for analytical laboratory use – Specification and test methods.*

¹⁾ This will be superseded by BS EN ISO 3071, *Determination of pH of the aqueous extract*, upon its being published.

3 Terms and definitions

For the purposes of this British Standard, the following terms and definitions apply.

- 3.1 felt**
fabric characterized by the entangled condition of most, or all, of the fibres of which it is composed
- 3.2 general purpose felt**
felt used for packaging, clothing, decorative and similar purposes
- 3.3 precision felt**
felt used in engineering applications, where close tolerances are necessary
- 3.4 pressed felt**
felt formed from a web or batt containing animal hair or wool, consolidated by the application of heat and mechanical action that causes the constituent fibres to mat together
- 3.5 white felt**
felt that has the colour of natural, unpigmented wool
NOTE White felts are used where visual appearance is important.
- 3.6 grey felt**
felt, the colour of which has been obtained from using mixtures of coloured wools and other fibres

4 Material requirements

Felts shall be manufactured from wool, or mixtures of wool with natural or man-made fibres. The minimum wool content shall be as specified in Table 1 and Table 4.

NOTE The fibres should be blended, carded and felted to form a uniform product substantially free from permanent ridges and creases. The product should be free from all non-fibrous agents, e.g. stiffening, loading or reinforcing agents of any kind.

5 Designation

Felts shall be designated by a condensed technical description (see Table 1 and Table 4) containing the following:

- a) a first letter to indicate whether the felt is general purpose (A) or precision (B);
- b) a number, consisting of two digits, to indicate the minimum percentage wool content;
- c) an oblique stroke;
- d) a single digit number, 1 to 8, to indicate the hardness or density grade;
- e) a letter to indicate the colour white (W), grey (G) or dyed (D).

NOTE If appropriate, interested parties can agree to include the additional designations in Table 6 and Table 7 in order to indicate that particular chemical and/or physical requirements have been conformed to (see 6.4 and 6.5).

EXAMPLE 1:

The designation, A75/1W, indicates that the felt is general purpose, with 75% wool content, extra hard and white.

EXAMPLE 2

The designation, B97/1G6.1–6.6, indicates that the felt is a precision felt with 97% wool content, extra hard, grey, having a minimum breaking strength of 5.5 MPa and having chemical properties conforming to 6.1 to 6.6 of Table 6.

6 Performance requirements

6.1 General purpose felts

General purpose felts, including packaging felts, shall conform to Table 1 and Table 2.

NOTE Commonly manufactured thicknesses are 1 mm, 3 mm, 5 mm, 10 mm, 15 mm, 20 mm and 25 mm but other thicknesses may be specified by the customer.

Table 1 General purpose felts

Designation			Colour	Hardness	Description	Nominal density in accordance with test method D.2 mg/mm
Minimum wool content in accordance with test method C.1 ^{A)}						
75%	90%	97%				
A75/1W	—	A97/1W	White	1	Extra hard	0.60
A75/1G	—	A97/1G	Grey			
A75/2W	—	A97/2W	White	2	Hard	0.46
A75/2G	—	A97/2G	Grey			
A75/3W	—	A97/3W	White	3	Extra firm	0.40
A75/3G	—	A97/3G	Grey			
A75/4W		A97/4W	White	4	Firm	0.34
A75/4G	A90/4G	A97/4G	Grey			
A75/5W	—	A97/5W	White	5	Medium firm	0.27
A75/5G	—	A97/5G	Grey			
A75/6W	—	A97/6W	White	6	Medium	0.23
A75/6G	—	A97/6G	Grey			
		A97/7D	Dyed	7	Medium soft	0.20
A75/8W	A90/8W	A97/8W	White	8	Soft	0.18
A75/8G	A90/8G	A97/8G	Grey			
A75/9W	—	A97/9W	White	9	Extra soft	0.15
A75/9G	—	A97/9G	Grey			

^{A)} These values are taken from the Ministry of Defence 83-19 [4].

Table 2 Tolerances on general purpose felts

Nominal thickness according to test method D.1 mm	Tolerance on nominal thickness and density %	Tolerance of individual thickness measurements %
≤ 3.0	$\pm 20^A)$	± 25
3.1 – 10	± 15	± 20
> 10	± 10	± 15

^{A)} See note to D.2.3.

6.2 Decorative felts

Decorative felts shall conform to 6.1 and shall meet the minimum colour fastness ratings detailed in Table 3.

6.3 Precision felts

Precision felts shall conform to Table 4 and Table 5.

6.4 Chemical properties

If felts are required to have particular chemical properties, the felts shall conform to the relevant requirements of Table 6.

NOTE 1 The manufacturer should query the purchaser as to whether there are any particular chemical properties that are required (see Annex A).

NOTE 2 For MOD purposes, general purpose felts and felts for aerospace purposes should conform to 6.1, 6.3 and Table 6.

The tests outlined in Annex C shall be used to determine the wool content of felts.

6.5 Physical properties

If felts are required to have particular physical properties, such as breaking strength and oil retention, they shall conform to the relevant requirements of Table 7.

NOTE The purchaser should specify whether any particular physical properties are required (see Annex A).

The tests outlined in Annex D shall be used to determine the physical properties of the felts.

6.6 Special finishes

Felts shall be manufactured either with or without special finishes imparting, for example, rot, mildew, moth, flame or water resistance, or a combination of these properties.

NOTE The purchaser should specify whether any special finishes are required (see Annex A).

Table 3 Decorative felts

Colour fastness (minimum rating) (1.8 mm coloured felt)					Test method	
	To light using Xenon arc		5	BS EN ISO 105-B02		
	To rubbing	Wet	3–4	BS EN ISO 105-X12		
		Dry				
	To water	Change in colour		4	BS EN 20105-C01/ISO 105-C01	
		Staining	on cotton	4		
			on wool	4		
			on polyester	4		
Bursting strength (minimum) (kPa)					Test method	
		for 1.6 mm thick felts	345	BS EN ISO 13938-1 (hydraulic) or BS EN ISO 13938-2 (pneumatic), using 30 mm aperture		
		for 1.8 mm thick felts	760			

Table 4 Precision felts

Designation		Colour	Hardness		Nominal Density according to test method D.2	Maximum swelling in water-alcohol mixture ^{A)} according to test method D.4	Minimum splitting resistance ^{B)} according to test method D.6
Minimum wool content according to test method C.1 ^{C)}			Grade	Description			
90 %	97 %						
B90/1W	B97/1W	White	1	Extra hard	0.60	20	100.0
B90/1G	B97/1G	Grey					
B90/2W	B97/2W	White	2	Hard	0.46	20	87.5
B90/2G	B97/2G	Grey					
B90/3W	B97/3W	White	3	Extra firm	0.40	20	70.0
B90/3G	B97/3G	Grey					
B90/4W	B97/4W	White	4	Firm	0.34	20	50.0
B90/4G	B97/4G	Grey					

A) Requirement for 97% minimum wool content felts only.

B) Requirement for felts of thickness equal to and greater than 5 mm only.

C) These values are taken from the Ministry of Defence 83-19 [4].

Table 5 Tolerances on precision felts

Nominal thickness according to test method D.1 mm	Tolerance on nominal thickness %	Tolerance on individual thickness measurements %	Tolerance on nominal density %
3 to 10	± 7.5	± 12.5	± 10
above 10	± 5	± 10	± 7.5

Table 6 Chemical properties

Designation	Property	Requirement	Test Method
6.1	pH value of aqueous extract	5.0 to 8.0	BS EN ISO 3071 using the hot water extraction method
6.2	Water soluble chloride, as NaCl	0.05(%) (maximum)	Annex E
6.3	Water soluble sulphate, as Na ₂ SO ₄ C1	0.25(%) (maximum) C1	
6.4	Matter soluble in toluene-methanol (other than matter derived from proofing agents)	5.0(%) (maximum)	C.2
6.5	Matter soluble in water after removal of matter soluble in toluene-methanol	3.0(%) (maximum)	C.2
6.6	Ash (other than the ash of proofing agents)	3.5(%) (maximum)	BS 6646
6.7	Rot-proofing	In accordance with BS 2087-1:1992, dichlorophen heavy process or copper 8 normal process	—
6.8	Soluble hexavalent chromium	0.01(%) (expressed as K ₂ Cr ₂ O ₇ ^{B)}) (maximum)	Clause 8.5 of BS 6810-2:2005

A) For determination of water soluble chloride, or water soluble sulphate the following alternative procedures may be used:

- a) for water soluble chloride, either:
 - 1) automatic microtitration using a chloride ion-selective electrode;
 - 2) ion-chromatography;
 - b) for water soluble sulphate, ion-chromatography.
- In cases of dispute, gravimetric methods as specified in BS EN 1413 are used.

B) For finished felt that has been chrome dyed only.

Table 7 Physical properties

Designation	Property	Requirement	Test method
7.1	Breaking strength	mg/mm ³	(Minimum MPa for nominal densities)
		0.60	5.5
		0.46	4.5
		0.40	3.8
		0.34	3.1
7.2	Oil retention	mg/mm ³	(Minimum % for nominal densities)
		0.60	80
		0.46	90
		0.40	100
		0.34	120

7 Inspection, sampling, conditioning and testing atmosphere

7.1 Inspection

Each manufactured piece shall be visually inspected for defects, e.g. permanent ridges and/or creases and holes.

NOTE 1 Interested parties can agree to the nature and number of defects which may be permitted on the marking of their positions in the roll or sheet and on the appropriate allowance to be made.

NOTE 2 Felts for MOD purposes should be substantially free from holes.

7.2 Sampling

7.2.1 Unless otherwise specified in the relevant test method (test methods are outlined in Annex C and Annex D, as well as referred to in Table 1, Table 2, Table 3, Table 4, Table 5, Table 6 and Table 7), samples of the felt shall be taken from each lot of 200 m² or less.

7.2.2 As a minimum, samples shall be taken either 1 m from either end of a roll or 10 cm from either end of a sheet.

7.2.3 Each sample shall consist of a strip or strips cut from across the full width of the felt to give a total mass sufficient to perform all tests required and of adequate dimensions appropriate to the tests to be performed.

For chemical tests, the sample shall be cut into cubes having sides no more than 5 mm long. The cubes shall be conditioned for 24 h in accordance with **7.3**. The cubes shall be mixed together and a number of them randomly selected to give a test specimen of mass appropriate to the test method under consideration.

7.3 Conditioning and testing atmosphere

Unless otherwise specified in the relevant test method, conditioning and testing shall be carried out in the standard temperate atmosphere specified in BS EN ISO 139:2005, i.e. a relative humidity of $(65 \pm 4)\%$ and a temperature of $(20 \pm 2)^\circ\text{C}$.

Laboratory samples shall be conditioned by exposing them for at least 24 h to the conditioning atmosphere.