

Specification for

Varnished fabrics and tapes for electrical purposes

Co-operating organizations

The Electrical Industry Standards Committee under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

Associated Offices' Technical Committee	Electronic Engineering Association*
Association of Consulting Engineers	Engineering Equipment Users' Association
Association of Mining Electrical and Mechanical Engineers	Independent Cable Makers' Association
Association of Supervising Electrical Engineers	Institution of Electrical Engineers
British Electrical and Allied Manufacturers' Association*	Ministry of Aviation*
British Railways Board	Ministry of Defence, Army Department*
Cable Makers' Association	Ministry of Defence, Navy Department*
Crown Agents for Oversea Governments and Administrations	Ministry of Labour (H.M. Factory Inspectorate)
Electric Lamp Industry Council	Ministry of Power
Electric Light Fittings Association	Ministry of Public Building and Works
Electrical Contractors' Association (Incorporated)	Municipal Passenger Transport Association (Incorporated)
Electrical Contractors' Association of Scotland	National Inspection Council for Electrical Installation Contracting
Electrical Research Association*	National Physical Laboratory (Ministry of Technology)
Electricity Council, The Generating Board and the Area Boards in England and Wales*	Oil Companies Materials Association
	Post Office*
	Public Transport Association (Incorporated)
	South of Scotland Electricity Board

The Government departments and scientific and industrial organizations 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 Electrical Machinery Trades	Tape Manufacturers' Association
British Plastics Federation	Telephone Manufacturers' Technical Development Committee
Glass Textile Association	
Radio and Electronic Component Manufacturers Federation	

This British Standard, having been approved by the Electrical Industry Standards Committee and endorsed by the Chairman of the Engineering Divisional Council, was published under the authority of the General Council on 5 August 1966

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Foreword

This standard makes reference to the following British Standards:

BS 870, *External micrometers*.

BS 2586, *Glass electrodes*.

BS 2757, *Classification of insulating materials for electrical machinery and apparatus on the basis of thermal stability in service*.

BS 3218, *Test tubes and boiling tubes*.

BS 3502, *List of common names and abbreviations for plastics*.

BS 3718, *Laboratory humidity ovens (non-injection type)*.

The information on which this revision is based was provided by the Electrical Research Association.

Varnished fabrics for use as electrical insulation are made from a variety of base fabrics woven from cotton, silk, and man-made fibres including glass, and treated with varnishes of various types based on natural and synthetic resins, drying oils and other substances such as bitumen.

Previous editions of this standard only dealt with varnished cotton fabrics but, in this revision, the opportunity has been taken to include fabrics woven from other materials.

The standard gives requirements for two types of varnished fabric. The yellow varnished fabric is manufactured with a clear varnish, usually consisting of a drying oil in combination with a resin, and the black varnished fabric is manufactured with a varnish usually consisting of a drying oil in combination with a bitumen-based substance. The black varnished fabric has greater moisture resistance and higher electric strength than the yellow varnished fabric, but with the introduction of new materials the distinction is no longer so apparent. However, the designation of yellow or black varnished fabric is maintained because these names are common usage in industry. A system of designation has been included which will assist in overcoming the apparent limitation imposed by the terms “yellow” and “black”.

Varnished fabrics based on cotton, silk and nylon are suitable for insulation in windings and other parts of electrical apparatus for which the maximum operating temperature is 105 °C (Class A, BS 2757¹).

Fabrics woven from polyethylene-terephthalate (PTP)² (e.g. Terylene)³ and glass filament yarns and treated with the same varnishes as used on cotton, silk or nylon, may be suitable for use at 120 °C (Class E, BS 2757⁴).

Glass fabric when varnished with special synthetic resin based varnishes is suitable for use at Class B⁴ (130 °C) or higher temperatures but in this revision only the minimum requirements for varnished glass fabrics are covered, and no attempt has been made to specify requirements for the more heat resistant grades.

The tests detailed in this specification are not intended to assess the suitability of the various varnished fabrics for use at given temperatures, e.g. those associated with Classes A, E and B⁴.

The test for ageing in oil, given in previous editions, has been omitted, because it is less severe than the test for ageing in air and gives no indication of the long term effect of oil on various varnished fabrics.

¹ BS 2757, “*Classification of insulating materials for electrical machinery and apparatus on the basis of thermal stability in service*”.

² BS 3502, “*List of common names and abbreviations for plastics*”, gives PTP as the recommended abbreviation for polyethylene-terephthalate.

³ Terylene is a registered trade name of Imperial Chemical Industries Ltd.

⁴ As given in BS 2757, “*Classification of insulating materials for electrical machinery and apparatus on the basis of thermal stability in service*”.

The long term effect of varnished fabrics on oil is also of importance and the possibility of including a test for this property is being examined.

NOTE 1 Where metric equivalents are given the figures in British units should be regarded as the standard. The metric equivalents are approximate. For more accurate conversion, reference should be made to BS 350, "*Conversion factors and tables*".

NOTE 2 In place of the customary but incorrect use of the pound, kilogramme and gramme as units of force, the units called pound-force (abbreviation lbf) kilogramme-force (kgf) and gramme force (gf) have been used in this standard. These are the forces which, when acting on a body of mass one pound, one kilogramme or one gramme respectively, give it an acceleration equal to that of standard gravity.

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 to iv, pages 1 to 19 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

This British Standard covers fabrics woven from cotton, silk, nylon polyethylene-terephthalate (PTP)⁵⁾ and glass, coated on both sides with varnish, and of nominal thickness from 4 mil (0.10 mm) to 10 mil (0.25 mm) supplied in the full width of approximately 36 inches (915 mm) or slit into tape. Although the types of varnished fabric are described throughout this standard as “yellow” and “black”, any varnish having the appropriate properties but differing in colour may be used, by agreement between the purchaser and the supplier.

2 Definitions

For the purposes of this specification the following definitions apply:

tape

material cut to a width not exceeding 4 inches (100 mm). It may be either straight-cut or bias-cut and has no selvages

straight-cut (S/C)

material in which one set of threads (usually the warp) is parallel with the edges and the other set at a right-angle

bias-cut (B/C)

material cut so that both the warp and weft threads make the same angles with the edges

panel form bias-cut

bias-cut material in short lengths not joined together

sewn bias-cut

bias-cut material in short lengths sewn together before or after varnishing to form a continuous length

stuck bias-cut

bias-cut material in short lengths stuck together with an adhesive or an adhesive tape after varnishing to form a continuous length

seamless bias-cut

bias-cut material woven and varnished in a continuous length

roll

material in roll form when the width is greater than 4 inches (100 mm)

reel

material in roll form when the width does not exceed 4 inches (100 mm)

3 Designation

For the purposes of this British Standard, varnished fabrics are designated by the base fabric and by the varnish used, as follows:

Type designation	Material	Colour designation
C1	Varnished cotton	Yellow
C2	Varnished cotton	Black
S1	Varnished silk	Yellow
S2	Varnished silk	Black
N1	Varnished nylon	Yellow
N2	Varnished nylon	Black
P1	Varnished PTP	Yellow
P2	Varnished PTP	Black
G1	Varnished glass	Yellow
G2	Varnished glass	Black

4 Quality

All the material in any one consignment shall be of the same quality and have the same properties, within the limits of this specification, throughout the whole length of each roll or reel.

The varnished fabric shall be flexible and the surface shall be uniform, reasonably smooth and free from defects, such as bubbles, pinholes, creases and flaws. It shall be capable of being unrolled without damage.

The material from which tape is cut shall comply with the requirements of this specification.

5 Thickness

The thickness, when determined as described in Appendix B shall lie within the, appropriate limits given in Table 1.

The tolerance on thickness of material of other nominal thicknesses, shall be the subject of agreement between the purchaser and the supplier.

⁵⁾ See BS 3502, “List of common names and abbreviations for plastics”.

Table 1 — Thickness

Material	Nominal thickness		Thickness limits			
			Minimum		Maximum	
	mil ^a	mm	mil ^a	mm	mil ^a	mm
Varnished cotton	5	0.13	5.0	0.13	6.0	0.15
	7	0.18	6.3	0.16	7.7	0.19
	10	0.25	9.0	0.23	11.0	0.28
Varnished silk	4	0.10	3.5	0.09	4.5	0.11
	5	0.13	4.5	0.11	5.5	0.14
	6	0.15	5.4	0.13	6.6	0.17
Varnished nylon	5	0.13	4.5	0.11	5.5	0.14
	6	0.15	5.4	0.13	6.6	0.17
	7	0.18	6.3	0.16	7.7	0.19
Varnished PTP	5	0.13	4.5	0.11	5.5	0.14
	6	0.15	5.4	0.13	6.6	0.17
	7	0.18	6.3	0.16	7.7	0.19
	10	0.25	9.0	0.23	11.0	0.28
Varnished glass	5	0.13	4.5	0.11	5.5	0.14
	6	0.15	5.4	0.13	6.6	0.17
	7	0.18	6.3	0.16	7.7	0.19
	10	0.25	9.0	0.23	11.0	0.28

^a 1 mil = 0.001 in (0.025 mm).

6 Width

The following tolerances shall be allowed on the width:

- The width of material nominally 36 inches (915 mm) wide shall be 36 ± 1 inch (915 ± 25 mm). The tolerance on nominal widths less than 36 inches (915 mm) and greater than 4 inches (100 mm) shall be the subject of agreement between the purchaser and the supplier.
- The tolerance on the width of straight-cut or bias-cut tape [i.e., nominal widths up to 4 inches (100 mm)] shall be $\pm 1/64$ inch (0.4 mm).

7 Length

The length of material in a roll or reel should be specified by the purchaser.

Recommended lengths are as follows:

Rolls: 50, 100 and 200 yards or metres ± 2 percent

Reels: 36, 50 and 72 yards ± 2 per cent or 50 and 100 metres ± 2 percent.

8 Joins

a) *Sewn and stuck bias-cut material.* The piece length of material between any two successive joins shall be not less than 48 inches (1.2 m). The material shall be in one continuous jointed length unless otherwise agreed between the purchaser and the supplier.

The joins shall be unmarked and their tensile strength shall comply with the requirements of Table 3 unless otherwise agreed between the purchaser and the supplier.

The adhesive or adhesive tape used for stuck joins and the method of making the join shall be the subject of agreement between the purchaser and the supplier.

b) *Straight-cut and seamless-bias-cut material.* The recommended roll or reel lengths shall be as far as possible continuous and unjointed. In no case shall there be more than two pieces or one join in rolls or reels of length up to 72 yards or 50 metres or three pieces or two joins in rolls or reels longer than 72 yards or 50 metres. No individual piece length or distance between joins shall be shorter than 10 yards (10 m). Any discontinuity in rolls shall be clearly marked.