British Standard

BRITISH STANDARD

BS 747:2000

Reinforced bitumen sheets for roofing — Specification

ICS 91.060.20

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee B/546, Flexible sheets for water and water vapour control, upon which the following bodies were represented:

Association of British Roofing Felt Manufacturers
Association of Building Component Manufacturers
British Flat Roofing Council
Construction Confederation
Consumer Policy Committee of BSI
Department of the Environment, Transport and the Regions (Represented by BSI)
Department of the Environment, Transport and the Regions
(Construction Directorate)
Flat Roofing Alliance
Mastic Asphalt Council Ltd.
National Federation of Roofing Contractors
National House Building Council
Royal Institute of British Architects

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

Builders Merchants Federation
London Chamber of Commerce Inc.

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Contents

Foreword

This British Standard has been prepared by Technical Committee B/546. It supersedes BS 747:1994, which is withdrawn.

Traditionally, products covered by this standard have been known as “felt”. Whilst the term remains valid in respect of class 4 products, the opportunity has been taken in this revision to change the title of the standard and of class 1, 3 and 5 products to the more accurate term “reinforced bitumen sheets for roofing”. This term also accords with titles of draft European Standards for these products.

This edition introduces changes which:

— improve the performance of type 3E mineral surface product by increasing the mass of the glass base and the amount of the bitumen coating;

— increase the number of class 5 products to include the ranges of polyester products in common use;

— introduce changes to the class 4 sheathing felts to reflect those now commonly and successfully used in practice.

The following types of pre-formed base roofing sheets are covered in this edition of BS 747.

Types of pre-formed base roofing sheets	Fibre base	Asbestos base	Glass fibre base	Polyester base
Fine mineral surfaced sheet, e.g. fine sand, talcum etc.	—	—	3B	5B and 5U
Granule surfaced sheet, e.g. slate granite or ceramic	—	—	3E	5E
Reinforced sheet	1F	—	—	—
Venting base layer	—	—	3G	—

A roofing sheet consists essentially of matted fibre rendered partially or completely impervious to water by treatment with bituminous materials. According to the purpose and type of roofing sheet required, the fibres may be derived from various sources, most commonly vegetable (e.g. cotton, jute, flax, wood pulp), mineral (e.g. glass), man made fibres (e.g. polyester) or a mixture of these.

Unproofed sheets are made in various thicknesses, masses, textures and mechanical strengths, depending partly upon the physical nature of the fibre. Whilst some are close textured and tough, others are of open texture and low strength, although treatment with the proofing generally increases the mechanical strength. The types of proofing materials, blended to give the required properties, include bitumens derived from petroleum oils.

Class 1, 3 and 5 products are manufactured by passing the untreated base through a tank containing a saturating material (bitumen), which is maintained in a hot fluid condition. Any excess saturant is removed by passing through rollers. These products are then coated with a more highly weather resistant material consisting of bitumen and a mineral filler. (The saturation process for the lightweight polyester and glass bases is optional as long as the material is sufficiently saturated during the coating process.)

The surface of the coated sheet is then covered with a surfacing material, appropriate to the type of product, which prevents sticking in the roll and which can also provide a decorative and protective finish.

Class 4 sheathing felts are not manufactured from a pre-formed base as with class 1, 3 and 5 products but are manufactured from comparatively long staple fibres, which are formed as a loose open batt on the production machine. This batt is immediately treated with the impregnating materials derived from petroleum oils or certain wood pitches and resins which bond the fibres together. These felts are used mainly as underlays for other roofing materials such as mastic asphalt and metal roof coverings.

Class 5 polyester-based products have improved performance capability, which is derived from the improved reinforcing properties and greater mechanical strength of the polyester base. The final properties of the bitumen polyester sheet are related to the mass/area ratio of the sheet, the composition of the base (polyester fibre/binder content) and the method of production. The four masses of polyester base which are in common use are now included in this standard, the properties of which are specified in Table 5.

The particular technical benefits conferred by bitumen polyester roofing sheets are:

— an improvement in the capability of the built up roof covering to accommodate deformation or movement;

— an increase in the puncture and general mechanical damage resistance of the covering;

— a higher nail holding or nail anchorage capability by virtue of the increased tear resistance of the polyester base.

Recommendations for the application of these products are given in BS 5534-1, BS 8000-4, BS 8204-5, BS 8217, BS 8218, CP 143-12 and CP 143-15.

Annex A is informative. Annexes B, C and D are normative.

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

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1 Scope

This British Standard specifies requirements for reinforced bitumen roofing sheets intended for use in the British Isles and countries with similar climate.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this British Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the normative document referred to applies.

BS 410, *Specification for test sieves.*

BS 2000-49, *Methods of test for petroleum and its products — Determination of needle penetration of bituminous material.*

BS 2000-58, *Methods of test for petroleum and its products — Determination of softening point of bitumen — Ring and ball method.*

BS 3690-2, *Bitumens for building and civil engineering — Specification for bitumens for industrial purposes.*

BS 5284:1993, *Methods of sampling and testing mastic asphalt used in building and civil engineering.*

3 Class 1 — Bitumen sheets (fibre base)

3.1 General

The products in this class comprise:

— type 1F reinforced bitumen sheet;

— type 1F reinforced bitumen sheet, aluminium faced.

Minimum masses for the base and bitumen components of class 1 bitumen sheets shall be as given in Table 1.

3.2 Requirements for constituent materials

3.2.1 *Base*

The base shall consist of animal fibres or vegetable fibres made into a close-textured absorbent sheet of fibre.

3.2.2 *Saturating material*

The saturating material shall consist of bitumen conforming to BS 3690-2 having a penetration within the range 60 to 230 at 25 °C when tested in accordance with BS 2000-49.

3.2.3 *Coating material*

The coating material shall have a softening point (ring and ball test) within the range 80 °C to 120 °C when tested in accordance with BS 2000-58 and shall consist of oxidized bitumen conforming to BS 3690-2 which may be stabilized with finely divided mineral filler. The proportion of stabilizing mineral filler shall not exceed 40 % by mass of the coating material.

3.2.4 *Mineral filler*

The mineral filler shall consist of finely divided mineral matter of which not less than 99 % by mass passes a 212 μm mesh sieve conforming to BS 410.

3.2.5 *Surfacing material*

The surfacing material shall consist of a fine mineral material, e.g. sand, talcum etc., or other suitable material according to the type of sheet.

3.3 Type 1F reinforced bitumen sheets

3.3.1 *Description*

Type 1F sheet shall comprise a bitumen-saturated and coated fibre base combined with a layer of jute hessian embedded in the coating on one side of the base so as to reinforce and strengthen the sheet. The sheet shall be coated with a fine surfacing material to prevent the product sticking in the roll. The presence of the hessian shall be obvious on inspection.

Type 1F sheet shall also be manufactured with an aluminium foil face on the hessian-reinforced side to provide a heat-reflecting under-slating sheet.

NOTE Uses for which type 1F sheet is suitable are described in annex A.

3.3.2 *Reinforcement*

The jute hessian used to reinforce the sheet shall have a nominal mass per unit area of not less than 110 g/m^2.

3.3.3 *Mass*

The nominal mass per unit area of type 1F sheet shall be 15.0 kg per 10 m^2 exclusive of wrappings or accessories. The mass of roll determined by the selection procedure in annex B (see **B.1**) shall be not less than 95 % of that calculated from the nominal mass per unit area. Masses per unit area of components and their corresponding values shall be as shown in Table 1 when determined by the method in **B.3**.

3.3.4 *Standard packages*

Type 1F sheets shall be marketed in rolls 1 m wide, in lengths of 15 m. The packages shall be marked with the name of the manufacturer, the number and date of this British Standard, i.e. BS 747:2000[1)], the type of sheet and the nominal length and width of the roll.

[1)] Marking BS 747:2000 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 solely the claimant's responsibility. Such a declaration is not to be confused with third-party certification of conformity.

3.3.5 *Colour code*

Type 1F sheet shall be provided with a single continuous strip of white surfacing along one longitudinal edge of the roll so as to be visible when unrolled. The white strip shall provide sufficient contrast with the surfacing material so as to be easily distinguished.

4 Class 3 — Bitumen sheets (glass fibre base)

4.1 General

The products in this class comprise the following types:

— type 3B: fine material surfaced bitumen glass fibre sheet;

— type 3E: granule surfaced bitumen glass fibre sheet;

— type 3G: bitumen glass fibre venting base layer sheet.

Class 3 bitumen sheet shall be made from a base consisting of a sheet of bonded glass fibres which does not require saturating.

In the manufacturing process coating material shall be applied to both sides of the sheet and shall be immediately coated with the appropriate surfacing to prevent the layers from sticking together in the roll.

The granule surfaced sheet (type 3E) shall be finished with mineral granules on the upper surface which in addition to improving its weathering properties has some decorative value.

The venting base layer (type 3G), a special underlayer sheet, shall be manufactured with a base specially perforated in order to provide a system of partial bonding when used as the first layer of built-up roofing.

4.2 Requirements for constituent materials

4.2.1 *Base*

The base of class 3 bitumen sheet shall consist of a sheet of bonded glass fibres conforming to the requirements for mass per unit area given in Table 2. Each test piece shall have a breaking strength of not less than 150 N when tested in accordance with annex C.

Table 1 — Masses per unit area of components and lengths of rolls of class 1 bitumen sheets (fibre base)

Type of sheet	Nominal mass per unit area	Nominal length of roll	Nominal mass per unit area of fibre base	Masses per unit area obtained by analysis		
				Base min.	Bitumen content min.	Surfacing material (nominal)
	kg/10 m^2	m	g/m^2	g/m^2	g/m^2	g/m^2
1F reinforced bitumen	15	15	160 (fibre) 110 (hessian)	140 90	550	450
1F reinforced bitumen, aluminium faced	13	15	160 (fibre) 110 (hessian)	140 90	550	250

Table 2 — Class 3 bitumen sheets (glass fibre base) — Composition and roll lengths

Type of sheet	Nominal mass per unit area	Nominal length of roll	Nominal mass per unit area of base	Mass per unit area obtained by analysis		
				Base min.	Total bitumen content	Surfacing material nominal min.
	kg/10 m^2	m	g/m^2	g/m^2	g/m^2	g/m^2
3B fine material surfaced bitumen glass fibre	18	20	60	55	780	450
3E granule surfaced bitumen glass fibre	32	10	100	90	850	1 000 (granules) 250 (fine surfacing)
3G bitumen glass fibre venting base layer	26	10	60[a]	55[a]	690[a]	1 000[a] (granules) 250[a] (fine surfacing)

[a] Excluding effect of perforations.

4.2.2 *Coating material*

The coating material shall have a softening point (ring and ball test) within the range 80 °C to 120 °C when tested in accordance with BS 2000-58, and shall consist of oxidized bitumen conforming to BS 3690-2 which may be stabilized with finely divided mineral filler. The proportion of stabilizing mineral filler shall not exceed 40 % by mass of the coating material.

4.2.3 *Mineral filler*

The mineral filler shall consist of finely divided mineral matter of which not less than 99 % by mass passes a 212 μm mesh sieve conforming to BS 410 and not less than 60 % by mass passes a 75 μm mesh sieve.

4.2.4 *Surfacing material*

The surfacing material shall consist of a fine mineral material, e.g. sand, talcum, or other suitable material according to the type of sheet.

4.3 Type 3B fine material surfaced bitumen glass fibre sheets

4.3.1 *Description*

Type 3B sheet shall comprise a bitumen coated glass base, covered with fine surfacing material on both sides to prevent the roofing sheet from sticking during manufacture and when in the roll.

NOTE Uses for which type 3B sheet is suitable are described in annex A.

4.3.2 *Mass*

The nominal mass per unit area of type 3B sheet shall be 18 kg per 10 m^2 exclusive of wrappings or accessories. The mass of roll determined by the method in **B.1** shall be not less than 95 % of that calculated from the nominal mass per unit area. Masses per unit area of components and their corresponding values shall be as shown in Table 2 when determined by the method in **B.3**.

4.3.3 *Standard packages*

Type 3B sheets shall be marketed in rolls 1 m wide, in lengths of 20 m. The packages shall be marked with the name of the manufacturer, the number and date of this British Standard, i.e. BS 747:2000[2)], the type of sheet, and the nominal length and width of the roll.

4.3.4 *Colour code*

Type 3B sheet shall be provided with a single continuous strip of red surfacing along the margin (or selvedge) of the roll so as to be visible when unrolled. The red strip shall provide sufficient contrast with the surfacing material so as to be easily distinguished.

4.4 Type 3E granule bitumen glass fibre sheet

4.4.1 *Description*

Type 3E sheet shall comprise a bitumen coated glass base, which is covered on the upper side with granules and on the lower side with fine surfacing material to prevent sticking in the roll. The upper surface finish shall have a decorative and protective value, the granules being partially embedded in the coating and firmly bonded to it. A minimum 50 mm margin shall be provided free of granules to facilitate bonding at the laps.

NOTE Uses for which type 3E sheet is suitable are listed in annex A.

4.4.2 *Mass*

The nominal mass per unit area of type 3E sheet shall be 32 kg per 10 m^2, exclusive of wrappings or accessories. The mass of roll determined by the method in **B.1** shall not be less than 95 % of that calculated from the nominal mass per unit area. Masses per unit area of components and their corresponding values shall be as shown in Table 2 when determined by the method in **B.3**.

4.4.3 *Standard packages*

Type 3E sheets shall be marketed in rolls 1 m wide, in lengths of 10 m. The packages shall be marked with the name of the manufacturer, the number and date of this British Standard, i.e. BS 747:2000[2)], the type of sheet, and the nominal length and width of the roll.

4.4.4 *Colour code*

Type 3E sheet shall be provided with a single continuous strip of red surfacing along the margin (or selvedge) of the roll so as to be visible when unrolled. The red strip shall provide sufficient contrast with the surfacing material so as to be easily distinguished.

4.5 Type 3G bitumen glass fibre venting base layer

4.5.1 *Description*

Type 3G sheet shall comprise a bitumen coated glass base (specially perforated) which is covered on one side (the lower surface) with granules and on the other side with fine surfacing material. It shall be produced with nominal 25 mm diameter perforations positioned at approximately 75 mm to 85 mm pitch throughout. A margin shall normally be provided to facilitate lapping of joints.

NOTE Uses for which 3G sheet is suitable are listed in annex A.

[2)] Marking BS 747:2000 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 solely the claimant's responsibility. Such a declaration is not to be confused with third-party certification of conformity.

4.5.2 *Mass*

The nominal mass per unit area of type 3G sheet shall be 26 kg per 10 m^2 exclusive of wrappings or accessories. The mass of roll determined by the method in **B.1** shall be not less than 95 % of that calculated from the nominal mass per unit area. Masses per unit area of components and their corresponding values shall be those shown in Table 2 when determined by the method in **B.3**.

4.5.3 *Standard packages*

Type 3G sheets shall be marketed in rolls 1 m wide and 10 m long. The packages shall be marked with the name of the manufacturer, the number and date of this British Standard, i.e. BS 747:2000[3)], the type of sheet, and the nominal length and width of the roll.

4.5.4 *Colour coding*

Type 3G sheet shall not be colour coded.

5 Class 4 — Sheathing felts

5.1 General

The felts in this class comprise the following types:

a) 4A: black sheathing felt (bitumen);

b) 4A: brown sheathing felt.

In contrast to class 1 and class 3 bitumen sheets, in which a preformed base made from short length fibres or glass filaments is used, sheathing felts shall be manufactured from comparatively long staple fibres, loosely felted together, and then treated with the impregnating materials specified in **5.2.2** and **5.2.3**.

The base, called the "batt", which is formed as a loose, open mixture of fibres on the felt manufacturing machine, shall be immediately treated with the impregnating material and passed through one or more pairs of heated press rollers. During this process, the impregnated batt shall be compressed to its final thickness and shall then be dusted or shived, according to the type of felt being manufactured, to prevent the felt sticking in the roll.

5.2 Requirements for constituent materials

5.2.1 *Batt*

As the composition of the batt depends upon the type of felt, the materials used shall be selected from the following:

— flax;

— jute; and/or

— other suitable fibres.

5.2.2 *Impregnating materials for black felts of type 4Aa)*

The impregnating material shall be bitumen.

5.2.3 *Impregnating materials for brown felts of type 4Ab)*

The impregnating material shall consist of brown wood tars, wood pitches or similar proofing materials.

5.3 Type 4A sheathing felts

5.3.1 *Description*

Sheathing felts shall be made from a batt of loose long fibres, these fibres being bonded together by the impregnating material.

NOTE 1 This prevents the movement of the individual fibres becoming cumulative, thus giving a dimensionally stable sheet, not prone to wrinkling or movement at the joints.

Sheathing felts shall be either black or brown in colour depending on the nature of the impregnating material.

NOTE 2 Uses for which sheathing felts are suitable are listed in annex A.

5.3.2 *Mass*

For each roll 810 mm wide and 25 m long the nominal masses exclusive of wrappings or accessories shall be in accordance with Table 3. The mass of roll of Type 4A sheathing felts shall be not less than 95 % of the nominal value.

Table 3 — Nominal masses of class 4 sheathing felts

Type of sheathing felt	Nominal mass of roll kg
Type 4Aa) Type 4Ab) Black sheathing felt (bitumen)	13
Brown sheathing felt (no. 2 inodourous)	18
Brown sheathing felt	13
NOTE Owing to the variation in the components of these felts, a table of masses of the consistuent materials cannot be given.	

5.3.3 *Standard packages*

Type 4A felts shall be marketed in rolls 810 mm wide and 25 m long and shall be marked with the name of the manufacturer, the number and date of this British Standard, i.e. BS 747:2000[3)], and the type of the particular felt.

[3)] Marking BS 747:2000 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 solely the claimant's responsibility. Such a declaration is not to be confused with third-party certification of conformity.

6 Class 5 – Bitumen sheets (polyester base) with oxidized bitumen coating

6.1 General

The products in this class comprise the following types:

— type 5B: fine material surfaced sheets, the nominal mass of the bases being 180 g/m^2 (5B/180), 250g/m^2 (5B/250) or 350 g/m^2 (5B/350);

— type 5E: granule surfaced cap sheets, the nominal mass of the bases being 180 g/m^2 (5E/180), 250 g/m^2 (5E/250) or 350 g/m^2 (5E/350);

— type 5U: fine material surfaced underlayer, the nominal mass of the base being 125 g/m^2 (5U/125).

6.2 Requirements for constituent materials

6.2.1 *Base*

The base shall consist of a non-woven sheet of polyester staple fibres or polyester continuous filaments conforming to the physical test requirements in Table 4. It shall be formed either by a needling system or by a spun-bonded system. The polyester fibres shall be bonded together by either:

a) impregnation with a chemical binder;

b) thermal fusion of polyester or polyamide coated polyester fibres.

If the polyester base incorporates a glass scrim or longitudinally arranged glass filament reinforcement the mass of the glass component shall not exceed 25 g/m^2.

6.2.2 *Impregnating material*

The impregnating material used for class 5 sheet shall consist of bitumen conforming to BS 3690-2 with a penetration within the range 20 to 200 at 25 °C when tested in accordance with BS 2000-49.

6.2.3 *Coating material*

The coating material for class 5 sheet shall have a softening point (ring and ball test) within the range 80 °C to 120 °C when tested in accordance with BS 2000-58, and shall consist of oxidized bitumen conforming to BS 3690-2, which may be stabilized with finely divided mineral filler. The proportion of stabilizing filler shall not exceed 30 % by mass of the coating material.

6.2.4 *Mineral filler*

The mineral filler for class 5 sheet shall consist of finely divided mineral matter of which not less than 99 % by mass passes a 212 μm mesh sieve conforming to BS 410 and not less than 60 % by mass passes a 75 μm mesh sieve conforming to BS 410.

6.2.5 *Surfacing material*

The surfacing material for class 5 sheet shall consist of a fine material, e.g. sand, talcum or other suitable material according to the type of sheet.

6.3 Type 5U fine material surfaced bitumen polyester underlayer

6.3.1 *Description*

Type 5U underlay shall comprise a bitumen impregnated and coated polyester base, covered with fine surfacing material on both sides to prevent sticking during manufacture and when in the roll.

NOTE Uses for which a type 5U underlayer is suitable are listed in annex A.

6.3.2 *Mass*

The nominal mass per unit area of type 5U underlay shall be 18 kg per 10 m^2 exclusive of wrappings or accessories. The mass of roll determined by the method in **B.1** shall not be less than 95 % of that calculated from the nominal mass per unit area. Masses per unit area of components and their corresponding values shall be as shown in Table 5 when determined by the method in **B.3**.

Table 4 — Physical test requirements of polyester base

Characteristic	Test method reference	Sample direction	Requirement			
			Nominal mass per unit area			
			350 g/m^2	250 g/m^2	180 g/m^2	125 g/m^2
Mass per unit area (g/m^2)	C2	—	330 min.	230 min.	165 min.	118 min.
Breaking strength (newtons per 50 mm)	C3	LD	550 min.	400 min.	350 min.	350 min.
		TD	550 min.	400 min.	350 min.	300 min.
Elongation at break (%)	C3	LD	20 min.	20 min.	20 min.	20 min.
		TD	20 min.	20 min.	20 min.	20 min.
Load at 2 % extension (newtons per 50 mm)	C3	LD	300 min.	200 min.	150 min.	120 min.
		TD	140 min.	140 min.	120 min.	100 min.
Heat stability shrinkage (%)	C4	LD	1.0 max.	1.0 max.	1.0 max.	1.0 max.
		TD	1.0 max.	1.0 max.	1.0 max.	1.0 max.
NOTE LD = longitudinal direction of roll; TD = transverse direction of roll.						

6.3.3 *Standard packages*

Type 5U underlay shall be marketed in rolls 1 m wide and, normally, in lengths of 16 m.

NOTE Other roll lengths may be supplied provided the requirements of Table 5 are met.

The packages shall be marked with the name of the manufacturer, the number and date of this British Standard, i.e. BS 747:2000[4)], the type of sheet, and the nominal length and width of the roll.

6.3.4 *Colour code*

Type 5U underlayer shall be provided with a continuous strip of blue surfacing along one longitudinal edge of the roll so as to be visible when unrolled. The blue strip shall provide sufficient contrast with the surfacing so as to be easily distinguished.

6.4 Type 5B fine material surfaced bitumen polyester sheets

6.4.1 Description

Type 5B sheet shall comprise a bitumen impregnated and coated polyester base, covered with fine surfacing material on both sides to prevent sticking during manufacture and when in the roll.

NOTE Uses for which type 5B sheets are suitable are described in annex A.

6.4.2 *Mass*

The nominal mass per unit area of type 5B sheet, exclusive of wrappings and accessories, shall be:

— 20 kg per 10 m^2 for type 5B/180;

— 30 kg per 10 m^2 for type 5B/250;

— 42 kg per 10 m^2 for type 5B/350.

The mass of roll determined by the method in **B.1** shall not be less than 95 % of that calculated from the nominal mass per unit area. Masses per unit area of components and their corresponding values shall be as shown in Table 5 when determined by the method in **B.3**.

6.4.3 *Standard packages*

Type 5B sheets shall be marketed in rolls 1 m wide and, normally, in lengths of 16 m for type 5B/180, 10 m for type 5B/250 and 8 m for type 5B/350.

NOTE Other roll lengths may be supplied provided the requirements of Table 5 are met.

The packages shall be marked with the name of the manufacturer, the number and date of this British Standard, i.e. BS 747:2000[4)], the type of sheet, and the nominal length and width of the roll.

6.4.4 *Colour code*

Type 5B sheets shall be provided with a continuous strip of blue surfacing along one longitudinal edge of the roll so as to be visible when unrolled. The blue strip shall provide sufficient contrast with the surfacing so as to be easily distinguished.

6.5 Type 5E granule surfaced bitumen polyester cap sheets

6.5.1 *Description*

Type 5E sheet shall comprise a bitumen impregnated and coated polyester base, covered on the upper side with granules and on the lower side with fine surfacing material. The particles shall be partially embedded in the upper surface coating and firmly bonded to it. A minimum 50 mm margin shall be provided free of mineral granules to facilitate bonding at the laps.

NOTE Uses for which type 5E sheets are suitable are described in annex A.

6.5.2 *Mass*

The nominal mass per unit area of type 5E sheet, exclusive of wrappings or accessories, shall be:

— 36 kg per 10 m^2 for type 5E/180;

— 40 kg per 10 m^2 for type 5E/250;

— 47 kg per 10 m^2 for type 5E/350.

The mass of roll determined by the method in **B.1** shall not be less than 95 % of that calculated from the nominal mass per unit area. Masses per unit area of components and their corresponding values shall be as shown in Table 5 when determined by the method in **B.3**.

6.5.3 *Standard packages*

Type 5E sheets shall be marketed in rolls 1 m wide and, normally, in lengths of 10 m for type 5E/180 and 8 m for types 5E/250 and 5E/350.

NOTE Other roll lengths may be supplied provided the requirements of Table 5 are met.

The packages shall be marked with the name of the manufacturer, the number and date of this British Standard, i.e. BS 747:2000[4)], the type of sheet, and the nominal length and width of the roll.

6.5.4 *Colour code*

Type 5E sheets shall be provided with a single continuous strip of blue surfacing along the margin (or selvedge) of the roll so as to be visible when unrolled. The blue strip shall provide sufficient contrast with the surfacing material so as to be easily distinguished.

[4)] Marking BS 747:2000 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 solely the claimant's responsibility. Such a declaration is not to be confused with third-party certification of conformity.

Table 5 — Class 5 bitumen polyester sheets — Composition

Type of sheet	Nominal mass per unit area	Nominal mass per unit area of base	Mass per unit area obtained by analysis		
			Base minimum	Total bitumen content min.	Surfacing material nominal
	kg/10 m^2	g/m^2	g/m^2	g/m^2	g/m^2
5U	18	125	118	700	450
5B/180	20	180	165	720	450
5B/250	30	250	230	1 350	450
5B/350	42	350	330	2 200	450
5E/180	36	180	165	1 220	1 000 (granules) 250 (fine surfacing)
5E/250	40	250	230	1 600	1 000 (granules) 250 (fine surfacing)
5E/350	47	350	330	2 000	1 000 (granules) 250 (fine surfacing)

6.6 Physical property requirements for class 5 sheets

To ensure that class 5 sheets have satisfactory handling and installation characteristics, they shall have the following physical properties.

a) *Resistance to tearing.* All class 5 sheets shall have a minimum resistance to tearing in both longitudinal and transverse directions of 175 N when measured in accordance with annex D (see **D.3**).

b) *Low temperature flexibility.* All class 5 sheets shall not crack when tested in accordance with **D.4**, at a temperature of 5 °C or above.

c) *Resistance to static indentation.* When tested in accordance with **D.5**, type 5B/350 and type 5E/350 sheets shall have a minimum classification of L3; type 5B/250, 5E/250, 5B/180, 5E/180 and 5U/125 shall have a minimum classification of L2.

Annex A (informative)
Uses of BS 747 products

A.1 Class 1 — Bitumen sheets (fibre base)

Type 1F sheet is suitable for use under tiles or slates, particularly when the sheet is not fully supported by boarding. It is not recommended for external use.

A.2 Class 3 — Bitumen sheets (glass fibre base)

A.2.1 *Type 3B fine material surfaced bitumen glass fibre sheets*

Type 3B sheet is suitable for use as the lower layer(s) of built-up roofing and as the top layer on flat roofs with an additional surface treatment, e.g. bitumen dressing compound, aggregate or other surface finish, etc. as described in BS 8217.

A.2.2 *Type 3E granule surfaced bitumen glass fibre sheets*

Type 3E sheet is suitable for use without additional surface treatment as an external layer of built-up roofing. It is also suitable for flashings, skirtings, cappings, etc., all as described in BS 8217.

A.2.3 *Type 3G bitumen glass fibre venting base layer sheet*

Type 3G sheet is suitable for use as the first layer in built-up roofing specifications when partial bonding and/or venting of the first layer of built-up roofing is required.

A.3 Class 4 — Sheathing felts

Sheathing felts, because they are dimensionally stable, are used as underlays for mastic asphalt roofing and flooring to isolate them from the substructure (see BS 8218 and BS 8204-5).

Sheathing felts are also used as sarking felts under metal roofing (see BS 6915 and CP 143-12 and CP 143-15).

Other uses include ship's sheathing, packing and special applications to meet various industrial requirements, especially in the boot and shoe trade.

A.4 Class 5 — Bitumen sheets (polyester base) with oxidized bitumen coating

A.4.1 *Type 5U fine material surfaced bitumen polyester underlayer*

Type 5U underlayer is suitable for use as the first layer of built-up polyester base roofing, including nailed first layers on timber decks, or for use as an intermediate layer when a venting layer or nailed first layer is to be used. It is suitable for use immediately beneath a layer of either type 5B or 5E sheet.

Type 5U underlayer is suitable for use under tiles or slates, particularly where the sheet is not supported by boarding, offering higher resistance to tearing by comparison with type 1F sheet. It may also be used in combination with type 1F underslating as an eaves starter strip where the rotproof base gives added durability.

Type 5U underlayer is also suitable for use as a vapour control layer under thermal insulation, including use on metal decks.

A.4.2 *Type 5B fine material surfaced bitumen polyester sheets*

Type 5B/180 and 5B/250 sheets are suitable for use as the lower layer(s) of built-up roofing

Type 5B/180, 5B/250 and type 5B/350 sheets are suitable for use as the top layer on flat roofs with an additional surface treatment, e.g. bitumen dressing compound, aggregate or other surface finish, etc., as described in BS 8217.

A.4.3 *Type 5E granule surfaced bitumen polyester cap sheets*

Type 5E sheets are suitable for use without additional surface treatment as a capping sheet in built-up roofing. They are also suitable for use on vertical surfaces and as flashings, skirtings and cappings.

Annex B (normative)
Procedure for sampling and selection of specimens of roofing sheets and methods of determining the masses of constituent materials

B.1 Selection of rolls for sampling

Where testing is to be carried out other than by or for the manufacturer, the manufacturer shall be given a reasonable opportunity to have a representative present at the time of sampling. To obtain an average sample of each consignment, select the following number of rolls at random for weighing:

— up to 100 rolls, select 5 rolls;
— over 100 up to 200, select 6 rolls;
— over 200 up to 500, select 7 rolls;
— over 500 up to 1 000 rolls, select 8 rolls;
— over 1 000 rolls, select 9 rolls.

Record the mass of each roll. Calculate the average mass of the selected rolls and record as the mass for each roll in the consignment.

B.2 Selection of samples

B.2.1 Select one of the rolls chosen in accordance with **B.1**. Unroll the selected roll approximately 3 m from the outside end and cut at right angles to the edge of the roll to obtain two samples 1 m in length by the width of the roll. Measure and weigh the samples to determine the mass per 10 m^2. If this mass varies by more than 1.5 % from the mass per 10 m^2 calculated from the mass of the selected roll, cut and weigh a further sample. Use one of the samples for analysis, retain the other for reference in case of dispute.

B.2.2 Cut three smaller samples $(0.01 \pm 0.000\ 1)$ m^2 in area, from the centre and both edges of the sample selected, after discarding the outer 76 mm on both edges. Weigh each sample to the nearest 0.1 g and record the total mass. This mass shall not be used for calculating the mass of the roll for the purposes of acceptance or rejection of the consignment.

B.3 Mass of components

B.3.1 *Bitumen content*

Use the three samples obtained in accordance with **B.2.2** to obtain the soluble bitumen content in accordance with the method in BS 5284:1993, **8.2**.

Determine the total mass per unit area of bitumen in kilograms per 10 square metres (kg/10 m^2) by the following formula:

total mass per unit area of bitumen
= (in kg/10 m^2) = $W_a \times 333$

where

W_a is the total mass of soluble bitumen extracted from the three samples in kilograms (kg).

B.3.2 *Moisture-free mass of extracted base*

Remove the three pieces of desaturated base from the filter paper (any adhering mineral matter being carefully removed), place in a tared weighing bottle and further dry at 105 °C to 110 °C for 30 min, cool in a desiccator and then weigh in accordance with the method in BS 5284.

Determine the total mass per unit area of the base in kilograms per 10 square metres (kg/10 m^2) by the following formula:

total mass per unit area of the base
kg/10 m^2 = $W_b \times 333$

where

W_b is the total mass of the base extracted from the three samples in kilograms (kg).

B.3.3 *Mineral matter and surfacing material*

Determine the total quantity of mineral matter remaining on the filter paper by deducting the total mass of bitumen and dry fibre base obtained in **B.3.1** and **B.3.2** from the total mass obtained in **B.2.1**.

Determine the total mass per unit area of mineral matter and surfacing material in kilograms per 10 square metres (kg/10 m^2) by the following formula:

total mass per unit area of mineral matter in
kg/10 m^2 = $W_c \times 333$

where

W_c is the total mass of the mineral matter extracted from the three samples.

NOTE If necessary, the granules and fine surfacing material can be separated by sieve analysis from the stabilizing filler; however, the figures obtained can only be regarded as very approximate.

Annex C (normative)

Procedure for the selection and testing of samples of base material

C.1 Selection of samples

Take undamaged sample pieces at least 2 m in length over the full width of the material, after removing the outer layer, from deliveries of the same consignment. Take samples from each of three rolls in the case of quantities up to 20 000 m^2 and from each of six rolls in the case of 20 000 m^2 and over.

C.2 Mass per unit area

To determine the mass per unit area, trim the edge of each sample and cut into nine pieces 300 mm × 200 mm. Weigh each piece to the nearest 0.1 g. Record the average mass of the nine pieces and calculate the mass per unit area in grams per square metre (g/m^2).

C.3 Breaking strength load at 2 % extension and elongation at break

C.3.1 *Apparatus*

C.3.1.1 *A tensile testing machine*, of the constant-rate-of-extension type, provided with means for indicating or recording the maximum load applied to the test specimen in stretching it to rupture. Under the conditions of use the error of the indicated or recorded maximum force shall not exceed ±1 %. The rate of separation of the grips shall be (100 ± 10) mm/min.

C.3.2 *Test specimens*

Cut 10 specimens 280 mm long and 50 mm wide in the longitudinal direction and 10 in the transverse direction.

C.3.3 *Procedure*

Set the clamps at a distance of (200 ± 1) mm apart. Secure a specimen in the grips and put the moving grip in motion.

Record the load at 2 % extension, the breaking strength of the specimen in newtons (N) and the distance in millimetres (mm) between the grips at break. Repeat the test on the remaining specimens.

C.3.4 *Expression of results*

Report the load at 2 % extension and the breaking strength in newtons per 50 mm (N/50 mm).

Calculate the percentage elongation at break from the expression:

$$\frac{D_2 - D_1 \times 100}{D_1}$$

where

D_1 is the clear distance between the grips holding the ends of the specimens when loading commences in millimetres (mm);

D_2 is the clear distance between the grip at rupture millimetres (mm).

C.4 Heat stability (shrinkage)

C.4.1 *Apparatus*

C.4.1.1 *A hot air oven*, set at (200 ± 2) °C.

C.4.1.2 *A measuring device*, of sufficient accuracy.

C.4.2 *Test specimen*

Cut a specimen approximately 200 mm × 200 mm from the sample with one edge in the longitudinal direction.

C.4.3 *Procedure*

Measure the distance between the mid-points of opposite sides of the specimen in each direction to an accuracy of 0.25 mm. Lay the specimen on a flat and rigid support and place in the oven. After 1 h remove the specimen and support from the oven and allow to cool for 1 h. Remeasure the specimen in each direction.

C.4.4 *Expression of results*

Calculate the percentage shrinkage of the specimen in each direction. Report the mean of the two results in each direction.

Annex D (normative)

Procedures for testing bitumen polyester sheets

D.1 Selection of samples

Samples shall be selected in accordance with **B.1** and **B.2**.

D.2 Test temperature

The test procedures described in this annex shall be carried out at a temperature of (23 ± 2) °C unless otherwise specified.

D.3 Resistance to tearing

D.3.1 *Apparatus*

D.3.1.1 *A tensile testing machine*, with a rate of separation of the grips of (100 ± 10) mm/min.

D.3.2 *Test specimens*

Cut five 200 mm × 50 mm specimens from the sample in the longitudinal direction and a further five in the transverse direction. Punch a 3 mm diameter hole in each specimen at a point on the centre line and 50 mm from one end.

D.3.3 *Procedure*

Place a (2.5 ± 0.1) mm diameter nail in the hole in a specimen and fix it to the lower clamp of the testing machine by means of a stirrup. Secure the other end of the specimen in the upper clamp. Start the testing machine and note the maximum recorded force, in newtons, to tear the specimen. Repeat for the remaining specimens.

D.3.4 *Expression of results*

Report the mean results, in newtons (N), for the five specimens in each direction.

D.4 Low temperature flexibility

D.4.1 *Apparatus*

D.4.1.1 *A refrigerator.*

D.4.1.2 *A cylindrical mandrel*, 20 mm in diameter.

D.4.2 *Test specimens*

Cut a specimen approximately 200 mm × 200 mm from the sample.

D.4.3 *Procedure*

Condition the specimens and the mandrel in the refrigerator for 2 h at (5 ± 0.5) °C. Remove a specimen and the mandrel from the refrigerator and roll the specimen round the mandrel in 5 s. Repeat for the remaining specimens. Examine the specimens for signs of cracking.

D.4.4 *Expression of results*

Report whether any of the specimens show evidence of cracking.

D.5 Resistance to static indentation

D.5.1 *Apparatus*

D.5.1.1 *A steel ball*, 10 mm in diameter

D.5.1.2 *A means of applying constant loads*, of 7 kg, 15 kg and 25 kg.

D.5.1.3 *A plane support*, of expanded polystyrene, density 20 kg/m^3 to 25 kg/m^3, not less than 200 mm × 200 mm and of minimum thickness 25 mm.

D.5.2 *Test specimen*

Cut a specimen approximately 200 mm × 200 mm from the sample.

D.5.3 *Procedure*

Place the specimen on the support and apply the steel ball with a load of 7 kg for 24 h. Remove the steel ball and examine the specimen for perforation both visually and using a 50 mm water column.

If no perforation occurs repeat the test at different positions on the specimen increasing the load in stages. Record the load at which the specimen is perforated.

D.5.4 *Expression of results*

Classify the material as follows:

— L_1 perforated by the 7 kg load;

— L_2 not perforated at 7 kg but perforated at 15 kg;

— L_3 not perforated at 15 kg but perforated at 25 kg;

— L_4 not perforated at 25 kg.

Bibliography

BS 5534-1:1997, *Code of practice for slating and tiling — Design.*

BS 6925:1988, *Specification for design and construction of fully supported lead sheet roof and wall coverings.*

BS 8000-4:1989, *Code of practice of waterproofing.*

BS 8204-5:1994, *Screeds, bases and in-situ floorings — Part 5: Code of practice for mastic asphalt underlays and wearing surfaces.*

BS 8217:1994, *Code of practice for built-up felt roofing.*

BS 8218:1998, *Code of practice for mastic asphalt roofing.*

CP 143-12:1970, *Code of practice for sheet roof and wall coverings — Part 12: Copper — Metric units.*

CP 143-15:1973, *Code of practice for sheet roof and wall coverings — Part 15: Aluminium — Metric units.*

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