BRITISH STANDARD

BS EN
12970:2000

Mastic asphalt for waterproofing — Definitions, requirements and test methods

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ICS 91.100.50; 93.080.20

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National foreword

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The UK participation in its preparation was entrusted by Technical Committee B/546, Flexible sheets for water and water vapour control, to Subcommittee B/546/7, Mastic asphalt for building purposes, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

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A list of organizations represented on this subcommittee can be obtained on request to its secretary.

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Summary of pages

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 314 "Mastic asphalt for waterproofing", the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2001, and conflicting national standards shall be withdrawn at the latest by March 2001.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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1 Scope

This European standard specifies mastic asphalts for waterproofing, states their characteristics, the test methods to be used to verify these characteristics, and their manufacturing and transport recommendations.

It applies to mastic asphalts used for waterproofing or by application on polymer bitumen sheets in the construction and civil engineering fields, such as roofing, parking, tanking, bridge decks (concrete and steel). It does not include functional requirements to the installed products.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

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EN 1871, *Road marking materials - Physical properties.*

EN 12591, *Bitumen and bituminous binders- Specifications for paving grade bitumen.*

EN 1426, *Bitumen and bituminous binders – Determination of needle penetration.*

pEN 13305, *Bitumen and bituminous binders - Specifications of hard grade bitumen.*

prEN 13043, *Aggregates for bituminous mixtures and surface dressings for roads airfields and other trafficked areas.*

prEN 13108-6, *Bituminous mixtures – Material specifications – Part 6 : Mastic Asphalt.*

prEN 13108-10, *Bituminous mixtures – Quality – Part 10 : Factory production control.*

prEN 12697-20, *Bituminous mixtures - Part 20 : Test methods for hot mix asphalt - Resistance to indentation of mastic asphalt, indentation test on cubes.*

prEN 12697-21, *Bituminous mixtures - Part 21 : Test methods for hot mix asphalt – Resistance to indentation of mastic asphalt, indentation test on plates.*

3 Definitions and description of the materials

3.1 Terminology - Vocabulary

For the purposes of this standard, the following definitions apply :

3.1.1
mastic asphalt (general definition)
dense mass consisting of chippings, and/or sand, and/or limestone fine aggregate, and/or filler and bitumen which may contain additives

The mineral aggregate is composed to be of low void content. The binder content is so adjusted to the void content of the mineral aggregate that the voids are completely filled and a slight excess of binder may be available.

Mastic asphalt is pourable and able to be spread in his hot condition. It requires no compaction on placement.

3.1.2
fine aggregate mastic asphalt
grade of mastic asphalt consisting of filler and/or limestone fine aggregate and/or natural rock asphalt powder and/or sand and bitumen. Bitumen and mastic asphalt may contain additives

3.1.3
coarse aggregate mastic asphalt
grade of mastic asphalt consisting of filler and/or sand and/or limestone fine aggregates and/or natural rock asphalt powder and coarse aggregates, and bitumen. Bitumen and mastic asphalt may contain additives

3.2 Classification of mastic asphalts for waterproofing

— Fine aggregate mastic asphalts

Mainly used for waterproofing layers.

Containing fine aggregate in any of the following combinations :

— natural rock asphalt powder ;

— fillers ;

— limestone fine aggregate ;

— sand.

NOTE 1 Roofing grade, fine aggregate mastic asphalt may also contain a proportion of aggregate up to 4 mm size (see Table 3a, types 3 and 5).

NOTE 2 Limestone fine aggregate may not comply fully with the definition in subclause 3.13 of pr EN 13043 in that the proportion passing a 0,063 mm sieve may marginally exceed 50 %.

— Coarse aggregate mastic asphalts

Mainly used for waterproofing layers or protection layers and/or trafficable protection layers.

Containing coarse aggregate and fine aggregate in any of the following combinations :

— natural rock asphalt powder ;

— limestone fine aggregate ;

— filler ;

— sand ;

— coarse aggregate.

4 Characteristics of the components

For special layers needing acid-resisting mastic asphalts, silicious and/or igneous aggregates must be used.

4.1 Natural rock asphalts and natural asphalts

4.1.1 Natural rock asphalt

Generally limestone, naturally impregnated with bitumen.

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Table 1 — Requirements on natural rock asphalts

Components	Required content (weight)
Soluble native bitumen	≥ 6 %
$CaCO_3$ from the mineral fraction	≥ 80 %

4.1.2 Natural rock asphalt powder

After bitumen has been extracted, the constituants of the residual crushed powder shall pass through square mesh sieves of :

— 2,00 mm : 100 % ;

— 0,063 mm : 80 % minimum.

4.1.3 Natural asphalts

Natural occuring bitumens, containing fines.

Table 2 — Requirements on natural asphalts

Components	Required soluble bitumen content (weight)
Soluble bitumen	≥ 50 %
Mineral aggregate	≤ 50 %

NOTE Examples of such natural occuring materials are " Lake Asphalt " Gilsonite and Selenitza. The most-widely used natural asphalt is " Trinidad Lake Asphalt " (commonly abbreviated to " TLA ").

4.2 Bituminous binders

The penetrability of commonly used bitumen for mastic asphalts shall be comprised between 6 and 220, 1/10 mm.

4.2.1 Paving grade bitumen

Conforming to EN 12591.

4.2.2 Modified bitumen

Conforming to EN 1426.

4.2.3 Hard grade bitumen

Conforming to prEN 13305.

4.3 Aggregates

4.3.1 Added fillers

Added fillers, components of mastic asphalt, may be issued from :

— crushed natural rock material such as limestone rock, silica rock, igneous rock ;

— rock asphalt powder ;

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— dust-extractor recovering.

Whatever their origin, fillers shall comply with the requirements of Table 10 of prEN 13043.

4.3.2 Limestone fine aggregates

Limestone fine aggregate shall consist of naturally occuring limestone with a calcium carbonate content of not less than 80 % by mass.

In limestone fine aggregates, a substantial proportion is retained on a 0,063 mm sieve most of which passes a 2 mm sieve. Limestone fine aggregate may not comply fully with the definition of prEN 13043 in that the proportion passing a 0,063 mm sieve may marginally exceed 50 %.

4.3.3 Fine aggregates (sand)

Fine aggregates shall comply as appropriate with prEN 13043.

4.3.4 Coarse aggregates

Coarse aggregates shall comply as appropriate with prEN 13043.

4.4 Reusable mastic asphalt

Reusable mastic asphalt may only be added to the manufacture of new mastic asphalt for protection layers.

When used, the amount and composition of reusable material shall :

— not contain other materials than mentioned in this standard ;

— be suitable for the type/specification required within permissible tolerances for new mastic asphalt.

4.5 Additives

The application and usage of mastic asphalts and the laying conditions sometimes require the use of additives such as :

— rubber ;

— polymers (granular/powder/liquid) ;

— fibres ;

— pigments ;

— waxes ;

— other suitable additives.

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The additives shall be uniformly distributed in the bitumen or mastic asphalt ; moreover, they shall not be harmful to the environment, be consistent with bitumen and thermal resistant and they shall have no negative influence on other essential mastic asphalt properties.

5 Composition characteristics of mixes

5.1 Composition

The mix design shall consider the usage, traffic and climatic conditions to which the mastic asphalt is to be subjected.

To meet the performance requirements, the following general criteria shall be as indicated in Tables 3 a) and 3 b) :

Table 3a — Requirements on fine aggregate mastic asphalt

MA-type	**Fine aggregate mastic asphalt**				
	Components in % by mass				
Mix types / **Components**	**Type 1**	**Type 2**	**Type 3**	**Type 4**	**Type 5**
Fines	25 – 60				
Rock asphalt powder		≥ 80			
Limestone fine aggregate		< 20 or < 20	> 85	100	≥ 80
Fine aggregate	40 – 75				
Coarse aggregate	0	0	≤ 15	0	≤ 20
Binder content [a]	13 – 22	≥ 16	≥ 11	≥ 12	> 10
Bitumen type [b]	20/30 up to 160/220 or PmB [c]	35/50 or PmB	30/50 or PmB	30/50 or PmB	15/25 or PmB

a Soluble bitumen content related to total mass of mix.

b Hard grade or industrial grade bitumens which have a penetration of not less than 0,6 mm may be added, provided the penetration of the final binder blend used to manufacture the mastic asphalt complies with the figures quoted in the table.

c Polymer modified bitumen

Type 1	Fines based fine aggregate mastic asphalt.
Type 2	Rock asphalt powder based fine aggregate mastic asphalt.
Type 3	Limestone fine aggregate based fine aggregate mastic asphalt.
Type 4	Tanking grade limestone fine aggregate mastic asphalt.
Type 5	Limestone fine aggregate based fine aggregate mastic asphalt for pedestrian access walkways.

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Table 3 b — Requirements on coarse aggregate mastic asphalt

MA-type	Coarse aggregate mastic asphalt												
	Components in % by mass												
Mix types Components	0/4		0/6		0/8		0/10		0/11		0/14		0/16
Fines		24-35 or 25-60		20-30		15-30		15-28		15-28	-	15-28	15-28
Rock asphalt powder	25-60 c										-	-	
Limestone fine aggregate	60-75		50-75		50-75		45-70		45-70		40-55	-	
Fine aggregate		25-50		20-40		20-40		20-45		20-45	-	12-37	12-37
Coarse aggregate	25-40	20-45	25-50	30-50	25-50	30-50	30-55	30-55	30-55	30-55	45-60	45-60	45-60
Binder content [a]	7,0-13,5		7,0-12,0		6,8-12,0		6,5-11,0		6,5-11,0		6,2-8,2		6,0-8,0
Bitumen type [b]	20/30 ; 30/45 ; 35/50 ; 40/60 ; 50/70 or PmB [d]												

a Soluble bitumen content related to total mass of mix.

b Other binders for example hard grade or industrial grade bitumens may be added, subject the penetration of the resulting binder is not less than 1,0 mm.

c Rock asphalt powder may be a part of the limestone fine aggregate.

d Polymer modified bitumen.

5.2 Test methods

5.2.1 Indentation

Indentation tests shall be performed in accordance with prEN 12697-20 or prEN 12697-21. See annex A.

The manufacturer shall choose the type of test (plate or cube) according to the application site and the method usually applied in the country of destination of the mastic asphalt. Modified indentation tests by variant to prEN 12697-20 & 21, may be specified according to local usages.

For fine aggregate type 1 (see Annex A, table A.1), waterproofing grade mastic asphalt, the indentation test may be replaced by a softening point test in accordance with EN 1871.

5.2.2 Additional tests

Additional tests may be specified if they offer complementary information on properties of mastic asphalt, e.g. the determination of dimensional stability of polymer modified mastic asphalt as shown in annex B.

5.3 Performance requirements

This European standard does not specify the level or class of a property that shall be achieved by a product to demonstrate fitness for purpose in a particular intended use.

These may be specified in local regulation or standards, taking into account the differing climatic and service conditions of the various mastic asphalt grades.

NOTE See in annex A the performance requirement limits that may be recommended.

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6 Manufacture of mastic asphalt

The following types of mixing plants may be used :

— asphalt mixing plants for road surfacing materials ;

— mixing plants for mastic asphalt (high speed stirrers) ;

— stationary or mobile mixers for mastic asphalt (slow speed stirrers).

6.1 Storage of components

Binders shall be stored in heated tanks or in block form (kegs). For each grade of binder, the maximum temperature given in Table 4 shall not be exceeded.

Maximum storage temperature for modified binders shall correspond to the instructions of the supplier.

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Table 4 — Maximum storage temperatures for binders

Grade of binder (pen)	Maximum temperature °C
160/220	170
100/150	170
70/100	180
50/70	180
40/60	180
35/50	190
30/50	190
30/45	190
20/30	200
10/20	220
6/12	220
Natural asphalt	190

Each nominal size of aggregate shall be stored separately. Filler, natural asphalt and additives shall be stored under dry condition and according to instructions of supplier.

Mastic asphalt which is to be reused shall be kept dry. It shall be of good quality and free from contamination.

6.2 Mixing of components

The proportions of binder and aggregate shall be combined according to the specific job requirements. Proportioning may be by mass or by volume.

Ensure that when the binder and filler are added, the temperature of the combined materials, containing a given grade of bitumen, does not exceed the corresponding maximum temperature given in Table 5.

Maximum storage temperature for mastic asphalts with modified binders shall be in accordance with the instructions of the supplier.

Table 5 — Maximum mixing temperatures for mastic asphalt

Grade of binder (pen)	Mastic asphalt with fine graded aggregate °C	Mastic asphalt with coarse graded aggregate °C
160/220	210	
100/150	210	
70/100	220	
50/70	220	240
40/60	230	240
35/50	230	250
30/50	230	250
30/45	230	250
20/30	240	250
10/20	240	250
6/12	240	250

The duration of mixing time shall be sufficient to ensure complete homogeneity in the mix.

When the mastic asphalt is only partly mixed before transfer to a mobile mixer, further mixing in the mobile mixer shall be undertaken until homogeneity in the mix is obtained.

When the mastic asphalt is not required for immediate use, it may be cast into blocks for subsequent remelting on site. The coarse aggregate content may not yet be included at this stage.

Remelting of block mastic asphalt on site shall be carried out in suitable mechanically stirred mixers or cauldrons. During remelting care shall be taken to ensure that the temperature of the molten mastic asphalt does not exceed the value for the corresponding grade of binder/mastic asphalt given in Table 5.

6.3 Addition of reusable mastic asphalt

The amount of reusable mastic asphalt to be added to the mix may be a specific requirement.

In transport mixers, care shall be taken to add reusable mastic asphalt in suitably sized increments to fresh material, to avoid undue falls in the temperature of the mix.

Depending upon the proportion of reusable mastic asphalt to be added and the type of mixing plant, it may be necessary to preheat the reusable asphalt in a suitable drier before it is mixed with fresh binder and aggregate in the mixing plant.

7 Transport

During transport in mobile mixers, to minimise hardening, and risk of thermal decomposition the mastic asphalt shall be maintained at the lowest practical temperature consistent with thorough mixing and not higher than the mixing temperature given in Table 5. In special cases, a higher temperature of + 10 °C may be accepted but no longer than 1 h.

In case modified binders are used, reference to manufacturers recommendations shall be made.

During transport, the lids of the mixers shall be kept closed.

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8 Evaluation of conformity (type testing and factory production control)

Type testing shall be performed according to prEN 13108-10.

Factory production control shall be performed according to prEN 13108-10.

9 Identification

The delivery ticket shall at least contain the following information relating to the identification :

— reference to this European standard ;

— manufacturer and mixing plant ;

— designation of the mixture : for example, fine mastic asphalt type 1 according to the requirements in Table 3a ;

— reference to the type testing report.

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Annex A
(informative)

Recommended performance requirements for fine and coarse aggregate mastic asphalts

Table A.1 — Recommended performance requirements for fine aggregate mastic asphalt

Fine aggregate mastic asphalt types / Test methods			Type 1	Type 2	Type 3	Type 4	Type 5
Cube test	[s]	A	45 – 180 [a]				
prEN 12697-20		B	45 – 240 [a]				
		C	60 – 240 [a]				
Ring & Ball test	[°C]		45 – 180				
EN 1871							
Plate test A	[0,1 mm]	A		35 - 70			
prEN 12697-21							
25 °C, 500 mm², 6 min		B		50 - 100			
Plate test W	[0,1 mm]			20 - 80	30 – 80	> 40	8 – 15
prEN 12697-21					(40-100) [b]	(> 55) [b]	(10-20) [b]
25 °C, 31,7 mm², (60 + 10) s							

a In accordance with variant indentation time (see 5.2.1).

b In accordance with plate test W if applied between 0-60 seconds.

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Table A.2 — Recommended performance requirements for coarse aggregate mastic asphalt

Coarse aggregate mastic asphalt types / Test methods		Category [a]				
		I	II	III	IV	V
Cube test – prEN 12697-20						
40 °C, 500 mm², 30 min	[mm]	1,0 - 2,5	1,0 - 3,5	1,0 - 5,0	3,0 - 10,0	10 - 15
increase after another 30 min	[mm]	≤ 0,4	≤ 0,4	≤ 0,6	≤ 0,8	≤ 1,0
Cube test – prEN 12697-20						
22 °C, 100 mm², 5 h	[mm]	1,0 - 4,5	1,0 - 4,5	1,5 – 4,5	4,5 - 10,0	
Plate test W – prEN 12697-21		1,0 - 2,0	1,5 - 2,5	2,0 – 5,0	3,0-15,0	
25 °C, 31,7 mm², (60+10) s	[mm]	(1,5 - 2,5) [b]	(2,0 - 3,0) [b]	(3,0 - 6,0) [b]		
Plate test A – prEN 12697-21						
25 °C, 500 mm², 6 min	[mm]					0,7 - 2,0
Plate test B – pr EN 12697-21						
40 °C, 500 mm², 31 min	[mm]		0,5 - 1,5	1,0 - 4,0	2,0 - 8,0	

a Categories similar to those of prEN 13108-6.

b In accordance with plate test W if applied between 0-60 seconds.

NOTE Plate test W as given in Table A.2 is carried out prior to the addition of coarse aggregate.

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Annex B
(informative)

Determination of dimensional stability of polymer modified mastic asphalts

B.1 Introduction

The method is intended for determining the dimensional stability of polymer modified mastic asphalt with nominal largest particle size 2 mm, e.g. fine aggregate mastic asphalt for bridge waterproofing conforming to BRO 94[1]. The change in dimensions of a sample of mastic asphalt after 24 h storage at 55 °C is measured.

The method has been developed on the basis of DIN 1996 Part 17, but differs from this in a number of respects.

B.2 Principle

A cube of polymer modified mastic asphalt (with a side 70 mm long conforming to prEN 12697-20 is stored for 24 h at 55 °C. The horizontal diagonal length is recorded before and after storage. The difference between the measured values provides a measure of the dimensional stability of the asphalt.

The method is suitable only for polymer modified fine aggregate mastic asphalt.

B.3 Equipment

B.3.1 Vernier caliper with an accuracy of max. 0,1 mm.

B.3.2 Heating cabinet capable of maintaining the specified temperature within ± 2°C.

B.3.3 Thermometer with an accuracy of max. 0,5 °C.

B.3.4 Metal plate with silicon paper coated with talcum or lime filler.

B.3.5 Metal mould according to prEN 12697-20 with internal dimension (70 ± 5) mm for casting test cubes.

NOTE In direct connection with the indentation test, cubes tested with regard to indentation time according to prEN 12697-20 (at 20 °C) may also be examined with regard to dimensional stability by using this method.

B.3.6 Release agents, such as glycerol, silicon preparations or powdered lime.

B.4 Sample preparation

Lightly brush or dust the inside of the mould with release agent.

Fill the mould completely and allow it to cool. The test cube is stored in the mould until testing is to take place.

B.5 Procedure

Examine two test cubes.

Check that the shaped sides of the test cubes are flat.

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[1] Swedish national specification BRO 94

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Place the test cube on the metal plate with the upper surface of the cube at the top. The upper surface is the side that has not been in contact with the mould.

Measure the horizontal diagonal lengths with a vernier caliper. Record the mean of the two individual measurements in both directions to the nearest millimetre.

Place the metal plate and cubes horizontally in the heating cabinet at (55 ± 2) °C for 24 h ± 10 min. Allow to cool to room temperature and then repeat the measurement of the diagonals. Place the vernier caliper so that the maximum horizontal diagonal distance is obtained (usually some way up from the lower edge of the cube). State the mean of the two individual measurements in both directions to the nearest millimetre.

The difference between the measured values before and after storage is reported as a measure of the dimensional stability of the test cube.

For the result, state the mean of the dimensional stability measurements for the two individual test cubes.

NOTE If the dimensional stability result exceeds 50 mm, this need not be stated with greater accuracy than such, i.e. the result obtained is reported as > 50 mm.

B.6 Test report

The test report shall contain the following information :

a) that testing has been performed in accordance with this method ;

b) the dimensional stability in millimeters, mean and all individual measurements ;

c) the test temperature and storage time.

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