

BS EN 13108-9:2016



BSI Standards Publication

Bituminous mixtures — Material specifications

Part 9: Asphalt for Ultra-Thin Layer (AUTL)

National foreword

This British Standard is the UK implementation of EN 13108-9:2016.

The UK participation in its preparation was entrusted to Technical Committee B/510/1, Asphalt products.

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

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Published by BSI Standards Limited 2016

ISBN 978 0 580 82042 7

ICS 93.080.20

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

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 June 2016.

Amendments/corrigenda issued since publication

Date	Text affected
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EUROPEAN STANDARD

EN 13108-9

NORME EUROPÉENNE

EUROPÄISCHE NORM

June 2016

ICS 93.080.20

English Version

**Bituminous mixtures - Material specifications - Part 9:
Asphalt for Ultra-Thin Layer (AUTL)**

Mélanges bitumineux - Spécifications pour le matériau
- Partie 9: Bétons bitumineux pour couches ultra-
minces (BBUM)

Asphaltnischgut - Mischgutanforderungen - Teil 9:
Asphaltnischgut für ultradünne Schichten
Asphaltbeton (AUTL)

This European Standard was approved by CEN on 27 February 2016.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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European foreword

This document (EN 13108-9:2016) has been prepared by Technical Committee CEN/TC 227 “Road materials”, the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by December 2016, and conflicting national standards shall be withdrawn at the latest by March 2018.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of Regulation (EU) No 305/2011 for construction products (CPR).

For relationship with Regulation (EU) No 305/2011 see informative Annex ZA which is an integral part of this European Standard.

This European Standard is one of a series as listed below:

- EN 13108-1, *Bituminous mixtures — Material specifications — Part 1: Asphalt Concrete*
- EN 13108-2, *Bituminous mixtures — Material specifications — Part 2: Asphalt Concrete for Very Thin Layers (BBTM)*
- EN 13108-3, *Bituminous mixtures — Material specifications — Part 3: Soft Asphalt*
- EN 13108-4, *Bituminous mixtures — Material specifications — Part 4: Hot Rolled Asphalt*
- EN 13108-5, *Bituminous mixtures — Material specifications — Part 5: Stone Mastic Asphalt*
- EN 13108-6, *Bituminous mixtures — Material specifications — Part 6: Mastic Asphalt*
- EN 13108-7, *Bituminous mixtures — Material specifications — Part 7: Porous Asphalt*
- EN 13108-8, *Bituminous mixtures — Material specifications — Part 8: Reclaimed Asphalt*
- EN 13108-9, *Bituminous mixtures — Material specifications — Part 9: Asphalt for Ultra-Thin Layer (AUTL)*
- EN 13108-20, *Bituminous mixtures — Material specifications — Part 20: Type Testing*
- EN 13108-21, *Bituminous mixtures — Material specifications — Part 21: Factory Production Control*

Annex A (normative) details the calculation of the penetration or the softening point in mixtures containing reclaimed asphalt from the penetrations or softening points of the added binder and the recovered binder from the reclaimed asphalt.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria,

Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

The aim of this European Standard is to enable specification of Asphalt for Ultra-Thin Layers (AUTL) mixtures on a performance basis. In general, however, there are currently more empirical tests available to describe the mixtures. Depending on the experience with the combination of requirements in this European standard more or less degrees of freedom for the producer may be given.

This European Standard covers a large variety of materials for different applications, traffic and climate conditions. EN 13108-9 gives properties and listings of possible categories. It has to accommodate the road industry for all of Europe. For this reason the menu approach for properties has been chosen. The tables represent categories that are required all over Europe. For this reason numerical values in tables do not always obey statistical rules. Based on conditions of use specific properties and categories may be defined in documents related to the application of the product. The categories defined in those documents need to take into account the reproducibility of the test when this is given in the appropriate test method.

Care should be taken to only select those tests which are relevant to the application of the asphalt and the use of the pavement and to avoid a combination of potentially conflicting requirements.

1 Scope

This European Standard specifies requirements of Asphalt for Ultra-Thin-Layers (AUTL) for use on roads, airfields and other trafficked areas.

AUTL is a hot mix asphalt road surface course laid on a bonding layer, at a nominal thickness between 10 mm and 20 mm with properties suitable for the intended use. The method of bonding is an essential part of the process and the final product is a combination of the bonding system and the bituminous mixture. The method of bonding of AUTL is out of the scope of this European Standard. Mixtures utilizing bitumen emulsion and bituminous materials based on *in situ* recycling are not covered by this standard.

This European Standard includes requirements for the selection of the constituent materials. It is designed to be read in conjunction with EN 13108-20 and EN 13108-21.

2 Normative references

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

EN 1097-6:2013, *Tests for mechanical and physical properties of aggregates — Part 6: Determination of particle density and water absorption*

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

EN 1427, *Bitumen and bituminous binders — Determination of the softening point — Ring and Ball method*

EN 12591, *Bitumen and bituminous binders — Specifications for paving grade bitumens*

EN 12697 (all parts), *Bituminous mixtures — Test methods for hot mix asphalt*

EN 13043, *Aggregates for bituminous mixtures and surface treatments for roads, airfields and other trafficked areas*

EN 13108-4:2016, *Bituminous mixtures — Material specifications — Part 4: Hot Rolled Asphalt*

EN 13108-8, *Bituminous mixtures — Material specifications — Part 8: Reclaimed asphalt*

EN 13108-20:2016, *Bituminous mixtures — Material specifications — Part 20: Type Testing*

EN 13108-21, *Bituminous mixtures — Material specifications — Part 21: Factory Production Control*

EN 13501-1:2007+A1:2009, *Fire classification of construction products and building elements — Part 1: Classification using data from reaction to fire tests*

EN 13924-2, *Bitumen and bituminous binders — Specification framework for special paving grade bitumen — Part 2: Multigrade paving grade bitumens*

EN 14023, *Bitumen and bituminous binders — Specification framework for polymer modified bitumens*

EN ISO 11925-2, *Reaction to fire tests — Ignitability of products subjected to direct impingement of flame — Part 2: Single-flame source test (ISO 11925-2)*

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

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

3.1.1

pavement

structure, composed of one or more courses, to assist the passage of traffic over terrain

3.1.2

layer

element of a pavement laid in a single operation

3.1.3

course

element of a pavement constructed with a single material

Note 1 to entry: A course may be laid in one or more layers.

3.1.4

surface course

upper course of the pavement, which is in contact with the traffic

3.1.5

binder course

structural course of the pavement between the surface course and the base

3.1.6

regulating course

course of variable thickness applied to an existing course or surface to provide the necessary profile for a further course of consistent thickness

3.1.7

base

main structural element of a pavement

Note 1 to entry: The base can be laid in one or more courses, described as "upper" base, "lower" base.

3.1.8

asphalt

homogenous mixture of coarse and fine aggregates, filler aggregate and bituminous binder which is used in the construction of pavement layers

Note 1 to entry: Asphalt can include one or more additives to enhance the laying characteristics, performance or appearance of the mixture.

3.1.9

natural asphalt

naturally occurring mixture of bitumen and finely divided mineral matter which is found in well-defined surface deposits and which is processed to remove unwanted components such as water and vegetable matter

Note 1 to entry: Natural asphalt is described in EN 13108-4.

3.1.10

Asphalt for Ultra-thin layers

AUTL

asphalt for surface courses with a thickness of 10 mm to 20 mm, in which the aggregate particles are generally gap-graded to form a stone to stone contact and to provide an open surface texture

3.1.11

mix formulation

composition of a single mixture expressed as a target composition

Note 1 to entry: A target composition is expressed in one of two ways (see 3.1.12 and 3.1.13).

3.1.12

input target composition

expression of a mix formulation in terms of the constituent materials, the grading curve and the percentage of bitumen added to the mixture

Note 1 to entry: This will usually be the result of a laboratory mix design and validation.

3.1.13

output target composition

expression of a mix formulation in terms of the constituent materials and the mid-point grading and soluble binder content to be found on analysis

Note 1 to entry: This will usually be the result of a production validation.

3.1.14

additive

constituent material that can be added in small to influence specific properties of the mixture

Note 1 to entry: For example additives are used to influence the affinity of binder to aggregate, and the mechanical properties when using inorganic and organic fibres and polymers. They are also used to influence the colour of the mixture.

3.1.15

conflicting requirements

combination of requirements or properties, which are impracticable to fulfil in their entirety

Note 1 to entry: This can occur by combining specific requirements for the composition and constituent materials together with more performance related tests. These are also relevant when two or more performances or test parameters are selected which measure similar properties using conflicting test methods resulting in a lack of clarity and consistency in the characteristics of the mixture.

3.1.16

premixed binder

bitumen which is blended on the site of the asphalt mixing plant, with an additive before or during the addition of the binder to the plant mixer, which in the case of a continuous plant, will be before or during the delivery of the binder to the mixing zone of the drier drum

3.1.17

category

defined level of a property of an asphalt mixture

Note 1 to entry: The designation of a category is expressed with a symbol and a numerical value representing the level.

EXAMPLE $B_{\min} 4,0$ means that the minimum binder content shall be 4,0 %.

Note 2 to entry: Defined categories for each property are listed in EN 13108-9.

3.1.18 class

range of levels defined by a minimum and a maximum value

3.2 Symbols and abbreviations

AUTL Asphalt for Ultra-Thin Layers

D the upper sieve size of the aggregate in the mixture, in millimetres (mm).

EXAMPLE AUTL10 50/70:

Asphalt for Ultra-Thin Layer with maximum aggregate size 10 mm, with penetration bitumen 50/70.

4 Requirements for constituent materials

4.1 General

Only constituent materials with established suitability shall be used. For all constituent materials the relevant properties shall be made available.

The establishment of suitability shall result from one or more of the following:

- European Standard;
- European Technical Approval;
- Specifications for materials based on a demonstrable history of satisfactory use in asphalt. Evidence shall be based on research and/or the evidence of satisfactory practical use. In documents related to the application of the product details for the assessment of this proof may be defined.

There can be technical limitations regarding the future recycling possibilities. Also traceability of the nature of constituent materials can affect the potential for future recycling.

4.2 Binder

4.2.1 General

The binder shall be a paving grade bitumen, a modified bitumen, a multigrade bitumen or a blend of one of them with natural asphalt. The paving grade bitumen shall conform to EN 12591, the modified bitumen to EN 14023 and the multigrade bitumen to EN 13924-2. When natural asphalt is used, it shall conform to EN 13108-4:2016, Annex B.

Premix binders that are not covered by EN 12591 or EN 14023 or EN 13924-1 and EN 13924-2 may be used provided that information is given as stated in 4.1, and that the base bitumen is conforming to EN 12591, EN 14023 or EN 13924-1 and EN 13924-2. The use of these binders may be defined in documents related to the application of the product.

4.2.2 Selection of binder

4.2.2.1 General

Depending on the conditions of use, the grade of the bitumen, the type and grade of modified bitumen and the amount and category of natural asphalt may be defined in documents related to the application of the product.

The type and grade of bitumen and the amount and category of natural asphalt shall be declared in the Type Test report.

NOTE EN 14023 for modified bitumen is a framework for classification and is only meant to characterize the modified bitumen. The modified bitumen specifications are not performance based. The same applies to multigrade bitumen according to EN 13924-2.

When an additive is used to lower the production temperature for Asphalt for Ultra-Thin Layers (AUTL) that influences the properties of the binder changing the properties of the mix not covered by the specifications in the standard, additional proof shall be provided. This proof shall be delivered through investigation using standards in the EN 12697 series, what the influence of the additive is on the performance of the Asphalt for Ultra-Thin Layers (AUTL). The proof may be based on research or evidence of satisfactory performance according to 4.1.

4.2.2.2 Surface courses with reclaimed asphalt

When using more than 10 % by mass of the total mixture of reclaimed asphalt from mixtures in which only paving grade bitumen has been used and when the binder added to the mixture is a paving grade bitumen and the grade of the bitumen is selected, the following requirements may be defined in documents related to the application of the product.

The penetration and/or the softening point of the binder in the resulting mixture, calculated from the penetrations and/or the softening points of the added binder and the recovered binder from the reclaimed asphalt, shall meet the penetration and/or softening point requirements of the specified grade. The calculation shall be performed according to the methods described in Annex A (normative). In some cases the binder of the reclaimed asphalt can be so hardened that a very soft bitumen shall be chosen to fulfil these requirements. In such cases an alternative grade to that calculated according to Annex A (normative) may be defined.

When using reclaimed asphalt from mixtures in which a modified bitumen and/or an additive has been used, and/or the mixture itself contains a modified bitumen or an additive, the amount of reclaimed asphalt may be limited to a maximum of 10 % by mass of the total mixture.

NOTE 1 The choice for this specification depends on the choice of requirements within this European Standard. For more performance designed mixes there might be no need to apply the pen and/or softening point rule. However, the pen or softening point rule is only valid for paving grade bitumen.

NOTE 2 When applying a recipe approach to the mixture using a too great a proportion of modified bitumen or additive could lead to an incorrect decision in respect to the addition of the new bitumen.

4.3 Aggregates

4.3.1 Coarse aggregate

Coarse aggregate shall conform to EN 13043 as appropriate for the intended use.

4.3.2 Fine aggregate

Fine aggregate shall conform to EN 13043 as appropriate for the intended use.

4.3.3 All-in aggregates

All-in aggregate shall conform to EN 13043 as appropriate for the intended use.

4.3.4 Added filler

Added filler shall conform to EN 13043 as appropriate for the intended use and may include materials such as cement, limestone and hydrated lime. Based on the experience in the place of use the type and amount of added filler may be defined in documents related to the application of the product.

NOTE The expression “as appropriate for the intended use” in 4.3.1 to 4.3.4 means that the selection of the requirements and the particular category depends on a number of conditions. These conditions include traffic density, climatic conditions, the construction of the course in which the mixture will be used, and economic considerations.

4.4 Reclaimed asphalt

The use and the amount of reclaimed asphalt and the mix group, and/or the courses from which the reclaimed asphalt has been or will be derived may be defined in documents related to the application of the product. In general the use of reclaimed asphalt will not be allowed due to the compulsory gap graded grading of the mixture, which is difficult to control with reclaimed asphalt.

The properties of reclaimed asphalt declared in accordance with EN 13108-8 shall conform to the requirements that may be selected appropriate for the intended use.

NOTE The expression “appropriate for the intended use” means that the selection of the requirements and the particular category depends on a number of conditions. These conditions include traffic density, climatic conditions, the construction of the course in which the mixture will be used, and economic considerations.

The upper sieve size D of the aggregate in the reclaimed asphalt shall not exceed the upper sieve size D of the mixture. The aggregate properties of the reclaimed asphalt or of the mixed aggregates from the reclaimed asphalt with the other aggregates shall fulfil the requirements for aggregate defined in documents related to the application of the mixture.

When required, the amount of reclaimed asphalt, the mix group and /or the courses from which the reclaimed asphalt has been or will be derived shall be declared in the Type Test report.

4.5 Additives

The nature and properties of all additives shall be declared and they shall conform to requirements referred to in 4.1. For specific applications and based on the experience in the place of use the amount of additives may be may be defined in documents related to the application of the product.

NOTE Chemical and organic additives can be used for example, to reduce production temperatures by influencing the viscosity of the binder. This might have an effect on other relevant mixture properties.

5 Requirements for the mixture

5.1 General

The mix formulation shall be declared in the Type Test report according to EN 13108-20, including:

- The target percentages passing the specified sieves. The target grading shall be declared for the sieve $1,4 D$ and the sieves as called up in Table 1, 2 or 3;
- the target binder content and where relevant, the binder content from reclaimed asphalt and/or binder content in natural asphalt;

- the percentage(s) of additive(s).

The target binder content comprises the total of added binder (including any additives in solution in the binder), binder in reclaimed asphalt and binder in natural asphalt.

At the target composition the mixture shall conform to the appropriate requirements in accordance with this European standard.

The test results in accordance with EN 13108-20:2016, 7.5, shall be made available.

5.2 Composition, grading, binder content

5.2.1 Composition

The grading shall be expressed in percentages by mass of total aggregate. The binder and additive content shall be expressed in percentages by mass of total mixture. The percentages passing the sieves, with exception of the sieve 0,063 mm shall be expressed to 1 %. The binder content, the percentage passing sieve 0,063 and any additive content shall be expressed to 0,1 %. Where appropriate the additive content shall be expressed to 0,01 %.

The angularity of the fine aggregates to be used and their ratio may be selected.

5.2.2 Grading

5.2.2.1 General grading requirements

The requirements for the overall grading are given in Table 1 and Table 2 for the sieves 1,4 D , D , 2 mm, and 0,063 mm.

The sieves to be used shall be either basic sieve set plus set 1 or basic sieve set plus set 2, according to EN 13043. A combination of sieve sizes from set 1 and set 2 shall not be permissible.

In addition the requirements for the grading envelope may include the percentages passing a maximum of 2 additional characteristic sieves between D and 2 mm and one additional characteristic sieve between 2 mm and 0,063 mm.

The target composition of the mix shall be within this grading envelope.

D and the characteristic sieves between D and 2 mm shall be selected from the following sieves:

- basic sieve set plus set 1: 4 mm; 5,6 mm; 8 mm; 11,2 mm;
- basic sieve set plus set 2: 4 mm; 6,3 mm; 8 mm; 10 mm.

The characteristic sieve between 2 mm and 0,063 mm shall be selected from the following sieves: 1 mm; 0,5 mm; 0,25 mm and 0,125 mm.

Table 1 — General grading requirements of target composition — Basic set plus set 1

<i>D</i>	4 or 5,6	8	11,2
Sieve mm	Percentage passing by mass		
1,4 <i>D</i> ^a	98 to 100	98 to 100	98 to 100
<i>D</i>	90 to 100	90 to 100	90 to 100
2	15 to 55	10 to 50	10 to 45
0,063	5,0 to 14,0	5,0 to 14,0	5,0 to 14,0

^a Where the sieve calculated as 1,4 *D* is not an exact number in the basic set plus set 1 series then the next nearest sieve in the set shall be adopted.

Table 2 — General grading requirements of target composition — Basic set plus set 2

<i>D</i>	4 or 6,3	8	10,0
Sieve mm	Percentage passing by mass		
1,4 <i>D</i> ^a	100	100	100
<i>D</i>	90 to 100	90 to 100	90 to 100
2	15 to 55	10 to 50	10 to 45
0,063	5,0 to 14,0	5,0 to 14,0	5,0 to 14,0

^a Where the sieve calculated as 1,4 *D* is not an exact number in the basic set plus set 2 series then the next nearest sieve in the set shall be adopted.

5.2.2.2 Grading envelope

The grading requirements may be defined in documents related to the application of the product. (see 5.6 for conflicting requirements). When required, the ranges between the maximum and minimum values for the grading envelope shall be selected as a single value within the given limits from Table 3.

Table 3 — Ranges between maximum and minimum percentage values for the selected grading envelope

Sieve mm	Ranges for grading envelope
Any additional characteristic sieves between <i>D</i> and 2	5 to 30 ^a
2	5 to 25 ^a
Additional characteristic fine sieve	4 to 20 ^a
0,063	2,0 to 10,0 ^a

^a Value to be selected within the given minimum and maximum value (both included).

In the case of a single point target grading meeting the requirements of Table 1 or Table 2, the use of the minimum range values in Table 3 is not required.

5.2.3 Minimum binder content

The minimum binder content may be defined in documents related to the application of the product and shall be selected to the nearest 0,1 %, between values of 5,0 % and 7,0 % for a mixture in which the aggregate density is assumed to be equal to 2,65 Mg/m³.

The selected minimum binder content shall be expressed as $B_{\min x}$ where x is the minimum binder content in %.

The minimum and maximum binder content of the target composition shall lie between minimum and maximum values selected from the categories in Tables 4 and 5. The minimum binder content of the mixture shall be corrected by multiplying by the factor:

$$\alpha = \frac{2,650}{\rho} \quad (1)$$

where

ρ is the weighted mean of the particle density of the aggregates at the target grading, in mega grams per cubic metre (Mg/m³), determined according to the appropriate clause or annex of EN 1097-6.

The appropriate particle density according to EN 1097-6 shall be declared in the type test report.

NOTE For normal weight aggregates with water absorption less than about 1,5 % the pre-dried particle density method as defined in EN 1097-6:2013, Annex A is applicable for aggregates passing the 63 mm test sieve and retained on the 0,063 mm test sieve. EN 1097-6:2013, Annex G is applicable to aggregates passing the 31,5 mm test sieve including the 0/0,063 mm size fraction.

Based on experience in the place of use for certain specific aggregates with particular granulometric characteristics the corrected minimum binder content may be adjusted appropriately. The adjustment shall be defined in documents related to the application of the product.

5.3 Properties

5.3.1 Specimens

For application of this European Standard specimens shall be in accordance with EN 13108-20:2016, 6.5.

5.3.2 Void content

The range of categories of minimum and maximum void contents is defined in Table 4.

The void content shall be determined in accordance with EN 12697-8 using the conditions defined in EN 13108-20:2016, D.2. The compaction of test specimens shall be selected from EN 13108-20:2016, Table C.1.

In documents related to the application of the product, categories or classes for the voids content may be defined when appropriate as maximum and minimum categories selected from Table 4.

Table 4 — Void content, V_{\min} and/or V_{\max}

Void content %	Minimum void content %	Maximum void content %
	Category V_{\min}	Category V_{\max}
1,5	V_{\min} 1,5	–
2,0	V_{\min} 2,0	
2,5	V_{\min} 2,5	
3,0	V_{\min} 3,0	V_{\max} 3,0
3,5	V_{\min} 3,5	V_{\max} 3,5
4,0	V_{\min} 4,0	V_{\max} 4,0
4,5	V_{\min} 4,5	V_{\max} 4,5
5,0	V_{\min} 5,0	V_{\max} 5,0
5,5	V_{\min} 5,5	V_{\max} 5,5
6,0	V_{\min} 6,0	V_{\max} 6,0
7,0	V_{\min} 7,0	V_{\max} 7,0
8,0	V_{\min} 8,0	V_{\max} 8,0
9,0	V_{\min} 9,0	V_{\max} 9,0
10,0	V_{\min} 10,0	V_{\max} 10,0
11,0	V_{\min} 11,0	V_{\max} 11,0
12,0	V_{\min} 12,0	V_{\max} 12,0
13,0	–	V_{\max} 13,0
14,0	–	V_{\max} 14,0
15,0		V_{\max} 15,0
16,0		V_{\max} 16,0
17,0		V_{\max} 17,0
18,0		V_{\max} 18,0
19,0		V_{\max} 19,0
20,0		V_{\max} 20,0
No requirement	V_{\min} NR	V_{\max} NR

5.3.3 Water sensitivity

The water sensitivity expressed as an Indirect Tensile Strength Ratio or Compression Strength Ratio shall be determined in accordance with EN 12697-12 using the conditions defined in EN 13108-20:2016, D.3.

The range of categories of water sensitivity of specimens is defined in Table 5.

In documents related to the application of the product, categories for the minimum water sensitivity selected from Table 5 may be defined.

Table 5 — Minimum water sensitivity, $ITSR_{min}$ or i/C_{min}

Minimum water sensitivity	Category $ITSR_{min}$	Category i/C_{min}
95	$ITSR_{min95}$	i/C_{min95}
90	$ITSR_{min90}$	i/C_{min90}
85	$ITSR_{min85}$	i/C_{min85}
80	$ITSR_{min80}$	i/C_{min80}
75	$ITSR_{min75}$	i/C_{min75}
No requirement	$ITSR_{minNR}$	i/C_{minNR}

5.3.4 Low temperature properties

The maximum failure temperature shall be determined in accordance with EN 12697-46 using the conditions defined in EN 13108-20:2016, D.18.

The compaction of test specimens shall be selected from EN 13108-20:2016, Table C.1 where the range between the upper and lower limits selected shall be 2 % based on compaction degree and 3 % based on void content.

The void content of the specimens shall be specified in accordance with EN 13108-20:2016, D.2.

The range of categories of maximum failure temperature of specimens is defined in Table 6.

In documents related to the application of the product categories for the maximum failure temperature selected from Table 6 may be defined.

Table 6 — Maximum failure temperature, $TSRST_{max}$

Maximum failure temperature °C	Category $TSRST_{max}$
-15,0	$TSRST_{max-15,0}$
-17,5	$TSRST_{max-17,5}$
-20,0	$TSRST_{max-20,0}$
-22,5	$TSRST_{max-22,5}$
-25,0	$TSRST_{max-25,0}$
-27,5	$TSRST_{max-27,5}$
-30,0	$TSRST_{max-30,0}$
No requirement	$TSRST_{maxNR}$

5.3.5 Friction after polishing

The minimum friction after polishing shall be determined in accordance with EN 12697-49 using the conditions defined in EN 13108-20:2016, D.20.

The compaction of test specimens shall be selected from EN 13108-20:2016, Table C.1, where the range between the upper and lower limits selected shall be 2 % based on compaction degree and 3 % based on void content.

The void content of the specimens shall be specified in accordance with EN 13108-20:2016, D.2.

The range of categories of minimum friction after polishing of specimens is defined in Table 7.

In documents related to the application of the product categories for the minimum friction after polishing selected from Table 7 may be defined.

Table 7 — Minimum friction after polishing, FAP_{min}

Minimum friction after polishing	Category FAP_{min}
0,30	FAP_{min30}
0,32	FAP_{min32}
0,34	FAP_{min34}
0,36	FAP_{min36}
0,38	FAP_{min38}
0,40	FAP_{min40}
0,42	FAP_{min42}
0,44	FAP_{min44}
0,46	FAP_{min46}
0,48	FAP_{min48}
0,50	FAP_{min50}
No requirement	FAP_{minNR}

5.3.6 Coating and homogeneity

The material when discharged from the mixer shall be homogenous in appearance with the aggregate completely coated with binder, and there shall be no evidence of balling of fine aggregate.

5.3.7 Reaction to fire

Where subject to regulation, the manufacturer shall declare the reaction to fire class according to EN 13501-1:2007+A1:2009, Table 2, according to the test method EN ISO 11925-2.

5.3.8 Resistance to fuel for application on airfields

The resistance to fuel shall be determined according EN 12697-43 using the conditions defined in EN 13108-20:2016, D.11

The compaction of test specimens shall be selected from EN 13108-20:2016, Table C.1 where the range between the upper and lower limits selected shall be 2 % based on compaction degree and 3 % based on void content.

The range of categories of resistance to fuel of specimens is defined in Table 8.

In documents related to the application of the product categories for the minimum resistance to fuel selected from Table 8 may be defined.

Table 8 — Resistance to fuel, maximum loss of mass, $C_{i\max}$

Resistance to fuel, maximum loss of mass %	Category $C_{i\max}$
1	$C_{i\max1}$
2	$C_{i\max2}$
3	$C_{i\max3}$
4	$C_{i\max4}$
5	$C_{i\max5}$
6	$C_{i\max6}$
7	$C_{i\max7}$
8	$C_{i\max8}$
No requirement	$C_{i\maxNR}$

5.3.9 Resistance to de-icing fluid for application on airfields

The resistance to de-icing fluids shall be determined according EN 12697-41 using the conditions defined in EN 13108-20:2016, D.12.

The compaction of test specimens shall be selected from EN 13108-20:2016, Table C.1, where the range between the upper and lower limits selected shall be 2 % based on compaction degree and 3 % based on void content.

The range of categories of resistance to de-icing fluid of specimens is defined in Table 9.

In documents related to the application of the product categories for the minimum retained strength selected from Table 9 may be defined.

Table 9 — Minimum retained strength, β_{\min}

Minimum retained strength %	Category β_{\min}
100	$\beta_{\min100}$
85	$\beta_{\min85}$
70	$\beta_{\min70}$
55	$\beta_{\min55}$
No requirement	β_{\minNR}

5.4 Temperature of the mixture

The maximum temperature requirements are intended to protect the integrity of the mixture. The maximum temperature applies at any place in the plant and shall be declared.

When using paving grade binder, the maximum temperature, measured according to EN 12697-13, shall not exceed the limits given in Table 10.

Table 10 — Maximum temperature of the mixture

Paving grade bitumen	Temperature °C
20/30	200
30/45	195
35/50,40/60	190
50/70,70/100	180
100/150	170
160/220	165
250/330	160
330/430	155

When using modified bitumen, multigrade bitumen, additives or premix bitumen, different temperatures may be applicable. These shall then be documented and declared.

The minimum temperature of the mixture at delivery shall be declared. Depending on local conditions and for specific application the minimum temperature, measured according to EN 12697-13, may be defined in documents related to the application of the product.

5.5 Regulated dangerous substances

When required, products covered by this European Standard shall comply with relevant regulations on dangerous substances in force in the intended place of use.

In the absence of International or European test methods, manufacturers shall verify and declare the release of regulated dangerous substances in accordance with provisions applicable in the intended place of use of the product.

NOTE An informative database of European and national regulations on regulated dangerous substances is available at the Construction website on EUROPA (accessed through <http://ec.europa.eu/enterprise/construction/cpd-ds>).

5.6 Conflicting requirements

The overall quality of an Asphalt for Ultra-Thin Layers (AUTL) mixture can be covered by different combinations of requirements. The selection of requirements and the appropriate values shall be selected in such a way that conflicting requirement is prevented.

To prevent conflicting requirements of mixtures the following combinations are not permissible:

- Requirements for resistance to polishing of coarse aggregates according to EN 13043 shall not be combined with requirements for the friction after polishing of the mixture (5.3.5).

6 Assessment and verification of constancy of performance — AVCP

The compliance of Asphalt for Ultra-Thin Layers (AUTL) with the requirements of this European Standard and with the performances declared by the manufacturer in the Declaration of Performance (DoP) shall be demonstrated by

- determination of the product type in accordance with EN 13108-20;
- Factory Production Control by the manufacturer, including product assessment in accordance with EN 13108-21.

The result of the product type determination will, for each relevant requirement, be expressed as a numerical value. The numerical value may be presented as a category as given in the standard, a class or a value declared by the manufacturer.

The manufacturer shall always retain the overall control and shall have the necessary means to take responsibility for the conformity of the product with its declared performance(s).

For the purpose of Type Testing, Asphalt for Ultra-Thin Layers may be grouped into families as described in EN 13108-20 where it is considered that the selected property or properties is or are common to all the mixtures within that family.

7 Identification

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

- manufacturer and mixing plant;
- mix identification code;
- how to obtain the full details demonstrating conformity with this European Standard;
- designation of the mixture

AUTL	<i>D</i>	binder
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where

AUTL is the Asphalt for Ultra-Thin Layers;

D is the upper aggregate size;

binder designation of binder category in the final product

EXAMPLE AUTL10 50/70:

Asphalt for Ultra-Thin Layer with maximum aggregate size 10 mm, with penetration bitumen 50/70

NOTE Information concerning regulatory marking accompanies the product but characteristics which are not necessarily part of regulatory marking, for example, special requirements for airfields could be made available by alternative means.

Annex A (normative)

Calculations of the penetration or the softening point of the binder of a mixture when reclaimed asphalt is used

A.1 General

These calculations shall be applied when paving grade bitumen has been used in the reclaimed asphalt and will be used as added binder.

A.2 Calculation of the penetration of the binder of a mixture

Use the following calculation:

$$a \lg pen_1 + b \lg pen_2 = (a + b) \lg pen_{mix} \quad (A.1)$$

where

- pen_{mix} is the calculated penetration of the binder in the mixture containing reclaimed asphalt;
- pen_1 is the penetration of the binder recovered from the reclaimed asphalt;
- pen_2 is the penetration of the added binder;
- a and b are the portions by mass of the binder from the reclaimed asphalt (a) and from the added binder (b) in the mixture; $a + b = 1$.

EXAMPLE $pen_1 = 20$; $pen_2 = 90$; $a = 0,25$ and $b = 0,75$

$$0,25 \lg 20 + 0,75 \lg 90 = \lg pen_{mix}$$

$$\lg pen_{mix} = 1,79094; \text{ therefore } pen_{mix} = 62$$

The recovery of binder from mixtures for testing shall be performed according to EN 12697-3 or EN 12697-4.

The penetrations of the added binder and the recovered binder shall be determined according to EN 1426.

A.3 Calculation of the softening point of the binder of a mixture

Use the following calculation:

$$T_{R\&B\ mix} = a \times T_{R\&B1} + b \times T_{R\&B2} \quad (A.2)$$

where

- $T_{R\&B\ mix}$ is the calculated softening point of the binder in the mixture containing reclaimed asphalt;

- $T_{R\&B1}$ is the softening point of the binder recovered from the reclaimed asphalt;
- $T_{R\&B2}$ is the softening point of the added binder;
- a and b are the portions by mass of binder from the reclaimed asphalt (a) and from the added binder (b) in the mixture; $a + b = 1$.

EXAMPLE $T_{R\&B1} = 62\text{ °C}$; $T_{R\&B2} = 48\text{ °C}$; $a = 0,25$ and $b = 0,75$

$$T_{R\&B\text{ mix}} = 0,25 \times 62 + 0,75 \times 48 = 51,5\text{ °C}$$

The softening points of the added binder and the recovered binder shall be determined according to EN 1427.

Annex ZA (informative)

Relationship of this European Standard with Regulation (EU) No. 305/2011

(When applying this standard as a harmonized standard under Regulation (EU) No. 305/2011, manufacturers and Member States are obliged by this regulation to use this annex.)

ZA.1 Scope and relevant characteristics

This European Standard has been prepared under standardization request M124 Road Construction given to CEN and CENELEC by the European Commission (EC) and the European Free Trade Association (EFTA).

When this European Standard is cited in the Official Journal of the European Union (OJEU), under Regulation (EU) No. 305/2011, it shall be possible to use it as a basis for the establishment of the Declaration of Performance (DoP) and the CE marking, from the date of the beginning of the co-existence period as specified in the OJEU.

Regulation (EU) No. 305/2011, as amended, contains provisions for the DoP and the CE marking.

Table ZA.1 — Relevant clauses for Asphalt for Ultra-Thin Layers (AUTL) for surface courses of roads, airfields, and other trafficked areas, whether subject or not to reaction to fire regulations

Product: Asphalt for Ultra-Thin Layers (AUTL) as covered in the Scope of this European Standard			
Intended use: For surface courses of roads, airfields, and other trafficked areas, whether subject or not to reaction to fire regulations			
Essential Characteristics	Requirement clauses in this and other European Standard(s)	Classes and/or threshold levels	Notes
Adhesion of binder to aggregate	5.2.3 Target binder content	–	Declared value
	5.3.2 Void content	–	Declared minimum or maximum categories, class or numerical value
	5.3.3 Water sensitivity	–	Declared minimum categories or numerical values
	5.4 Temperature of the mixture	–	Declared values
Skid resistance	5.2.2 Target grading	–	Declared values
	5.2.3 Target binder content	–	Declared value
	5.3.2 Void content	–	Declared minimum or maximum categories, class or numerical value
	5.3.5 Friction After Polishing		Declared minimum category or numerical value
Resistance to abrasion	5.2.2 Target grading	–	Declared value
	5.2.3 Target binder content	–	Declared value
Reaction to fire ^a	5.3.6 Fire class	A1 _{fl} to F _{fl}	Declared class
Durability of the above characteristics against ageing, weathering, oxidation, wear, ravelling, chemicals, wear of studded tyres, stripping, ... as relevant	All above mentioned requirement clauses are related to durability.		
	5.3.4 Low temperature properties	–	Declared categories
	5.3.8 Resistance to fuel for application on airfields	–	Declared categories
	5.3.9 Resistance to de-icing fluids for application on airfields	–	Declared categories
^a Relevant only for Asphalt for Ultra-Thin Layers intended for uses subject to reaction to fire regulations.			

ZA.2 System of Assessment and Verification of Constancy of Performance (AVCP)

The AVCP systems of Asphalt for Ultra-Thin Layers (AUTL) indicated in Table ZA.1, can be found in the EC legal acts adopted by the EC decision 1998/601/EC of 13 October 1998 (OJ L 287; p. 41) amended by the Commission decision 2001/596/EC of 8 January 2001 (OJ L 209; p. 33).

Micro-enterprises are allowed to treat products under AVCP system 3 covered by this standard in accordance with AVCP system 4, applying this simplified procedure with its conditions, as foreseen in Article 37 of Regulation (EU) No. 305/2011.

ZA.3 Assignment of AVCP tasks

The AVCP systems of Asphalt for Ultra-Thin Layers (AUTL) as provided in Table ZA.1 are defined in Tables ZA.3.1 to ZA.3.3 resulting from application of the clauses of this or other European Standards indicated therein. The content of the tasks assigned to the notified body shall be limited to those essential characteristics, if any, as provided for in Annex III of the relevant standardization request and to those that the manufacturer intends to declare.

Taking into account the AVCP systems defined for the products and the intended uses the following tasks are to be undertaken by the manufacturer and the notified body respectively for the assessment and verification of the constancy of performance of the product.

Table ZA.3.1 — Assignment of AVCP tasks for Asphalt for Ultra-Thin Layers (AUTL) under system 2+ and subject to reaction to fire under system 1

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to essential characteristics of Table ZA.1 relevant for the intended use which are declared	EN 13108-21
	Determination of the product-type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product	Parameters related to essential characteristics of Table ZA.1 relevant for the intended use which are declared except reaction to fire	EN 13108-20
	Further testing of samples taken at factory according to the prescribed test plan	Essential characteristics of Table ZA.1 relevant for the intended use which are declared	EN 13108-21
Tasks for the notified product certification body	Determination of the product type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product	Reaction to fire	EN 13501-11:2007+A1:2009, Table 2 and EN ISO 11925-2
	Initial inspection of manufacturing plant and of FPC	Parameters related to essential characteristic of Table ZA.1, relevant for the intended use which is declared, namely reaction to fire. Documentation of the FPC.	EN 13108-21
	Continuous surveillance, assessment and evaluation of FPC	Parameters related to essential characteristic of Table ZA.1, relevant for the intended use which is declared, namely reaction to fire. Documentation of FPC	EN 13108-21

Tasks for the notified production control certification body	Initial inspection of the manufacturing plant and of FPC	Parameters related to essential characteristics of Table ZA.1, relevant for the intended use which is declared, except reaction to fire. Documentation of the FPC.	EN 13108-21
	Continuous surveillance, assessment and evaluation of FPC	Parameters related to essential characteristics of Table ZA.1, relevant for the intended use which is declared, except reaction to fire. Documentation of the FPC.	EN 13108-21

Table ZA.3.2 — Assignment of AVCP tasks for Asphalt for Ultra-Thin Layers (AUTL) under system 2+ and subject to reaction to fire under system 3

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to essential characteristics of Table ZA.1 relevant for the intended use which are declared	EN 13108-21
	Determination of the product-type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product	Parameters related to essential characteristics of Table ZA.1 relevant for the intended use which are declared except reaction to fire	EN 13108-20
	Further testing of samples taken at factory according to the prescribed test plan	Essential characteristics of Table ZA.1 relevant for the intended use which are declared	EN 13108-21
Tasks for a notified testing laboratory	Determination of the product-type on the basis of type testing (based on sampling carried out by the manufacturer), type calculation, tabulated values or descriptive documentation of the product	Reaction to fire	EN 13501-11:2007+A1:2009, Table 2 and EN ISO 11925-2
Tasks for the notified production control certification body	Initial inspection of the manufacturing plant and of FPC	Parameters related to essential characteristics of Table ZA.1, relevant for the intended use which is declared. Documentation of the FPC.	EN 13108-21
	Continuous surveillance, assessment and evaluation of FPC	Parameters related to essential characteristics of Table ZA.1, relevant for the intended use which is declared. Documentation of the FPC.	EN 13108-21

Table ZA.3.3 — Assignment of AVCP tasks for Asphalt for Ultra-Thin Layers (AUTL) under system 2+ and subject to reaction to fire under system 4

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to essential characteristics of Table ZA.1 relevant for the intended use which is declared	EN 13108-21
	determination of the product-type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product	Parameters related to essential characteristics of Table ZA.1 relevant for the intended use which is declared	EN 13108-20
	Further testing of samples taken at factory according to the prescribed test plan	Essential characteristics of Table ZA.1 relevant for the intended use which is declared	EN 13108-21
Tasks for the notified production control certification body	Initial inspection of the manufacturing plant and of FPC	Parameters related to essential characteristics of Table ZA.1, relevant for the intended use which is declared. Documentation of the FPC.	EN 13108-21
	Continuous surveillance, assessment and evaluation of FPC	Parameters related to essential characteristics of Table ZA.1, relevant for the intended use which is declared. Documentation of the FPC.	EN 13108-21

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