

Bitumen and bituminous binders — Specifications for paving grade bitumens

ICS 91.100.50; 93.080.20

National Foreword

This British Standard is the UK implementation of EN 12591:2009. It supersedes BS EN 12591:2000 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee B/510, Road materials, to Subcommittee B/510/19, Bitumen and related products.

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

This Standard is a revision of BS EN 12591:2000 and incorporates the principle changes outlined below:

- further harmonization of the original standard;
- inclusion of Evaluation of Conformity and CE marking (presently voluntary in the UK);
- the properties of paving grade bitumens 20/30 pen through to 160/220 pen are now specified in Table 1A;
- paving grade bitumen 250/330 pen is now specified in Table 2A;
- addition of Table 3A for soft bitumens, however, these grades are not used in the UK.

In the tables, properties are subdivided into two groups as follows:

1. The properties in Table 1A, Table 2A and Table 3A are specified for all paving grade bitumens listed in each table. They are associated with regulatory or safety requirements. Furthermore, two severity levels for resistance to hardening are stated as alternatives in Table 1A.
2. The properties in Table 1B, Table 2B and Table 3B are required to meet specific regional requirements. They are associated with regulatory or other regional requirements.

Guidance for users on the implementation of BS EN 12591:2009 for paving grade bitumens for use in the construction and maintenance of roads and airfields in the UK is included in National Annex NA (informative).

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

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

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**Bitumen and bituminous binders - Specifications for paving
grade bitumens**

Bitumes et liants bitumineux - Spécifications des bitumes
routiers

Bitumen und bitumenhaltige Bindemittel - Anforderungen
an Straßenbaubitumen

This European Standard was approved by CEN on 14 March 2009.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

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Contents

Page

Foreword.....	3
Introduction	4
1 Scope	5
2 Normative references	5
3 Terms and definitions	6
4 Sampling	6
5 Requirements and test methods	6
6 Evaluation of conformity.....	14
Annex A (normative) Calculation of the penetration index, I_p	17
Annex B (informative) Complementary information on grade selection	19
Annex ZA (informative) Clauses of this European Standard addressing the provisions of the EU Construction Products Directive.....	20
Bibliography	29

Foreword

This document (EN 12591:2009) has been prepared by Technical Committee CEN/TC 336 “Bituminous binders”, 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 October 2009, and conflicting national standards shall be withdrawn at the latest by October 2009.

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.

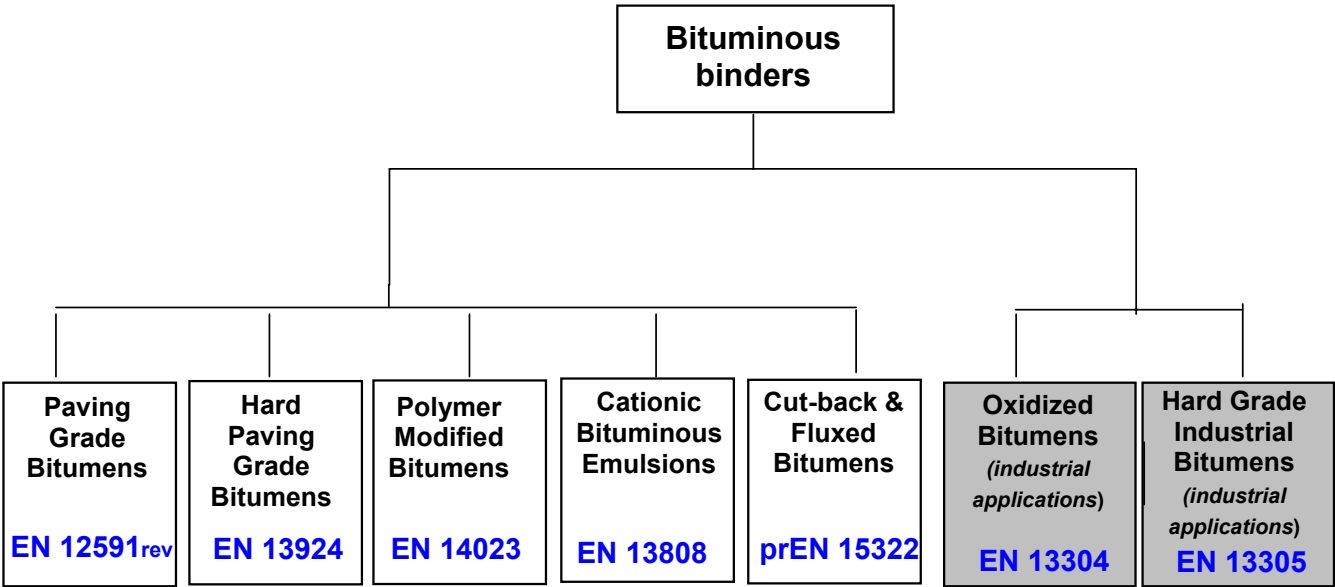
This document supersedes EN 12591:1999.

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 EU Construction Product Directive (89/106/EEC).

For relationship with EU Construction Product Directive (89/106/EEC), see informative Annex ZA, which is an integral part of this document.

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

This European Standard is part of a family of European Standards for bitumen as follows:



NOTE Industrial applications are not covered by mandate M/124.

Introduction

This European Standard describes the performance required for a number of properties of bitumen and bituminous binders, as shown in Table 1 to Table 3 inclusive. Some of the properties are required by regulation in at least one EU or EFTA country (see Table ZA.1.1 and Table ZA.1.2) and some are included only for the benefit of industry to assist specifying appropriate performances for different end uses.

For paving grade bitumen, the testing of the following also gives an indication that its intrinsic cohesive properties are adequate for normal use.

- a) Consistency at intermediate service temperature;
- b) Consistency at elevated service temperature;
- c) Durability of consistency.

The properties of "adhesion" and "setting ability" are indicated by tests used on either the finished asphalt mixtures or on aggregate-bitumen combinations, i.e. EN 12697-1, EN 12697-11, EN 12697-12, EN 12697-26 [1 to 4], rather than tests on the bitumen itself.

This European Standard still consists of specifications based upon traditional test methods. Work programs are being undertaken to evaluate alternative properties and test methods in order to develop new specifications that are more directly performance-related. The progress of those work programmes are reported in CEN/TR 15352 [17], and the results will be considered for future revisions of this European Standard.

1 Scope

This European Standard provides a framework for specifying a range of properties and relevant test methods for bitumens, which are suitable for use in the construction and maintenance of roads, airfields and other paved areas, together with requirements for evaluation of conformity.

This European Standard does not directly address 'cohesion, adhesion and setting ability' (see Introduction).

NOTE Although industrial bitumens are specified according to EN 13305, it should be underlined that paving grade bitumens, specified according to this European Standard, can also be used for industrial applications.

2 Normative references

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

EN 58, *Bitumen and bituminous binders – Sampling bituminous binders*

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 12592, *Bitumen and bituminous binders – Determination of solubility*

EN 12593, *Bitumen and bituminous binders – Determination of the Fraass breaking point*

EN 12594, *Bitumen and bituminous binders – Preparation of test samples*

EN 12595, *Bitumen and bituminous binders – Determination of kinematic viscosity*

EN 12596, *Bitumen and bituminous binders – Determination of dynamic viscosity by vacuum capillary*

EN 12597, *Bitumen and bituminous binders – Terminology*

EN 12607-1, *Bitumen and bituminous binders – Determination of the resistance to hardening under the influence of heat and air – Part 1: RTFOT method*

EN 12607-2, *Bitumen and bituminous binders – Determination of the resistance to hardening under the influence of heat and air – Part 2: TFOT method*

EN 15326, *Bitumen and bituminous binders – Measurement of density and specific gravity – Capillary-stoppered pycnometer method*

EN ISO 2592, *Determination of flash and fire points – Cleveland open cup method (ISO 2592:2000)*

EN ISO 2719, *Determination of flash point – Pensky-Martens closed cup method (ISO 2719:2002)*

EN ISO 4259, *Petroleum products – Determination and application of precision data in relation to methods of test (ISO 4259:2006)*

EN ISO 9001:2000, *Quality management systems – Requirements (ISO 9001:2000)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12597:2000 apply.

4 Sampling

Samples of bulk products shall be taken as described in EN 58.

Test samples shall be taken from the laboratory samples, and prepared for testing, as described in EN 12594.

5 Requirements and test methods

5.1 General

European product standards cover a large variety of road materials for different applications, to accommodate local traffic loads and climatic conditions. This European Standard therefore also covers a large range of bitumens to facilitate the production and application of the designed paving. The variety of production techniques and applications makes it more practical to split bitumens into three separate tables.

The requirements for the properties for a specific grade shall be selected from Table 1A, Table 1B, Table 2A, Table 2B, Table 3A and Table 3B by choosing a column representing the specified values or ranges.

There is a subdivision of properties into two groups in the tables. The properties in Table 1A, Table 2A and Table 3A shall be specified for all paving grade bitumens. They are associated with regulatory or HSE requirements. The properties in Table 1B, Table 2B and Table 3B are required to meet specific regional conditions. They are associated with regulatory or other regional requirements.

Two severity levels for resistance to hardening are stated as alternatives as, under specific conditions, a larger increase in softening point after Rolling Thin Film Oven Test (RTFOT) may be allowed (i.e. Severity level 2) without detrimental effect if this increase is associated with requirements for Fraass breaking point or penetration index (I_p) or both.

NOTE For complementary information on grade selection, see Annex B.

5.2 Properties and related test methods

5.2.1 General

The properties of paving grade bitumens and related test methods shall be in accordance with Table 1A and Table 1B, or Table 2A and Table 2B or Table 3A and Table 3B. When tested by the methods given in the Tables, the various paving grades shall conform to the limits specified.

The grades are designated by the nominal penetration or viscosity ranges as appropriate.

5.2.2 Consistency at intermediate service temperature

Consistency at intermediate service temperature shall conform to the requirements for penetration value in Table 1A or Table 2A.

5.2.3 Consistency at elevated service temperature

Consistency at elevated service temperature shall conform to the requirements for softening point in Table 1A (penetration graded), softening point or dynamic viscosity in Table 2A (penetration graded), or kinematic viscosity in Table 3A (kinematic viscosity graded).

5.2.4 Brittleness at low service temperature

Brittleness at low service temperature may be required to meet specific regional conditions in countries susceptible to extreme cold. Where required, paving grade bitumens shall conform to the requirements for Fraass breaking point in Table 1B or Table 2B.

5.2.5 Temperature dependence of consistency

Temperature dependence of consistency may be required to meet specific regional conditions. Where required, paving grade bitumens shall conform to the requirement for dynamic viscosity or penetration index (I_p) or both in Table 1B.

5.2.6 Durability – Resistance to hardening

Durability is demonstrated by compliance with the required surrogate characteristics of “Resistance to hardening”, defined in Table 1A, Table 2A or Table 3B.

Resistance to hardening shall be tested according to the Rolling Thin Film Oven Test (RTFOT) in accordance with EN 12607-1 for binders from Table 1A and Table 2A.

Resistance to hardening shall be tested according to the Thin Film Oven Test (TFOT) in accordance with EN 12607-2 for binders from Table 3A.

5.2.7 Other properties

5.2.7.1 Density

Although requirements for the density of paving grade bitumens are not given in this document, density shall be determined, when necessary, in accordance with EN 15326.

5.2.7.2 Flash point

Flash point shall be determined by the Cleveland open cup method in EN ISO 2592 for binders in Table 1A and by the Pensky-Martens closed cup method, EN ISO 2719, for binders in Table 2A and Table 3A.

NOTE For bitumens in Table 1A, the Pensky-Martens closed cup method may be used to investigate possible contamination but is likely to give lower values than the Cleveland open cup method.

5.3 Release of dangerous regulated substances

Materials used in products shall not release any dangerous substances in excess of the maximum permitted levels specified in a relevant European Standard for the material or permitted in the national regulations of the member state of destination.

5.4 Precision

The test methods referred to in this document include precision statements when available. In cases of uncertainty, the procedures described in EN ISO 4259 for interpretation of the results based on test method precision shall be used.

**Table 1A — Paving grade bitumen specifications for grades from 20 x 0,1 mm to 220 x 0,1 mm penetration —
Properties applying to all paving grade bitumen listed in this table**

Property	Test method	Unit	20/30	30/45	35/50	40/60	50/70	70/100	100/150	160/220
Penetration at 25 °C	EN 1426	0,1 mm	20 – 30	30 – 45	35 – 50	40 – 60	50 – 70	70 – 100	100 – 150	160 – 220
Softening point	EN 1427	°C	55 – 63	52 – 60	50 – 58	48 – 56	46 – 54	43 – 51	39 – 47	35 – 43
Resistance to hardening at 163 °C	EN 12607-1									
Retained penetration		%	≥ 55	≥ 53	≥ 53	≥ 50	≥ 50	≥ 46	≥ 43	≥ 37
Increase in softening point, - <i>Severity 1</i> <i>or</i> Increase in softening point, - <i>Severity 2</i> ^a		°C	≤ 8 <i>or</i>	≤ 8 <i>or</i>	≤ 8 <i>or</i>	≤ 9 <i>or</i>	≤ 9 <i>or</i>	≤ 9 <i>or</i>	≤ 10 <i>or</i>	≤ 11 <i>or</i>
		°C	≤ 10	≤ 11	≤ 11	≤ 11	≤ 11	≤ 11	≤ 12	≤ 12
Change of mass ^b (absolute value)		%	≤ 0,5	≤ 0,5	≤ 0,5	≤ 0,5	≤ 0,5	≤ 0,8	≤ 0,8	≤ 1,0
Flash point	EN ISO 2592	°C	≥ 240	≥ 240	≥ 240	≥ 230	≥ 230	≥ 230	≥ 230	≥ 220
Solubility	EN 12592	%	≥ 99,0	≥ 99,0	≥ 99,0	≥ 99,0	≥ 99,0	≥ 99,0	≥ 99,0	≥ 99,0
^a When Severity 2 is selected it shall be associated with the requirement for Fraass breaking point or penetration index or both measured on the unaged binder (see Table 1B) ^b Change in mass can be either positive or negative.										

The properties in Table 1A shall be specified for all paving grade bitumens listed in this Table. They are associated with regulatory or HSE requirements and shall be included in all specifications.

**Table 1B — Paving grade bitumen specifications for grades from 20 x 0,1 mm to 220 x 0,1 mm penetration -
Properties associated with regulatory or other regional requirements**

Property	Test method	Unit	20/30	30/45	35/50	40/60	50/70	70/100	100/150	160/220
Penetration index ^a	Annex A ^b	—	- 1,5 to + 0,7 <i>or</i> NR ^c	- 1,5 to + 0,7 <i>or</i> NR ^c	- 1,5 to + 0,7 <i>or</i> NR ^c	- 1,5 to + 0,7 <i>or</i> NR ^c	- 1,5 to + 0,7 <i>or</i> NR ^c	- 1,5 to + 0,7 <i>or</i> NR ^c	- 1,5 to + 0,7 <i>or</i> NR ^c	- 1,5 to + 0,7 <i>or</i> NR ^c
Dynamic viscosity at 60 °C	EN 12596	Pa · s	≥ 440 <i>or</i> NR ^c	≥ 260 <i>or</i> NR ^c	≥ 225 <i>or</i> NR ^c	≥ 175 <i>or</i> NR ^c	≥ 145 <i>or</i> NR ^c	≥ 90 <i>or</i> NR ^c	≥ 55 <i>or</i> NR ^c	≥ 30 <i>or</i> NR ^c
Fraass breaking point ^a	EN 12593	°C		≤ - 5 <i>or</i> NR ^c	≤ - 5 <i>or</i> NR ^c	≤ - 7 <i>or</i> NR ^c	≤ - 8 <i>or</i> NR ^c	≤ - 10 <i>or</i> NR ^c	≤ - 12 <i>or</i> NR ^c	≤ - 15 <i>or</i> NR ^c
Kinematic viscosity at 135 °C	EN 12595	mm ² /s	≥ 530 <i>or</i> NR ^c	≥ 400 <i>or</i> NR ^c	≥ 370 <i>or</i> NR ^c	≥ 325 <i>or</i> NR ^c	≥ 295 <i>or</i> NR ^c	≥ 230 <i>or</i> NR ^c	≥ 175 <i>or</i> NR ^c	≥ 135 <i>or</i> NR ^c
^a When Severity 2 is selected it shall be associated with the requirement for Fraass breaking point or penetration index or both measured on the unaged binder. ^b Reference to normative Annex A in this document dealing with the calculation of penetration index. ^c NR. No Requirement may be used when there are no regulations or other regional requirements for the property in the territory of intended use.										

The properties in Table 1B are required to meet specific regional conditions. They are associated with regulatory or other regional requirements.

**Table 2A — Paving grade bitumen specifications for grades from 250 x 0,1 mm to 900 x 0,1 mm penetration -
Properties applying to all paving grade bitumen listed in this table**

Property	Test method	Unit	250/330	330/430	500/650	650/900
Penetration at 25 °C <i>or</i>	EN 1426	0,1 mm	250 – 330	–	–	–
Penetration at 15 °C	EN 1426	0,1 mm	70 – 130	90 – 170	140 – 260	180 – 360
Dynamic viscosity at 60 °C <i>or</i>	EN 12596	Pa · s	≥ 18	≥ 12	≥ 7,0	≥ 4,5
Softening point	EN 1427	°C	30 - 38	–	–	–
Resistance to hardening at 163 °C	EN 12607-1					
Viscosity ratio at 60 °C <i>or</i>		–	≤ 4,0	≤ 4,0	≤ 4,0	≤ 4,0
Increase in softening point		°C	≤ 11	–	–	–
Change of mass ^a (absolute value)		%	≤ 1,0	≤ 1,0	≤ 1,5	≤ 1,5
Flash point	EN ISO 2719	°C	≥ 180	≥ 180	≥ 180	≥ 180
Solubility	EN 12592	%	≥ 99,0	≥ 99,0	≥ 99,0	≥ 99,0
^a Change in mass can be either positive or negative.						

The properties in Table 2A shall be specified for all paving grade bitumens listed in this table. They are associated with regulatory or HSE requirements and shall be included in all specifications.

Table 2B — Paving grade bitumen specifications for grades from 250 x 0,1 mm to 900 x 0,1 mm penetration - Properties associated with regulatory or other regional requirements

Property	Test method	Unit	250/330	330/430	500/650	650/900
Fraass breaking point	EN 12593	°C	≤ - 16 <i>or</i> NR ^a	≤ - 18 <i>or</i> NR ^a	≤ - 20 <i>or</i> NR ^a	≤ - 20 <i>or</i> NR ^a
Kinematic viscosity at 135 °C	EN 12595	mm ² /s	≥ 100 <i>or</i> NR ^a	≥ 85 <i>or</i> NR ^a	≥ 65 <i>or</i> NR ^a	≥ 50 <i>or</i> NR ^a
^a NR. No Requirement may be used when there are no regulations or other regional requirements for the property in the territory of intended use.						

The properties in Table 2B are required to meet specific regional conditions. They are associated with regulatory or other regional requirements.

Table 3A — Paving grade bitumen specifications – Soft bitumens: bitumens designated and specified by kinematic viscosity at 60 °C - Properties applying to all paving grade bitumen listed in this table

Property	Test method	Unit	V1500	V3000	V6000	V12000
Kinematic viscosity at 60 °C	EN 12595	mm ² /s	1000 – 2000	2000 – 4000	4000 – 8000	8000 – 16000
Resistance to hardening at 120 °C	EN 12607-2					
Change of mass ^a (absolute value)		%	≤ 2,0	≤ 1,7	≤ 1,4	≤ 1,0
Flash point	EN ISO 2719	°C	≥ 160	≥ 160	≥ 180	≥ 180
Solubility	EN 12592	%	≥ 99,0	≥ 99,0	≥ 99,0	≥ 99,0
^a Change in mass can be either positive or negative.						

The properties in Table 3A shall be specified for all paving grade bitumens listed in this table. They are associated with regulatory or HSE requirements and shall be included in all specifications.

**Table 3B — Paving grade bitumen specifications –Soft bitumens: bitumens designated and specified by kinematic viscosity at 60 °C-
Properties associated with regulatory or other regional requirements**

Properties	Test method	Unit	V1500	V3000	V6000	V12000
Resistance to hardening at 120 °C TFOT	EN 12607-2					
Viscosity ratio at 60 °C		–	≤ 3,0 or NR ^a	≤ 3,0 or NR ^a	≤ 2,5 or NR ^a	≤ 2,0 or NR ^a
^a NR. No Requirement may be used when there are no regulations or other regional requirements for the property in the territory of intended use.						

The properties in Table 3B are required to meet specific regional conditions. They are associated with regulatory or other regional requirements.

6 Evaluation of conformity

6.1 General

The compliance of paving grade bitumens with the requirements of this European Standard and with the stated values (including grades) shall be demonstrated by:

- a) Initial Type Testing (ITT),
- b) Factory Production Control (FPC).

NOTE The information from evaluation of conformity can be available for audit as detailed in a manufacturer's quality plan.

6.2 Type testing

6.2.1 Initial Type Testing (ITT)

Initial type tests shall be performed to show the conformity of the bitumen/bituminous binder with this European Standard. Tests previously performed in accordance with the provisions of this European Standard (same product, same characteristic(s), test method, sampling procedure, system of attestation of conformity, etc...) may be taken into account. All the characteristics required in the European Standard shall be subject to initial type testing except dangerous substances, which may be declared by control of the raw materials, and characteristics where NR is chosen.

6.2.2 Further Type Testing

Whenever a change occurs in the base materials or the production process, which would change significantly one or more of the characteristics, the further type test shall be repeated for the appropriate characteristic(s).

6.2.3 Sampling, testing and compliance criteria

Sampling shall be taken as specified in Clause 4.

The results of all type tests (initial and further type tests) shall be recorded, held by the manufacturer for at least five years from the date of the test and be available for inspection.

6.3 Factory Production Control (FPC)

6.3.1 General

The manufacturer shall establish, document and maintain an FPC system to ensure that the products placed on the market conform to the stated performance characteristics. The FPC system shall consist of procedures, regular inspections, tests or assessments and the use of the results to control the quality of the finished product.

An FPC system conforming to the requirements of EN ISO 9001 and made specific to the requirements of this standard shall be deemed to satisfy the above requirements.

The results of inspections, tests or assessments requiring action shall be recorded, as shall any action taken. The action to be taken when control values or criteria are not met shall be recorded and retained for the period specified in the manufacturer's FPC procedures.

6.3.2 Equipment

In accordance with testing, all weighing, measuring and testing equipment shall be calibrated and regularly inspected according to documented procedures, frequencies and criteria.

In accordance with manufacturing, all equipment used in the manufacturing process shall be regularly inspected and maintained to ensure use, wear or failure does not cause inconsistency in the manufacturing process. Inspections and maintenance shall be carried out and recorded in accordance with the manufacturer's written procedures on equipment identified by the manufacturer as necessary to achieve or maintain product quality and the records retained for the period defined in the manufacturer's FPC procedures.

6.3.3 Base materials

The acceptance criteria for all incoming base materials shall be documented, as shall the inspection scheme for ensuring their conformity.

6.3.4 Product testing and evaluation

The manufacturer shall establish procedures to ensure that the stated values of all the characteristics are maintained. The characteristics and the means of control are:

- all characteristics shall be subject to the tests described in 6.2 and a minimum of once per year;
- routine control of product quality shall be on a basis of checks, of a type and a frequency to be defined and documented, to ensure that properties do not change significantly from those subject to type testing.

The tests for consistency at intermediate and elevated service temperatures, and for durability, shall be carried out on a representative sample of product for supply to customers.

Where batch production is carried out, the sample should be taken from the batch, which is considered as the quantity of bitumen produced and stored in one tank once the production run into tank has been completed. The batch is considered to remain the same as long as no new production has been added.

In case of loading through an in-line blender, the routine quality control may be carried out on the feeder tanks and a procedure for checking the performance of the blender shall be in place.

The appropriate testing frequencies vary with individual supply facilities, throughput and processes. Minimum frequencies shall be:

- a) consistency at intermediate service temperature: daily; if product is supplied directly from a tank that has not received new production then the minimum test frequency may be extended to a batch;
- b) consistency at elevated service temperatures: monthly;
- c) durability, brittleness at low service temperature, temperature dependence of consistency: annually.

6.3.5 Traceability and marking

Individual product batches shall be identifiable and traceable with regard to their production origin. The manufacturer shall have written procedures ensuring that processes related to affixing traceability information and/or markings are inspected regularly. Compliance with EN ISO 9001:2000, sub-clause 7.5.3 shall be deemed to satisfy the requirements of this sub-clause.

6.3.6 Non-conforming products

The manufacturer shall have written procedures which specify how non-conforming products shall be dealt with. Any such events shall be recorded as they occur and these records shall be kept for the period defined

in the manufacturer's written procedures. Compliance with EN ISO 9001:2000, sub-clause 8.3 shall be deemed to satisfy the requirements of this sub-clause.

6.3.7 Corrective action

The manufacturer shall have documented procedures that instigate action to eliminate the cause of non-conformities in order to prevent recurrence. Compliance with EN ISO 9001:2000, sub-clause 8.5.2 shall be deemed to satisfy the requirements of this sub-clause.

6.3.8 Handling, storage and packaging

The manufacturer shall have procedures providing methods of product handling and shall provide suitable storage areas preventing damage or deterioration.

Annex A (normative)

Calculation of the penetration index, I_p

A.1 Scope

This Annex specifies the procedure to be used for calculating the penetration index, I_p , of paving grade bitumens when required, e.g. in relation to the specification for resistance to hardening given in Table 1A for grades between 20/30 and 160/220.

A.2 Definition

For the purposes of this Annex, the following definition applies:

A.2.1

penetration index, I_p

indication of the thermal susceptibility of a bituminous binder

A.3 Principle

The penetration index, I_p is calculated from the values of penetration at 25 °C, 100 g, 5 s, determined in accordance with EN 1426, and the softening point, determined in accordance with EN 1427.

NOTE 1 It is based on the following hypothesis of Pfeiffer and Van Doormael:

- At the temperature of the softening point, the penetration of a bitumen is $(800 \times 0,1)$ mm.
- When the logarithm (base 10) of penetration is plotted against temperature, a straight line is obtained, the slope A of which is defined by:

$$A = \frac{(20 - I_p)}{(10 + I_p)} \times \frac{1}{50} \quad (\text{A.1})$$

NOTE 2 A penetration index of zero is attributed to a bitumen with a penetration at 25 °C of $200 \times 0,1$ mm and a softening point of 40 °C.

A.4 Determination

Calculate the I_p from the following equation:

$$I_p = \frac{20 \times t_{RaB} + 500 \times \lg P - 1952}{t_{RaB} - 50 \times \lg P + 120} \quad (\text{A.2})$$

where:

t_{RaB} is the softening point, in degrees Celsius;

$\lg P$ is the logarithm (base 10) of the penetration at 25 °C (in 0,1 mm)

A.5 Expression of results

Report the penetration index as the value, calculated according to A.4, rounded to the nearest 0,1 of a unit.

A.6 Precision

A.6.1 Repeatability

The difference between two successive test results, obtained by the same operator with the same apparatus under constant operating conditions on identical test material would exceed 0,3 in only one case in twenty.

A.6.2 Reproducibility

The difference between two single and independent results obtained by different operators working in different laboratories on identical test material would exceed 0,5 in only one case in twenty.

Annex B (informative)

Complementary information on grade selection

The general principle adopted was to provide a range of grades suitable for the manufacture of the bituminous mixtures used, and the climatic and traffic conditions encountered, in all the Member States. It is useful for each country to define and recommend the most suitable grades for that country in a national informative guidance document.

Annex ZA (informative)

Clauses of this European Standard addressing the provisions of the EU Construction Products Directive

ZA.1 Scope and relevant characteristics

This European Standard has been prepared under Mandate M/124 "Road Construction Products" given to CEN by the European Commission and the European Free Trade Association.

The clauses of this European Standard shown in this Annex meet the requirements of the Mandate given under the EU Construction Products Directive (89/106/EEC).

Compliance with these clauses confers a presumption of fitness of the paving grade bitumens covered by this Annex for the intended uses indicated herein; reference shall be made to the information accompanying the CE marking.

WARNING — Other requirements and other EU Directives, not affecting the fitness for intended uses, can be applicable to the paving grade bitumen falling within the scope of this European Standard.

NOTE 1 In addition to any specific clauses relating to dangerous substances contained in this standard, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply.

NOTE 2 An informative database of European and national provisions on dangerous substances is available at the Construction web site on EUROPA, (accessed through http://ec.europa.eu/enterprise/construction/internal/dangsub/dangmain_en.htm).

This Annex establishes the conditions for the CE marking of paving grade bitumens intended for the uses indicated in Table ZA.1.1 and Table ZA.1.2 and shows the relevant clauses applicable.

This Annex has the same scope as Clause 1 of this standard and is defined by Table ZA.1.1 and Table ZA.1.2.

**Table ZA.1.1 — Relevant clauses for paving grade bitumens
from Table 1A, Table 1B, Table 2A and Table 2B**

Construction Product(s): paving grade bitumens			
Intended use(s): For construction and maintenance of roads, airfields and other paved areas (graded by penetrability)			
Requirement/ Characteristic from the Mandate:	Requirement clause(s) in this or other European Standard(s)	Mandated level(s) and/or class(es)	Notes
Consistency at intermediate service temperature ^a	5.2.2	None	Grade: declared range
Consistency at elevated service temperature	5.2.3	None	Declared range
Brittleness at low service temperature	5.2.4	None	Declared maximum value NPD may be used
Temperature dependence of consistency	5.2.5	None	Declared range NPD may be used
Durability of the consistency at intermediate and elevated service temperatures	5.2.6	None	Declared minimum value for retained penetration and Declared maximum increase in softening point
Dangerous regulated substances	5.3	None	See ZA.1, NOTE 2
^a Not appropriate for soft bitumens (See, Table ZA.1.2 and Table 3A)			

**Table ZA.1.2 — Relevant clauses for paving grade bitumens
from Tables 3A and Table 3B**

Construction Product(s): paving grade bitumens - Soft bitumens			
Intended use(s): For construction and maintenance of roads, airfields and other paved areas (graded by viscosity)			
Requirement/ Characteristic from the Mandate:	Requirement clause(s) in this or other European Standard(s)	Mandated level(s) and/or class(es)	Notes
Consistency at elevated service temperature	5.2.3	None	Grade: declared range
Durability of the consistency at elevated service temperatures	5.2.6	None	Declared maximum value for viscosity ratio NPD may be used
Dangerous regulated substances	5.3	None	See ZA.1, NOTE 2

The requirement on a certain characteristic is not necessary in those Member States (MSs) where there are no regulatory requirements on that characteristic for the intended use of the product. In this case, manufacturers placing their products on the market of these MSs are not obliged to determine nor declare the performance of their products with regard to this characteristic and the option "No performance determined" (NPD) in the information accompanying the CE marking (see Clause ZA.3) may be used.

ZA.2 Procedure for attestation of conformity of paving grade bitumens

ZA.2.1 System of attestation of conformity

The system of attestation of conformity of paving grade bitumens indicated in Table ZA.1.1 and Table ZA.1.2, in accordance with the Decision of the Commission 98/601/EC of 13 October 1998 (published as doc. L287 the 24th October 1998) amended by the Commission decision 01/596/EC of 8th January 2001 (published as doc. L209 the 2nd August 2001) and as given in Annex III of the Mandate M/124 are shown in Table ZA.2 for the indicated intended use and relevant levels or classes.

Table ZA.2 — System of attestation of conformity for paving bitumens

Product	Intended use	Level(s) or class(es)	Attestation of conformity system
Bitumen	For road construction and surface treatment of roads	None	2+
System 2+: See Directive 89/106/EEC (CPD) Annex III.2.(ii), first possibility, including certification of the factory production control by an approved body on the basis of initial inspection of factory and of factory production control as well as of continuous surveillance, assessment and approval of factory production control.			

The attestation of conformity of the products in Table ZA.1.1 and Table ZA.1.2, shall be according to the evaluation of conformity procedures indicated in Table ZA.3 resulting from application of the clauses of this European Standard indicated herein.

Table ZA.3 — Assignment of evaluation of conformity tasks

Tasks		Content of the task	Evaluation of conformity clauses to apply
Tasks under the responsibility of the manufacturer	Factory Production Control (FPC)	Parameters related to all characteristics of Tables ZA.1.1 or ZA.1.2.	6.3
	Initial Type Testing (ITT)	All characteristics of Tables ZA.1.1 or ZA.1.2.	6.2.1
	Certification of FPC by a Notified Body on the basis of:	Initial inspection by a Notified Body of factory and of FPC. Parameters related to all characteristics of Tables ZA.1.1 or ZA.1.2, i.e. - <i>Consistency at intermediate service temperature,</i> - <i>Consistency at elevated service temperature,</i> - <i>Brittleness at low service temperature</i> - <i>Temperature dependence of consistency</i> - <i>Durability of the consistency at intermediate and/or elevated service temperatures</i>	6.3
		Continuous surveillance, assessment and approval of FPC Parameters related to all characteristics of Tables ZA.1.1 or ZA.1.2, i.e. - <i>Consistency at intermediate service temperature,</i> - <i>Consistency at elevated service temperature,</i> - <i>Brittleness at low service temperature</i> - <i>Temperature dependence of consistency</i> - <i>Durability of the consistency at intermediate and/or elevated service temperatures</i>	6.3

ZA.2.2 EC Certificate and Declaration of conformity

When compliance with the conditions of this Annex is achieved, and once the notified body has drawn up the certificate mentioned below, the manufacturer or his agent established in the EEA shall prepare and retain a declaration of conformity, which entitles the manufacturer to affix the CE marking. This declaration shall include:

- a) name and address of the manufacturer, or his authorized representative established in the EEA, and the place of production,

NOTE 1 The manufacturer may also be the person responsible for placing the product onto the EEA market, if he takes responsibility for CE marking.

- b) description of the product (type, identification, use, ...) and a copy of the information accompanying the CE marking,

NOTE 2 Where some of the information required for the Declaration is already given in the CE marking information, it does not need to be repeated.

- c) provisions to which the product conforms (i.e. Annex ZA of this EN), and a reference to the ITT report(s) and factory production control records (if appropriate),
- d) particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions),
- e) the number of the accompanying factory production control certificate, and FPC records, where applicable,
- f) name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or his authorized representative.

The declaration shall be accompanied by a factory production control certificate, drawn up by the notified inspection body, which shall contain, in addition to the information above, the following:

- g) name and address of the notified body,
- h) the number of the factory production control certificate,
- i) conditions of validity of the certificate, where applicable,
- j) name of, and position held by, the person empowered to sign the certificate.

The above mentioned declaration and certificate shall be presented in the language or languages accepted in the Member State in which the product is to be used.

ZA.3 CE marking and labelling

The manufacturer or his authorized representative established within the EEA is responsible for the affixing of the CE marking. The CE marking symbol to affix shall be in accordance with Directive 93/68/EC and shall be shown on the relevant commercial documents or on the packaging where possible. The following information shall accompany the CE marking symbol together with the relevant test method against the characteristic if more than one test method is available under this standard:

- a) identification number of the certification body,
- b) name or identifying mark and registered address of the manufacturer (see Note 1 in ZA.2.2),
- c) the last two digits of the year in which the marking is affixed,
- d) number of the factory production control certificate,

- e) reference to this European Standard (EN 12591),
- f) description of the product: generic name and grade,
- g) information on those relevant essential characteristics listed in Table ZA.1.1 or Table ZA.1.2 which are to be declared presented as follows:
 - 1) declared values and, where relevant, level or class to declare for each essential characteristic as indicated in Notes in Tables ZA.1.1 or ZA.1.2;
 - 2) "No performance determined" for characteristics where this is relevant.

The NPD option may be used when and where the characteristic, for a given intended use, is not subject to regulatory requirements in the Member State of destination.

Figure ZA.1 gives an example of a shortened CE marking for a delivery note.

Figure ZA.2 and Figure ZA.3 give examples of the information to be given on the commercial documents.

<div>CE</div> <div>01234</div>	<div>CE conformity marking, consisting of the "CE"-symbol given in Directive 93/68/EEC.</div> <div>Identification number of the notified body</div>
<div>AnyCo Ltd, P.O. Box 21, B – 1050</div> <div>09</div> <div>01234-CPD-00234</div>	<div>Name or identifying mark and registered address of the manufacturer</div> <div>Last two digits of year in which the CE marking was affixed</div> <div>Certificate number</div>
<div>EN 12591:2009</div> <div>Paving grade bitumen: 50/70</div>	<div>Reference to the European Standard</div> <div>Description of product</div>

Figure ZA.1 — Example of shortened CE marking for delivery note

<div>CE</div> <div>01234</div>
<div>AnyCo Ltd, P.O. Box 21, B – 1050</div> <div>09</div> <div>01234-CPD-00234</div>
<div>EN 12591:2009</div> <div>Paving grade bitumen: 50/70</div> <div>Penetration at 25 °C 50 - 70 x 0,1 mm</div> <div>Softening point 46 - 54 °C</div> <div>Resistance to hardening at 163 °C (EN 12607-1)</div> <div>Retained penetration at 25 °C..... ≥ 50 %</div> <div>Increase in softening point ≤ 9 °C</div>

CE conformity marking, consisting of the "CE"-symbol given in Directive 93/68/EEC.

Identification number of the notified body

Name or identifying mark and registered address of the manufacturer

Last two digits of year in which the CE marking was affixed

Certificate number

Reference to the European Standard

Description of product and

information on regulated characteristics

Figure ZA.2— Example of CE marking information and values

<div>CE</div> <div>01234</div>	<div>CE conformity marking, consisting of the "CE"-symbol given in Directive 93/68/EEC.</div> <div>Identification number of the notified body</div>
<div>AnyCo Ltd, P.O. Box 21, B – 1050</div> <div>09</div> <div>01234-CPD-00234</div>	<div>Name or identifying mark and registered address of the manufacturer</div> <div>Last two digits of year in which the CE marking was affixed</div> <div>Certificate number</div>
<div>EN 12591:2009</div> <div>Paving grade bitumen: 50/70</div> <div>Penetration at 25 °C 50 - 70 x 0,1 mm</div> <div>Softening point 46 - 54 °C</div> <div>Resistance to hardening at 163 °C (EN 12607-1) Retained penetration at 25 °C..... ≥ 50 % Increase in softening point ≤ 9 °C</div> <div>Penetration Index..... -1,5 to + 0,7</div> <div>Dynamic viscosity at 60 °C..... NPD</div> <div>Fraass Breaking point ≤ - 8 °C</div>	<div>Reference to the European Standard</div> <div>Description of product and information on regulated characteristics</div>

Figure ZA.3 — Example of CE marking information and values with associated regulatory regional requirements

In addition to any specific information relating to dangerous substances shown above, the product should also be accompanied, when and where required and in the appropriate form, by documentation listing any other legislation on dangerous substances for which compliance is claimed, together with any information required by that legislation.

- NOTE 1 European legislation without national derogations need not be mentioned.
- NOTE 2 Affixing CE marking symbol means, if a product is subject to more than one directive, that it complies with all applicable directives.

Bibliography

- [1] EN 12697–1, *Bituminous mixtures - Test methods for hot mix asphalt - Part 1: Soluble binder content*
- [2] EN 12697–11, *Bituminous mixtures - Test methods for hot mix asphalt - Part 11: Determination of the affinity between aggregate and bitumen*
- [3] EN 12697–12, *Bituminous mixtures - Test methods for hot mix asphalt - Part 12: Determination of the water sensitivity of bituminous specimens*
- [4] EN 12697–26, *Bituminous mixtures - Test methods for hot mix asphalt - Part 26: Stiffness*
- [5] EN 13108-1, *Bituminous mixtures – Material specifications - Part 1: Asphalt concrete*
- [6] EN 13108-2, *Bituminous mixtures – Material specifications - Part 2: Asphalt concrete for very thin layers*
- [7] EN 13108-3, *Bituminous mixtures – Material specifications - Part 3: Soft Asphalt*
- [8] EN 13108-4, *Bituminous mixtures – Material specifications - Part 4: Hot Rolled Asphalt*
- [9] EN 13108-5, *Bituminous mixtures – Material specifications - Part 5: Stone Mastic Asphalt*
- [10] EN 13108-6, *Bituminous mixtures – Material specifications - Part 6: Mastic Asphalt*
- [11] EN 13108-7, *Bituminous mixtures – Material specifications - Part 7: Porous Asphalt*
- [12] EN 13304, *Bitumen and bituminous binders – Framework for specification of oxidised bitumens*
- [13] EN 13305, *Bitumen and bituminous binders – Framework of specification of hard industrial bitumens*
- [14] EN 13808, *Bitumen and bituminous binders – Framework for specifying cationic bituminous emulsions*
- [15] EN 13924, *Bitumen and bituminous binders – Specifications for hard paving grade bitumens*
- [16] EN 14023, *Bitumen and bituminous binders – Framework specification for polymer modified bitumens*
- [17] CEN/TR 15352, *Bitumen and bituminous binders – Development of performance-related specifications: status report 2005*
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National Annex (informative)

National Guidance for the use of BS EN 12591:2009 in the UK

Introduction

This National Annex NA (informative) provides guidance to manufacturers, users, suppliers and specifiers on the implementation of BS EN 12591:2009, Specifications for paving grade bitumens, for use in products for the construction and maintenance of roads and airfields in the UK.

BS EN 12591 is not a performance related specification but contains options for some properties allowing the selection of the most suitable specification for the bitumen taking account of its use and of the local climate.

Possible poor selection of properties has been recognised by UK industry and guidance on selection of properties suitable for use in products for the construction and maintenance of roads and airfields in the UK is included in NA.2.

NA.1 Implementation

In the UK, paving grade bitumens have previously been specified to BS EN 12591:2000, which has been superseded by this Standard.

A suggested specification clause that a Client, e.g. a highway authority, could use in a contract, is as follows:

“Paving Grade Bitumens shall conform to the requirements of BS EN 12591:2009, National Annex NA (informative), Table NA.1 or Table NA.2 as appropriate.”

NA.2 Selection of properties

It is recommended that paving grade bitumens for use in products for the construction and maintenance of roads and airfields in the UK are specified as given in Table NA.1 or Table NA.2, as appropriate.

NOTE 1: There are no changes in the recommended properties and values in BS EN 12591:2009, National Annex NA (informative) Table NA.1 or Table NA.2 as appropriate, from those previously specified in BS EN 12591:2000 for paving grade bitumens used in the UK.

NOTE 2: The recommended grade selections for Asphalt Concrete (BS EN 13108-1), Hot Rolled Asphalt (BS EN 13108-4) and Stone Mastic Asphalt (BS EN 13108-5) for use in the UK are given in Annexes B, C and D of PD 6691:2007, *Guidance on the use of BS EN 13108 Bituminous mixtures*.

NA.3 Evaluation of Conformity

Requirements for “evaluation of conformity” detail the steps which manufacturers need to take in order to demonstrate conformity with the specification. These procedures start with “type testing”, which details the way conformity with all the requirements is determined, and include “factory production control”, which indicates the procedures to be adopted during production to ensure consistent conformity. These procedures need to be followed whether CE marking is being undertaken or not.

NA.3.1 Type Testing

All tests detailed in the specification should be carried out as part of the initial evaluation of a paving grade bitumen; this is called “Initial Type Testing”. All the characteristics given in Table NA.1 or Table NA.2 as appropriate should be subject to initial type testing. For those characteristics in Table 1B or Table 2B of the

Standard which are not listed in Table NA.1 or Table NA.2, NR should be chosen and initial type testing is not required. In addition, whenever the manufacturer makes a change to the base materials or production process, which they expect could make a significant change to one or more of the characteristics of the bitumen, the relevant test(s) should be repeated.

NA.3.2 Factory Production Control (FPC)

Paving grade bitumen manufacturers should operate a quality management scheme that should be in accordance with the FPC requirements in BS EN 12591 and gives a schedule for the specific type of quality control system. This may be based on the requirements of existing third party accredited systems, i.e. BS EN ISO 9001 and the requirements of National Highway Sector Scheme 15.

NA.3.3 Attestation of Conformity

Compliance with the requirements in BS EN 12591 for factory production control, initial type testing, ongoing surveillance and accreditation by a notified body, will entitle a manufacturer to prepare a declaration of conformity for his paving grade bitumen(s). This declaration needs to include information about the bitumen(s), the manufacturer and quality assurance. The requirements are detailed in the informative Annex ZA of the Standard. The declaration should be available on demand to the user.

NA.4 CE Marking

After the declaration of conformity, BS EN 12591 suggests that a supplier is entitled to affix CE marking. Although this will be a requirement — effectively a licence to trade — in most of the European Economic Area (EEA), it is not a legal requirement at the present time in the UK. Examples of CE marking suitable for use in the UK are given in figures ZA.1a and ZA.1b in Annex ZA of the Standard. Information from the declaration of conformity is required plus the information that is needed to meet the EC Mandate M/124.

As it is not practical to physically attach the CE marking (logo) to the binder, it is recommended that it should appear on the CE marking documentation. It should be as shown in the example in the Standard, but can not be less than 5mm high and can be positioned at any appropriate location. Further information to appear on the CE marking documentation is the nomenclature of the paving grade bitumen.

Table NA.1 — Paving grade bitumen specifications for grades from 20 x 0,1 mm to 220 x 0,1 mm penetration

Property	Test method	Unit	20/30	30/45	35/50	40/60	50/70	70/100	100/150	160/220
Penetration at 25 °C	EN 1426	0,1 mm	20 – 30	30 – 45	35 – 50	40 – 60	50 – 70	70 – 100	100 – 150	160 – 220
Softening point	EN 1427	°C	55 – 63	52 – 60	50 – 58	48 – 56	46 – 54	43 – 51	39 – 47	35 – 43
Resistance to hardening at 163 °C	EN 12607-1									
Retained penetration		%	≥ 55	≥ 53	≥ 53	≥ 50	≥ 50	≥ 46	≥ 43	≥ 37
Increase in softening point, - <i>Severity 1</i>		°C	≤ 8	≤ 8	≤ 8	≤ 9	≤ 9	≤ 9	≤ 10	≤ 11
Change of mass ^a (absolute value)		%	≤ 0,5	≤ 0,5	≤ 0,5	≤ 0,5	≤ 0,5	≤ 0,8	≤ 0,8	≤ 1,0
Flash point	EN ISO 2592	°C	≥ 240	≥ 240	≥ 240	≥ 230	≥ 230	≥ 230	≥ 230	≥ 220
Solubility	EN 12592	%	≥ 99,0	≥ 99,0	≥ 99,0	≥ 99,0	≥ 99,0	≥ 99,0	≥ 99,0	≥ 99,0
Kinematic viscosity at 135 °C	EN 12595	mm ² /s	≥ 530	≥ 400	≥ 370	≥ 325	≥ 295	≥ 230	≥ 175	≥ 135
^a Change in mass can be either positive or negative.										

Table NA.2 — Paving grade bitumen specifications for grades from 250 x 0,1 mm to 900 x 0,1 mm penetration

Property	Test method	Unit	250/330
Penetration at 25 °C	EN 1426	0,1 mm	250 – 330
Softening point	EN 1427	°C	30 - 38
Resistance to hardening at 163 °C	EN 12607-1		
Increase in softening point		°C	≤ 11
Change of mass ^a (absolute value)		%	≤ 1,0
Flash point	EN ISO 2719	°C	≥ 180
Solubility	EN 12592	%	≥ 99,0
Kinematic viscosity at 135 °C	EN 12595	mm ² /s	≥ 100

^a Change in mass can be either positive or negative.

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